

The Air War Against the Islamic State

THE ROLE OF AIRPOWER IN
OPERATION INHERENT RESOLVE

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Preface

This report documents and analyzes the employment of airpower against the Islamic State of Iraq and Syria (ISIS) by the United States and its coalition partners during Operation Inherent Resolve between August 2014 and March 2019. By identifying strategic- and operational-level insights from the air war against ISIS, this report may help the U.S. Air Force, joint force, and coalition partners better plan and prepare for future air wars against nonstate and near-peer adversaries. This report should be of value to the national security community and interested members of the general public, especially those with an interest in the fight against ISIS and the history of airpower.

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Summary

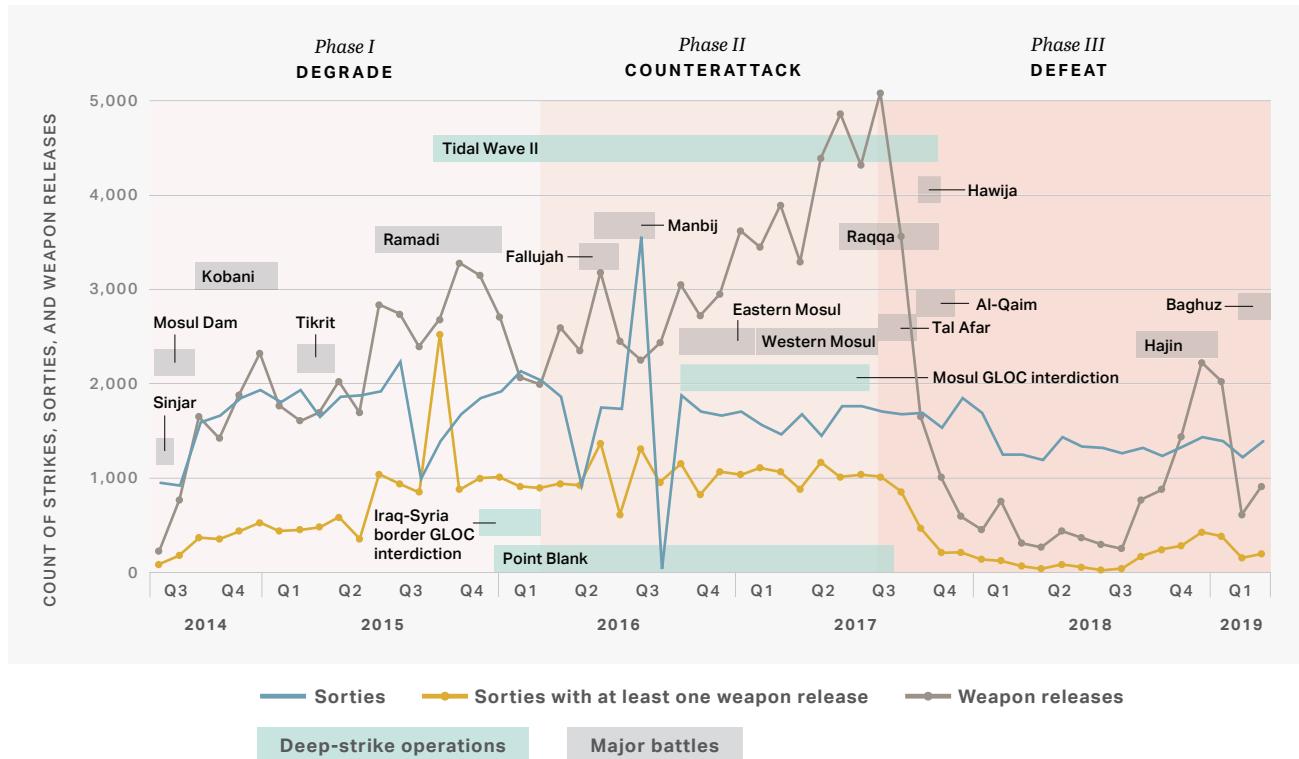
Issue

There is significant debate over whether airpower was harnessed to its full potential in the U.S.-led fight against the Islamic State of Iraq and Syria (ISIS). Some argue that airpower could have been applied more vigorously in Operation Inherent Resolve (OIR) to have more quickly defeated ISIS. This report provides an operational history of the air operation against ISIS, assesses the relationship between airpower effects, and analyzes the strategic and operational impacts of airpower in OIR. The findings will help the U.S. Air Force (USAF) and joint force better plan and prepare for future air wars against nonstate and near-peer adversaries.

Approach

This report relies on three primary inputs: (1) official documents, periodicals, and OIR and coalition government press statements, briefings, and testimonies; (2) a data set of Coalition Joint Task Force—Operation Inherent Resolve strike releases and a data set of U.S. Air Forces Central airpower summaries, which we used to analyze strike sorties, target sets, weapons released, and enabling missions, such as aerial refueling; and (3) interviews with more than 50 current and former participants in OIR. Leveraging these sources, we charted the application of airpower in OIR to assess airpower’s contribution to achieving U.S. and coalition operational and strategic objectives in this conflict. We used case studies of specific operations and battles to explore how airpower was applied in both the close and the deep fights. Figure S.1 highlights major ground battles and deep-strike operations, as well as the number of air-to-ground sorties and weapons released across the operation.

Figure S.1
OIR Air-to-Ground Operations and Major Battles, August 2014–March 2019



NOTE: GLOC = ground line of communication; Q = quarter.

Conclusions

Our analysis supports the following conclusions:

- Airpower played a critical role in OIR based on the “by, with, and through” strategy, which placed local partners as leaders of the fight to destroy the caliphate. In turn, partners’ capabilities and interests shaped how airpower was used.
- Although more-aggressive air operations might have slightly accelerated the defeat of ISIS, they are unlikely to have significantly altered the timeline.
- The deep fight in OIR affected ISIS’s finances, but it could not affect ISIS’s main center of gravity—territory—meaning that strategic attacks hurt ISIS’s finances but less than initially thought.
- Critical enablers, such as remotely piloted aircraft and aerial refueling aircraft, were in high demand and provided vital capabilities but were at times overstretched.
- Essential wartime skills, such as deliberate-targeting and defensive counterair operations, were used for the first time in years in a real operation, requiring reinvigoration of these proficiencies.
- Battlespace management within the OIR coalition was a point of disagreement, particularly between the Combined Joint Task Force Commander and the Combined Air Forces Component Commander, and affected the development of the deep fight.
- Necessary efforts to prevent civilian casualties and reduce collateral damage depleted precision-guided munition stockpiles.

Recommendations

These findings led us to the following recommendations for the joint force and the USAF:

- The joint force should revise its targeting doctrine based on the experience in OIR, to include potentially incorporating the strike cell or reverting back to using the Joint Air Ground Integration Center.
- The joint force should reinvigorate, reexamine, and revise the target-development process to make it more efficient.
- The joint force should modify the allocation process for high-demand assets in joint campaigns to reduce inefficiencies and increase agility.
- The joint force should reexamine battlespace management and revise doctrine or tactics, techniques, and procedures so that it can more dynamically manage both the close and the deep fights.

- The USAF will need to limit civilian casualties and collateral damage, requiring it to allocate precision-guided munitions efficiently across theaters and identify how to safely use second- and third-choice munitions.
- The USAF should continue to develop more targeteers and intelligence professionals to support a reinvigoration of the target-development process.
- Self-defense rules of engagement in air-to-air operations should be stressed to airmen in training and real-world flying events to better prepare airmen for flying missions in contested airspace against near-peer or more-capable adversaries.

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Abbreviations

AB	air base
AEW&C	airborne early warning and control
AFCENT	U.S. Air Forces Central
AFHRA	Air Force Historical Research Agency
AMRAAM	Advanced Medium-Range Air-to-Air Missile
AOC	Air Operations Center
AOR	area of responsibility
ARCENT	U.S. Army Central
ATAK	Android Tactical Advise Kit
ATO	air tasking order
AUAB	Al Udeid Air Base
AWACS	Airborne Warning and Control System
BIAP	Baghdad International Airport
C2	command and control
CAOC	Combined Air Operations Center
CAP	combat air patrol
CAS	close air support
CENTCOM	U.S. Central Command
CFACC	Combined Forces Air Component Commander
CJFLCC	Combined Joint Forces Land Component Command
CJOC	Combined Joint Operations Center
CJOC-B	Combined Joint Operations Center–Baghdad
CJOC-E	Combined Joint Operations Center–Erbil
CJTF-OIR	Combined Joint Task Force–Operation Inherent Resolve
CSG	carrier strike group
CTS	Counter Terrorism Service (Iraq)

DCA	defensive counterair
DIUx	Defense Innovation Unit Experimental
DoD	U.S. Department of Defense
FLOT	forward line of own troops
FMV	full-motion video
FOB	forward operating base
FSCL	Fire Support Coordination Line
FY	fiscal year
GLOC	ground line of communication
HIMARS	High Mobility Artillery Rocket System
HUMINT	human intelligence
IADS	Integrated Air Defense System
IED	improvised explosive device
ISF	Iraqi Security Forces
ISIL	Islamic State of Iraq and the Levant
ISIS	Islamic State of Iraq and Syria
ISR	intelligence, surveillance, and reconnaissance
JAGIC	joint air-ground integration center
JDAM	Joint Direct Attack Munition
JFLCC	Joint Force Land Component Command
JIPTL	joint integrated prioritized target list
JTAC	joint terminal attack controller
LGB	laser-guided bomb
LOAC	Law of Armed Conflict
LOC	line of communication
MERV	Middle Euphrates River Valley
MRTT	Multi Role Tanker Transport
NATO	North Atlantic Treaty Organization
NCV	noncombatant casualty cutoff value
OIR	Operation Inherent Resolve
PKK	Partiya Karkerên Kurdistanê (Kurdistan Workers' Party)
PMF	Popular Mobilization Forces
Q	quarter
Q-West	Qayyarah Airfield West

RAF	Royal Air Force
ROE	rules of engagement
ROVER	Remote Operated Video Enhanced Receiver
RPA	remotely piloted aircraft
SAM	surface-to-air missile
SDF	Syrian Democratic Forces
SOF	special operations forces
SOJTF	Special Operations Joint Task Force
TEA	target engagement authority
TQ	At-Taqaddum
UAE	United Arab Emirates
UAS	unmanned aerial system
USAF	U.S. Air Force
USMC	U.S. Marine Corps
VBIED	vehicle-borne improvised explosive device
VSO	vetted Syrian opposition
X-CAS	on-call close air support
YPG	Yekîneyê Parastina Gel (People's Protection Units)

Airpower and the War Against the Islamic State

On the morning of June 8, 2017, two F-15E Strike Eagles from the 492nd Expeditionary Fighter Squadron were flying a defensive counterair (DCA) mission near the exclusion zone around al-Tanf garrison in eastern Syria, where a small contingent of U.S. special operations forces (SOF) operated with Syrian militias that were aligned against the Islamic State of Iraq and Syria (ISIS). U.S. and UK-supported Syrian forces had seized al-Tanf—a strategically located outpost near the triborder area of Syria, Iraq, and Jordan—from ISIS fighters in March 2016 to pressure one of the militants’ key lines of communication (LOCs) connecting Syria and Iraq and reduce the threat to Jordan, a valuable U.S. partner in the Middle East.¹ Al-Tanf was subsequently used by U.S. forces to train Syrian militias combating ISIS, including the Syrian Democratic Forces (SDF), and to support counter-ISIS operations in the Euphrates River Valley. By May 2017, however, pro-Syrian regime ground forces had advanced into the triborder area and begun to challenge the 55-kilometer deconfliction zone around al-Tanf garrison established by the United States.² Pro-Syrian regime forces sought to capture the outpost, which was astride a critical highway linking Damascus to Baghdad and needed to create a critical supply corridor. Before long, pro-Syrian regime air forces—including Russian and Iranian aircraft—had also begun to challenge the al-Tanf garrison deconfliction zone.

During the F-15E combat air patrol (CAP), one of the U.S. pilots identified an Iranian-made Shahed 129 unmanned aerial system (UAS) armed with two Hellfire-like missiles orbiting above the Syrian forces and their U.S. advisers, likely operated by pro-Syrian regime forces.³ After notifying the Combined Air Operations Center (CAOC) located at Al Udeid Air Base (AUAB), the F-15E Strike Eagle and a wingman circled the UAS for approximately 30 minutes, watching the potentially hostile

¹ Nicholas Blanford, “At Remote Desert Garrison in Syria, a US-Iran Confrontation Is Brewing,” *Christian Science Monitor*, June 6, 2017.

² Alexander Decina, “The Right Way to Confront Iran in Syria,” Defense One, June 5, 2017.

³ Throughout this report, we use *UASs* to refer to partner and adversary unmanned aircraft, as they are less advanced than U.S. Air Force (USAF) and coalition remotely piloted aircraft (RPAs). Joshua Kleinholtz, “Mad-hatters Build on Legacy of Accomplishment,” photograph, U.S. Air Forces Central Command, October 27, 2017.

UAS and waiting for guidance.⁴ Because the Strike Eagles were running low on gas, both flew to a nearby tanker to be air-refueled rather than doing “yo-yo” operations, in which one aircraft is refueled while the other provides support for ground troops.⁵ During the Strike Eagles’ absence, U.S. SOF reported that a missile had been fired at them but failed to detonate. According to one of the F-15E pilots, when the two-ship returned, “We did another pass close by the drone and, lo and behold, one of the missiles is gone. At that point, we pretty much had him red-handed.”⁶

The pilots had been briefed that their DCA mission was operating under self-defense rules of engagement (ROE), and they were permitted to use force to defend themselves and U.S. and partner ground forces if they encountered demonstrated hostile intent or a hostile act.⁷ Believing that there was proof of hostile intent, one USAF pilot radioed that he intended to destroy the UAS but was told by the CAOC that “nonkinetic effects”—likely jamming from an electronic warfare aircraft—were being employed.⁸ Although the electronic jamming initially worked, after 30 minutes, the UAS turned back toward the U.S. and partner ground forces. This was again interpreted by the pilot as hostile intent, but the presence of two Russian Su-27 Flankers configured for air-to-air operations within range complicated the situation. The F-15E pilot was concerned that the Flankers would believe that a missile fired at the drone from this angle was actually aimed at them. Wary of unintended escalation, he waited to shoot until the missile did not pose a threat to the Russian aircraft.⁹ Meanwhile, the CAOC issued guidance to the pilot that, “if that thing [UAS] turns hot, smoke it,” because the aircraft jamming the UAS was low on fuel.¹⁰ Less than an hour and a half after the Strike Eagles initially spotted the UAS, it made an aggressive turn toward the U.S. outpost at al-Tanf garrison.¹¹ One of the F-15E pilots launched an AIM-120C

⁴ “How U.S. F-15E Drone Shoot-Down Changed Air Game in Syria,” *Aviation Week Network*, September 18, 2017; Phil Stewart, “In Syrian Skies, U.S. Pilots Learn How Fast Air War Can Morph,” *Reuters*, August 28, 2017.

⁵ “How U.S. F-15E Drone Shoot-Down Changed Air Game in Syria,” *Aviation Week Network*, September 18, 2017; RAND interview with Gen Jeffrey Harrigian, December 17, 2019.

⁶ “How U.S. F-15E Drone Shoot-Down Changed Air Game in Syria,” *Aviation Week Network*, September 18, 2017.

⁷ RAND interview with Gen Jeffrey Harrigian, December 17, 2019.

⁸ “How U.S. F-15E Drone Shoot-Down Changed Air Game in Syria,” *Aviation Week Network*, September 18, 2017; RAND interview with Gen Jeffrey Harrigian, December 17, 2019.

⁹ “How U.S. F-15E Drone Shoot-Down Changed Air Game in Syria,” *Aviation Week Network*, September 18, 2017.

¹⁰ RAND interview with Gen Jeffrey Harrigian, December 17, 2019.

¹¹ Joshua Kleinholtz, “Madhatters Build on Legacy of Accomplishment,” photograph, U.S. Air Forces Central Command, October 27, 2017.

Advanced Medium-Range Air-to-Air Missile (AMRAAM), which hit the UAS and caused it to crash to the ground.¹²

The shootdown of the Iranian UAS was the first of three air-to-air shootdowns that occurred over Syria during the month of June 2017 as part of Operation Inherent Resolve (OIR). This included the June 18 shootdown of a Syrian Air Force Su-22 Fitter by a U.S. Navy F/A-18E, the first U.S. air-to-air kill of a manned aircraft since 1999.¹³ Air-to-air combat is not expected during an air war against a terrorist organization. Indeed, recent U.S. efforts against insurgent organizations in Afghanistan and Iraq did not feature significant air-to-air combat or shootdowns. But the U.S.-led air war against ISIS was unique and complicated and differed from more-recent U.S. engagements. The war spanned two countries—Syria and Iraq—each with different authorities under which U.S. forces operated. In civil-war-ravaged Syria, U.S. military operations were not explicitly approved by the Syrian regime, nor did the United States support regime forces; instead, U.S. aircraft were supporting Syrian Kurdish and Arab militias that were fighting ISIS. In Iraq, U.S. forces operated at the invitation of the government of Iraq and supported its forces against an ISIS insurgency. Moreover, U.S. partners in this air war—the countries that would eventually compose the military coalition against ISIS—had varying restrictions on their operations. In addition to this complicated picture, Syria featured potentially hostile third parties on the ground and in the air—including Syrian, Iranian, and Russian aircraft—that were fighting to reassert the Syrian regime's control over all its territory.

The U.S. military effort to defeat ISIS began in August 2014, when the Barack Obama administration initially intervened to protect American personnel in Erbil and Yazidi refugees trapped on Mount Sinjar from ISIS attack.¹⁴ The militant organization had emerged from the remnants of al-Qaeda in Iraq and launched an offensive in 2014 that saw it take control of more than 40,000 square miles of territory in Iraq and Syria, including what would become its twin capitals of Mosul and Raqqa, and a population of 8 million people whom it ruled with brutality.¹⁵ ISIS would continue to expand its territory in Iraq and Syria until it controlled more than 62,000 square miles

¹² "How U.S. F-15E Drone Shoot-Down Changed Air Game in Syria," *Aviation Week Network*, September 18, 2017.

¹³ Veselin Toshkov, "NATO Shoots Down Yugoslav MiG Jet over Serbia," Associated Press, May 5, 1999. In 1999, a USAF F-16 Fighting Falcon shot down a Serbian MiG-29 during Operation Allied Force.

¹⁴ Barack Obama, "Statement by the President," speech delivered at the White House State Dining Room, Washington, D.C., August 7, 2014.

¹⁵ Seth G. Jones, James Dobbins, Daniel Byman, Christopher S. Chivvis, Ben Connable, Jeffrey Martini, Eric Robinson, and Nathan Chandler, *Rolling Back the Islamic State*, Santa Monica, Calif.: RAND Corporation, RR-1912, 2017, pp. 9–10.

and nearly 11 million people, spurring the United States and its coalition partners to action.¹⁶

What was intended to be a limited intervention soon grew as the federal government of Iraq and the Kurdistan Regional Government continued to request military assistance to contain and roll back ISIS's territorial gains. This war was fundamentally an Iraqi and Syrian war, but the U.S. Department of State mobilized the large, multinational Global Coalition to Defeat ISIS to "provid[e] military support" to U.S. partners.¹⁷ The U.S. strategy to defeat ISIS consisted of nine lines of effort, two of which were primarily the U.S. Department of Defense's (DoD's) responsibility: denying ISIS safe haven and building partner capacity.¹⁸ The military missions were commanded by the newly established Combined Joint Task Force—Operation Inherent Resolve (CJTF-OIR), led by the United States.

From the outset, the U.S. military operation to defeat ISIS primarily took the form of an air war. This reflected the U.S. and coalition preference for a light-footprint operation, which combined air strikes against ISIS with a limited number of U.S. military personnel working on the ground, "by, with, and through" local partner forces to roll back ISIS in Iraq and Syria. This followed the tradition of several recent expeditionary coalition campaigns, such as Operations Odyssey Dawn and Unified Protector in Libya, Operation Enduring Freedom in Afghanistan, and Operation Allied Force in Kosovo, which sought to leverage the involvement of U.S. allies and partners to promote burden-sharing and limit strategic liabilities.¹⁹ Many of these campaigns saw a modest number of SOF and general-purpose ground forces deployed as force multipliers but obviated the need for a large commitment of U.S. ground forces.

Thus, the United States and other coalition members predominantly contributed air support, and their direct military contributions to the combat operations largely

¹⁶ Seth G. Jones, James Dobbins, Daniel Byman, Christopher S. Chivvis, Ben Connable, Jeffrey Martini, Eric Robinson, and Nathan Chandler, *Rolling Back the Islamic State*, Santa Monica, Calif.: RAND Corporation, RR-1912, 2017, p. xi.

¹⁷ U.S. Department of State, "About Us—the Global Coalition to Defeat ISIS," webpage, undated; White House, "FACT SHEET: The Administration's Strategy to Counter the Islamic State of Iraq and the Levant (ISIL) and the Updated FY 2015 Overseas Contingency Operations Request," press release, November 7, 2014. The coalition did not include the government of Iraq or Syrian partners.

¹⁸ White House, "FACT SHEET: The Administration's Strategy to Counter the Islamic State of Iraq and the Levant (ISIL) and the Updated FY 2015 Overseas Contingency Operations Request," press release, November 7, 2014. For a broader discussion of how coalition and U.S. lines of effort differed and were integrated, see Linda Robinson, *Assessment of the Politico-Military Campaign to Counter ISIL and Options for Adaptation*, Santa Monica, Calif.: RAND Corporation, RR-1290-OSD, 2016.

¹⁹ Bruce R. Nardulli, Walter L. Perry, Bruce R. Pirnie, John Gordon IV, and John G. McGinn, *Disjointed War: Military Operations in Kosovo, 1999*, Santa Monica, Calif.: RAND Corporation, MR-1406-A, 2002; Benjamin S. Lambeth, *Air Power Against Terror: America's Conduct of Operation Enduring Freedom*, Santa Monica, Calif.: RAND Corporation, MG-166-1-CENTAF, 2006; Karl P. Mueller, ed., *Precision and Purpose: Airpower in the Libyan Civil War*, Santa Monica, Calif.: RAND Corporation, RR-676-AF, 2015.

occurred in the air. Therefore, airpower played—and continues to play, as the campaign is still ongoing despite the U.S. declaration that ISIS was defeated in December 2018—a pivotal role in the fight against ISIS.

Purpose of This Report

The purpose of this report is to provide an initial unclassified history of the air campaign against ISIS, to document how airpower was employed in this war, and to assess airpower's effectiveness and contribution to ISIS's defeat. Our narrative and assessment reside at the operational and strategic levels of war. We seek to answer five questions: What happened during the air war? How was airpower employed? Was airpower effective against different ISIS target sets? What did airpower accomplish or contribute to the defeat of ISIS? What lessons should the USAF and the joint force derive from this campaign?

This report is not intended to be the definitive history or evaluation of airpower in OIR, but it is a preliminary account and assessment based on open-source information. Because of this limitation, less detail is provided about SOF operations. Operations led by Special Operations Joint Task Force (SOJTF) are highlighted in the Kobani and Raqqa case studies, but we did not assess SOJTF operations to target ISIS leadership, except to note where some of these provided important intelligence that facilitated other air operations. We created two separate data sets from publicly released CJTF-OIR air strike releases and U.S. Air Forces Central (AFCENT) airpower summaries on the different types of air operations, which includes Air Force Special Operations Command strikes. But we did not have access to complete information about the types of aircraft used, the types of weapons that were employed, or official battle damage assessments.²⁰ Where possible, we have referenced ISIS's documents to shed light on the effect of airpower on its operations, but we were limited to the few accounts that had been released at the time of this research.²¹ Our claims, therefore, are circumscribed, but this report provides an evidentiary and analytical starting point for future studies. Future work needs to be done to more thoroughly examine the contribution of SOJTF operations, especially in terms of how SOF integrated with partner ground forces, raids and strikes against ISIS leaders, and other vital missions, such as combat

²⁰ CJTF-OIR, "Strike Releases," webpage, undated; AFCENT, "Airpower Summaries," webpage, undated.

²¹ By the time that this research was completed, for example, "ISIS Files" from the *New York Times* and George Washington University had not yet been publicly released. See Rukmini Callimachi, "The ISIS Files," *New York Times*, April 4, 2018. There is available reporting on some of these documents, as well as the Combating Terrorism Center's Harmony Program.

search and rescue.²² Moreover, as more ISIS documents become available, additional assessments of the effects of airpower on ISIS operations should be undertaken.

Despite the central role of airpower in OIR, this subject has received remarkably limited attention. To date, there has been little published analysis of the impact of air operations on the campaign and the circumstances under which they were conducted. Nevertheless, old debates about how airpower should be employed, what it can achieve, and which domain and service are more important have resurfaced during OIR.

Airpower advocates have attributed the length of OIR and its initial shortcomings to political constraints that limited airpower's effectiveness and prolonged the campaign. They have argued that once airpower and SOF were aggressively used to destroy a range of ISIS targets in Syria and Iraq, the militants were quickly dispatched.²³ On the other hand, others have focused on the limitations of airpower against a hybrid enemy such as ISIS.²⁴ Our goal is to contribute to this debate by providing a balanced look at these issues that is informed by a systematic analysis of the air war. This report will provide an evenhanded evaluation that offers a starting point for further analysis and will also identify insights from OIR that aim to make airpower more effective in future joint operations.

²² There are a few notable assessments of the combat search and rescue mission in OIR: Forrest L. Marion, "The Contract Broken and Restored: Air Rescue in "Operation Inherent Resolve, 2014–2017 (Part 1 of 2)," *European, Middle Eastern, and African Affairs*, Vol. 1, No. 2, Winter 2019; Forrest L. Marion, "The Contract Broken and Restored: Air Rescue in "Operation Inherent Resolve, 2014–2017 (Part 2 of 2)," *European, Middle Eastern, and African Affairs*, Vol. 2, No. 1, Spring 2020.

²³ Mark Gunzinger and John Stillion, "The Unserious Air War Against ISIS," *Wall Street Journal*, October 14, 2014; Benjamin S. Lambeth, "The U.S. Is Squandering Its Airpower," *Washington Post*, March 5, 2015; David A. Deptula, "How to Defeat the Islamic State," *Washington Post*, June 5, 2015; David A. Deptula, "The St. Andrews Proclamation: A Pragmatic Assessment of 21st Century Airpower," Arlington, Va.: Mitchell Institute for Aerospace Studies, June 2018; Adam J. Hebert, "In Case You Missed It: Airpower Killed ISIS," *Air Force Magazine*, January, 29, 2018; Mike Pietrucha and Jeremy Renken, "Airpower May Not Win Wars, But It Sure Doesn't Lose Them," *War on the Rocks*, August 19, 2015; Daniel Goure, "The Air War That Is Defeating ISIS," *Real Clear Defense*, August 8, 2017. See also the book Benjamin S. Lambeth, *Airpower in the War Against ISIS*, Annapolis, Md.: Naval Institute Press, 2021.

²⁴ Daniel Byman, "The Limits of Air Strikes When Fighting the Islamic State," *Lawfare*, December 5, 2016; Max Boot, "Why Air Power Alone Won't Beat ISIS," *Wall Street Journal*, December 8, 2015; Steven Metz, "For U.S., Ignoring the Limitations of Airpower a Recipe for Disaster," *World Politics Review*, January 29, 2016; Daniel Dolan, "Opinion: U.S. Air Power Won't Defeat ISIS," *USNI News*, June 17, 2014; Mark Thompson, "Why More Airstrikes Won't Beat ISIS," *Time*, November 17, 2015; James R. Holmes, "What Air Power Can and Cannot Accomplish: The War Against ISIS Can't Be Won from the Air, but Air Forces Can Keep IS from Winning," *The Diplomat*, October 7, 2014. For a survey of various views of airpower's utility against irregular targets, see John T. Farquhar, "Airpower and Irregular War: A Battle of Ideas," *Air and Space Power Journal*, Spring 2017.

Methodology and Study Scope

To answer the five research questions, we conducted a historical analysis of the air war against ISIS. As a first step, we created two new data sets on OIR air operations from the CJTF-OIR strike releases and the AFCENT airpower summaries, which are detailed in Appendix D. We then synthesized the data from the strike release and airpower summary data sets with information drawn from primary sources, interviews, and secondary sources. We critically appraised these sources and evaluated them according to our understanding about the actors, their interests, and the context, composing a historiographical approach.²⁵ Whenever possible, we triangulated references and included only information that was confirmed by multiple sources in our analysis to reduce bias and improve accuracy.²⁶

This report relies on three primary types of inputs. First, we conducted research on air operations in OIR, drawing on official documents, CJTF-OIR and coalition government press statements, briefings, testimonies, and news articles. We also reviewed unclassified documents related to OIR, as provided to us by the office of the USAF Chief of Staff, AFCENT, and the Joint History Office. Together, these formed the backbone of our understanding of the air war against ISIS.

Second, we consolidated CJTF-OIR strike releases and AFCENT airpower summaries into two data sets. The first data set, drawn from the CJTF-OIR strike releases, details strikes against ISIS, including the general location, target, and effect of a strike. This data set enabled us to analyze close air support (CAS), interdiction, and strategic attack missions. The second data set, drawn from the AFCENT airpower summaries, details the overall number of sorties and weapons released, as well as sortie numbers for specific missions, such as intelligence, surveillance, and reconnaissance (ISR); airlift; and aerial refueling. This data set allowed us to identify key metrics at various points in the campaign and to analyze sorties for missions that enabled the counterland missions. Our analysis of these data is present throughout this report, and more information about our data sets and analysis can be found in Appendix D.

Third, we conducted interviews with more than 50 current and former participants in OIR, including senior leaders, other military personnel, and government officials from eight coalition member countries. Given time and resource constraints, we could not interview every key official involved in this nearly five-year operation, but we made a point to interview both USAF and Army officials in AFCENT and CJTF-OIR during critical points of the campaign. These were coupled with interviews of

²⁵ Historiography is defined as “the writing of history based on a selective, critical reading of sources that synthesizes particular bits of information into a narrative description or analysis of a subject.” Cameron G. Thies, “A Pragmatic Guide to Qualitative Historical Analysis in the Study of International Relations,” *International Studies Perspectives*, Vol. 3, No. 4, 2002.

²⁶ Cameron G. Thies, “A Pragmatic Guide to Qualitative Historical Analysis in the Study of International Relations,” *International Studies Perspectives*, Vol. 3, No. 4, 2002, p. 359.

airmen who participated in OIR provided to us by the Air Force Historical Research Agency (AFHRA) from its oral history archive. We treated interviews as the perceptions of deployed personnel of the complex events they experienced, not as definitive accounts of what occurred. Wherever possible, we cross-checked what we heard with other interviews, media reporting, and available strike data.

This preliminary assessment is a strategic and operational one that is based on publicly available data. Therefore, it necessarily excludes some sensitive but vital operations that were conducted by SOF. It is not an evaluation of tactical outcomes or particular weapon systems. We conducted a rough qualitative assessment, depending on the type of data available, that examined the relationship, usually, between air strikes—mainly the number and type of targets bombed—and the attainment of different objectives. In other words, we attempted to correlate major shifts in how the campaign was prosecuted with critical battlefield outcomes. As a part of this process, we identified the impact that U.S. planners envisioned airpower having, considered whether it met those expectations, and then assessed whether and how this might have contributed to higher-level objectives using our understanding of ISIS's operations. For instance, if an operation aimed to counter ISIS's ability to use vehicle-borne improvised explosive devices (VBIEDs), we first determined what actually happened in that operation and whether air strikes occurred in the time frame at the anticipated level. Next, we considered whether these air strikes hit their targets by both examining the strike data and identifying evidence that these strikes had some effect on ISIS. We then concluded by examining how neutralizing the VBIED threat affected the overall battle and course of the war.

Even when there are enormous amounts of data and clearly defined operational goals, the criteria for military effectiveness are fuzzy and subject to interpretation. Moreover, effective militaries do not always win.²⁷ Metrics can be misleading and might not be tied to what success actually means.²⁸ This is particularly true for warfare against irregular opponents, such as ISIS. Typical metrics of success often focus on gaining control of a domain, especially territory, and comparing relative orders of battle and the number of enemy forces attrited in contrast to friendly-force losses. But past experience in Vietnam and other wars has clearly demonstrated that a focus on body counts—the number of enemy combatants killed—as a measure of success contributed to failure at the operational and strategic levels.²⁹ At times, increased effective-

²⁷ Alan R. Millet, Williamson Murray, and Kenneth H. Watman, "The Effectiveness of Military Organizations," *International Security*, Vol. 11, No. 1, Summer 1986. According to Millet, Murray, and Watman, "the basic characteristics of military effectiveness cannot be measured with precision."

²⁸ James Clancy and Chuck Crossett, "Measuring Effectiveness in Irregular Warfare," *Parameters*, Summer 2007, p. 88; Mark Stout, "Are We Winning Yet? Led Astray by Metrics," *War on the Rocks*, October 2, 2013.

²⁹ Gregory A. Daddis, *No Sure Victory: Measuring U.S. Army Effectiveness and Progress in the Vietnam War*, Oxford, UK: Oxford University Press, 2011; Scott Sigmund Gartner and Marissa Edson Myers, "Body Counts and 'Success' in the Vietnam and Korea Wars," *Journal of Interdisciplinary History*, Vol. 25, No. 3, Winter 1995.

ness and lethality at the tactical and even operational levels could undermine strategic goals, if, for instance, many civilians are also killed.

Our assessment began by identifying the United States' strategic and operational goals and then considered how airpower contributed to achieving these goals. The overriding objective was an enduring defeat of ISIS.³⁰ To achieve this, military operations sought to destroy the physical caliphate and eliminate the militants' ability to seize, hold, and govern territory. Additionally, the United States aimed to disrupt ISIS's finances and to pursue its leaders to degrade its command and control (C2).³¹ We did not assess the latter goal because these targeted killings were mostly conducted by SOF and intelligence agencies, and detailed information about this line of effort remains classified. These objectives are not mutually exclusive, as, for instance, controlling territory enabled ISIS to tax the population, which was a primary source of revenue. Nevertheless, we examine the movement of the front lines, comparing ISIS-controlled territory with that of the government of Iraq and Syrian partners, as well as damage to ISIS's oil and gas business and its cash holdings.

To explore airpower's contribution to territorial control and degradation of ISIS's finances, we examine in detail three counterland missions: CAS to Iraqi and Syrian forces, interdiction strikes against ISIS fighters and supplies, and strategic attacks against ISIS's oil enterprise and its cash stockpiles. We assess the performance and role of airpower in executing these missions and the overall relationship between air and land components.

Although operations against ISIS are still ongoing at the time of writing, our analysis applies to the first three phases of OIR, as defined by the coalition. Phase I, Degrade, occurred from August 2014 to March 2016; Phase II, Counterattack, took place from April 2016 to August 2017; and Phase III, Defeat, took place from August 2017 to March 2019. We conclude our analysis at the end of Phase III because it marked the operational defeat of ISIS, when it no longer held territory and shifted from being a state-like entity to operating as a loose insurgent movement.

Our geographic scope is limited to Iraq and Syria. ISIS branches have emerged in other locations since 2014—notably, Libya, Somalia, Egypt's Sinai Peninsula, and Afghanistan—resulting in U.S. or allied military operations against ISIS targets in these locations. However, although these strikes might have fallen under the broader rubric of OIR, they are distinct from the fight in Iraq and Syria and involve different participants, forces, and strategies.

After more than five years of fighting and with OIR still under way, our study does not seek to provide a comprehensive history of the operation in all its dimensions.

³⁰ Ash Carter, "A Lasting Defeat: The Campaign to Destroy ISIS," Belfer Center for Science and International Affairs, Harvard Kennedy School, October 2017, p. 8.

³¹ Ben Connable, Natasha Lander, and Kimberly Jackson, *Beating the Islamic State: Selecting a New Strategy for Iraq and Syria*, Santa Monica, Calif.: RAND Corporation, RR-1562-OSD, 2017, pp. 22–24.

As discussed above, because of sensitivity, U.S. SOF operations are an area in need of additional research. Because the focus of this report is on airpower, the critical coalition ground efforts in OIR—the train, advise, and assist missions for building Iraqi, Kurdish, and Syrian partners and the coordination and delivery of ground-based fires—are not emphasized. The report also does not focus on some of the smaller air activities in OIR, such as transport and attack helicopter aviation, combat search and rescue, or the USAF’s security cooperation efforts to rebuild the Iraqi Air Force. Finally, we largely exclude coalition special operations—including aviation special operations—from our discussion because of the unclassified nature of this study.

Airpower’s Contribution to OIR

Airpower was indispensable to defeating ISIS. Because the United States wanted a *limited liability, limited risk* approach that also produced an enduring outcome, the United States identified Iraqi and Syrian partner ground force operations as the primary effort.³² This in turn meant that CAS was prioritized over strategic attack operations. Airpower was critical to enabling partner ground operations by providing much-needed intelligence and precise firepower. Perhaps equally important, airpower bolstered these troops’ confidence and motivation against an enemy that waged sophisticated psychological warfare. RPAs accompanied partner forces from the skies above, enabling coalition airpower to be effectively integrated with the Iraqi and Syrian units without inserting joint terminal air controllers (JTACs) on the front lines. The physical caliphate was ISIS’s center of gravity, as control of territory was critical to the group’s strategy and ideological appeal, as well as its financial well-being, since extortion and taxation were its primary sources of revenue.³³ Additionally, strategic air strikes against ISIS’s oil business and its cash reserves further stressed the organization’s finances. These strategic strikes, however, were a small part of the overall air operations. Other deep strikes attempting to interdict ISIS’s LOCs proved tactically successful but operationally and strategically ineffective.

Despite the importance of airpower in OIR, there is significant debate over whether airpower was harnessed to its full potential, especially early in the operation.³⁴ Some have argued that airpower would have been employed more vigorously and to greater effect had an airman been in command of the operation. Critics also lambasted

³² We thank Adam Grissom for this term.

³³ Laurence Bindner and Gabriel Poirot, *ISIS Financing in 2015*, Paris: Center for the Analysis of Terrorism, May 2016, p. 4; Patrick B. Johnston, Moana Alami, Colin P. Clarke, and Howard J. Shatz, *Return and Expand? The Finances and Prospects of the Islamic State After the Caliphate*, Santa Monica, Calif.: RAND Corporation, RR-3046, 2019, pp. 20–23, 51–52.

³⁴ Daniel Byman, “The Limits of Air Strikes When Fighting the Islamic State,” *Lawfare*, December 5, 2016.

the Obama administration for the constraints that it imposed on the use of airpower in an effort to limit civilian casualties.³⁵ The evidence for these two claims is mixed. Even a USAF commander would have had difficulty prosecuting sustained strategic attacks against ISIS in the first months of the operation because of the intelligence problems that impeded the development of deliberate targets. Even after these problems had been fixed, it is unclear whether the strategic attacks against ISIS's finances could have been significantly expanded, given that these operations relied heavily on exquisite intelligence, and there was a finite number of targets. Once the major oil and banking targets had been neutralized, the remaining targets were mainly small smuggling operations and were not likely worth expending scarce resources while ground battles were ongoing. This is particularly true because control of territory provided most of ISIS's wealth.

In contrast, the centralization of authority to approve air strikes clearly limited the employment of airpower against ISIS in the first year of OIR. When target engagement authority (TEA) was delegated to lower echelons, airpower was able to be more responsive and effective against small, mobile ISIS targets, resulting in improved battlefield outcomes and significant pressure on the organization's finances. Moreover, members of the coalition and the Iraqi government proved willing to incur risk and tolerate an increased—although still limited—number of civilian casualties. Nevertheless, it is not clear that an expansion of TEA earlier in the operation would have accelerated the defeat of ISIS, because there were few Iraqi and Syrian partners capable and willing to go on the offensive, and the coalition did not have sufficient intelligence to systematically undertake strategic air strikes.

In this report, we seek to unpack these issues, detailing how airpower was applied in OIR and how it was related to strategic and operational outcomes. We chart the evolution of the joint air operations against ISIS, paying particular attention to counterland missions, as well as the critical enablers that aided these missions. We highlight the unique attributes of this air war, as well as changes that occurred in how airpower was applied. In so doing, we identify emerging and enduring issues for the USAF, the joint force, and coalition partners that can inform future coalition air operations. These relate to ongoing debates about the utility and the evolving nature of airpower, both in theory and in practice. Therefore, the findings of this study provide useful implications for future joint operations against both nonstate and near-peer adversaries.

This report is broken into two parts. The first provides the overall historical narrative of the operation and assesses progress made over time. This sets the context for the reader, which is important for the subsequent chapters, which look at particular

³⁵ Mark Gunzinger and John Stillion, "The Unserious Air War Against ISIS," *Wall Street Journal*, October 14, 2014; Benjamin S. Lambeth, "The U.S. Is Squandering Its Airpower," *Washington Post*, March 5, 2015; David A. Deptula, "How to Defeat the Islamic State," *Washington Post*, June 5, 2015; David A. Deptula, "The St. Andrews Proclamation: A Pragmatic Assessment of 21st Century Airpower," Arlington, Va.: Mitchell Institute for Aerospace Studies, June 2018.

airpower missions. The organization of this report is as follows: Chapters Two and Three provide a chronological overview of the air war against ISIS. Drawing on our data sets, we also examine how airpower was applied over the course of the operation and consider the overall effectiveness of air operations—in particular, whether and how airpower contributed toward territorial gains and overall progress toward the goal of defeating ISIS. Chapter Four examines the close fight, detailing six battles in Iraq and Syria that involved CAS, and assesses the integration of air and ground power and how effective airpower was at supporting the ground fight.³⁶ Chapter Five assesses deep-strike operations, examining four deliberately planned air operations against strategic targets and interdiction strikes beyond the front lines of the close fight. Chapter Six explores the application of DCA and air mobility, including airlift and aerial refueling, to enable other operations. The report concludes with an examination of the evolution of airpower in this campaign before providing recommendations, based on the OIR experience, to the USAF, the joint force, and coalition partners for future air wars against nonstate actors and near-peer competitors.

Four appendixes to this report are included as background to, or further explanation of, the main text. Appendix A is a timeline of political and military events in Iraq and Syria that unfolded over the course of the fight against ISIS. Appendix B is a discussion of OIR's C2 construct and how it evolved from 2014 to 2019. Appendix C is an unclassified air order of battle, listing coalition members' fixed-wing aircraft that participated in air operations and when and where the aircraft were deployed during the campaign. Appendix D provides information about how we created and coded our two data sets, noting the intricacies and limitations of the data.

³⁶ Throughout this report, we use the terms *close* and *deep fight* to describe air operations in different parts of the battlespace. This is aligned with how airmen informally think and talk about counterland operations, which delineate the battlespace *inside* the Fire Support Coordination Line (FSCL) as the close fight, where it provides CAS to troops in contact, and *outside* the FSCL as everywhere else in the area of operation. This conception of the battlespace is also similar to, but not the same as, the U.S. Army's operational framework, which divides the area of operations into *deep*, *close*, and *support*. For the Army, the close area is the area under the control of subordinate maneuver forces, while the deep area extends beyond the reach of maneuver units' capabilities and is under the command of higher-echelon units, such as a corps. The USAF concept of *deep operations* is much broader than the Army's concept. Army Techniques Publication 3-94.2, *Deep Operations*, Washington, D.C.: U.S. Army, September 2016.

PART I

The History of Airpower in Operation Inherent Resolve

The Air War Against the Islamic State, Phase I, August 2014–March 2016

Part I of this report provides an overview and overall assessment of airpower's contributions to the fight to defeat ISIS between August 2014 and March 2019. This high-level summary of the air war's progress includes the decision to intervene and the evolution of the operation, which initially focused on degrading ISIS, then shifted to counterattacking and whittling away ISIS's territory, and ultimately transitioned to defeating ISIS and eliminating the physical caliphate.

This chapter focuses on Phase I of the operation. We examine the United States' initial decision to take military action against ISIS and the multilateral strategy that the United States developed to defeat ISIS and explain why airpower was central to this effort. The discussion then moves to Phase I operations and assesses the progress made during the first 20 months of the operation.

The Decision to Intervene, June–August 2014

The self-proclaimed Islamic State emerged from the remnants of al-Qaeda in Iraq and, like its predecessor, had a strong base of support in the disaffected Sunni minority in Iraq, as well as the Sunni majority in Syria.¹ ISIS was the latest in a string of Sunni jihadist organizations that broadly adopted the radical Salafist Islamic ideology of al-

¹ For more on ISIS, see William McCants, *The ISIS Apocalypse: The History, Strategy and Doomsday Vision of the Islamic State*, New York: St. Martin's Press, 2015; Jessica Stern and J. M. Berger, *ISIS: The State of Terror*, New York: Ecco, 2015; Michael Weiss and Hassan Hassan, *ISIS: Inside the Army of Terror*, New York: Regan Arts, 2015; Daniel Byman, *Al Qaeda, the Islamic State, and the Global Jihadist Movement: What Everyone Needs to Know*, New York: Oxford University Press, 2015; Joby Warrick, *Black Flags: The Rise of ISIS*, New York: Doubleday, 2015; Lina Khatib, "The Islamic State's Strategy: Lasting and Expanding," Carnegie Middle East Center, June 29, 2015; Daniel Byman, *Road Warrior: Foreign Fighters in the Armies of Jihad*, New York: Oxford University Press, 2019; Howard J. Shatz and Erin-Elizabeth Johnson, *The Islamic State We Knew: Insights Before the Resurgence and Their Implications*, Santa Monica, Calif.: RAND Corporation, RR-1267-OSD, 2015; Patrick B. Johnston, Jacob N. Shapiro, Howard J. Shatz, Benjamin Bahney, Danielle F. Jung, Patrick Ryan, and Jonathan Wallace, *Foundations of the Islamic State: Management, Money, and Terror in Iraq, 2005–2010*, Santa Monica, Calif.: RAND Corporation, RR-1192-DARPA, 2016; Eric Robinson, Daniel Egel, Patrick B. Johnston, Sean Mann,

Qaeda. Unlike its precursors, ISIS aimed to immediately establish an Islamic state, or “rightly guided” caliphate, that was governed by its own extremist interpretation of sharia law. The outbreak of the Syrian civil war provided the nascent militant organization the time and space to gain strength and flourish in Syria’s ungoverned territories. ISIS employed conventional, guerrilla, and terrorist tactics to shock and intimidate and was able to seize, hold, and govern territory. To preserve its independence, ISIS eschewed donations and instead pursued a diverse financial strategy based on taxation, extortion, oil smuggling, and other illicit activities.

In the summer of 2014, ISIS launched a massive offensive in which it seized large portions of Iraqi territory and was threatening Baghdad. See Figure 2.1 for a map of ISIS territorial control. After ISIS conquered Mosul in June 2014, its leader, Abu Bakr al-Baghdadi, proclaimed the establishment of a caliphate. A week later, ISIS launched a major offensive into northwestern Iraq, seizing the cities of Samarra and Tikrit.² Five of the 18 Iraqi Army and Federal Police divisions stationed between Mosul and Tikrit collapsed within the attack’s first 48 hours, as U.S.-trained Iraqi soldiers and police abandoned their posts and ceded border crossings, strategic outposts, and storage depots to the advancing militants.³ On June 18, as ISIS militants battled for a major oil refinery in Tal Afar and rumors of an imminent attack on Baghdad circulated, Iraqi Prime Minister Nouri al-Maliki formally requested U.S. air strikes to halt the ISIS advance.⁴

The United States intervened reluctantly against ISIS. Even after the militants’ shocking summer 2014 offensive left large swaths of territory under ISIS control and its fighters were poised to threaten Baghdad from two axes, President Obama was hesitant to become involved in another prolonged and costly war in the Middle East.⁵ Initially, the United States employed military force against ISIS only to prevent a mass atrocity and to protect the lives of Americans in Iraq. Quickly, however, Obama concluded that that ISIS had “the capacity to set the whole region on fire. That’s why we have to fight it.”⁶ Still, the United States sought a *limited liability, limited risk* strategy instead of

Alexander D. Rothenberg, and David Stebbins, *When the Islamic State Comes to Town: The Economic Impact of Islamic State Governance in Iraq and Syria*, Santa Monica, Calif.: RAND Corporation, RR-1970-RC, 2017.

² For a U.S. account of the June 2014 offensive, see Brett McGurk, “Iraq at a Crossroads: Options for U.S. Policy,” testimony before the U.S. Senate Foreign Relations Committee, Washington, D.C., July 24, 2014.

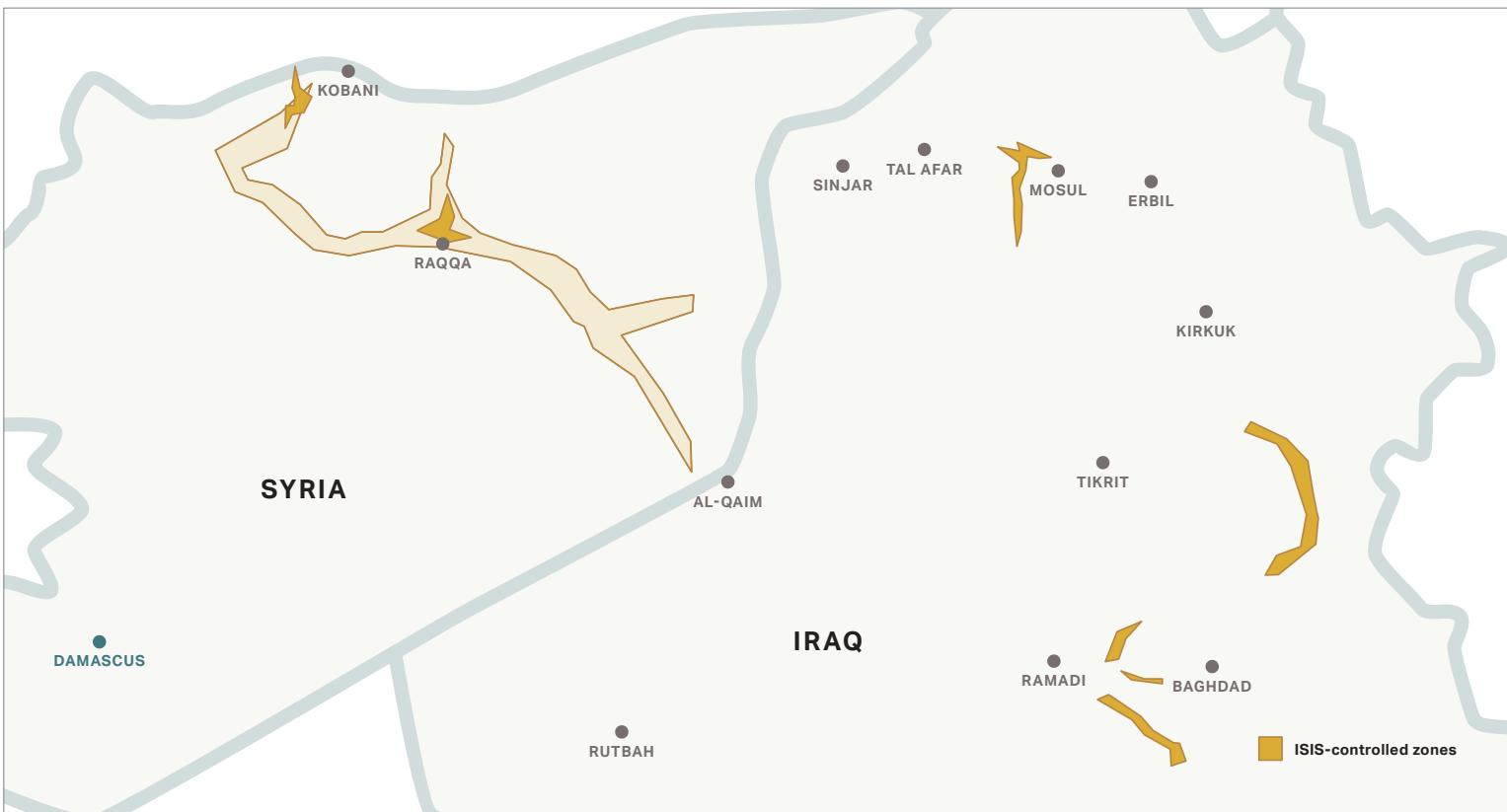
³ Brett McGurk, “Iraq at a Crossroads: Options for U.S. Policy,” testimony before the U.S. Senate Foreign Relations Committee, July 24, 2014; Rod Nordland and Alissa J. Rubin, “Iraq Insurgents Reaping Wealth as They Advance,” *New York Times*, June 20, 2014.

⁴ Ghazwan Hassan and Phil Stewart, “Iraq Asks United States for Air Support to Counter Rebels,” Reuters, June 18, 2014.

⁵ Seth G. Jones, James Dobbins, Daniel Byman, Christopher S. Chivvis, Ben Connable, Jeffrey Martini, Eric Robinson, and Nathan Chandler, *Rolling Back the Islamic State*, Santa Monica, Calif.: RAND Corporation, RR-1912, 2017, p. 85. According to the authors, at its peak, ISIS controlled 5,800 square kilometers in Iraq.

⁶ Jeffrey Goldberg, “The Obama Doctrine,” *The Atlantic*, April 2016.

Figure 2.1
Map of ISIS Territorial Control, June 10, 2014



another major U.S. ground war.⁷ The tool that immediately enabled the United States to intervene against ISIS without committing large numbers of American troops was airpower.⁸

An early critic of the decision to invade Iraq in 2003, President Obama believed that American policymakers had grown overly reliant on the military, and he argued for a greater emphasis on economic and diplomatic tools of statecraft, while force was reserved as a tool of last resort or self-defense.⁹ He demonstrated a willingness to authorize limited military operations, overseeing the rapid expansion in U.S. drone operations against extremist groups in Southwest Asia and Africa, but proved reluctant to intervene in humanitarian or civil conflicts. Obama demonstrated a preference for multilateral interventions, arguing that the United States' strength rested in its unique capacity to mobilize and lead international coalitions.¹⁰ He also sought to extract the United States from what he viewed as never-ending wars in the Middle East and North Africa, which indefinitely committed the United States to policing and governing the region. Consequently, Obama resisted pressure to intervene in the Syrian civil war from Arab partners, such as Saudi Arabia, Qatar, and the United Arab Emirates, and instead opted to “contain and mitigate” the conflict, which he viewed as having few direct implications for U.S. national security.¹¹ Therefore, it was not surprising that the President was initially averse to employing the military to counter ISIS, particularly when faced with the absence of clear and effective Syrian and Iraqi partners for such an operation.

The United States conditioned any future American military action on the formation of a representative government in Baghdad, arguing that the sectarian policies of al-Maliki’s government contributed to ISIS’s appeal.¹² “The bottom line here is that Iraqis have to pull together to defeat this enemy,” Vice President Joe Biden told report-

⁷ This phrase was coined by our colleague Adam Grissom to refer to U.S. counterterrorism operations in Africa, but it also applies here.

⁸ Airpower had become the “instrument of choice” for policymakers. Karl P. Mueller, *Air Power*, Santa Monica, Calif.: RAND Corporation, RP-1412, 2010, p. 7.

⁹ Barack Obama, “Remarks by the President at the Acceptance of the Nobel Peace Prize,” transcript, White House, December 10, 2009. For Obama’s views on the use of force, see Barack Obama *The Audacity of Hope: Thoughts on Reclaiming the American Dream*, New York: Random House, 2006; Derek Chollet, *The Long Game: How Obama Defied Washington and Redefined America’s Role in the World*, New York: Public Affairs, 2016, pp. 69, 79–81; Jeffrey Goldberg, “The Obama Doctrine,” *The Atlantic*, April 2016.

¹⁰ Barack Obama, “Remarks by the President at the Acceptance of the Nobel Peace Prize,” transcript, White House, December 10, 2009.

¹¹ Derek Chollet, *The Long Game: How Obama Defied Washington and Redefined America’s Role in the World*, New York: Public Affairs, 2016, p. 139; Ben Hubbard and Anne Barnard, “Clashing Goals in Syria Strikes Bedevil Obama,” *New York Times*, September 25, 2014.

¹² Lead Inspector General for Overseas Contingency Operations, *Operation Inherent Resolve: Quarterly Report and Biannual Report to the United States Congress; December 17, 2014–March 31, 2015*, Washington, D.C.: U.S. Department of State, 2015.

ers, adding that this would require “setting aside sectarianism, building an inclusive security force and ensuring that voices of all communities in Iraq are heard.”¹³

What would have happened if the United States had decided to forcefully intervene in mid-June at al-Maliki’s request? Counterfactual analysis is difficult, but one can imagine that, with the appropriate authorities, U.S. aircraft already in the region, along with some rapid reinforcements, could have slowed—if not stopped—ISIS’s offensives earlier.¹⁴ These large offensives required ISIS to mass forces, making them an easy target for airpower. Thus, the United States might have been able to limit the gains made by ISIS in Iraq. Subsequent events suggest, however, that airpower alone would not have been effective at dislodging ISIS from territory it already controlled. Moreover, removing al-Maliki from power would likely have been more difficult, leaving the United States supporting a sectarian and dysfunctional Iraqi government that inflamed the underlying issues that generated support for ISIS within the Sunni population.

ISIS’s assault stunned Washington. Within the span of a mere two weeks, the group had shattered Iraq’s U.S.-trained security forces, fanned the country’s sectarian fires, and seized territory and, with it, millions in cash, weaponry, ammunition, and equipment—much of it American supplied—from Iraqi banks and Army depots.¹⁵ The militants’ rapid assault contradicted previous estimates of the group’s strength and forced senior officials to reconsider their assumption that the threat could be contained to Syria. “I don’t think we truly understood the depth of the problem until the fall of Mosul,” one of the president’s advisers remarked.¹⁶ U.S. intelligence had missed the fact that ISIS had been systematically preparing the battlespace in Iraq with a series of suicide bombings and assassinations, which encouraged the Iraqi forces to collapse during the ISIS offensive.¹⁷ There were serious deliberations within the White House about evacuating the U.S. embassy in Baghdad for fear of another Benghazi situation.¹⁸

On June 19, a day after the attack on the Tal Afar refinery, the White House announced that the United States had augmented its ISR aircraft in Iraq and was

¹³ Arshad Mohammed, Matt Spetalnick, and Tricia Zengerle, “U.S. Puts Onus for Peace on Iraqis; Obama to Brief Lawmakers,” Reuters, June 17, 2014.

¹⁴ Another counterfactual analysis reaches a similar conclusion: Hal Brands and Peter Feaver, “Was the Rise of ISIS Inevitable?” *Survival*, Vol. 59, No. 3, June–July 2017.

¹⁵ Liz Sly and Ahmed Ramadan, “Insurgents Seize Iraqi City of Mosul as Security Forces Flee,” *Washington Post*, June 10, 2014; Liz Sly and Abigail Hauslohner, “U.S. Starts Removing Embassy Staff from Baghdad as ISIS Grabs Iraqi Town of Tal Afar,” *Washington Post*, June 15, 2014.

¹⁶ Martin Smith, “Obama at War,” *Frontline*, May 26, 2015; Derek Chollet, *The Long Game: How Obama Defied Washington and Redefined America’s Role in the World*, New York: Public Affairs, 2016, pp. 148–149.

¹⁷ Susan Glasser, John R. Allen, Lise Grande, and Brett McGurk, “The Counter-ISIS Coalition: Diplomacy and Security in Action,” panel, Washington, D.C., Brookings Institution, September 10, 2019.

¹⁸ Susan Glasser, John R. Allen, Lise Grande, and Brett McGurk, “The Counter-ISIS Coalition: Diplomacy and Security in Action,” panel, Washington, D.C., Brookings Institution, September 10, 2019.

prepared to use the newly established Counterterrorism Partnerships Fund to set up joint operations centers to share intelligence, coordinate military planning, and provide additional equipment.¹⁹ Additionally, DoD had taken steps to position additional military assets in the region and would deploy up to 300 military advisers to evaluate the needs of the Iraqi Security Forces (ISF) and prepare a training program. The President added that he was ready to take “targeted and precise military action, if and when the situation on the ground requires it”—a threat, administration officials clarified, that included a campaign of air strikes that could extend into Syria.²⁰ As a part of these preparations, U.S. Central Command (CENTCOM) designated U.S. Army Central (ARCENT), an operational-level force and the Army’s component to CENTCOM led by a three-star general, as a Joint Force Land Component Command (JFLCC) for operations in Iraq because it had forces in the region, ties to Iraqi partners, and the capability to quickly command and control operations.²¹ In contrast, the USAF did not have a readily available joint task force—trained and —capable headquarters.²² Moreover, the AFCENT Commander was already stretched, as he was responsible for air operations in the entire CENTCOM area of responsibility (AOR), which included Afghanistan, Yemen, and Iran. This decision put the ARCENT Commander and his staff in charge of anti-ISIS operations in Iraq, which imprinted a significant ground mindset on the operation, even though the main weapon likely to be employed—at least initially—was airpower.

Meanwhile, ISIS continued to consolidate its position in Iraq, where it controlled most of the major Sunni urban areas and major Syrian border crossing by transporting equipment and weapons from Syria into Iraq.²³ After the fall of Mosul, Shiite Grand Ayatollah Ali al-Sistani issued a fatwa calling on Shiite men to defend their country from ISIS, which led to the creation of an umbrella militia organization called the

¹⁹ Deputy Secretary McGurk later testified that Defense Secretary Chuck Hagel ordered the USS *Mesa Verde*, carrying a complement of MV-22 Osprey tilt-rotor aircraft, into the Persian Gulf on June 16, where it joined the aircraft carrier USS *George H.W. Bush*, a cruiser, and three destroyers. See Brett McGurk, “Iraq at a Crossroads: Options for U.S. Policy,” testimony before the U.S. Senate Foreign Relations Committee, Washington, D.C., July 24, 2014; Mark Landler and Michael R. Gordon, “U.S. to Send up to 300 Military Advisers to Iraq,” *New York Times*, June 19, 2014.

²⁰ Barack Obama, “Remarks by the President on the Situation in Iraq,” transcript, White House, June 19, 2014. The president first publicly recognized the prospect of U.S. military action three days earlier. See Barack Obama, “Statement by the President on Iraq,” transcript, White House, June 13, 2014.

²¹ Center for Army Lessons Learned, *ARCENT Transition to Combined Joint Task Force—Operation Inherent Resolve: Lessons and Best Practices*, Fort Leavenworth, Kan., March 2016; RAND interview with LTG (ret.) James L. Terry, March 27, 2020.

²² In 2018, Ninth Air Force was certified as a joint task force—capable headquarters. Amanda Dick, “Ninth AF Certifies as JTF-Capable HQ with Joint, Coalition Partners,” U.S. Air Force, December 18, 2018.

²³ Alissa J. Rubin and Duraid Adnan, “Iraq’s Hold on Border Crossings Weakening as at Least 34 Are Killed in Battle,” *New York Times*, June 20, 2014.

Popular Mobilization Forces (PMF).²⁴ These Shia mobilization groups aligned with al-Maliki slowed the group's advance, but only somewhat. A Pentagon assessment concluded that only half of the Iraqi Army's operational units met the basic standards for American assistance. Baghdad now depended on Iranian-trained and -advised Shia militia groups to conduct basic operations—many of which had previously fought the U.S. and coalition presence.²⁵

On August 1, ISIS turned north, and, within three days, the militants routed Kurdish Peshmerga forces—widely viewed in Washington as more capable than the ISF—and seized control of Wana, Sinjar, and Zummar, putting the group within striking distance of Mosul Dam, the country's largest source of electricity and water, and the Kurdish capital of Erbil.²⁶ Fearing that ISIS might destroy the dam and flood Iraq's second-largest city and propel a 15-foot tidal wave hundreds of miles toward Baghdad,²⁷ the United States began to prepare contingency plans to respond to an ISIS effort to weaponize the potential deluge.²⁸ Meanwhile, ISIS consolidated control of the Nineveh governorate and trapped an estimated 40,000–50,000 Yazidi refugees in the inhospitable Sinjar Mountains.²⁹ The Yazidis are a minority in Iraq and adherents of a monotheistic religion that blends elements of Judaism, Nestorian Christianity, and Islam. Because ISIS considers the Yazidis infidels, it sought to eliminate them through genocide.³⁰ Reports of mass executions and the enslavement of hundreds of Yazidi women triggered an international call for action. The situation in Iraq had reached a “tipping point,” according to Ben Rhodes, a former presidential adviser.³¹

On August 7, President Obama announced that he had “authorized two operations in Iraq—targeted airstrikes to protect our American personnel, and a humani-

²⁴ Kirk H. Sowell, “The Rise of Iraq’s Militia State,” *Sada* (Carnegie Endowment for International Peace), April 23, 2015.

²⁵ Alissa J. Rubin and Michael R. Gordon, “Iraq’s Military Seen as Unlikely to Turn the Tide,” *New York Times*, June 22, 2014; Eric Schmitt and Michael R. Gordon, “U.S. Sees Risks in Assisting a Compromised Iraqi Force,” *New York Times*, July 13, 2014.

²⁶ Loveday Morris, “Islamic State Seizes Town of Sinjar, Pushing Out Kurds and Sending Yazidis Fleeing,” *Washington Post*, August 3, 2014. There were also some members of the Sunni PMF.

²⁷ Thomas Gibbons-Neff, “This Is What Could Happen If the Islamic State Destroys the Mosul Dam,” *Washington Post*, August 8, 2014.

²⁸ Ben Rhodes, *The World as It Is*, New York: Random House, 2018.

²⁹ Tim Arango, “Sunni Extremists in Iraq Seize 3 Towns from Kurds and Threaten Major Dam,” *New York Times*, August 3, 2014; Naomi Kikoler, “Our Generation Is Gone”: *The Islamic State’s Targeting of Iraqi Minorities in Nineva*, Washington, D.C.: United States Holocaust Memorial Museum, 2015.

³⁰ Valeria Cetorelli, Isaac Sasson, Nazar Shabila, and Gilbert Burnham, “ISIS’ Yazidi Genocide: Demographic Evidence of the Killings and Kidnapping,” *Foreign Affairs*, June 8, 2017. In the end, nearly 9,900 Yazidis were kidnapped or killed in August.

³¹ Ben Rhodes, *The World as It Is*, New York: Random House, 2018.

tarian effort” to save the Yazidis trapped on Mount Sinjar.³² Moreover, “at the request of the Iraqi government,” the United States would use its “unique capabilities to help avert a massacre” and “to prevent a potential act of genocide.”³³ Three years after the last combat forces withdrew from Iraq, and seven weeks after Prime Minister al-Maliki’s first request for U.S. air strikes, U.S. forces resumed combat operations in Iraq.

The First Air Strikes, August 8–9 2014

On the evening of August 8, a B-1B Lancer from the 9th Expeditionary Bomb Squadron was on the ramp at AUAB in Qatar preparing to take off to conduct a mission over Afghanistan when it unexpectedly received new orders to fly to northern Iraq on a mission to counter ISIS fighters threatening Erbil. There were no preplanned targets for the B-1, so once the bomber arrived on station, the crew used its Sniper Advanced Targeting Pod to search for ISIS units or vehicles. After scanning the area and observing suspicious traffic, the B-1 crew eventually located an ISIS artillery site. The target was validated, but the Lancer was not given authority to drop its bombs because the government of Qatar had not been consulted about the strike mission over Iraq.³⁴ Consequently, the B-1 passed the target to two F/A-18 Hornets from Strike Fighter Squadron 213 from the USS *George H.W. Bush* (CVN-77) aircraft carrier in the Arabian Sea, which arrived near Erbil after receiving gas from a USAF KC-135 tanker aircraft.³⁵ The F/A-18 fighters dropped 500-pound GBU-54 laser-guided-bombs (LGBs) on the ISIS artillery site, silencing a gun that had previously been shelling Kurdish forces.³⁶ A few hours later, an RPA fired a Hellfire missile at an ISIS mortar location while, in two passes, four F/A-18 fighters dropped eight LGBs on a parked convoy of seven ISIS vehicles and a mortar position on the outskirts of Erbil.³⁷ The next day, two F-15E Strike Eagles and two F-16C Fighting Falcons launched eight strikes against ISIS units

³² Helene Cooper, Mark Landler, and Alissa J. Rubin, “Obama Allows Limited Airstrikes on ISIS,” *New York Times*, August 7, 2014.

³³ Barack Obama, “Statement by the President,” speech delivered at the White House State Dining Room, Washington, D.C., August 7, 2014.

³⁴ Joe Pappalardo, “Year One: Inside the Air War Against ISIS,” *Popular Mechanics*, September 21, 2015; AFHRA interview with Col Jose E. Sumangil, September 23, 2019. The Qataris had authorized nonlethal operations over Iraq, but the United States had not inquired about combat operations. Not long after these first strikes, the Qataris permitted USAF aircraft to use AUAB to support combat operations.

³⁵ Dan Lamothe, “Why F/A-18F Super Hornets Dropped the First U.S. Bombs in Iraq,” *Washington Post*, August 11, 2014. The F/A-18s were not restricted from striking, because a U.S. carrier is considered sovereign and therefore does not require permissions from the host nation. RAND interview with U.S. Navy officer, January 28, 2020.

³⁶ John Kirby, “Statement by Pentagon Press Secretary Rear Admiral John Kirby on Airstrikes in Iraq,” transcript, U.S. Department of Defense, August 8, 2014.

³⁷ John Kirby, “Statement by Pentagon Press Secretary Rear Admiral John Kirby on Airstrikes in Iraq,” transcript, U.S. Department of Defense, August 8, 2014.

that were advancing on Erbil, hitting command posts, training camps, and combat vehicles.³⁸

Meanwhile, U.S. cargo aircraft, operating from Qatar and Kuwait, alleviated the humanitarian crisis on Mount Sinjar by air-dropping food and water to the Yazidis, who had been trapped for more than a week with few provisions.³⁹ On August 7, a C-17 Globemaster and two C-130 Hercules escorted by F-16 fighters dropped 72 bundles of supplies, followed by additional airdrops the next evening, bringing the total supplies provided within two days of operations to 36,224 meals and 6,822 gallons of fresh drinking water.⁴⁰ The Pentagon also announced the deployment of an additional 130 U.S. Marine Corps and unspecified SOF military advisers to assist in planning for the evacuation of Mount Sinjar, although American officials insisted that U.S. ground forces would not engage in combat.⁴¹ Over the next seven nights, nine C-17 and 16 C-130 cargo aircraft participated in the relief effort and delivered more than 35,000 gallons of water and more than 100,000 meals to the beleaguered Yazidis.⁴² Although some of the drops reportedly missed their target, the nourishment provided by the airdrops enabled thousands of Yazidis to flee the mountain. To clear a path for their exit, two F-16 fighters from the 13th Expeditionary Fighter Squadron flew nearly 900 nautical miles round trip to Mount Sinjar in a demanding eight-hour mission. At Mount Sinjar, the fighters shattered the ISIS blockade with four precise strikes, which destroyed three barriers, multiple armored vehicles, and an observation post, and killed dozens of fighters.⁴³ Fleeing the air strikes, the remaining ISIS fighters dispersed, which opened the way for an estimated 35,000–45,000 Yazidis to escape.⁴⁴

Limited Combat Operations in Iraq, August 2014

These air strikes and relief operations, however, did not immediately lead to an extensive effort to systematically defeat ISIS. Throughout August, U.S. aircraft were authorized to launch targeted strikes to defend American personnel and prevent mass humanitarian suffering as the United States considered options for a broader intervention in Iraq, despite al-Maliki remaining in power. CENTCOM officials developed contingency plans to ensure the security of Americans in Iraq and to avoid humanitar-

³⁸ Joe Pappalardo, “Year One: Inside the Air War Against ISIS,” *Popular Mechanics*, September 21, 2015.

³⁹ For more on the humanitarian airdrop at Mount Sinjar, see Chapter Six.

⁴⁰ U.S. Department of Defense, “Update on Humanitarian Assistance Operations Near Sinjar, Iraq,” August 8, 2014.

⁴¹ Helene Cooper, “In Increase, U.S. to Send 130 Advisers to Aid Iraqis,” *New York Times*, August 12, 2014.

⁴² Jennifer Hlad, “Breaking the Siege on Sinjar,” *Air Force Magazine*, September 28, 2015.

⁴³ These F-16C pilots won the 2014 Mackay Trophy for this mission. See Benjamin W. Stratton, “Misawa Pilots Save Iraqi Civilians, Earn 2014 Mackay Trophy,” U.S. Indo-Pacific Command, December 15, 2015.

⁴⁴ Liz Sly, “Exodus from the Mountain: Yazidis Flood into Iraq Following U.S. Airstrikes,” *Washington Post*, August 10, 2014.

ian tragedies. They identified a number of red lines, including threats to religious sites, critical infrastructure, and U.S. installations, that if ISIS crossed would prompt a U.S. decision about whether to launch air strikes.⁴⁵

On August 14, Prime Minister al-Maliki resigned and President Obama authorized U.S. air strikes to support a combined Kurdish-Iraqi offensive to retake Mosul Dam.⁴⁶ In pointed public warnings throughout the summer, senior American officials had pressed al-Maliki to bring marginalized Sunni and Kurdish minorities into the political process, arguing that his government's autocratic and ineffective policies contributed to ISIS's appeal.⁴⁷ Al-Maliki's departure removed one of the key obstacles to greater U.S. involvement, as the United States had conditioned any future American military action on the formation of a representative government in Baghdad.

Nevertheless, Mosul Dam was not a clear-cut case in which ISIS crossed one of the redlines recently established by CENTCOM, as the dam had been under ISIS control since before the first U.S. air strike. Yet the President decided that the risk of leaving the largest dam in Iraq in ISIS's hands was too great. If ISIS deliberately damaged or inadequately maintained this critical piece of infrastructure, which required extensive daily upkeep, it would flood much of the country, including locations with U.S. personnel in Baghdad. On August 15, to prepare the battlefield for the ground assault, U.S. fighters, bombers, and RPAs began three days of bombardment and destroyed 90 ISIS targets, including vehicles, equipment, and fighting positions.⁴⁸ The Kurdish Peshmerga, the military forces of the autonomous Kurdish region of Iraq, and elite Iraqi Counter Terrorism Service (CTS), Iraq's special operations force, began their offensive on August 17; by the next day, they had cleared the dam complex of the nearly 500 ISIS fighters.⁴⁹

The Mosul Dam operation was the first time that U.S. aircraft provided CAS to Kurdish and Iraqi forces, which involved engaging "targets that are in close proximity to friendly forces and that require detailed integration of each air mission with the

⁴⁵ RAND interview with LTG (ret.) James L. Terry, March 27, 2020.

⁴⁶ White House, "Letter from the President—War Powers Resolution Regarding Iraq," press release, August 17, 2014.

⁴⁷ Lead Inspector General for Overseas Contingency Operations, *Operation Inherent Resolve: Quarterly Report and Biannual Report to the United States Congress; December 17, 2014–March 31, 2015*, Washington, D.C.: U.S. Department of State, 2015.

⁴⁸ John Kirby, "Statement by Pentagon Press Secretary Rear Admiral John Kirby on Airstrikes in Iraq," transcript, U.S. Department of Defense, August 8, 2014.

⁴⁹ Nour Malas and Tamer El-Ghobashy, "Militants Driven from Mosul Dam; Iraqi and Kurdish Forces, Backed by U.S. Airstrikes, Push Out Islamic State," *Wall Street Journal*, August 18, 2014. For more on the Peshmerga and the CTS, see Linda Robinson, *Assessment of the Politico-Military Campaign to Counter ISIL and Options for Adaptation*, Santa Monica, Calif.: RAND Corporation, RR-1290-OSD, 2016, pp. 37–40.

fire and movement of those forces” to avoid accidentally striking friendly forces.⁵⁰ A JTAC is normally on the battlefield with the ground troops calling for air support and is responsible for coordinating the attack.⁵¹ In OIR, however, JTACs and U.S. advisers were not initially authorized to accompany partner forces on the front lines, which led to a non doctrinal innovation for targeting and the approval of fires—the strike cell.⁵²

Strike cells are command posts led by a one-star U.S. officer who has TEA and is responsible for validating and authorizing each air strike.⁵³ Iraqi or Kurdish officers were also present in the strike cells—albeit physically located in a separate section of the post, apart from U.S. and coalition personnel—and had to approve every bomb dropped in Iraq. The strike cell was an in-stride adaptation that had its roots in SOF tactics, techniques, and procedures for air-ground integration and the joint air-ground integration center (JAGIC).⁵⁴ Most CAS missions provide fires in response to emergent targets—that is, ones that were not deliberately planned or included on the air tasking order (ATO)—and engagement decisions had to be made quickly. Either frontline Iraqi forces or members of the strike cell could nominate targets, which were then vetted and planned by a JTAC, an ISR liaison officer, a collateral damage estimation and weaponeering specialist, a weather officer, and an Army operational lawyer. Ultimately, the one-star general and the Iraqi or Kurdish partner both had to approve that something was a valid target for it to be engaged. This process was possible because strike cells had legal and operational experts who were watching several RPA full-motion video (FMV) feeds of the battlefield, as well as access to other ISR assets. Additionally, the strike cell was connected to the sensors, shooters, and ground forces with high-bandwidth communications. In the case of the Mosul Dam operation, the

⁵⁰ Curtis E. LeMay Center for Doctrine Development and Education, Air University, *Counterland Operations*, Annex 3-03, Maxwell Air Force Base, Ala., February 5, 2019. See also Joint Publication 3-09, *Joint Fire Support*, Washington, D.C.: Joint Chiefs of Staff, April 10, 2019.

⁵¹ Joint Publication 3-09, *Joint Fire Support*, Washington, D.C.: Joint Chiefs of Staff, April 10, 2019; Benjamin S. Lambeth, *Air Power Against Terror: America’s Conduct of Operation Enduring Freedom*, Santa Monica, Calif.: RAND Corporation, MG-166-1-CENTAF, 2006, pp. 258–262.

⁵² Because the strike cells are non doctrinal, they were not standardized, which led to varying levels of proficiency and effectiveness. RAND interview with USAF officer, July 30, 2020.

⁵³ The Joint Staff J-7 Joint Lessons Learned Division, “USCENTCOM Strike Cell Study,” June 1, 2018; email correspondence with former USAF officer, April 15, 2020; RAND interview with Maj Gen (ret.) Scott Zobrist, December 2, 2019; RAND interview with USAF official, December 2, 2019; RAND interview with USAF officer, February 4, 2020; Justin Fishel, Martha Raddatz, and Luiz Martinez, “Inside the US Command Center at the Front Lines of ISIS Fight,” ABC News, November 19, 2015.

⁵⁴ JAGICs are command posts that enable the division to manage its own airspace by colocating members from the land and air components responsible for integrating fires and air operations. See Army Techniques Publication 3-91.1, *The Joint Air Ground Integration Center*, Washington, D.C.: U.S. Department of the Army, April 2019. In OIR, the United States did not want to deploy formal JAGIC capabilities, and the fact that many strike cells did not have JAGIC training affected their proficiency. RAND email exchange with USAF officer, July 31, 2020.

United States had a strike cell at the Combined Joint Operations Center (CJOC) in Erbil that was responsible for air strikes in the Kurdish region, and there was also a strike cell at the CJOC in Baghdad, which approved fires in the rest of Iraq.⁵⁵ Air-to-ground coordination and the Mosul Dam operation are described in greater detail in Chapter Four.

The SOF strike cells, which controlled air-to-ground integration in Syria, served the same function as the CJOCs in Iraq, but they were much smaller than the Iraqi command posts. One of the early Syria strike cells had only three people in it, but over time, as the mission grew, the staff expanded but capped out at around 20 people. With this relatively lean staff, the SOF strike cell was able to provide fires support to the SDF around the clock. In contrast to the CJOCs, the commander of a SOF strike cell was a major, although this commander did not have TEA until after authorities were delegated down.⁵⁶ A second difference was that the physical location of the SOF strike cells moved, whereas the CJOCs remained at Union III in Baghdad and the Erbil International Airport for most of the campaign.

When ISIS went on the offensive in 2013 and 2014, it began to capture Westerners in Syria, mainly journalists and aid workers, and held them captive. The militants sought to trade the hostages for ransom, but after the U.S. air strikes to liberate Mosul Dam, ISIS beheaded James Foley, an American journalist, and released a video of the brutal killing in retaliation for the U.S. attacks.⁵⁷ At the same time, ISIS threatened to kill another hostage, Steven Sotloff, if the U.S. offensive continued.⁵⁸ President Obama was “appalled” by the killing, but ISIS’s executions of hostages also shifted the general public sentiment in favor of military action against the organization.⁵⁹

The United States continued limited strikes in support of averting humanitarian disasters, including efforts to break ISIS’s two month siege of the Turkmen community at Amirli, while British, French, Australian, and American cargo aircraft air-dropped food, water, and medical supplies.⁶⁰ As U.S. aircraft continued limited combat operations over Iraq, the announcement that the United States would begin manned and unmanned reconnaissance flights over Syria on August 26 fueled speculation that the

⁵⁵ Dana Pittard and Wes Bryant, *Hunting the Caliphate: America’s War on ISIS and the Dawn of the Strike Cell*, New York: Post Hill Press, 2019.

⁵⁶ RAND interview with USAF officer, August 20, 2020.

⁵⁷ Rukmini Callimachi, “The Horror Before the Beheadings,” *New York Times*, October 25, 2014.

⁵⁸ Rukmini Callimachi, “Militant Group Says It Killed American Journalist in Syria,” *New York Times*, August 19, 2014.

⁵⁹ Michael D. Shear and Julie Hirschfeld Davis, “Obama, ‘Appalled’ by Beheading, Will Continue Airstrikes,” *New York Times*, August 20, 2014.

⁶⁰ Matt Bradley and Julian Barnes, “Iraq Crisis: U.S. Airstrikes Help Break Islamic States Siege on Amirli,” *Wall Street Journal*, September 1, 2014; USAF, “AF Conducts Airstrikes Against ISIL, Airdrops Humanitarian Aid Near Amirli,” September, 2, 2014.

administration was preparing for a larger air operation.⁶¹ Yet a few days later, the President held a press conference in which he emphasized the limited nature of the operation and admitted that “we don’t have a strategy yet.”⁶²

By the end of August, the United States had flown 949 air-to-ground sorties, but at least one weapon was released in only 100 of those sorties, and, in total, only 211 weapons were dropped on ISIS targets. Additionally, the United States flew 332 ISR aircraft sorties to find and monitor ISIS targets and 675 tanker sorties to refuel U.S. aircraft, 3,971 times, that were primarily flying from relatively distant bases in the Persian Gulf. Finally, cargo aircraft flew 162 sorties and air-dropped 910,000 pounds of supplies, mainly in support of humanitarian relief efforts.⁶³ These figures demonstrate that U.S. aircraft were increasingly undertaking operations to counter ISIS, but in comparison to other recent air operations—even limited ones—this intervention was small. For instance, the 1995 U.S. air war against the Serbs in Bosnia and Herzegovina (Operation Deliberate Force) lasted only three weeks, but the United States and its allies flew 3,500 combat sorties, an average of 1,200 a week—more than three times what U.S. aircraft had flown over a comparable period against ISIS. Neither Operation Deliberate Force nor the initial month of air strikes against ISIS hold a candle to the large 1991 air campaign against Iraq (Operation Desert Storm), in which the United States averaged 19,800 sorties per week for six weeks and flew more than 118,000 total sorties.⁶⁴

A Multilateral Strategy to Defeat ISIS, September 2014

Although U.S. operations remained limited, preparations to broaden the operation and go on the offensive continued as the scale of ISIS’s territorial holdings, its extensive and diverse revenue streams, and its capacity to rally foreign fighters across the globe persuaded Obama that the group presented a direct threat to U.S. interests—and potentially the U.S. homeland. Additionally, the brutality of ISIS’s tactics, darkly illustrated in a series of videos depicting the beheading of American and European hostages in retaliation for the air strikes, further hardened the President’s resolve.⁶⁵

⁶¹ “Obama Approves Surveillance Flights,” BBC, August 26, 2014.

⁶² Barack Obama, “Statement by the President,” transcript, White House, August 28, 2014.

⁶³ AFCENT, *Combined Forces Air Component Commander 2010–2014 Airpower Statistics*, Shaw Air Force Base, S.C., August 31, 2014.

⁶⁴ Karl P. Mueller, ed., *Precision and Purpose: Airpower in the Libyan Civil War*, Santa Monica, Calif.: RAND Corporation, RR-676-AF, 2015, p. 4.

⁶⁵ Jeffrey Goldberg, “The Obama Doctrine,” *The Atlantic*, April 2016.

But the administration did not want to act alone.⁶⁶ By sharing the burden and strengthening partners in Iraq and Syria, Washington could take advantage of other countries' expertise, especially their understanding of the physical and sociopolitical terrain, and avoid “own[ing]” the ISIS problem outright,” thereby preserving its ability to disengage if needed.⁶⁷ Moreover, effectively countering a transnational, hybrid threat such as ISIS required coordination and cooperation in the diplomatic, military, economic, and information domains to destroy the physical caliphate while ensuring that the liberation process did not precipitate a humanitarian crisis.⁶⁸ John Allen, the former presidential envoy for the counter-ISIS campaign, later pointed out that a coalition produced “the moral suasion of accumulation,” providing the defeat-ISIS strategy with much-needed international legitimacy, which in turn encouraged regional partners hesitant to align publicly with the United States.⁶⁹ The support of Arab and Muslim-majority states was believed to be especially important because it countered the jihadist narrative that the United States and West were imperial powers invading and subjugating Muslim populations.

The campaign to recruit a broad global coalition began in earnest in early September. U.S. officials emphasized the variety of ways in which countries could contribute to the coalition, underscoring that coordinated economic, political, humanitarian, and ideological actions would be needed over a period of years in addition to military operations. In a communiqué released on September 5, the United Kingdom, France, Australia, Canada, Germany, Turkey, Italy, Poland, and Denmark pledged to coordinate efforts to bolster the Iraqi government; combat ISIS’s financing, recruitment, and propaganda; and ease the humanitarian crisis.⁷⁰ At an emergency meeting of the Arab League in Cairo on September 7, regional leaders pledged to “do their share” to combat ISIS and issued a joint communiqué supporting the United States’ broad strategy to

⁶⁶ Obama’s creation of an ad hoc coalition to fight ISIS was in some ways quite similar to President George W. Bush’s coalition of the willing that was assembled for the 2003 invasion of Iraq. Justin Wm. Moyer, “Islamic State: Why Obama Doesn’t Say ‘Coalition of the Willing,’” *Washington Post*, September 15, 2014.

⁶⁷ Derek Chollet, *The Long Game: How Obama Defied Washington and Redefined America’s Role in the World*, New York: Public Affairs, 2016, p. 149; Helene Cooper, “Obama Enlists 9 Allies to Help in the Battle Against ISIS,” *New York Times*, September 5, 2014.

⁶⁸ John Kerry and Chuck Hagel, “Joint Statement by Secretary Kerry and Secretary Hagel on the ISIL Meeting,” U.S. Department of Defense, September 5, 2014; Susan Glasser, John R. Allen, Lise Grande, and Brett McGurk, “The Counter-ISIS Coalition: Diplomacy and Security in Action,” panel, Washington, D.C., Brookings Institution, September 10, 2019.

⁶⁹ Susan Glasser, John R. Allen, Lise Grande, and Brett McGurk, “The Counter-ISIS Coalition: Diplomacy and Security in Action,” panel, Washington, D.C., Brookings Institution, September 10, 2019.

⁷⁰ John Kerry and Chuck Hagel, “Joint Statement by Secretary Kerry and Secretary Hagel on the ISIL Meeting,” U.S. Department of Defense, September 5, 2014.

combat the militant group.⁷¹ Four days later, the Gulf Cooperation Council countries joined Egypt, Iraq, Jordan, and Lebanon in pledging to provide military support and humanitarian aid.⁷²

On September 10, after a new Iraqi government had formed, President Obama announced the formation of a U.S.-led “broad coalition to roll back this terrorist threat” in a televised address from the White House. Speaking from the State Floor, Obama acknowledged that this would be a long-term effort to “degrade, and ultimately destroy, ISIL through a comprehensive and sustained counterterrorism strategy.”⁷³ The President differentiated the defeat-ISIS operation from previous wars in Iraq and Afghanistan and reiterated his vow not to “involve American combat troops fighting on foreign soil.” Instead, the global coalition would pursue “a systematic campaign of airstrikes”; expanded military assistance to Iraqi, Kurdish, and Syrian opposition forces; and integrated global initiatives to “cut off [ISIS’s] funding, improve our intelligence, strengthen our defenses, counter its warped ideology, and stem the flow of foreign fighters into and out of the Middle East.”⁷⁴

The administration’s desire to stabilize Iraq and destroy ISIS while minimizing the risk of entanglement in a long and costly ground war meant relying on indigenous ground forces to reclaim territory with support from U.S. aircraft. Therefore, Iraqi and Syrian partners had to own this war.⁷⁵ Moreover, as the President explained in a 2015 speech, he barred U.S. ground forces from the war against ISIS because “that’s what groups like ISIL want. . . . They know they can’t defeat us on the battlefield,” but “if we occupy foreign lands, they can maintain insurgencies for years, killing thousands of our troops, draining our resources, and using our presence to draw new recruits.”⁷⁶

It is important to remember that the U.S. air war against ISIS began at the invitation of the government of Iraq. The United States strongly preferred to avoid committing American ground combat forces and instead rely mainly on air strikes to support the Iraqi ground units that were trained, advised, and assisted by a limited number of American troops. It is unclear whether the Iraqis would have accepted a truly U.S.-led intervention, with American troops leading ground combat operations. Iraq was grateful for U.S. military assistance, but it also sought to “preserv[e] its sovereignty and

⁷¹ Michael R. Gordon and David A. Kirkpatrick, “Kerry Scours Mideast for Aid in ISIS Fight,” *New York Times*, September 13, 2014.

⁷² The Gulf Cooperation Council countries are defined as Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates. Office of the Spokesman, U.S. Department of State, “Jeddah Communiqué,” September 11, 2014. For discussion of previous speculation, see Eyder Peralta, “U.S. Announces Coalition to Fight Against the Islamic State,” NPR, September 5, 2014.

⁷³ ISIS is also known as the Islamic State of Iraq and the Levant (ISIL) or by its Arabic initials, styled as *Daesh*.

⁷⁴ Barack Obama, “Statement by the President on ISIL,” Washington, D.C.: White House, September 10, 2014.

⁷⁵ Barack Obama, “Statement by the President on ISIL,” Washington, D.C.: White House, September 10, 2014.

⁷⁶ Barack Obama, “Address to the Nation by the President,” White House, December 6, 2015.

its ability to take decisions independently” and insisted that “both of which must be honoured in all circumstances.”⁷⁷ The fact that this was Iraqi and Syrian partners’ war fundamentally shaped the way that airpower was employed against ISIS.

In Iraq, the coalition partnered primarily with three forces: the ISF, the CTS, and the Kurdish Security Forces. The ISF was the central government’s force, which had a strength of between 64,000 and 100,000, and consisted of the Iraqi Army and the Interior Ministry’s Federal Police, but it was also the weakest.⁷⁸ The United States had spent years training and equipping the ISF to prepare it for counterinsurgency operations, but it was a “hollow and brittle force” with low morale that crumbled in the face of the aggressive ISIS assault and hybrid conventional-irregular tactics.⁷⁹

In contrast, the elite CTS, which consisted of only approximately 8,000 troops, was more capable and as a result played a disproportionately large role in the offensives to counter ISIS, including the first significant counterattack at Mosul Dam.⁸⁰ The primary limitation with the CTS was its size and the fact that elite forces cannot quickly be regenerated. Similarly, the Kurdish Security Forces, which consisted of the Peshmerga and the interior ministry forces, was quite capable and determined, but even these accomplished fighters were overwhelmed by the larger ISIS force that was armed with heavy weapons in the summer of 2014.⁸¹ The Kurdish Security Forces was able to liberate Mount Sinjar only with the help of Syrian Kurdish People’s Protection Units (Yekîneyê Parastina Gel; YPG).⁸² Moreover, the Kurdish Security Forces was organized into company or smaller-sized units and in some ways was similar to reserve forces because members would alternate several weeks on the front line with several weeks of leave.⁸³

⁷⁷ Mohamad Ali Alhakim, “Letter Dated 20 September 2014 from the Permanent Representative of Iraq to the United Nations Addressed to the President of the Security Council,” United Nations Security Council, September 22, 2014.

⁷⁸ Linda Robinson, *Assessment of the Politico-Military Campaign to Counter ISIL and Options for Adaptation*, Santa Monica, Calif.: RAND Corporation, RR-1290-OSD, 2016, pp. 26–28.

⁷⁹ Michael Knights, *The Future of Iraq’s Armed Forces*, Baghdad, Iraq: Al-Bayan Center for Planning and Studies, March 2016, p. 20.

⁸⁰ Linda Robinson, *Assessment of the Politico-Military Campaign to Counter ISIL and Options for Adaptation*, Santa Monica, Calif.: RAND Corporation, RR-1290-OSD, 2016, pp. 28–30.

⁸¹ Dana Pittard and Wes Bryant, *Hunting the Caliphate: America’s War on ISIS and the Dawn of the Strike Cell*, New York: Post Hill Press, 2019.

⁸² Jim Zanotti, Carla E. Humud, Christopher M. Blanchard, and Rhoda Margesson, *Kurds in Iraq and Syria: U.S. Partners Against the Islamic State*, Washington, D.C.: Congressional Research Service, December 28, 2016, p. 2. For more on the sources of these tensions, see Larry Hanauer, Jeffrey Martini, and Omar Al-Shahery, *Managing Arab-Kurd Tensions in Northern Iraq After the Withdrawal of U.S. Troops*, Santa Monica, Calif.: RAND Corporation, OP-339-USFI, 2011.

⁸³ Linda Robinson, *Assessment of the Politico-Military Campaign to Counter ISIL and Options for Adaptation*, Santa Monica, Calif.: RAND Corporation, RR-1290-OSD, 2016, p. 30.

To complicate matters further, there were tensions between the three Iraqi partners—and especially the Kurds and the ISF and CTS—as the Kurds were wary of central-government forces operating in their region, and in turn the Kurdish Security Forces was reluctant to go on the offensive against ISIS outside the Kurdistan region of Iraq.⁸⁴ Finally, there were the previously mentioned militias—mainly composed of Shiites—that fought for the Iraqi government under the banner of the PMF, but the coalition provided only air support to “forces operating strictly under Iraqi command and control.”⁸⁵

Finding a suitable and competent partner was a challenge in Syria. The United States initially established a train-and-equip program to build an entirely new 5,000-person strong Syrian militia dedicated to countering ISIS.⁸⁶ After this effort failed, in October 2015, the Obama administration began to support approved Syrian militias that were already fighting ISIS—most notably, the Kurdish YPG. The YPG was not the United States’ first choice, because the Kurdish organization had strong ties to the Kurdistan Workers’ Party (Partiya Karkerên Kurdistanê; PKK), a group that the United States and Turkey had designated a terrorist organization.⁸⁷ Moreover, U.S. officials recognized the significant strain that partnering with the YPG would place on the U.S.-Turkish relationship. The Turkish government views the establishment of an autonomous Kurdish region along the Turkish-Syrian border as an existential threat and feared that a strengthened YPG would be in a position to create such an entity. In the absence of other Syrian militias capable and willing to counter ISIS, the United States committed to working with the YPG under the leadership of General Mustafa Mazloum but encouraged him to downplay the group’s Kurdish identity by forming a multiethnic organization called the SDF.⁸⁸ The United States consistently emphasized the diverse composition of the SDF, but this did little to alleviate Turkey’s

⁸⁴ Jim Zanotti, Carla E. Humud, Christopher M. Blanchard, and Rhoda Margesson, *Kurds in Iraq and Syria: U.S. Partners Against the Islamic State*, Washington, D.C.: Congressional Research Service, December 28, 2016, p. 11.

⁸⁵ Linda Robinson, *Assessment of the Politico-Military Campaign to Counter ISIL and Options for Adaptation*, Santa Monica, Calif.: RAND Corporation, RR-1290-OSD, 2016, pp. 32–34; Brett McGurk, “Global Efforts to Defeat ISIS,” testimony before the Senate Foreign Relations Committee, June 28, 2016. Other PMF units might have incidentally received U.S. air support because they were operating near ISF forces. Barbara Opall-Rome, “Commander: US-Led Assault in Iraq ‘Incidentally’ Benefits Iran-Backed Militias,” *Defense News*, August 25, 2017.

⁸⁶ Paul McLeary, “U.S. Acknowledges Reality and Scraps Failed Syria Training Program,” *Foreign Policy*, October 9, 2015.

⁸⁷ U.S. Department of State, “Foreign Terrorist Organizations,” webpage, undated.

⁸⁸ Ash Carter, “Behind the Plan to Defeat ISIS,” *The Atlantic*, October 31, 2017, p. 23; David R. Kogon, “The Coalition Military Campaign to Defeat the Islamic States in Iraq and Syria 21 Aug 2016–05 Sep 2017,” Combined Joint Task Force—Operation Inherent Resolve, 2017, pp. 37–38; Jim Zanotti, Carla E. Humud, Christopher M. Blanchard, and Rhoda Margesson, *Kurds in Iraq and Syria: U.S. Partners Against the Islamic State*, Washington, D.C.: Congressional Research Service, December 28, 2016, pp. 12–15.

concerns that the United States was aiding and arming an organization that it viewed as a threat.⁸⁹ As a result, the United States often found that Turkey was working at cross-purposes with the defeat-ISIS operation, and bilateral relations between the two allies fell to new lows.⁹⁰

A key part of the U.S. strategy to defeat ISIS was the prioritization of Iraq over Syria. “In Iraq, the government could be part of the solution, while in Syria the government was part of the problem,” one senior official explained, noting that “the Baghdad government was imperfect, but one we could cooperate with; we could share intelligence, coordinate airstrikes, provide lethal assistance, and deploy US troops to help train the Iraqi security forces.”⁹¹ Only once the situation in Iraq was stabilized would the strategy move forward to address ISIS’s base in Syria.⁹² Nevertheless, Obama vowed that he would “not hesitate to take action against ISIL in Syria” as needed.⁹³

By September’s end, more than 60 countries had enlisted in the fight against ISIS, a number that would continue to grow over the subsequent years to 82 members thanks to sustained lobbying by the United States and its partners.⁹⁴ By encouraging states to contribute as they could, and by avoiding setting minimum contributions, the United States mobilized a broad-based coalition of international partners who now flew alongside U.S. aircraft, lent materiel and humanitarian assistance, shared intelligence, and pledged to root out ISIS sources of revenue, fighters, and other resources. Within the global coalition, a smaller “core coalition” was envisioned of mainly European and Middle Eastern partners (see Figure 2.2) with the experience, resources, or proximity necessary to contribute meaningfully to the air operations and the ground security assistance efforts. By 2019, there were 28 countries plus the North Atlantic Treaty Organization (NATO) that had agreed to join the military coalition against ISIS.⁹⁵

⁸⁹ Cameron Abadi, “Why Is Turkey Fighting Syria’s Kurds?” *Foreign Policy*, October 17, 2019; “Turkey v Syria’s Kurds: The Short, Medium and Long Story,” BBC, October 23, 2019. For a longer treatment, see Aaron Stein, “Reconciling U.S.-Turkish Interests in Northern Syria,” Council on Foreign Relations, February 2017.

⁹⁰ Jim Zanotti and Clayton Thomas, *Turkey Background and U.S. Relations in Brief*, Washington, D.C.: Congressional Research Service, April 7, 2020, pp. 10–12; Feisal al-Istrabadi, “Regional Constraints on the U.S. Confrontation of ISIS,” in Feisal al-Istrabadi and Sumit Ganguly, eds, *The Future of ISIS Regional and International Implications*, Washington, D.C.: Brookings Institution Press, 2018, pp. 184–187; Aaron Stein, “The Crisis Is Coming: Syria and the End of the U.S.-Turkish Alliance,” *War on the Rocks*, August 5, 2019.

⁹¹ Derek Chollet, *The Long Game: How Obama Defied Washington and Redefined America’s Role in the World*, New York: Public Affairs, 2016, p. 152.

⁹² Kenneth M. Pollack, “Assessing the Obama Administration’s Iraq-Syria Strategy,” Brookings Institution, September 26, 2014.

⁹³ Barack Obama, “Statement by the President on ISIL,” Washington, D.C.: White House, September 10, 2014.

⁹⁴ By 2019, there were 82 members of the coalition.

⁹⁵ Kathleen J. McInnis, *Coalition Contributions to Countering the Islamic State*, Washington, D.C.: Congressional Research Service, August 24, 2016, pp. 8–12.

Figure 2.2
The Global Coalition to Defeat ISIS



SOURCE: Information taken in 2019 from U.S. Department of State, "Global Coalition to Defeat ISIS," website, undated.

In addition to the United States, aircraft from 19 nations, plus NATO, participated in OIR air operations. Table 2.1 shows the type of fixed-wing aircraft that different coalition members committed to OIR. A complete list of the different types of fixed-wing aircraft contributed by country is detailed in Appendix C. Allied contributions were important to give the operation legitimacy and to provide additional capacity, but operating as a part of a multilateral coalition did introduce complications. Eight non-Arab powers—Australia, Belgium, Canada, Denmark, France, the Netherlands, Turkey, and the United Kingdom—and the United States contributed strike aircraft to fight ISIS in Iraq and subsequently Syria. Initially, most of these members were only willing to fly over Iraq because the Iraqi government had explicitly authorized the operation, but they did not have the similar support of the Syrian government.⁹⁶ Three additional coalition members—Germany, Italy, and Poland—flew tactical reconnaissance missions in OIR over Iraq and Syria but did not conduct kinetic strikes. Although strike aircraft often gained the most attention, coalition members also contributed vital ISR and tanker aircraft, which were always in high demand and enabled the entire air war (see Table 2.1).

Within the coalition, the six Arab air forces (Bahrain, Jordan, Morocco, Qatar, Saudi Arabia, and the United Arab Emirates) initially flew against ISIS in Syria during the early months of OIR. The number of missions that they flew was relatively small, but their participation was important for the political optics of the operation and the coalition. Qatar flew combat missions only in September, thereafter citing a concern for the safety of its airmen flying over ISIS-controlled territory. Others' contributions diminished further as the operation went on and, in the case of all but Jordan, halted completely as a result of the intervention in Yemen in March 2015 (see Figure 2.3).⁹⁷ Many Arab leaders were hesitant about aligning closely with the United States because they did not “want to be seen supporting a Shiite-led effort” and were “reluctant to condone military action against fellow Muslims.”⁹⁸

Figure 2.3 details when different nations deployed ground- and sea-based combat aircraft to participate in OIR. Above the timeline, the colored bars show when different countries’ ground-based strike aircraft participated in OIR. The color indicates whether the aircraft were authorized to engage in offensive operations—in either Iraq or Syria, or both. Below the timeline, the other bars indicate when U.S. Navy

⁹⁶ Christopher Blanchard and Carla E. Humud, *The “Islamic State” Crisis and U.S. Policy*, Washington, D.C.: Congressional Research Service, May 27, 2015, p. 29; Carol J. Williams, Paul Richter, and Laura King, “U.S. Faces Uncertain Task in Building Coalition Against Islamic State,” *Los Angeles Times*, September 11, 2014; RAND interview with USAF official, December 3, 2019.

⁹⁷ Helene Cooper and Eric Schmitt, “Airstrikes by U.S. and Allies Hit ISIS Targets in Syria,” *New York Times*, September 22, 2014; Eric Schmitt and Michael R. Gordon, “As U.S. Escalates Air War on ISIS, Allies Slip Away,” *New York Times*, November 7, 2015.

⁹⁸ Carol J. Williams, Paul Richter, and Laura King, “U.S. Faces Uncertain Task in Building Coalition Against Islamic State,” *Los Angeles Times*, September 11, 2014.

Table 2.1
Coalition Contributions to OIR, by Fixed-Wing Aircraft Category

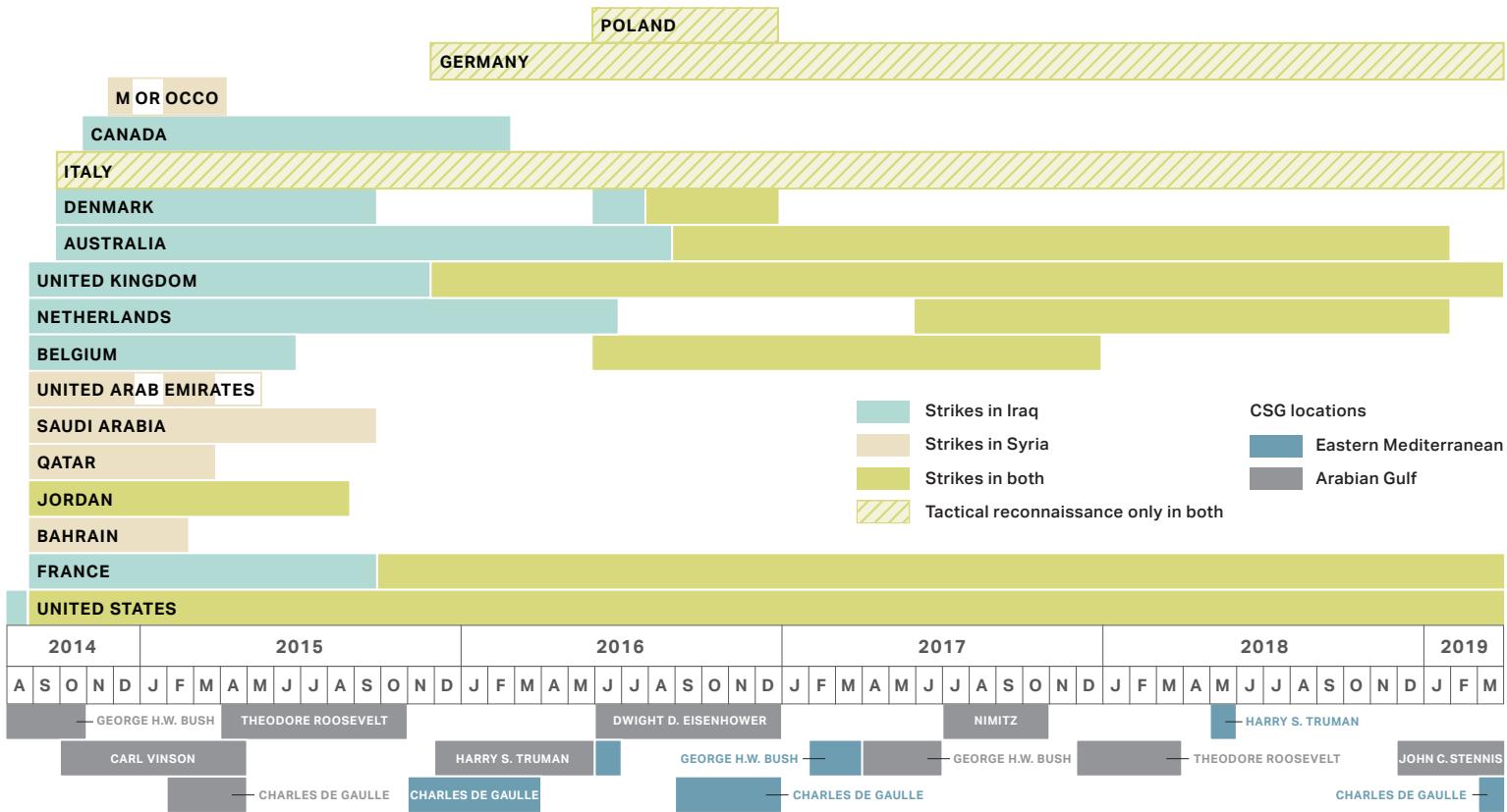
Country	Fighter/Attack	Bomber	RPA	AEW&C	Other ISR	Tanker	Transport
Australia	X			X		X	
Bahrain	X						
Belgium	X						X
Canada	X				X	X	
Denmark	X						X
France	X			X	X	X	X
Germany	(X)						X
Italy	(X)		X		X	X	
Jordan	X						
Morocco	X						
NATO					X		
Netherlands	X						
New Zealand							X
Poland	(X)						
Qatar	X						X
Saudi Arabia	X						
Singapore						X	
Turkey	X						
United Arab Emirates	X						
United Kingdom	X		X	X	X	X	X
United States	X	X	X	X	X	X	X

NOTES: German, Italian, and Polish aircraft flew only ISR missions. For details of aircraft types and numbers, see Appendix C. AEW&C = airborne early warning and control.

and French aircraft carriers were participating in OIR. All the carriers, except for the *Charles de Gaulle*, were American. The colors indicate which were stationed in the Arabian Gulf versus the Eastern Mediterranean.

As shown in Figure 2.3, by the summer of 2016, most coalition members, which had been galvanized by the ISIS attacks in Europe, were flying combat missions in Syria and Iraq. In general, coalition partners preferred to participate in air strikes that were executed through the deliberate-targeting process, which, in contrast to dynamic

Figure 2.3
Coalition Strike Aircraft and Carrier Strike Group Participation in OIR



SOURCE: The timeline is derived from the sources listed in Appendix C.

NOTE: Dates shown indicate periods when strike aircraft from each coalition member were deployed to OIR, starting with the date when they began participating in strikes against ISIS (each month is indicated by its first letter). For Germany and Italy, start dates of tactical reconnaissance flights are shown. Some end dates are approximate. All carrier strike groups (CSGs), except the *Charles de Gaulle*, were American.

strikes, provided them with more time to plan the mission and access to more intelligence.⁹⁹ All partners had their own national caveats and had a “red card holder,” their own TEA, who was on the floor of the CAOC and had to determine whether the country’s aircraft were authorized to engage targets, which added a step to the target-approval process.¹⁰⁰ Many coalition members were unwilling to risk any civilian causalities and therefore frequently requested additional intelligence or their red card holder would decline strike-cell requests to service targets.¹⁰¹ Out of frustration, some JTACs in the strike cells tried to ensure that their dynamic-targeting requests only went to U.S. aircraft. They used a variety of workarounds, such as requesting the employment of a specific munition that only U.S. aircraft carried.¹⁰² If the CAOC became aware that a strike cell was trying to preferentially task U.S. aircraft, its staff would facilitate a conversation between the JTACs and coalition members to improve mutual understanding so that the strike cells could better understand the partner caveats.¹⁰³

Additionally, the rules of engagement for each coalition partner were dictated by their national laws and therefore partners had their own interpretation of what was considered to be self-defense and which types of targets it was legal to attack. For instance, many partners refused to engage oil tankers because the truck drivers were civilians.¹⁰⁴ Similarly, after ISIS fighters retreated to uninhabited parts of Iraq and Syria, they hid in tunnels and caves. Although U.S. aircraft carried out attacks on these targets, French and the British aircraft often could not participate because their nation’s laws prohibited undue suffering, which could result if the cave or tunnel was not entirely destroyed and the militants were left alive but trapped inside.¹⁰⁵

Finally, some coalition members’ interests and actions simply clashed with those of the United States. The starker example of this is the U.S.-Turkish relationship and their different views about working with the Syrian Kurds. Turkish President Recep Tayyip Erdogan initially refused to join the coalition because it would not target the Syrian regime and for fear that the operation would strengthen Iraqi and Syrian Kurds

⁹⁹ RAND interview with USAF official, March 11, 2020.

¹⁰⁰ RAND interview with Dutch official; RAND interview with USAF official, March 4, 2020; RAND interview with USAF official, March 11, 2020.

¹⁰¹ RAND interview with USAF official, March 11, 2020; RAND interview with USAF official, December 3, 2019.

¹⁰² These JTAC practices might have been the result of a lack of training or familiarity with JAGIC tactics, techniques, and procedures, which managed such issues through improved communication. RAND email exchange with USAF official, July 17, 2020.

¹⁰³ RAND interview with USAF official, March 11, 2020; RAND email exchange with USAF official, July 17, 2020.

¹⁰⁴ RAND interview with USAF official, December 3, 2019.

¹⁰⁵ RAND interview with USAF official, March 4, 2020; RAND interview with UK official, March 4, 2020.

tied to PKK.¹⁰⁶ Turkey eventually joined the coalition in October 2014, after its Parliament ratified strikes against ISIS, but given its concerns about the Kurds establishing an autonomous zone in northern Syria, Turkey's actions often complicated the coalition's efforts to work with the SDF to defeat ISIS.¹⁰⁷ Turkey was one of the few countries that initially did not permit U.S. aircraft to fly strike missions from its bases. Turkish bases were desirable because of their proximity to northern Syria and Iraq, which improved responsiveness for time-sensitive missions, such as combat search and rescue, and increased aircraft time on station.¹⁰⁸ Even after Erdogan relented in July 2015, access permissions remained problematic and a cause of frequent friction.¹⁰⁹ After the July 2016 attempted coup in Turkey, the United States opted to move most of its strike aircraft that had been briefly based in Turkey to other countries.¹¹⁰ Equally problematic, Turkey began direct military operations in Syria in August 2016 to limit the gains made by the SDF and in early 2018 Turkish forces attacked SDF fighters in Afrin.¹¹¹

Other members of the defeat-ISIS coalition also supported military operations by providing base access for U.S. and coalition aircraft. Figure 2.4 displays major air bases used to support OIR. Early in the operation, U.S. aircraft primarily operated from air bases in Jordan, Kuwait, Qatar, and the United Arab Emirates. For more information on basing and the aircraft laydown, see Appendix C.

Although the coalition had access to a well-developed base infrastructure, most of these bases were fairly far from the main area of operations (see Table 2.2). Distant basing reduced the responsiveness of air forces, increased the length of time in flight, and reduced the amount of time on station. This was particularly a problem for slow RPAs. For example, it takes an MQ-9 Reaper approximately two and half hours to fly the 475 nautical miles from Ali Al Salem Air Base in Kuwait to Mosul, which in total means that more than one-third of its maximum flight time is expended trans-

¹⁰⁶ Tim Arango, "Turkey Denies Reports of Deal for Use of Its Bases in Fight Against Islamic State," *New York Times*, October 14, 2014; Editorial Board, "Mr. Erdogan's Dangerous Game," *New York Times*, October 8, 2014; Mark Landler, Anne Barnard, and Eric Schmitt, "Turkish Inaction on ISIS Advance Dismays the U.S.," *New York Times*, October 7, 2014; Anne Barnard and Mark Landler, "Turkey Inching Toward Alliance in Syria Conflict," *New York Times*, September 28, 2014.

¹⁰⁷ Isabel Hunter, "War Against ISIS: Turkey Joins Western Coalition in Fight to Stop Militants," *The Independent*, October 2, 2014.

¹⁰⁸ AFHRA interview with Maj John S. Graham, August 8, 2018; AFHRA interview with Col Dustin P. Smith, September 6, 2018.

¹⁰⁹ Marcus Weisgerber, "Turkey Opens Key Air Bases for US Strikes on ISIS," Defense One, July 23, 2015.

¹¹⁰ Eric Schmitt and Dan Bilefsky, "Turkey Interrupts U.S. Air Missions Against ISIS at Major Base," *New York Times*, July 16, 2016; AFHRA interview with Col Christopher K. Fuller, USAF, September 12, 2019.

¹¹¹ Jim Zanotti and Clayton Thomas, "The Kurds in Iraq, Turkey, Syria, and Iran," Washington, D.C.: Congressional Research Service, January 23, 2019, p. 2.

Figure 2.4
Principal Air Bases for OIR Combat Operations



NOTE: FOB = forward operating base; AB = air base; RAF = Royal Air Force.

Table 2.2
Ranges to Targets from Main Fighter and RPA Operating Bases

Country	Base	Users	Approximate Range (nm) to:			
			Ramadi	Mosul	Kobani	Raqqa
Kuwait	Ali Al Salem AB	United States, Canada, United Kingdom, Italy	329	475	643	583
	Ahmad al-Jaber AB	United States, Canada, Denmark, Italy, Poland	356	502	675	616
Qatar	AUAB	United States, Singapore	653	794	972	907
United Arab Emirates	Al Dhafra AB	United States, France, Morocco	810	934	1,123	1,064
	Al Minhad AB	Australia, New Zealand				
Cyprus	RAF Akrotiri	United Kingdom	513	508	297	302
Turkey	Incirlik AB	United States, Denmark, Germany, Saudi Arabia	443	373	140	184

SOURCE: We calculated distance using Google Maps.

NOTES: Straight-line distances are shown, but sortie distances from some locations might have been longer because of overflight restrictions, routing around Russian or Syrian forces, or other considerations. We were not given access to information about overflight.

siting.¹¹² For manned aircraft that can be refueled in the air, relatively distant bases increased the requirement for tanker support. An A-10 Thunderbolt II attack aircraft, for instance, would often need to fly a nine-hour mission and refuel three times to have one hour on station over the Middle Euphrates River Valley (MERV).¹¹³

Going on the Offensive: Degrading ISIS, September 2014–March 2016

At first, the operation to defeat ISIS was hard to distinguish from the limited attacks that had previously been undertaken against the group. The first year was an improvised effort—where, in the words of one former Obama administration official, “we were flying the plane while we were building it.”¹¹⁴ This involved standing up a joint task force headquarters to command the defeat-ISIS campaign, developing a strategy that had the buy-in of coalition and Iraqi and Syrian partners, and strengthening Iraqi

¹¹² USAF, “MQ-9 Reaper,” September 23, 2015; AFHRA interview with Lt Col Troy A. Dupont, September 3, 2019.

¹¹³ RAND interview with USAF official, January 29, 2020.

¹¹⁴ RAND interview with DoD official, March 13, 2020.

and Syrian ground forces, while waging an air war to weaken ISIS and halt the expansion of the caliphate in Iraq and Syria.

The intensity and efficacy of operations the first year disappointed some, but the air war was shaped by the United States' overarching approach—which insisted that this was an Iraqi and Syrian war and that the coalition worked “by, with, and through” local partners.¹¹⁵ As one official explained “it wasn’t ‘shock and awe’ with hundreds of airstrikes,” because the administration did not want “this to look like an American war.”¹¹⁶ Moreover, the air war was shaped by several additional factors, including stringent rules of engagement, a lack of clear guidance to prosecute deliberate targets, challenges in finding and developing ISIS targets, and a fragmented C2 construct. By mid-2015, there was a new Secretary of Defense, Ashton Carter; a new Combined Forces Air Component Commander (CFACC), Lt Gen Charles Q. Brown; and a new Joint Task Force—Operation Inherent Resolve Commander, LTG Sean MacFarland; together, they pushed for a more deliberate and aggressive approach to the campaign and began to turn the tide against ISIS.

A Slow Start: The Challenges of Targeting a Hybrid Adversary, September 2014–May 2015

When the coalition to defeat ISIS was formed, ISIS was at its territorial peak in Iraq and Syria. As Figure 2.5 shows, the caliphate stretched from just outside Aleppo in the west to Mosul in the northeast. ISIS also controlled two primary north-south corridors along the Euphrates and Tigris Rivers and was on the outskirts of Iraq’s capital, Baghdad. ISIS’s protostate consisted of 58,372 square kilometers of land in Iraq (13 percent of Iraq’s territory), mainly in Al Anbar, Nineveh, Kirkuk, and Salah ad Din governorates, and 47,497 square kilometers of land in Syria (25 percent of the country), mainly in Aleppo, Raqqa, Al-Hasakah, and Deir ez-Zur governorates.¹¹⁷ Although the United States had prioritized liberating Iraqi territory, in testimony before the Senate, the Chairman of the Joint Chiefs of Staff, GEN Martin Dempsey, insisted that the defeat-ISIS operation was an “Iraq-first strategy” but not “Iraqi only.”¹¹⁸ Dempsey also outlined a plan to train and equip vetted “moderate Syrians” to fight ISIS, which was

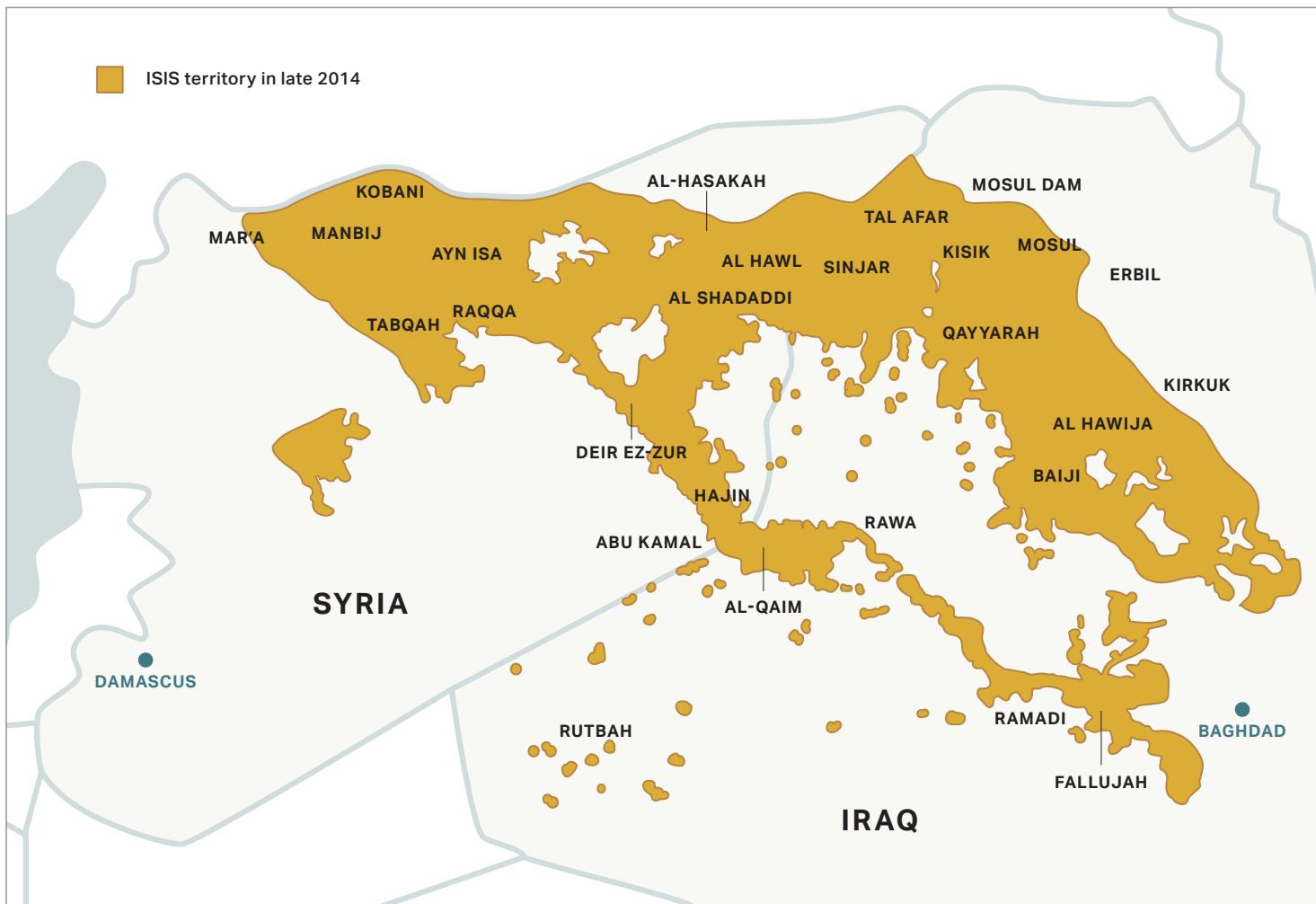
¹¹⁵ GEN Joseph Votel and COL Eero Keravuori defined *by, with, and through* as “operations led by our partners, state or nonstate, with enabling support from the United States or U.S.-led coalitions, and through U.S. authorities and partner agreements.” Joseph L. Votel and Eero R. Keravuori, “The By-With-Through Operational Approach,” *Joint Force Quarterly*, Vol. 89, April 12, 2018.

¹¹⁶ David E. Sanger, Michael R. Gordon, and Eric Schmitt, “Arab Nations Offer to Fight ISIS from Air,” *New York Times*, September 14, 2014.

¹¹⁷ Seth G. Jones, James Dobbins, Daniel Byman, Christopher S. Chivvis, Ben Connable, Jeffrey Martini, Eric Robinson, and Nathan Chandler, *Rolling Back the Islamic State*, Santa Monica, Calif.: RAND Corporation, RR-1912, 2017, p. 20.

¹¹⁸ Jim Garamone, “Dempsey Discusses Anti-ISIL Strategy at Senate Hearing,” U.S. Department of Defense, September 16, 2014.

Figure 2.5
ISIS Caliphate at Its Largest, September 2014



approved by Congress several days later. Dempsey's assertion about the scope of the operation was quickly substantiated, as the first air strikes into Syria were launched only six days later.

On September 22, 2014, just 12 days after the coalition was established, the United States and some of its Arab allies launched several air and missile strikes against ISIS strongholds in northeastern Syria. This significantly expanded the scope of the defeat-ISIS operations and complicated air operations, because, in contrast to the permissive airspace in Iraq, the airspace over Syria was potentially contested. Although the Syrian government did not officially condone the coalition's intervention, regime aircraft and surface-to-air missiles (SAMs) were a latent threat, which required U.S. aircraft to take additional precautions, such as establishing DCA CAPs.¹¹⁹

Syrian air defenses were largely antiquated and had fallen into disrepair during the civil war, but they retained some capabilities, especially around Damascus, where there are overlapping systems and some of the more-modern SAMs (see Figure 2.6). Prior to the civil war, Syria had 130 active SAM sites, early warning radars, 4,000 anti-aircraft guns, and a few thousand man-portable air defenses (MANPADs).¹²⁰ Most of Syria's long-range air defenses were older SA-2, SA-5, and SA-6 Russian systems, but it also had more-advanced tactical SAMs, including SA-17s, SA-22s, and Pantsir S-1s. Moreover, since 2013, Syrian air defenses fired an average of more than 100 missiles a year against Israeli aircraft, although they hit only one Israeli F-16 in 2018, suggesting that their capability was limited.¹²¹ This high miss rate is likely attributed to Syria's semiautomated C2 system and its reliance on communications that are vulnerable to electronic attack.¹²²

In 2015, Russia deployed its sophisticated long-range S-400 SAMs to protect its air base at Latakia on the northwestern coast of Syria. Then, after Syria accidentally shot down a Russian ISR aircraft in September 2018, Moscow provided Damascus with also very-capable S-300 SAMs, but they have not been fired because they are under the control of Russian advisers.¹²³ Although information available about over-flight routes is limited, it appears that the U.S. and coalition aircraft have generally avoided western and central Syrian airspace and typically operated only over eastern

¹¹⁹ Christopher M. Blanchard, Carla E. Humud, and Mary Beth D. Nikitin, *Armed Conflict in Syria: Overview and U.S. Response*, Washington, D.C.: Congressional Research Service, February 12, 2020, p. 7; Brian Everstine, "Air Force: Lost Predator Was Shot Down in Syria," *Air Force Times*, June 29, 2015.

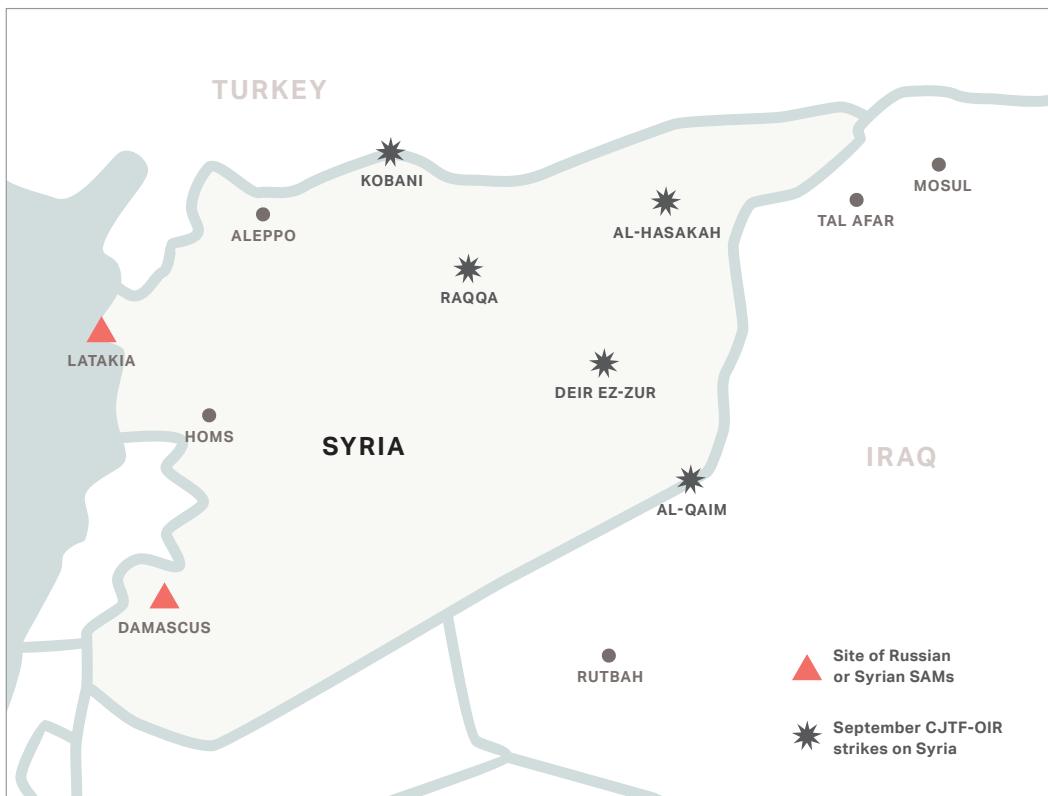
¹²⁰ Chandler P. Atwood and Jeffrey White, "Syrian Air-Defense Capabilities and the Threat to Potential U.S. Air Operations," Washington Institute, May 23, 2014.

¹²¹ Yossi Melman, "Why Syria Isn't Firing Its S-300 Missiles at Israeli Jets," *Haaretz*, May 15, 2020; "Syria—Air Force," *Jane's World Air Forces*, June 22, 2020.

¹²² Chandler P. Atwood and Jeffrey White, "Syrian Air-Defense Capabilities and the Threat to Potential U.S. Air Operations," Washington Institute, May 23, 2014.

¹²³ Yossi Melman, "Why Syria Isn't Firing Its S-300 Missiles at Israeli Jets," *Haaretz*, May 15, 2020.

Figure 2.6
Syrian Air Defenses and CJTF-OIR Strikes



SOURCE: Chandler P. Atwood and Jeffrey White, "Syrian Air-Defense Capabilities and the Threat to Potential U.S. Air Operations," Washington Institute, May 23, 2014; CENTCOM, "U.S. Military, Partner Nations Conduct Airstrikes Against ISIL in Syria," YouTube video, September 30, 2014.

Syria.¹²⁴ Aircraft flying from Jordan or the Eastern Mediterranean, including the British base on Cyprus, appear to fly over Israel, Jordan, and Iraq instead of directly over western Syria, which is the most heavily defended airspace and also where the Russians are operating.

Over time, as pro-Bashar al-Assad ground forces increasingly came into contact with the coalition-backed SDF on the ground, aircraft aligned with the regime also became more aggressive, requiring the coalition to step up its own air defenses and leading to a number of air-to-air incidents. The Syrian Arab Air Force, however, is mostly made up of third- and fourth-generation Soviet aircraft, and its capability has declined because of its high operational tempo during the civil war, which is why

¹²⁴ RAND interview with coalition officer, March 4, 2020.

Russian aircraft were needed to supplement Syria's capabilities.¹²⁵ The Syrian Air Force has focused on supporting ground operations, but it has engaged in some air-to-air encounters, which are discussed in greater detail in Chapter Six.

Syrian air defenses did not attempt to intercept the September 22 coalition strikes, which were the largest to date: 47 Tomahawk cruise missiles were launched from a destroyer, USS *Arleigh Burke*, and a cruiser, USS *Philippine Sea*. Air-to-ground strikes from the USAF, U.S. Navy, U.S. Marine Corps (USMC), Bahraini, Jordanian, Saudi, Qatari, and Emirati aircraft; coalition missiles; and bombs hit ISIS headquarters and C2 locations, storage facilities, finance centers, supply trucks, vehicles, and fighters in Raqqa, Deir ez-Zur, Al-Hasakah, and Abu Kamal.¹²⁶ U.S. and some of the Arab coalition members' aircraft continued to strike various ISIS strongholds in Syria throughout the rest of September, but the real escalation in Syria did not occur until coalition air-power was used to thwart the ISIS advance on Kobani beginning in October.

By mid-September, there was a growing humanitarian crisis in the small northern Syrian town of Kobani—tens of thousands of Kurds fled the approximately 4,000 advancing ISIS fighters and sought refuge in Turkey.¹²⁷ The United States hoped that by pressuring ISIS elsewhere in Syria it might relieve the pressure on Kobani, but on September 27, it launched the first attack directly in defense of the Kurdish town.¹²⁸ As Gen John Allen, former special presidential envoy for the global coalition fighting against ISIS in Syria and Iraq, later noted, Kobani was the “first real battle . . . where we had an opportunity to make a difference, [and] it was clear that the Islamic state wanted to wipe out the Kurdish population.”¹²⁹ In defense of Kobani, the coalition launched 417 strikes during the last three months of 2014, in contrast to 51 strikes in Syria the prior month.¹³⁰

The extension of the air war into Syria seems to have been prompted by several factors, including a recognition that the Iraqi and Syrian fights were inextricably linked and that the coalition could not prevail in Iraq without pressuring ISIS in Syria and stemming the flow of foreign fighters into Iraq.¹³¹ Additionally, the United States wanted the Arab coalition members to participate in combat operations to enhance OIR’s legitimacy, but they were willing to do so only in Syria—not Iraq—because

¹²⁵ “Syria—Air Force,” *Jane’s World Air Forces*, June 22, 2020.

¹²⁶ CENTCOM, “U.S. Military, Partner Nations Conduct Airstrikes Against ISIL in Syria,” YouTube video, September 30, 2014.

¹²⁷ “Battle for Kobani: Key Events,” BBC, June 25, 2015; Rebecca Grant, “The Siege of Kobani,” *Air Force Magazine*, August 29, 2018.

¹²⁸ For more on the battle for Kobani, see Chapter Four.

¹²⁹ Susan Glasser, John R. Allen, Lise Grande, and Brett McGurk, “The Counter-ISIS Coalition: Diplomacy and Security in Action,” panel, Washington, D.C., Brookings Institution, September 10, 2019.

¹³⁰ CENTCOM and CJTF-OIR strike data were compiled by RAND. See Appendix D for more details.

¹³¹ Kevin Liptak, “How Obama Came to Launch Strikes in Syria,” CNN, September 23, 2014.

of long-standing political tensions with Baghdad, which had roots in Iraq's invasion of Kuwait during the Gulf War. Moreover, just hours after the cruise missile strikes, Syrian President al-Assad indicated that he was in favor of "any international anti-terrorism effort," suggesting that the coalition had a tacit green light to intervene.¹³²

Even as the operation progressed, the U.S. Department of State led the effort to work with its coalition partners to flesh out a detailed plan for achieving the stated goal of degrading and ultimately defeating ISIS.¹³³ In early September, the coalition to defeat ISIS agreed on five lines of effort: providing military support to partners, impeding the flow of foreign fighters, stopping financing and funding, addressing humanitarian crises in the region, and exposing true nature (which meant highlighting the group's brutality and demonstrating how ISIS's actions were against the religious tenets it claimed to uphold).¹³⁴ In November, the White House unveiled a strategy to coordinate the defeat-ISIS campaign along nine lines of effort:

1. Supporting effective governance in Iraq;
2. Denying ISIS safe haven through a system campaign of airstrikes in Iraq and Syria;
3. Building partner capacity by providing training, advice, and equipment to Iraqi security forces, Kurdish forces, and Syrian moderate opposition groups;
4. Enhancing intelligence collection and information sharing;
5. Disrupting ISIL's finances by reducing its oil revenue, denying it populations to extort; combating kidnapping for ransom, and disrupting its international trade and donor network;
6. Exposing ISIS's true nature and countering its propaganda;
7. Disrupting the flow of foreign fighters;
8. Protecting the homeland by improving screening, identifying and prosecuting violent extremists at home, and strengthening border security;
9. Humanitarian support to the displaced and vulnerable in Iraq and Syria.¹³⁵

¹³² Albert Aji and Ryan Lucas, "Assad Backs All Efforts to Fight Terrorism," Associated Press, September 23, 2014; Krishnadev Calamur, "Obama Has Support for Syria Strikes, but Are They Legal?" NPR, September 24, 2014.

¹³³ It is not clear exactly what was meant by *degrade* or *defeat*. See Ben Connable, Natasha Lander, and Kimberly Jackson, *Beating the Islamic State: Selecting a New Strategy for Iraq and Syria*, Santa Monica, Calif.: RAND Corporation, RR-1562-OSD, 2017, pp. 21–22.

¹³⁴ U.S. Department of State, "About Us—the Global Coalition to Defeat ISIS," webpage, undated.

¹³⁵ White House, "FACT SHEET: The Administration's Strategy to Counter the Islamic State of Iraq and the Levant (ISIL) and the Updated FY 2015 Overseas Contingency Operations Request," press release, November 7, 2014.

As Figure 2.7 shows, these two descriptions of the defeat strategy—one developed by the coalition, which was led by the U.S. Department of State, and the other by the White House—were not entirely congruent. Moreover, there was no public discussion of how the various lines of effort would lead to the desired outcomes, nor any discussion of sequencing and prioritization among these activities.¹³⁶ Many of the actions identified by the coalition and the United States were primarily going to be efforts that were conducted by agencies other than DoD. For the military operations, there was no plan to explain how and in what order the coalition would defeat the caliphate.¹³⁷ Strategic disagreements, national rivalries, and political differences within the coalition complicated the United States’ efforts to articulate a coherent strategy to defeat and degrade ISIS. The coalition was working with various partners on the ground—

Figure 2.7
Comparing Coalition and White House Counter-ISIS Strategy, 2014



¹³⁶ Ash Carter, “A Lasting Defeat: The Campaign to Destroy ISIS,” Belfer Center for Science and International Affairs, Harvard Kennedy School, October 2017, p. 12.

¹³⁷ Ash Carter, “A Lasting Defeat: The Campaign to Destroy ISIS,” Belfer Center for Science and International Affairs, Harvard Kennedy School, October 2017, p. 12.

many of whom, like the Kurds and Iraqis, did not always get along—and had to get them to agree to a campaign plan, as their forces would be responsible for the ground attack. For the remainder of 2014, U.S. officials continued to alternate between the two frameworks, sowing confusion over the administration’s priorities, the relationship among its stated objectives, and its plans to implement each line of effort.¹³⁸

In October, the United States took several steps to formalize the operation against ISIS, first by naming the operation and then by establishing a combined joint task force to command the campaign. On October 15, CENTCOM announced that the ongoing coalition operations against ISIS had been designated OIR. A press release explaining the selection said that the name was “intended to reflect the unwavering resolve and deep commitment of the U.S. and partner nations” and to “symboliz[e] the willingness and dedication of coalition members to work closely with our friends in the region and apply all available dimensions of national power necessary . . . to degrade and ultimately destroy ISIL.”¹³⁹

Standing Up CJTF-OIR

CENTCOM Commander GEN Lloyd Austin formally established CJTF-OIR at ARCENT headquarters at Camp Arifjan in Kuwait under the command of U.S. Army LTG James L. Terry on October 17, 2014.¹⁴⁰ One Air Force officer characterized Terry as probably “the most receptive” of any commander to airpower because it was the only tool at his disposal without soldiers on the ground.¹⁴¹ Terry specifically asked for his deputy to be a USAF major general, but many positions earmarked for airmen within the task force staff were left unfilled because the USAF initially did not prioritize filling the billets.¹⁴² CJTF-OIR had two deputies: a deputy commander of strategy and sustainment, filled by a British Army major general, and a deputy commander of operations and intelligence, filled by a USAF major general.¹⁴³ The CFACC was separate from the CJTF and supporting the CJTF-OIR Commander. Additional details on the C2 construct are found in Appendix B.

¹³⁸ For discussion of the Obama administration’s conflicting strategic statements, see Ben Connable, Natasha Lander, and Kimberly Jackson, *Beating the Islamic State: Selecting a New Strategy for Iraq and Syria*, Santa Monica, Calif.: RAND Corporation, RR-1562-OSD, 2017, pp. 22–24.

¹³⁹ CENTCOM, “Iraq and Syria Operations Against ISIL Designated as Operation Inherent Resolve,” press release, October 15, 2014.

¹⁴⁰ Operation Inherent Resolve, “Mission,” webpage, U.S. Department of Defense, undated.

¹⁴¹ RAND interview with Maj Gen (ret.) Bruce Miller, January 8, 2020.

¹⁴² RAND interview with Maj Gen (ret.) Bruce Miller, March 27, 2020. In the fall of 2017, USAF Chief of Staff Gen David Goldfein established a team to rectify this issue and filled 109 billets on the CJTF-OIR staff to ensure that the USAF had influence in the areas of ISR, targeting, and fires. RAND email exchange with USAF officer, July 31, 2020.

¹⁴³ CJTF-OIR, “Biographies,” webpage, undated.

In many ways, the decision to place ARCENT and LTG Terry at the helm of CJTF-OIR made perfect sense. Terry and ARCENT had been running the U.S. operations against ISIS since it began as the JFLCC for U.S. operations in Iraq, and ARCENT had been transformed into a combined joint task forces three times since 2001.¹⁴⁴ ARCENT and Terry also had connections and relationships with many of the key Iraqi partners, and since this was an Iraqi- and Syrian-led war, this attribute was particularly desirable. Moreover, recent CENTCOM combatant commanders have overwhelming been drawn from either the Army or USMC and have unsurprisingly selected leaders from one of the more ground-minded forces to lead joint task forces in their AORs.¹⁴⁵ Army commands, especially corps and division headquarters, are often chosen to lead joint task forces because they have an organic ability to command and control cross-domain operations and therefore quickly can get joint headquarters operations up and running.¹⁴⁶ Recent experience, preexisting relationships with partners, ground service dominance in CENTCOM, and extant headquarters capacity all were reasons for selecting ARCENT to lead the operation.

Another factor that is sometimes considered when determining operational command, however, is a service's understanding of and fit for the dominant type of operations being undertaken.¹⁴⁷ From this standpoint, the logic for selecting ARCENT is less clear. On the one hand, President Obama had proscribed American ground forces from combat against ISIS, which in turn meant that the U.S. combat role was limited to air strikes. On the other hand, the counter-ISIS strategy emphasized defeating the physical caliphate and the fact that this was really an Iraqi and Syrian ground war against ISIS. If the former logic held, an airman should have been in charge of OIR because coalition combat operations primarily took place in the air—at least for the first year or two—while partner ground force capability was reconstituted. According to the latter logic, OIR was first and foremost a maneuver war and close fight—although not an American one—that should be led by a ground commander and someone who had close ties to the primary ground force partners.

¹⁴⁴ Center for Army Lessons Learned, *ARCENT Transition to Combined Joint Task Force—Operation Inherent Resolve: Lessons and Best Practices*, Fort Leavenworth, Kan., March 2016, p. 1.

¹⁴⁵ Caitlin Lee, Bart E. Bennett, Lisa M. Harrington, and Darrel D. Jones, *Rare Birds: Understanding and Addressing Air Force Underrepresentation in Senior Joint Positions in the Post—Goldwater-Nichols Era*, Santa Monica, Calif.: RAND Corporation, RR-2089-AF, 2017, pp. 19–20.

¹⁴⁶ Caitlin Lee, Bart E. Bennett, Lisa M. Harrington, and Darrel D. Jones, *Rare Birds: Understanding and Addressing Air Force Underrepresentation in Senior Joint Positions in the Post—Goldwater-Nichols Era*, Santa Monica, Calif.: RAND Corporation, RR-2089-AF, 2017, p. 35. ARCENT, however, experienced problems manning CJTF-OIR, and many staff members were dual-hatted. Center for Army Lessons Learned, *ARCENT Transition to Combined Joint Task Force—Operation Inherent Resolve: Lessons and Best Practices*, Fort Leavenworth, Kan., March, pp. 5–6.

¹⁴⁷ Caitlin Lee, Bart E. Bennett, Lisa M. Harrington, and Darrel D. Jones, *Rare Birds: Understanding and Addressing Air Force Underrepresentation in Senior Joint Positions in the Post—Goldwater-Nichols Era*, Santa Monica, Calif.: RAND Corporation, RR-2089-AF, 2017, p. 33.

The U.S. Army—first ARCENT, then rotating annually between the Army’s III and XVIII Airborne Corps—ultimately ended up commanding CJTF-OIR. Reportedly, GEN Austin had asked AFCENT Commander Lt Gen John Hesterman to lead the task force, but he declined.¹⁴⁸ If true, one potential reason for this decision is that the AFCENT Commander is responsible for all of the air operations in CENTCOM’s AOR, which included Afghanistan, Yemen, and the defense of the Arabian Gulf. These other responsibilities may have prevented the AFCENT Commander from having the capacity to also run a joint task force. Additionally, in 2014, the USAF did not have a designated unit that trained and equipped to be the core of a deployable joint task force headquarters.¹⁴⁹

The issue of CJTF-OIR leadership is not simply about service pride or standing, but critics of OIR have asserted that leadership fundamentally shaped how the air war was prosecuted. Lt Gen (ret.) David Deptula, for instance, argued that “if there was an Airman in charge . . . the air operations against ISIS would have been designed as an air campaign against a state, rather than as another chapter of the counterinsurgency campaigns waged in Iraq and Afghanistan that were the recent experience of the U.S. Army commanders in charge.” According to Deptula, if “rapidly crushing” ISIS “was the ‘first priority,’ an ‘air-based strategy against the Islamic State in Syria’ should have been chosen “over the ground-based strategy applied that treated airpower as simply an aerial artillery element.”¹⁵⁰

This argument ignores the fact that an aggressive air war was not in line with the chosen political strategy or the U.S. and coalition members’ preferences that civilian casualties be minimized to the greatest extent possible. It is likely that a combined joint task force commanded by an airman would have tried to prosecute a more balanced air operation and allocated more assets to developing deliberate targets so that airpower could have systematically attacked deep strategic targets, while also providing on-call support for partner ground forces. By focusing exclusively on the close fight, airmen argue that ISIS was allowed to operate with near impunity in Syria, which allowed it to largely unmolested resupply, train, and reinforce its forces in Iraq.¹⁵¹ In other words, ISIS grew more powerful and more resilient because of the lack of pressure it received in Syria. The question is how much pressure could have been applied and would it have been effective against a distributed hybrid organization like ISIS.

¹⁴⁸ RAND interview with USAF official, December 2, 2019.

¹⁴⁹ In December 2018, 9th Air Force was certified as a joint task force–capable headquarters with coalition partners. Amanda Dick, “Ninth AF Certifies as JTF-Capable HQ with Joint, Coalition Partners,” U.S. Air Force, December 28, 2018.

¹⁵⁰ David A. Deptula, “The St. Andrews Proclamation: A Pragmatic Assessment of 21st Century Airpower,” Arlington, Va.: Mitchell Institute for Aerospace Studies, June 2018, pp. 11–12.

¹⁵¹ Email exchange with Maj Gen (ret.) Scott Zobrist, June 26, 2020.

There are reasons to question whether a more airpower-centric approach from the start in OIR would have more quickly resulted in the defeat of ISIS because of the absence of capable ground partners that could clear and hold territory and insufficient intelligence on ISIS's network and operations. As will be discussed further, the joint deliberate-targeting process was unable to generate enough targets for a strategic bombing operation in the first year of OIR. This was due to inadequate intelligence on ISIS's operations, a lack of capacity in terms of people and tools, and very robust requirements for validating a target.¹⁵²

This argument also taps into the long-standing debate between airmen and soldiers about the appropriate role of airpower in air-ground operations.¹⁵³ Soldiers tend to prefer that airpower focus on the CAS mission, which requires aircraft on call and providing timely fires to support the ground scheme of maneuver.¹⁵⁴ In contrast, airmen believe that overwatch missions squander airpower's flexibility, speed, and ability to "bypass the fielded forces to the maximum extent possible" and "weaken the adversary's ability or will to engage in conflict" independently through strategic attacks.¹⁵⁵ Generations of airpower theorists and advocates have tended to argue that air forces are most strategically effective when their capabilities are used in strategic strikes against an enemy's centers of gravity—that is, high-value targets that produce disproportionate effects against an adversary's military or political will to fight. According to this perspective, CAS is an important mission but essentially an inefficient use of airpower because its effects are localized and tactical.¹⁵⁶

In OIR, this debate about the appropriate use of airpower continued, albeit in a much less contentious manner than in the past. Most airmen acknowledged that airpower alone was not going to defeat ISIS, but they still maintained that the deep fight was underresourced and that more strategic attacks against ISIS resources and C2 nodes in Syria and interdiction strikes against ISIS logistics would have helped to

¹⁵² RAND interview with Gen Jeffrey Harrigan, June 5, 2020.

¹⁵³ For more on this debate, see David E. Johnson, *Learning Large Lessons: The Evolving Roles of Ground Power and Air Power in the Post–Cold War Era*, Santa Monica, Calif.: RAND Corporation, MG-405-1-AF, 2007; Bruce R. Pirnie, Alan J. Vick, Adam R. Grissom, Karl P. Mueller, and David T. Orletsky, *Beyond Close Air Support: Forging a New Air-Ground Partnership*, Santa Monica, Calif.: RAND Corporation, MG-301-AF, 2005.

¹⁵⁴ David E. Johnson, *Learning Large Lessons: The Evolving Roles of Ground Power and Air Power in the Post–Cold War Era*, Santa Monica, Calif.: RAND Corporation, MG-405-1-AF, 2007, p. 13.

¹⁵⁵ This is the USAF doctrinal definition of *strategic attack*. Notably, strategic attacks receive less attention in joint doctrine. Curtis E. LeMay Center for Doctrine Development and Education, Air University, *Strategic Attack*, Annex 3-70, Maxwell Air Force Base, Ala., July 12, 2019, pp. 5, 8.

¹⁵⁶ See Phillip S. Meilinger, "Air Strategy: Targeting for Effect," *Aerospace Power Journal*, Winter 1999; and Philip S. Meilinger, *Paths of Heaven: The Evolution of Airpower Theory*, Maxwell Air Force Base, Ala.: Air University Press, 1997. Even theorists who argue in favor of using airpower against fielded forces have tended to advocate air interdiction in preference to CAS. See, for example, J. C. Slessor, *Air Power and Armies*, Oxford, UK: Oxford University Press, 1936; Robert A. Pape, *Bombing to Win: Air Power and Coercion in War*, Ithaca, N.Y.: Cornell University Press, 1996.

more quickly defeat the enemy. According to this view, CENTCOM and CJTF-OIR leaders, with the notable exception of LTG Sean MacFarland, tended to overwhelmingly focus on the close fight and on strikes against ISIS fighters on the front lines. This tension was played out in the competition over scarce ISR resources. Additionally, this debate took a new turn, as some airmen questioned whether many of the air strikes that followed CAS tactics, techniques, and procedures for terminal control actually required close integration with partner ground forces. According to this perspective, the strike cells were unnecessarily providing terminal guidance for many air strikes when partner ground forces were not in close contact with the enemy.¹⁵⁷ We will consider these debates in the forthcoming analysis. One fact that the next section makes clear is that airpower was not employed forcefully nor optimally in the first ten months of OIR.

The Application of Airpower, August 2014–May 2015

Figure 2.8 depicts the total number of air-to-ground sorties, the number of air-to-ground sorties with at least one weapon release, and the total number of weapons released. These statistics clearly show that the pace and the intensity of air strikes in Phase I of OIR, particularly in 2014, were low and only gradually increased. In 2014, aircraft participating in OIR launched in total only 1,377 strikes and dropped 1,889 weapons over five months of operations. This averaged out to 275 strikes and 1,178 weapons released a month, despite flying an average of 1,397 air-to-ground sorties each month. In early 2015, the pace of operations increased; five months later, a further 4,084 strikes had been launched, 3,837 air-to-ground sorties had resulted in at least one weapon release, and 15,248 weapons had been employed by the end of May. This raised the ten-month total to an average of 408 strikes a month, 383 air-to-ground sorties a month with one weapon release, and 1,524 bombs dropped a month.

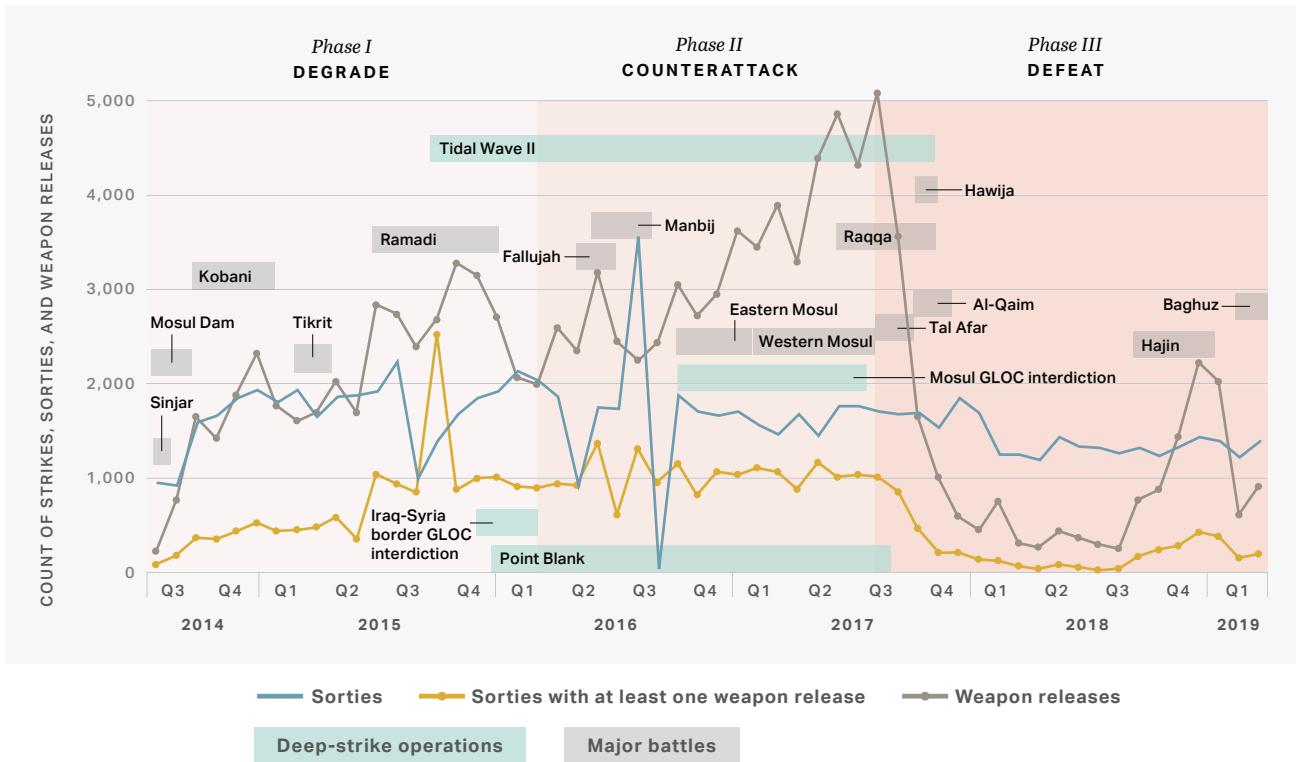
Looking at Table 2.3, which depicts AFCENT's data on air-to-ground and ISR sorties for OIR between the start of the operation in August and the end of 2014, one can see that the number of air-to-ground sorties increased but that the vast majority of these missions did not result in any bombs being dropped on ISIS targets. Figure 2.9 depicts the percentage of sorties flown by month that resulted in at least one weapon release.

In August, U.S. aircraft flew 949 air-to-ground sorties, but only 11 percent of those missions resulted in a weapon release.¹⁵⁸ In September, while the United States flew nearly double the number of air-to-ground sorties (1,871), in only

¹⁵⁷ RAND email exchange with USAF officer, July 31, 2020.

¹⁵⁸ Efficiency is desirable in air operations because there is an irreducible amount of risk each time that the aircraft flies and creates wear and tear on its systems. Additionally, mission planners normally consider the amount of resources and capacity needed to achieve certain effects. Thomas A. Keaney and Eliot A. Cohen, *Revolution in Warfare? Air Power in the Persian Gulf*, Annapolis, Md.: Naval Institute Press, 1995.

Figure 2.8
OIR Air-to-Ground Operations and Major Battles, August 2014–March 2019



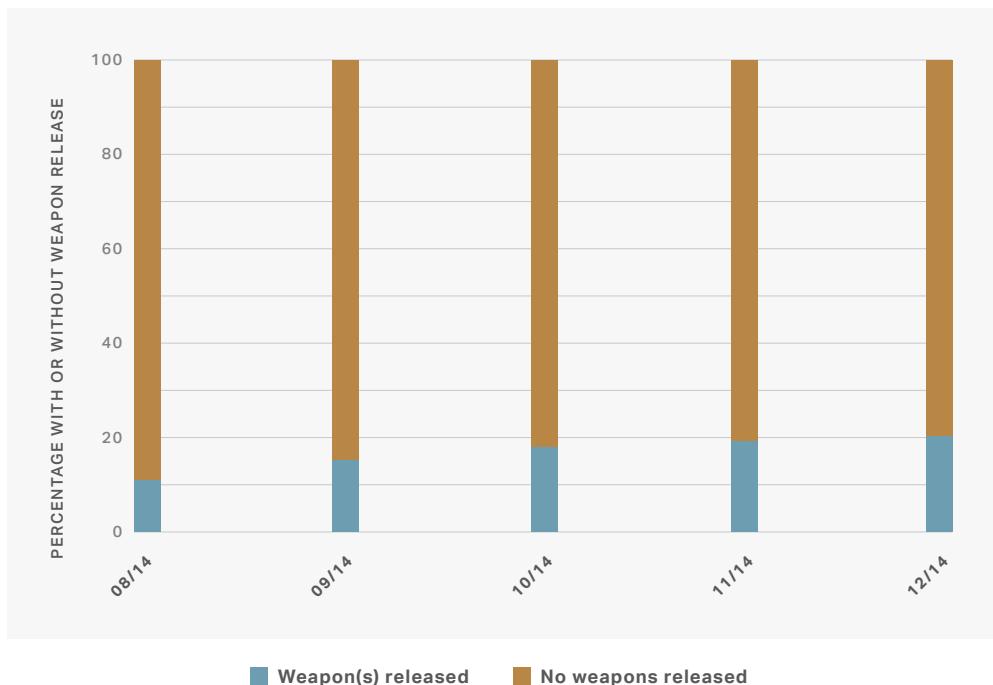
NOTE: GLOC = ground line of communication; Q = quarter.

Table 2.3
OIR Air-to-Ground and ISR Statistics, 2014

Date	Sorties	Sorties with at Least One Weapon Release	Total Weapons Released	ISR Sorties
August 2014	949	100	211	332
September 2014	1,871	280	760	723
October 2014	3,468	637	1,641	1,141
November 2014	5,136	981	1,407	1,622
December 2014	6,981	1,411	1,867	2,164

SOURCE: RAND AFCENT airpower summary data set.

Figure 2.9
Percentage of OIR Air-to-Ground Sorties with One Weapon Release in 2014



SOURCE: RAND AFCENT airpower summary data set.

15 percent of those missions were bombs dropped, an increase of only 4 percentage points from August, although the total number of weapons released was nearly three and a half times that of the August figure. In December, air-to-ground sorties flown and their efficiency peaked with 6,981 missions completed and 20 percent of those

sorties resulting in weapons being expended, for a total of 1,867 total weapons released that month. Air-to-ground strikes in the early months were hampered by a lack of ISR, in particular RPAs, whose FMV was used by the TEA to validate and approve targets. In August, there were only 332 ISR sorties flown, but that number steadily increased over 2014. By December, there were 2,164 ISR missions completed, which was nearly six and a half times that of the first month. Additionally, pilots reported that the target-approval process for dynamic strikes routinely took more than 30 minutes and sometimes even lasted hours.¹⁵⁹ An A-10 pilot complained that an overabundance of caution kept the coalition from targeting ISIS “centers of gravity in Raqqa” and other locations because the pilot could not “get authority to engage.”¹⁶⁰

Approval to engage ISIS targets was not forthcoming because of a CENTCOM-imposed civilian casualty threshold, known as a noncombatant casualty cutoff value (NCV) of zero and because TEA was held at a high level.¹⁶¹ The NCV meant that if one civilian might die, the strike required a more senior leader’s approval. After the President authorized using military force against ISIS, the first air strikes in early August were approved by CENTCOM Commander GEN Austin.¹⁶² Thereafter, LTG Terry was the only person who approved strikes until the fall of 2014, when TEA was delegated to the one-star commanders of the strike cells.¹⁶³ These constraints were put in place to protect civilian lives and in part to obtain and maintain the support of coalition and partner forces.¹⁶⁴ Critics argued that OIR was hindered by “an excessive focus on the avoidance of collateral damage and casualties.”¹⁶⁵ They alleged that the “most obsessively restrictive”¹⁶⁶ ROE ever resulted in a “timorous use of airpower,”¹⁶⁷ which produced little more than a “drizzle” of air strikes.¹⁶⁸ Senator John McCain dismissed

¹⁵⁹ Joe Pappalardo, “Year One: Inside the Air War Against ISIS,” *Popular Mechanics*, September 21, 2015; Eric Schmitt, “U.S. Caution in Strikes Gives ISIS an Edge, Many Iraqis Say,” *New York Times*, May 26, 2015.

¹⁶⁰ Eric Schmitt, “U.S. Caution in Strikes Gives ISIS an Edge, Many Iraqis Say,” *New York Times*, May 26, 2015.

¹⁶¹ Kristina Wong, “US Aim for ‘Zero Civilian Casualties’ Draws Criticism,” *The Hill*, June 24, 2015; RAND interview with LTG (ret.) James L. Terry, March 27, 2020; Sarah B. Sewall, *Chasing Success: Air Force Efforts to Reduce Civilian Harm*, Maxwell Air Force Base, Ala.: Air University Press, 2016, p. 183.

¹⁶² RAND interview with LTG (ret.) James L. Terry, March 27, 2020.

¹⁶³ RAND interview with LTG (ret.) James L. Terry, March 27, 2020; Dana Pittard and Wes Bryant, *Hunting the Caliphate: America’s War on ISIS and the Dawn of the Strike Cell*, New York: Post Hill Press, 2019.

¹⁶⁴ RAND interview with VADM (ret.) John Miller, January 28, 2020.

¹⁶⁵ David A. Deptula, “How to Defeat the Islamic State,” *Washington Post*, June 5, 2015.

¹⁶⁶ Michael Knights, “Campaign Acceleration: How to Build on Progress and Avoid Stalemate Against ISIL,” *War on the Rocks*, November 3, 2015.

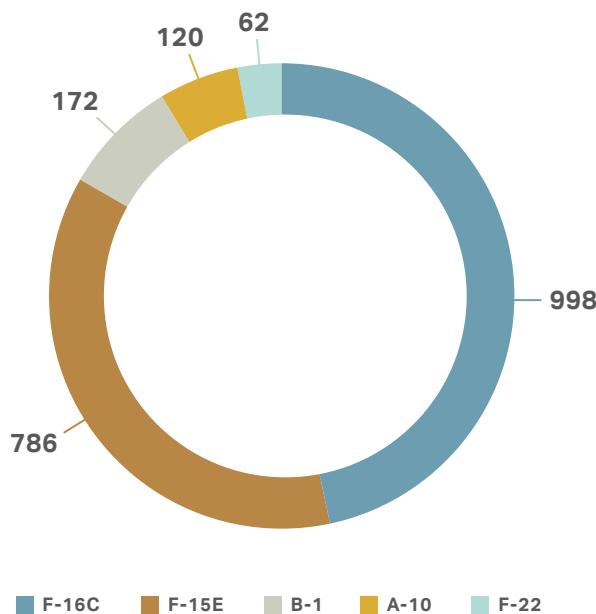
¹⁶⁷ Mark Gunzinger and John Stillion, “The Unserious Air War Against ISIS,” *Wall Street Journal*, October 14, 2014.

¹⁶⁸ David A. Deptula, “How to Defeat the Islamic State,” *Washington Post*, June 5, 2015.

“the air campaign” as “totally ineffectual.”¹⁶⁹ We did not have direct information about how allies and Iraqi and Syrian partners viewed this issue. Anecdotally, we often heard that Iraqi ground forces were frustrated by the slow target-approval process and wanted coalition air strikes to be more responsive to their needs. But the views of the government of Iraq, Syrian partners, and other coalition members might have been different.

As of December 9, 2014, fighter and attack aircraft had flown 92 percent of the USAF missions in OIR. As depicted in Figure 2.10, F-16C fighters and F-15E fighters were the workhorses, having flown 998 and 786 sorties, respectively, which equaled 84 percent of the USAF combat sorties to date. The stealthy F-22 Raptors had made their combat debut in September but flew only 62 sorties (3 percent), while the venerable A-10 attack aircraft had flown 120 missions (5 percent). B-1B bombers based at Al Udeid had completed 172 missions, which constituted 8 percent of total USAF combat sorties to date. In particular, the B-1B bombers from the 9th Bomb Squadron were heavily employed in the defense of Kobani, because the town was one of the most

Figure 2.10
Strike Sorties Flown by USAF Aircraft Employed in OIR as of December 2014



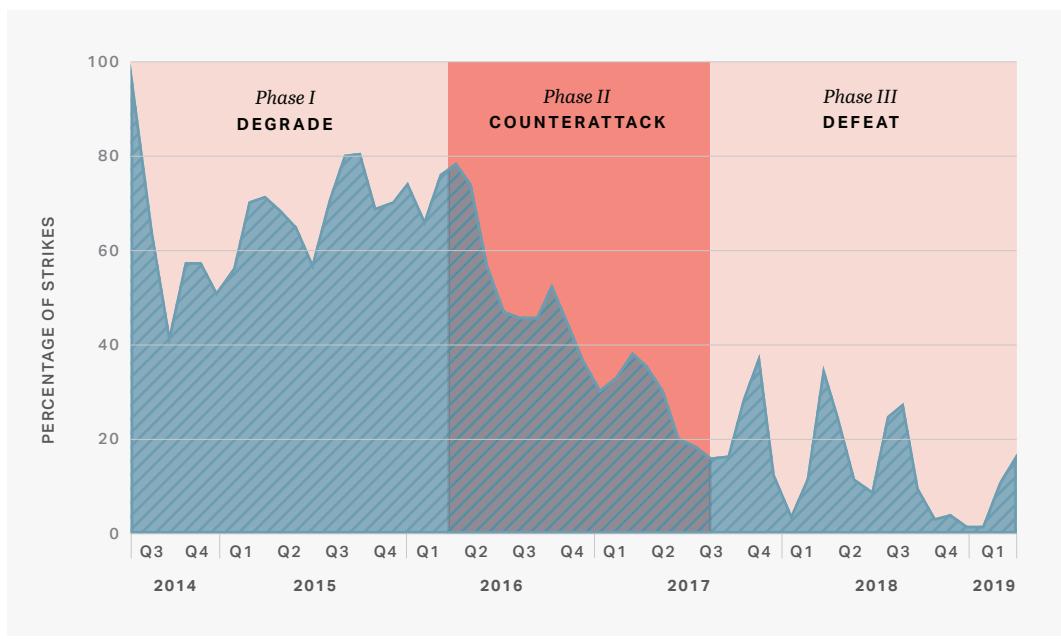
SOURCE: Data taken from AFCENT, “OIR Fighter/Bomber USAF Sorties Flown,” briefing, December 9, 2014.

¹⁶⁹ Kristina Wong, “US Aim for ‘Zero Civilian Casualties’ Draws Criticism,” *The Hill*, June 24, 2015.

distant operating locations, which meant that the B-1 bomber's endurance and large payload made it the most efficient way to deliver airpower.¹⁷⁰ Because most USAF aircraft were operating from fairly distant air bases in Kuwait, Qatar, and the United Arab Emirates, tanker aircraft were in high demand. By the end of 2014, KC-135 and KC-10 tankers had flown 4,828 sorties, an average of 966 per month, and carried out nearly 29,000 in-flight refuelings in support of OIR.¹⁷¹

In Phase I, the preponderance of OIR strikes occurred in Iraq, which is what one would expect, given that the strategy prioritized Iraq. Figure 2.11 shows the relative weight of effort between CJTF-OIR strikes in Iraq and those that targeted Syria, while Figure 2.12 shows the absolute number of targets engaged in each country by quarter. During the first ten months of operations, there were 4,814 air strikes in Iraq, while only 2,829 targets were engaged in Syria. On average that meant that the coalition was hitting 481 targets a month in Iraq, compared with 283 in Syria; however, briefly during the final stages of the liberation of Kobani in January, the number of strikes

Figure 2.11
Percentage of CJTF-OIR Strikes in Iraq and Syria

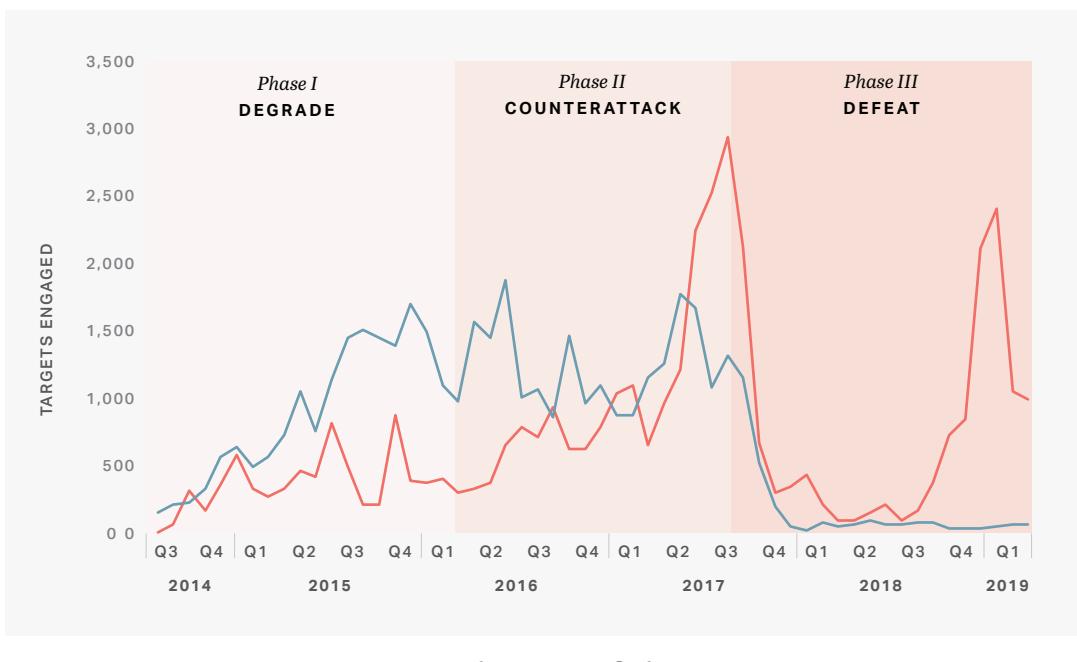


SOURCE: RAND CJTF-OIR strike release data set.

¹⁷⁰ AFHRA interview with Col Jose E. Sumangil, September 23, 2019.

¹⁷¹ RAND AFCENT airpower summary data set.

Figure 2.12
Total Targets Engaged by Country



SOURCE: RAND CJTF-OIR strike release data set.

across the two countries was nearly equal (633 in Iraq and 575 in Syria). Although this tracks with the defeat-ISIS strategy, the emphasis on Iraq does lend some credence to the criticisms that CJTF-OIR did not wage a diversified air war—and therefore did not hit many strategic targets in Phase I, especially in Syria.

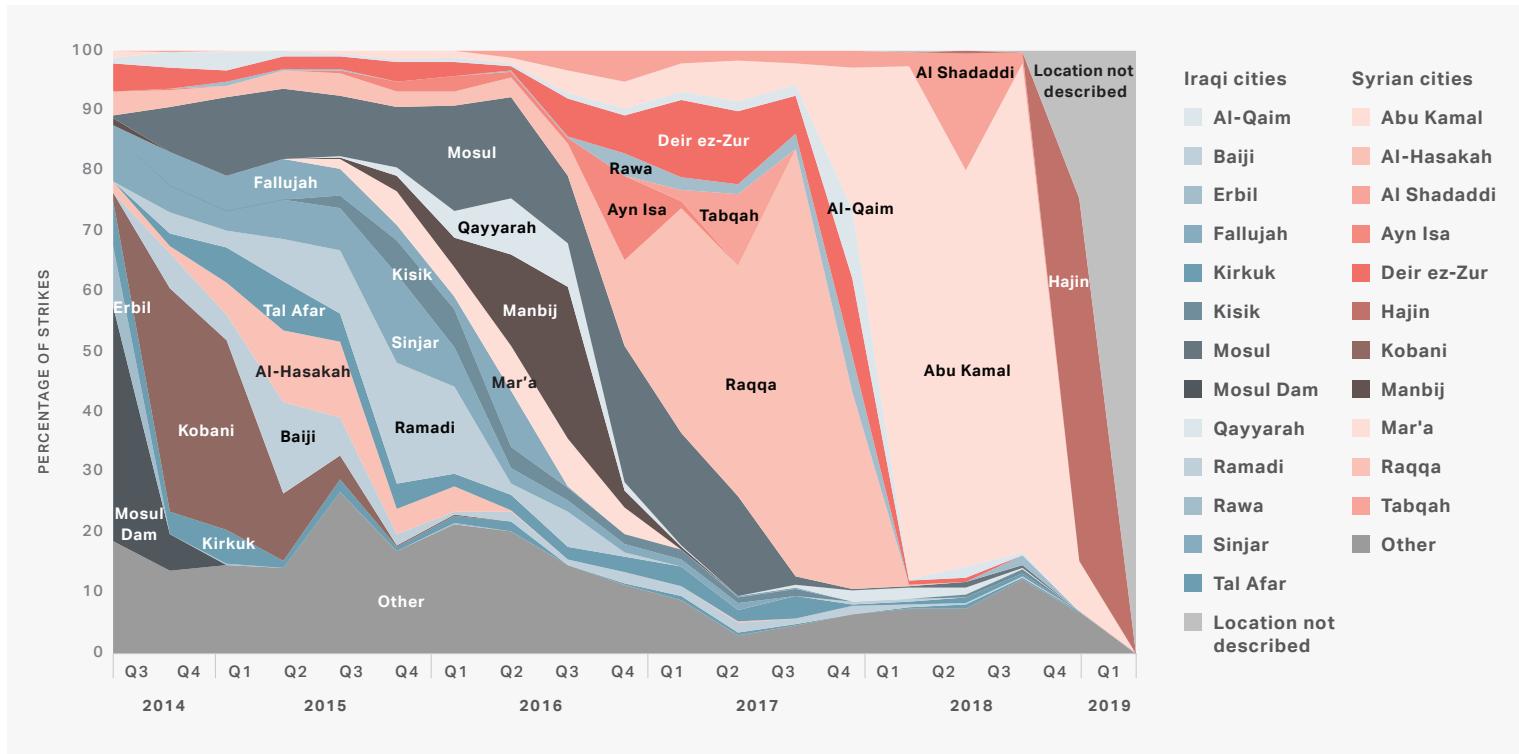
The relative weight of effort placed on Kobani at the end of 2014 is visible in Figures 2.13 and 2.14, which depict the percentage and absolute number of strikes by location, respectively. Over the last three months of 2014 and the first month of 2015, the coalition launched 887 strikes in Kobani.¹⁷² GEN Dempsey stated that he was “fearful that Kobani will fall” and that he had “no doubt” that ISIS would commit terrible atrocities if it seized the city.¹⁷³ Consequently, the coalition committed even more airpower to save the town, flying CAPs 24 hours a day over the city.¹⁷⁴ ISIS tried to

¹⁷² RAND CJTF-OIR strike release data set.

¹⁷³ Terri Moon Cronk, “Dempsey Expresses Concern Kobani Could Fall to ISIL,” U.S. Department of Defense, October 12, 2014.

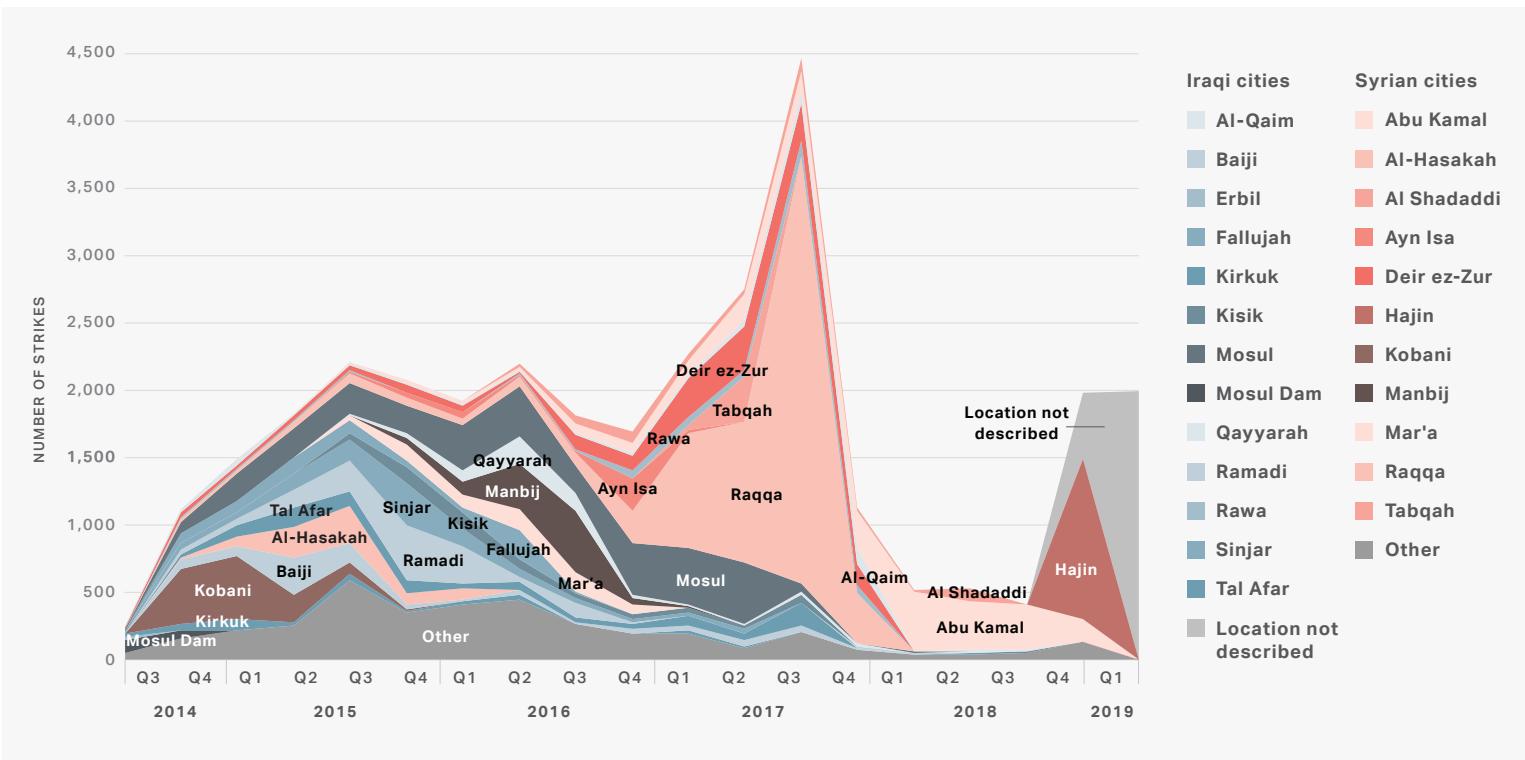
¹⁷⁴ Rebecca Grant, “The Siege of Kobani,” *Air Force Magazine*, August 29, 2018.

Figure 2.13
Proportion of CJTF-OIR Strikes, by Town



SOURCE: RAND CJTF-OIR strike release data set.

Figure 2.14
Number of CJTF-OIR Strikes, by Location



SOURCE: RAND CJTF-OIR strike release data set.

make a stand at Kobani by flowing reinforcements into the fight to show that it could prevail against the Syrian Kurds and withstand coalition airpower.¹⁷⁵

Kobani was a relatively rare opportunity in the first year of OIR; ISIS forces massed and presented many lucrative targets that coalition aircraft could quickly and easily identify and hit. AFCENT Commander Lt Gen Hesterman observed that, when ISIS tried “to act like an army . . . we kill them at a very great rate.”¹⁷⁶ This process was aided by the fact that, unlike much of OIR during the Battle of Kobani, there was a clear forward line of troops (FLOT) delineating the ISIS-controlled areas where bombs could be dropped without concern about hitting friendly forces.¹⁷⁷ Hesterman maintained that the average time for strikes authorization in battle for Kobani was “measured in minutes, not hours, or even halves of hours,” which was a stark contrast to the hours that authorization often took in other locations, especially in Iraq.¹⁷⁸ Coalition aircraft had to clear their attacks with the SOF JTACs in the strike cell watching the three to four FMV feeds from MQ-1 Predators orbiting the city, but unlike attacks in Iraq, strikes in Syria did not require clearance from a host-nation government, which expedited the process.¹⁷⁹ Over the five months of operations in Kobani, the coalition employed 2,025 weapons, 1,700 of which were precision-guided munitions.¹⁸⁰ The B-1 bombers went “winchester”—expending their entire loads out of weapons during a sortie—on 31 missions during the battle, and multiple airmen noted that the ROE in Kobani were significantly more permissive than in Afghanistan.¹⁸¹ The liberation of Kobani was completed at the end of January and is discussed in greater detail in Chapter Four.

For the first ten months of the operation, coalition air strikes were distributed across both Syria and Iraq, with few locations beside Kobani being targeted more than 50 times a quarter. Although Kobani was struck more than 400 times, the next-closest location was Mosul, with 196 strikes in the first quarter of 2015. Coalition aircraft attacked more than 50 ISIS targets in Baiji, Fallujah, Kirkuk, Sinjar, and Tal Afar, while the only Syrian city besides Kobani that was targeted more than 50 times was Al-Hasakah. Additionally, 13 to 14 percent of the strikes occurred in various other locations. The geographic spread of air strikes suggests that airpower was being employed

¹⁷⁵ Derek Henry Flood, “The Battle for Kobani Comes to the Fore,” *CTC Sentinel*, Vol. 7, No. 11, November–December 2014.

¹⁷⁶ Rebecca Grant, “The Siege of Kobani,” *Air Force Magazine*, August 29, 2018.

¹⁷⁷ AFHRA interview with Col Jose E. Sumangil, September 23, 2019.

¹⁷⁸ Rebecca Grant, “The Siege of Kobani,” *Air Force Magazine*, August 29, 2018.

¹⁷⁹ AFHRA interview with LTC Douglas J. Olsen, September 25, 2019.

¹⁸⁰ Oriana Pawlyk, “B-1B Lancer’s Evolving Mission Includes More Close-Air Support,” Military.com, January 14, 2018.

¹⁸¹ AFHRA interview with Col Jose E. Sumangil, September 23, 2019; Oriana Pawlyk, “B-1B Lancer’s Evolving Mission Includes More Close-Air Support,” Military.com, January 14, 2018.

in a reactive fashion, which was confirmed by multiple interviewees.¹⁸² Moreover, targets of opportunity became harder to find in the fall of 2014, as ISIS adapted its tactics to improve the survivability of its forces. After suffering heavy losses at Kobani, ISIS proved to be less willing to go on the offensive and seize new territory.¹⁸³ ISIS, therefore, lost the initiative and began spending more time and resources on constructing layered defenses to slow the advance of Iraqi and Syrian forces and maximize enemy and civilian casualties.¹⁸⁴

ISIS quickly modified its behavior in response to coalition air strikes, which further complicated the challenge of distinguishing ISIS fighters from civilians. As GEN Dempsey noted, “[t]hey don’t fly flags and move around in large convoys the way they did,” nor do they have headquarters that are “visible or identifiable.”¹⁸⁵ In November, 2014, GEN Austin observed that ISIS fighters “are afraid to congregate in any sizable formation, because they know that if we can see them, we’re going to engage them, and we’re going to get what we’re aiming at.”¹⁸⁶ At a press conference in the summer of 2015, Lt Gen Hesterman contested the assertion that “we’re observing large numbers” of ISIS fighters “and not killing them.” Instead, he described the significant challenges of targeting ISIS, which “wrapped itself around a friendly population.” Hesterman asserted that it was “nearly impossible” to distinguish friend from foe in Iraq because “they dress roughly the same and are using the same equipment.”¹⁸⁷

Figure 2.15 displays the type of targets prosecuted by coalition aircraft over Phase I and shows how ISIS’s efforts to distribute its forces and conceal its operations affected the air war. On average, ISIS fighters remained the largest percentage of targets engaged in the first ten months of OIR (42 percent), but there was a precipitous decline in the number of strikes against ISIS forces between August and October 2014, which went from 77 percent of the targets engaged in August to 33 percent of the targets hit in October. On average during Phase I of OIR, military forces were 39 percent of the targets attacked, and 24 percent of the targets were terrain and LOCs, 21 percent were ISIS facilities, and 16 percent were vehicles.

¹⁸² RAND interview with Maj Gen (ret.) Scott Zobrist, December 2, 2019; RAND interview with USAF official, March 4, 2020.

¹⁸³ Aymenn al-Tamimi, “The Evolution in Islamic State Administration: The Documentary Evidence,” in “Special Issue on the Islamic State,” *Perspectives on Terrorism*, Vol. 9, No. 4, August 2015.

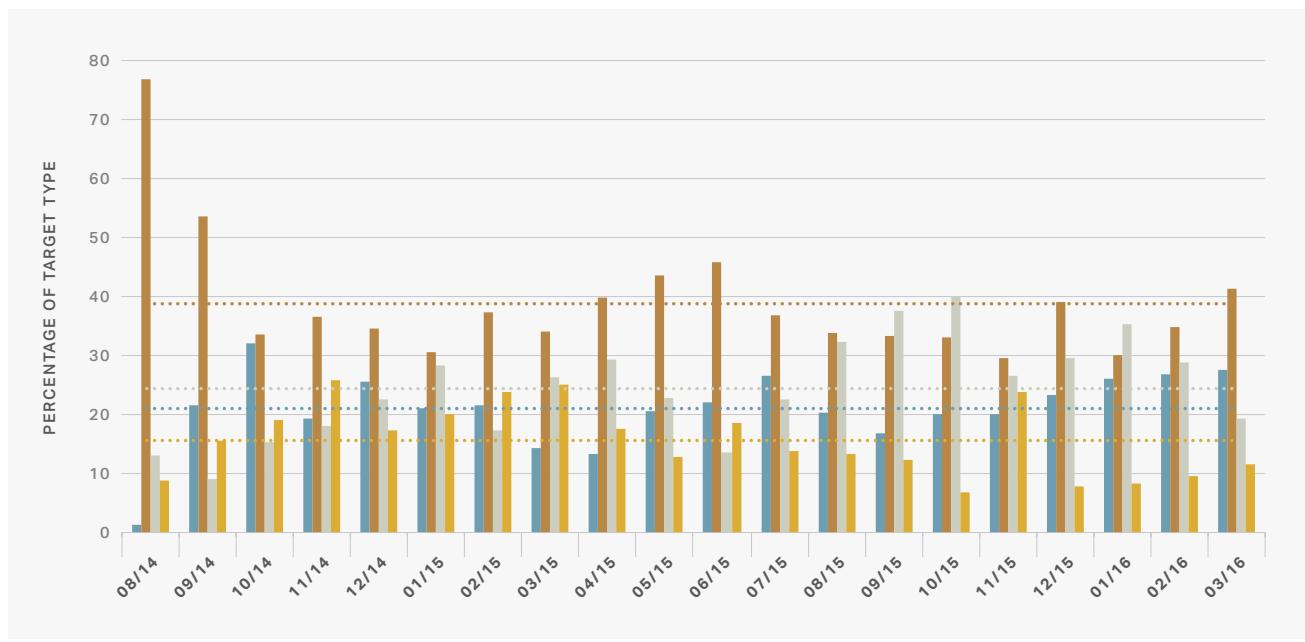
¹⁸⁴ Jessica Lewis McFate, *The ISIS Defense in Iraq and Syria: Countering an Adaptive Enemy*, Washington, D.C.: Institute for the Study of War, 2015, pp. 27–28.

¹⁸⁵ Terri Moon Cronk, “Dempsey Expresses Concern Kobani Could Fall to ISIL,” U.S. Department of Defense, October 12, 2014.

¹⁸⁶ Nick Simeone, “Centcom Chief Notes ‘Significant’ Progress in ISIL Fight,” U.S. Department of Defense, November 9, 2014.

¹⁸⁷ John W. Hesterman III, “Department of Defense Press Briefing by Lt. Gen. Hesterman Via Telephone from the Combined Air and Space Operations Center, Southwest Asia in the Pentagon Press Briefing Room,” transcript, U.S. Department of Defense, June 5, 2015.

Figure 2.15
CJTF-OIR Type of Targets Engaged in Phase I



..... Facilities and resources (average) Military forces (average) Terrain and LOCs (average) Vehicles (average)
 ■ Facilities and resources ■ Military forces ■ Terrain and LOCs ■ Vehicles

SOURCE: RAND CJTF-OIR strike release data set.

In December 2014, LTG Terry asserted that “we’re seeing initial successes” and that ISIS “has been halted” and is “transitioning to the defense” in an attempt “to hold what they currently have.¹⁸⁸ In general, evidence does seem to suggest that ISIS lost the initiative, but the group retained the vast bulk of its core territory.¹⁸⁹ Yet, after Kobani, the air war seemed to lose momentum with fewer weapons released despite a relatively consistent number of air-to-ground sorties per month (see Figure 2.8). Although some of the early strikes against ISIS had been preplanned—deliberate strikes that were executed through the ATO, usually against fixed targets—once these were prosecuted, there was not, as Hesterman admitted, “a well-developed target set” for ISIS, and those targets that were generated were not a product of systematic target analysis.¹⁹⁰

According to Air Force doctrine, there are two types of targeting processes: deliberate and dynamic. The former process is typically employed for strategic and interdiction strikes, while the latter is used for CAS. Deliberate targets are generated through a joint targeting cycle that begins with the commander’s guidance and then moves through a rigorous target-development process in which considerable intelligence is collected and evaluated as a part of a target-system analysis before a target can be approved and added to a joint integrated prioritized target list (JIPTL). A capability analysis then evaluates different weapon options for validated targets to achieve desired damage levels, the commander decides whether to engage the target and allocate resources to achieve the desired effect, the attack is executed, and then its effects are assessed. In OIR, the deliberate-targeting process had demanding intelligence requirements—usually including some specific number of hours of uninterrupted FMV to minimize civilian casualties. As a result, it typically took between three and six weeks to generate deliberate targets.

Dynamic targeting was used for any enemy targets that were not identified early enough to be included in the deliberate process, which in OIR was the bulk of air strikes. Dynamic targets were established by Iraqi or Syrian forces, nominated by a strike cell, or spotted by an aircrew. A target identified by any of these sources then went through a compressed targeting process in which the strike cell vetted the target to determine whether it was legitimate and if it complied with the ROE and weaponized it, and the U.S. TEA (at this point a one-star general) and the Iraqi or Kurdish government official decided whether U.S. forces were authorized to engage it. The timeline for the dynamic-targeting process varied, but it typically took somewhere between minutes in the case of Kobani and hours. Nonetheless, there were pilot and

¹⁸⁸ James L. Terry, “Department of Defense Press Briefing by Lt. Gen. Terry in the Pentagon Briefing Room,” transcript, U.S. Department of Defense, December 18, 2014.

¹⁸⁹ Jessica Lewis McFate, *The ISIS Defense in Iraq and Syria: Countering an Adaptive Enemy*, Washington, D.C.: Institute for the Study of War, 2015, p. 27.

¹⁹⁰ John W. Hesterman III, “Department of Defense Press Briefing by Lt. Gen. Hesterman Via Telephone from the Combined Air and Space Operations Center, Southwest Asia in the Pentagon Press Briefing Room,” transcript, U.S. Department of Defense, June 5, 2015.

partner complaints that the dynamic-targeting process was too prolonged and that air strikes were not sufficiently responsive.

The CJTF-OIR-led targeting enterprise had atrophied and struggled during the first year of OIR because of a lack of intelligence on ISIS, extremely stringent CENTCOM-set requirements for validating deliberate targets, and the absence of clear commander guidance on deliberate-targeting priorities, which in turn made it difficult to obtain ISR assets for target development. In part because the coalition's targeting enterprise, led by CJTF-OIR, could not consistently produce a stream of well-developed and vetted targets over the first year, there were few deep strikes against ISIS strategic targets.¹⁹¹

Most aircraft did not know their targets before they took off and instead flew to assigned coordinates on a grid, where they circled and searched for possible ISIS activity. If they found suspected ISIS activity or if ground partners requested air support through the strike cells, the strike cells verified that these targets were the enemy, and that there were no civilians around, then aircraft would be allowed to engage the targets. Dynamic targeting against a hybrid enemy, in the absence of ground operations, and with relatively tight ROE, inevitably led to airpower being employed in a restrained way to support political objectives. Between August and May, only 26 percent of the air-to-ground missions dropped at least one weapon. Because the situation on the ground also remained relatively static, some began to question the efficacy of the U.S.-led intervention and the administration's strategy for defeating ISIS and concluded that the war was at a stalemate.¹⁹²

In February 2015, Ash Carter was sworn in as the new Secretary of Defense, replacing Chuck Hagel. Carter quickly concluded that more needed to be done to “accelerate” the campaign against ISIS. Although generally supportive of the “by, with, and through” defeat-ISIS strategy, Carter believed that the current approach was poorly explained to the public and that the United States needed to develop a more detailed operational plan that laid out the sequence of steps that would ultimately result in “a lasting defeat” of ISIS.¹⁹³ But this required a coordinated effort that needed the approval of not only President Obama but also Iraqi and Syrian partners and the international coalition.

In testimony to Congress in March, Undersecretary of Defense Christine Wormuth reported that the coalition had “blunted ISIL’s momentum” and “degraded its

¹⁹¹ RAND interview with Maj Gen (ret.) Scott Zobrist, December 2, 2019.

¹⁹² William M. Thornberry, “Opening Statement from Hon. William M. ‘Mac’ Thornberry,” statement before the House Committee on Armed Services, March 3, 2015; Loveday Morris, “Iraqi Offensive for Tikrit Stalls as Casualties Mount,” *Washington Post*, March 16, 2015.

¹⁹³ Ash Carter, “A Lasting Defeat: The Campaign to Destroy ISIS,” Belfer Center for Science and International Affairs, Harvard Kennedy School, October 2017, pp. 5–6.

ability to mass and maneuver forces.”¹⁹⁴ This was a key part of the Obama administration’s strategy. Coalition airpower would grant the Iraqi government and security forces enough time to regroup and prepare for and launch a sustained counterattack.¹⁹⁵ CENTCOM Commander GEN Austin agreed that air strikes had ISIS in a “defensive crouch in Iraq” and pointed to the fact that the coalition had killed more than 8,500 ISIS fighters and destroyed hundreds of vehicles, tanks, and weapons as signs of progress. But because “this is an Iraqi effort,” Iraqis will have to take the next steps.¹⁹⁶ The metrics cited by DoD and CENTCOM officials indicated that OIR was realizing tactical achievements by destroying ISIS equipment and killing its fighters, but beyond stopping ISIS’s offensive, these indicators were not tied to other operational and strategic gains. In February, a CENTCOM official announced that the Iraqis would launch the counterattack on Mosul in the April–May time frame, but some, such as Secretary Carter, doubted the feasibility of this timeline and began to worry that the United States would need to commit more forces to break the gridlock.¹⁹⁷

Moreover, the Iraqis did not seem eager to go on the offensive. In April and March 2015, there was one major Iraqi counterattack—the liberation of Tikrit. Coalition aircraft, however, barely participated in this difficult operation because of the prominent role played by the Shia militias under the direction of Iranian General Qasem Soleimani. The United States refused to provide air support for the so-called PMF, the Iraqi Shia militias, because they were backed by Iran, some of them had attacked American troops during Operation Iraqi Freedom, and they had been accused of committing atrocities during the course of the war against ISIS.¹⁹⁸

Before this initiative could make much progress, however, OIR suffered a series of setbacks in May 2015 because of successful ISIS attacks on the Iraqi town of Ramadi and the Syrian town of Palmyra.¹⁹⁹ These losses, in particular Ramadi, raised questions about the progress made to date against ISIS and the overall feasibility of the

¹⁹⁴ Christine E. Wormuth, “Statement of Honorable Christine E. Wormuth, Undersecretary of Defense for Policy, U.S. Department of Defense,” statement before the House of Representatives Committee on Armed Services, March 3, 2015.

¹⁹⁵ John W. Hesterman III, “Department of Defense Press Briefing by Lt. Gen. Hesterman Via Telephone from the Combined Air and Space Operations Center, Southwest Asia in the Pentagon Press Briefing Room,” transcript, U.S. Department of Defense, June 5, 2015.

¹⁹⁶ Lloyd J. Austin III, “Statement of GEN Lloyd J. Austin, III, USA, Commander, U.S. Central Command,” statement before the House of Representatives Committee on Armed Services, March 3, 2015.

¹⁹⁷ Bill Chappell, “U.S.: Major Offensive Planned Against ISIS in Mosul This Spring,” NPR, February 20, 2015; Ash Carter, “A Lasting Defeat: The Campaign to Destroy ISIS,” Belfer Center for Science and International Affairs, Harvard Kennedy School, October 2017, p. 14.

¹⁹⁸ Michael Weiss and Michael Pregent, “The U.S. Is Providing Air Cover for Ethnic Cleansing in Iraq,” *Foreign Policy*, March 28, 2015.

¹⁹⁹ Anne Barnard and Hwaida Saad, “ISIS Fighters Seize Control of Syrian City of Palmyra, and Ancient Ruins,” *New York Times*, May 20, 2015.

“by, with, and through” strategy. In Ramadi, ISIS took advantage of a sandstorm, which grounded coalition aircraft during the initial assault.²⁰⁰ In scenes reminiscent of the summer 2014 offensive, the ISF “weren’t driven out of Ramadi” the Chairman of the Joint Chiefs of Staff candidly explained; “they drove out of Ramadi” without putting up much of a fight.²⁰¹ ISIS’s assault on Palmyra was similarly unmolested by coalition air strikes. The United States had limited its attacks in Syria to the northeast, which was far from the Syrian government’s control, and avoided locations, such as Palmyra, where the air strikes were likely to help al-Assad’s forces to make gains on the ground.²⁰² U.S. officials portrayed this as a tactical gain for ISIS and a part of the inevitable back and forth that occurs during a war but maintained that the coalition’s strategy remained sound and was weakening ISIS. The losses at Ramadi and Palmyra, however, set the stage for a series of alterations to OIR, which helped the defeat-ISIS campaign gain momentum.

Picking Up the Pace: Establishing a Deep Fight and Starting the Counterattack, June 2015–March 2016

During the second part of Phase I, the coalition turned the tables on ISIS and began to make incremental, but consistent, progress by eliminating ISIS’s territorial holdings and stressing its finances. A number of factors drove these changes and contributed to this outcome. In addition to the new Secretary of Defense, there was a new CFACC and a new CJTF-OIR Commander, all of whom worked together to improve the efficacy of the coalition’s air operations and to make headway toward the ultimate goal of a lasting defeat of ISIS.

When Lt Gen Charles Q. Brown took over command of AFCENT in June 2015, he found that well over 90 percent of the OIR air strikes were dynamic targets, which resulted in U.S. aircraft reactively bombing ISIS with incredible accuracy and tactical proficiency but with little long-term impact because ISIS’s distributed operations made it resilient, and it was able to quickly regenerate lost capacity.²⁰³ The problem was not an insufficient amount of coalition combat airpower. There were approximately 70 to 80 combat aircraft that were flying, on average, 120 hours of on-station overwatch missions per day, enabling the CAOC to provide continuous coverage over two to three locations, while having a little excess capacity for strikes elsewhere. Instead of a linear approach in which the bulk of the airpower was providing overwatch of particu-

²⁰⁰ Eric Schmitt and Helene Cooper, “ISIS Fighters Seized Advantage in Iraq by Striking During Sandstorm,” *New York Times*, May 18, 2015.

²⁰¹ Jim Garamone, “Dempsey: Iraqi Forces Not Driven from Ramadi, They Drove out of Ramadi,” U.S. Department of Defense, May 20, 2015.

²⁰² Anne Barnard and Hwaida Saad, “ISIS Fighters Seize Control of Syrian City of Palmyra, and Ancient Ruins,” *New York Times*, May 20, 2015.

²⁰³ RAND interview with Gen Charles Q. Brown, February 20, 2020.

lar areas or maneuver forces, Brown wanted more-diverse, “proactive” air operations that applied “pressure in multiple locations.”²⁰⁴ CJTF-OIR was focused almost exclusively on the tactical fight in Iraq because of the defeat-ISIS strategy, the absence of a detailed campaign plan that linked ground maneuvers with deep-strike operations, and the dominance of the strike cells, as well as, to a certain extent, because of the familiarity of U.S. Army officers with the country after years of operations there.²⁰⁵ The CFACC worried that a single-minded focus on Iraq would be ineffective because ISIS had sanctuary in Syria and that airpower should be used to pressure and cripple ISIS operations in Syria, while awaiting the Iraqi counteroffensive.

Yet the CJTF-OIR-led joint targeting process could not generate more than a handful of deliberate targets at a time, given inefficiencies within the target-development process and a shortage of RPAs and other intelligence platforms allocated to conduct ISR for deep operations, which meant that Lt Gen Brown could not effectively advocate for a more strategic application of airpower in ISIS’s rear areas. After decades of flying primarily overwatch mission with little but CAS and dynamic targets since September 11, the joint community’s ability and capacity to plan and develop a deliberate strike operation in the deep areas atrophied.²⁰⁶ This meant that many practitioners lacked experience in applying these processes to real-world operations and the “muscle memory” to rapidly execute them. The joint targeting enterprise also was underresourced, with insufficient people and antiquated tools (e.g., software) and processes that were cumbersome.²⁰⁷ Finally, deliberate targeting required a shift in mindset from a focus on providing time-sensitive on-call support to a longer-term perspective that weighed future collection opportunities.

In the summer of 2015, Lt Gen Brown ordered AFCENT to “fix the target development process” because it was “broken.”²⁰⁸ As discussed in greater detail in Chapter Five, AFCENT supplemented its limited intelligence capacity, which was a major factor that inhibited the development of target packages, by building a federated ISR system that pulled together information from intelligence organizations across DoD. These analysts also began to conduct a target system analysis to identify ISIS centers of gravity and understand how the network worked, so that they could have a more enduring impact on its operations.²⁰⁹ The deliberate target-development process

²⁰⁴ RAND interview with Gen Charles Q. Brown, February 20, 2020.

²⁰⁵ RAND interview with USAF official, December 3, 2019.

²⁰⁶ Email exchange with Lt Gen Scott Kindsvater, June 26, 2020.

²⁰⁷ RAND interview with Gen Jeffrey Harrigian, June 5, 2020.

²⁰⁸ RAND interview with Gen Charles Q. Brown, February 20, 2020.

²⁰⁹ Michael R. Gordon and Eric Schmitt, “U.S. Steps Up Its Attacks on ISIS Controlled Oil Fields in Syria,” *New York Times*, November 12, 2015. Carter also noted “the paucity of intelligence” on ISIS. Ash Carter, “A Lasting Defeat: The Campaign to Destroy ISIS,” Belfer Center for Science and International Affairs, Harvard Kennedy School, October 2017. For more on targeting a hybrid adversary, see Chance A. Smith and Steve W. Rust, “Geo-

remained challenging because ISIS was not a conventional enemy with an array of traditional military targets; it also became increasingly difficult as ISIS went underground, because it was often time-consuming to discriminate between civilians and the enemy and to verify that a particular target was indeed ISIS.

As the CAOC worked to build a deliberately planned deep fight, two developments helped propel this process forward. The first was a SOF raid that killed an ISIS financial emir, Abu Sayyaf, in May 2015 and yielded a rich trove of documents that detailed ISIS financial operations, identifying targets that could be prosecuted from the air.²¹⁰ The second was transition of command of CJTF-OIR to LTG Sean MacFarland and III Corps, in September 2015. The transition to III Corps brought in a commander who was able to focus on the military operation because he was unencumbered by ARCENT's Title 10 responsibilities, which also demanded a good bit of Terry's time.²¹¹ As a corps commander, MacFarland had a broad perspective of the battlespace and was aware of the need to vigorously prosecute the deep fight to shape the close fight and accelerate the defeat of ISIS. Toward this end, MacFarland reworked the campaign plan that had begun under Terry to synchronize and sequence Syrian and Iraqi partners' schemes of maneuver with deep-strike operations, so that the deep fight could support the close one. By doing so, with coalition air support, Iraqi and Syrian ground forces were able to seize the initiative from ISIS and gain momentum. MacFarland specifically laid out priorities for the deep fight as enemy resources, C2, and LOCs, which eased the process of obtaining ISR assets to develop these targets. The integrated campaign plan aimed for a more even division of air strikes between dynamic frontline targeting and deliberate deep strikes to synergize air strikes' effects by simultaneously applying pressure on ISIS from multiple directions.²¹²

Additionally, because Secretary Carter had attributed many of the challenges with the operation to the "fractured" command construct, he centralized control of all counter-ISIS efforts in Iraq and Syria, with the exception of tier 1 SOF, under CJTF-OIR and MacFarland.²¹³ The newly empowered CJTF-OIR Commander, in partner-

graphic Component Network Analysis: A Methodology for Deliberately Targeting a Hybrid Adversary," *Joint Forces Quarterly*, Vol. 88, January 2018.

²¹⁰ Eric Schmitt, "A Raid on ISIS Yields a Trove of Intelligence," *New York Times*, June 8, 2015.

²¹¹ Unlike ARCENT, which is responsible for administrative control of all Army forces in CENTCOM and the Army support to other services and Title X duties, a corps headquarters is unencumbered by these responsibilities. This meant that MacFarland had more time to focus on military operations than Terry did. Also, MacFarland had the benefit of having a Combined Joint Forces Land Component Command (CJFLCC) subordinate commander, while Terry did not. We thank COL Francis Park at the Joint History Office for raising this point.

²¹² RAND interview with LTG (ret.) Sean MacFarland, March 31, 2020.

²¹³ Ash Carter, "A Lasting Defeat: The Campaign to Destroy ISIS," Belfer Center for Science and International Affairs, Harvard Kennedy School, October 2017; RAND interview with LTG (ret.) Sean MacFarland, March 31, 2020. Tier 1 SOF remained outside the CJTF-OIR Commander's chain of command, but he retained veto authority over all their operations.

ship with the CFACC, now sought to turn up the pressure on ISIS by targeting its finances, while continuing to soften ISIS defenses in Ramadi in preparation for the impending ISF counterattack.

AFCENT officials also noted that around the same time there were changes made to clarify battlefield geometry—the division of the battlespace into separate areas of operations with different fire-control measures—which facilitated the execution of deep-strike operations.²¹⁴ Although the CJTF-OIR Commander controlled all the air-space over Syria and Iraq, he delegated responsibility for parts of it, which were within the FSCL, to CJOCS in Iraq. Beyond the FSCL, LTG MacFarland, authorized the CFACC, Coalition Forces Land Component Command, and SOJTF to engage targets without going through additional coordination measures. In part, the absence of a CFACC-controlled battlespace is a symbolic issue that reflects the lack of early focus on deep strikes. But it also had implications for the target-engagement process because, by default, air-to-ground operations required coordination with ground commanders and terminal control by a JTAC, which slowed down the process of approving air strikes. In Syria, approximately 90 percent of the time, it was the CFACC who was undertaking deep strikes to support the task force’s campaign plan.²¹⁵

Before that could happen, however, Russia began conducting air strikes in Syria on September 30, 2015, further complicating already-challenging airspace. Russian forces intervened in the Syrian civil war to prop up the faltering al-Assad regime. Although Russia had supported al-Assad since the civil war began in 2011, it had refrained from direct involvement in the conflict. After ISIS defeated Syrian regime forces in Palmyra, however, Moscow feared that the regime was about to collapse and that Syria would become a haven for Islamic extremists, which posed a threat to Russia.²¹⁶ Although claiming to only target terrorists, Russia actually focused its strikes on opponents of the Syrian regime.²¹⁷ The United States was already “flying permissively in a nonpermissive environment” in Syria, since the Syrian government had not approved of the coalition air strikes, but neither had the coalition disabled Syrian air defenses.²¹⁸ Now it had to contend with additional potentially hostile aircraft that at times tried to intimidate coalition pilots by flying aggressively close to them and even more-capable Russian air defenses.

²¹⁴ RAND interview with Gen Charles Q. Brown, February 20, 2020; RAND interview with Maj Gen (ret.) Scott Zobrist, December 2, 2019.

²¹⁵ RAND interview with LTG (ret.) Sean MacFarland, March 31, 2020.

²¹⁶ Samuel Charap, Elina Treyger, and Edward Geist, *Understanding Russia’s Intervention in Syria*, Santa Monica, Calif.: RAND Corporation, RR-3180-AF, 2019, pp. 4–5.

²¹⁷ Helene Cooper, Michael R. Gordon, and Neil MacFarquhar, “Russians Strike Targets in Syria, but Not ISIS Areas,” *New York Times*, September 30, 2015.

²¹⁸ RAND interview with Gen Charles Q. Brown, February 2020.

After Russia annexed Crimea in 2014, Congress inserted a provision in the Fiscal Year (FY) 2016 National Defense Authorization Act that prohibited military cooperation with Russia.²¹⁹ In accordance with this law, CENTCOM refused to cooperate or coordinate with the Russians, but it did take measures to deconflict air operations. Within a month of the first Russian air strike, Moscow and Washington reached a memorandum of understanding “aimed at minimizing the risk of inflight incidents” that outlined safety protocols and established a direct LOC.²²⁰ The communication channel established in the memorandum of understanding decreased the risk of a potential hostile event. In 2015, U.S. and Russian air operations were over different parts of Syria, but, over time, as the proximity of coalition and Russian air operations converged, the communication channel’s frequency of use increased, and coalition pilots established procedures to clearly signal that they would hold their position and would act to defend themselves if threatened. This was another factor that distinguished operations in the airspace over Syria from Iraq, making them increasingly dissimilar, just as CJTF-OIR sought to increase the pressure on ISIS in Syria.

OIR’s first large deliberate-targeting operation began on October 21, 2015, when bombers and fighters struck 26 ISIS targets at al-Omar oil field in Syria, marking a significant shift in air operations.²²¹ The effort, named Operation Tidal Wave II, aimed to destroy ISIS’s oil enterprise by systematically attacking oil extraction, production, and distribution targets. Although aircraft had bombed ISIS’s oil infrastructure previously, these attacks were prosecuted as they were identified, often as one-off strikes, and ISIS quickly repaired the damage and resumed operations. Tidal Wave II aimed to cripple ISIS’s oil operations for months if not years in a far more destructive and expansive wave of strikes, including attacks against tanker trucks.²²² Previously, the trucks had not been targeted because the drivers were designated as civilians and thus protected under the Law of Armed Conflict (LOAC). Tidal Wave II is discussed in greater detail in Chapter Five.

The defeat-ISIS operation gained additional urgency after ISIS began to horizontally escalate by launching terrorist attacks in other theaters. On November 13, ISIS gunmen and suicide bombers launched nearly simultaneous attacks on a concert hall, stadium, restaurants, and bars in Paris, killing 130 and wounding hundreds more.²²³ The Paris attacks made it clear that ISIS posed a growing threat to Europe

²¹⁹ Public Law 114-92, National Defense Authorization Act for Fiscal Year 2016, November 25, 2015.

²²⁰ Lisa Ferdinando, “U.S., Russia Sign Memorandum on Air Safety in Syria,” U.S. Department of Defense, October 20, 2015.

²²¹ Michael R. Gordon and Eric Schmitt, “U.S. Steps Up Its Attacks on ISIS Controlled Oil Fields in Syria,” *New York Times*, November 12, 2015.

²²² Matthew Reed, “Blowing Up the Islamic State’s Oil Company,” *Foreign Policy*, October 26, 2016; Stephen Losey, “A-10s and C-130s Destroy Islamic State Fuel Trucks,” *Air Force Times*, November 19, 2015.

²²³ “Paris Attacks: What Happened on the Night,” BBC, December 9, 2015.

and potentially the United States and galvanized support for intensifying the operation against ISIS in the coalition.²²⁴ Shortly thereafter, the British government decided to begin to target ISIS in Syria, and other European coalition members soon followed suit.²²⁵ Secretary of Defense Carter informed Congress in early December about a series of accelerants that President Obama had approved before the Paris attacks that were intended to build momentum behind the military operations against ISIS. These measures included deploying U.S. SOF to Syria and a specialized expeditionary targeting force to work with Iraqi special forces.²²⁶

Moreover, by this point the coalition's train-and-equip program with the Iraqi and Peshmerga forces was yielding some modest results, which meant that ground partners in Iraq were now capable of going on the offensive.²²⁷ As GEN Dempsey had noted earlier, "the silver bullet was getting the Iraqis to fight," because this was their war.²²⁸ But, additionally, capable ground forces had a synergistic effect with airpower. In the north, Kurdish and Yazidi forces supported by coalition aircraft reclaimed Sinjar in two days in mid-November after 15 months of ISIS occupation. Coalition aircraft executed 30 strikes the day before the ground assault and provided air support as the Kurds and Yazidis advanced into the town. As a part of the same operation, ISIS also lost control of the strategic east-west Highway 47, which was a heavily trafficked route linking its two capitals—Raqqa and Mosul.²²⁹

In December, the ISF began the long-awaited attack to liberate Ramadi, which, in contrast to the Sinjar operation, was a "grind."²³⁰ As discussed in Chapter Four, the attacking Iraqi force was much more powerful than the ISIS force defending the city, yet it was still difficult to motivate the Iraqis to go on the offensive, and the battle "devolved into a slog" in part because the coalition had not waged a deep fight to shape the close fight.²³¹ Other factors were stacked in the favor of the ISF, which had

²²⁴ Ash Carter, "A Lasting Defeat: The Campaign to Destroy ISIS," Belfer Center for Science and International Affairs, Harvard Kennedy School, October 2017; Brett McGurk, "Coalition Efforts Against ISIL," transcript, U.S. Department of State, November 20, 2015.

²²⁵ Ash Carter, "Statement from Secretary Carter on Counter-ISIL Actions by the United Kingdom and Germany," transcript, U.S. Department of Defense, December 2, 2015.

²²⁶ Ash Carter, "Statement on Counter-ISIL Campaign Before the Senate Armed Services Committee," transcript, U.S. Department of Defense, December 9, 2015.

²²⁷ Linda Robinson, *Assessment of the Politico-Military Campaign to Counter ISIL and Options for Adaptation*, Santa Monica, Calif.: RAND Corporation, RR-1290-OSD, 2016, p. 47.

²²⁸ Jim Garamone, "Dempsey Describes ISIL Strategy, 'Uncertain' Global Security," U.S. Department of Defense, July 7, 2015.

²²⁹ Michael R. Gordon and Rukmini Callimachi, "Kurdish Fighters Retake Iraqi City of Sinjar from ISIS," *New York Times*, November 13, 2015; Denise Natali, "Lessons from the Liberation of Sinjar," *War on the Rocks*, November 25, 2015.

²³⁰ Email exchange with LTG (ret.) Sean MacFarland, June 25, 2020.

²³¹ RAND interview with LTG (ret.) Sean MacFarland, March 31, 2020.

heavy weapons, numerical superiority, and coalition air support. The Iraqis eventually prevailed in Ramadi because it was a relatively small city, it had been mostly evacuated, and it was relatively proximate to ISF bases that facilitated operations. There was a notable difference between the Iraqi units that had been trained by the coalition and those that had not. The former fought hard and executed complicated combined arms maneuvers, while the latter's performance was generally less impressive.²³² Nevertheless, as LTG MacFarland argued, “The cumulative impact of our airstrikes has ground the enemy down. When applied in support of our partners we've forced the enemy to give up terrain.” MacFarland went out to assert that “the recapture of Ramadi was a turning point in this campaign,” in part because it boosted the ISF’s confidence and demonstrated that ISIS could be defeated.²³³ The liberation of Ramadi did indeed mark the first major victory in what was a fairly long road to eliminating ISIS in Iraq. CJTF-OIR also learned valuable lessons from the Battle of Ramadi—most importantly that the task force would need to do a much better job of shaping Mosul and Raqqa with deep air strikes to weaken ISIS before beginning a direct assault.²³⁴

While these ground maneuvers were occurring, Operation Tidal Wave II continued and CJTF-OIR sought to expand the deep fight by hitting ISIS stores of cash (Operation Point Blank) and initiating an interdiction operation to stop ISIS forces from moving between Iraq and Syria.²³⁵ Operation Point Blank had some spectacular successes, such as the Mosul bank strike on January 11, 2016, which sent piles of burning cash into the air, as shown in a video released by DoD.²³⁶ To execute this mission, intelligence was fused from multiple sources to gain a detailed understanding of where ISIS fighters were in the building and where the money was stored, which was used by targeteers to develop weaponeering that incinerated the cash while minimizing civilian casualties.²³⁷ Another strike on a cash-collection site followed a week later, bringing the total of ISIS cash-distribution sites destroyed at the time to nine.²³⁸ More details of Operation Point Blank can be found in Chapter Five. A U.S. military spokesperson,

²³² Kenneth M. Pollack, “What the Liberation of Ramadi Means for Iraq, Iran, and the U.S.,” Brookings Institution, December 29, 2015; Linda Robinson, *Assessment of the Politico-Military Campaign to Counter ISIL and Options for Adaptation*, Santa Monica, Calif.: RAND Corporation, RR-1290-OSD, 2016, p. 48.

²³³ Sean MacFarland, “Department of Defense Press Briefing by Gen. MacFarland via Teleconference in the Pentagon Press Briefing Room,” transcript, U.S. Department of Defense, February 1, 2016.

²³⁴ Email correspondence with LTG (ret.) Sean MacFarland, June 25, 2020.

²³⁵ See Chapter Five for more details.

²³⁶ Barbara Starr and Daniella Diaz, “First on CNN: Pentagon Releases Video of U.S. Bombing ‘Millions’ in ISIS Cash,” CNN, January 16, 2016.

²³⁷ RAND interview with Gen Charles Q. Brown, February 20, 2020; AFHRA interview with Brig Gen Daniel J. Orcutt, September 25, 2019.

²³⁸ Tara Copp, “US Airstrikes in Mosul Destroy ‘Tens of Millions’ in Islamic State Money,” *Stars and Stripes*, January 20, 2016.

COL Steven Warren, indicated that the rules of engagement had been slightly relaxed to bomb these money storage facilities, as the coalition had been prepared to accept “some”—single digit—number of civilian casualties to destroy “roughly tens of millions of dollars.”²³⁹

GEN Austin maintained that the cumulative effect of bombing the banks, when “combined with all the other strikes . . . done on ISIL’s gas and oil production and distribution capabilities,” meant that ISIS assuredly was “feeling the strain on his checkbook.”²⁴⁰ There was evidence that ISIS quickly adapted by storing its cash in a more distributed fashion, but these attacks had already “impacted” its “ability to pay [ISIS] fighters in the near term.”²⁴¹ As more evidence has become available about ISIS’s operations, it appears that the coalition overestimated the impact of its air strikes against ISIS resources. Although these deep strikes were tactically very successful and certainly deprived ISIS of some income, the bulk of ISIS’s revenue came from taxation and extortion of the people under its control, not from its oil business.²⁴² Since the ground campaign began to make progress around the same time that the strategic strikes against ISIS’s resources were occurring, it is difficult to disentangle the effects of each effort. CJTF-OIR’s campaign plan aimed to attack ISIS from multiple axes, presenting it with multiple problems, with the hope that the cumulative impact was greater than the sum of the individual parts. We did not have sufficient information about the different specific types of attacks and ISIS’s operations to determine whether this goal was realized.

The destruction of some of ISIS’s hard-currency stockpiles immediately pressured the militant’s operations, but CJTF-OIR’s efforts to cut off ISIS’s GLOCs in the Euphrates River Valley had less of an impact, as detailed in Chapter Five. After months of attempting to develop targets, eight coalition nations dropped 77 precision-guided munitions on C2, logistics, and storage sites in Al-Qaim, Iraq, and Abu Kamal, Syria, in February 2016.²⁴³ Although these strikes destroyed all intended targets, this did not significantly affect ISIS’s ability to resupply its forces in Iraq. After these less-than-impressive results, the interdiction operation fizzled out, at least in part because of an insufficient amount of ISR allocated to target development.²⁴⁴

²³⁹ Idrees Ali, “Recent Strike Targets Mosul ‘Cash Collection Point’: U.S. Military,” Reuters, January 20, 2016.

²⁴⁰ Barbara Starr and Daniella Diaz, “First on CNN: Pentagon Releases Video of U.S. Bombing ‘Millions’ in ISIS Cash,” CNN, January 16, 2016.

²⁴¹ Idrees Ali, “Recent Strike Targets Mosul ‘Cash Collection Point’: U.S. Military,” Reuters, January 20, 2016; Tara Copp, “US Airstrikes in Mosul Destroy ‘Tens of Millions’ in Islamic State Money,” *Stars and Stripes*, January 20, 2016.

²⁴² Sarah Almukhtar, “ISIS Finances Are Strong,” *New York Times*, May 19, 2015.

²⁴³ Charles Q. Brown Jr., “Department of Defense Press Briefing by Lt. Gen. Brown via Teleconference from al-Udeid Air Base, Qatar,” transcript, U.S. Department of Defense, February 18, 2016.

²⁴⁴ RAND interview with Maj Gen (ret.) Scott Zobrist, December 2, 2019.

All the named deep-strike operations were hamstrung because ISR assets, especially the RPAs, which had always been in high demand, were even more scarce once ground operations in Iraq began. In the first ten months of OIR, the United States flew 5,574 ISR sorties; in the second ten months, it flew 8,104 ISR sorties, which included manned and unmanned aircraft. The RPAs, however, were the most sought-after platform because of the ground commanders' insatiable demand for FMV to support partner ground forces. Adding to the requirement for RPAs was the CENTCOM policy—that before a deliberate target could be authorized, there must be a certain number of hours of uninterrupted FMV footage to ensure that civilians were not inadvertently hit.²⁴⁵

Ground commanders insisted that they needed the unmanned aircraft overhead not only to provide them with the video feed that enabled them to authorize air strikes from strike cells, the remote command posts, but also to monitor and track partner units. CAS requires close air-ground integration because hostile targets are in close proximity to friendly forces. There are three different elements that make safe execution possible: a ground commander authorized to approve strikes, a JTAC to guide and coordinate the strike, and an aircraft to deliver the weapon.²⁴⁶ Moreover, U.S. forces also have a tracking and communications system that provides near real-time situational awareness of American forces and helps avoid fratricide, called the *blue force tracker*.²⁴⁷ In prior wars, including Afghanistan, the United States typically had JTACs on the front lines with partners and therefore had eyes on the target, and therefore reliable knowledge about the location of friendly forces. Until late December 2016 in OIR, the JTAC and commander were prohibited from being on the battlefield and were instead in command posts, so their only way of visually observing the front lines was by using RPAs. Thus, RPAs became a substitute for JTACs and also operated as an optical green (allied) force tracker.²⁴⁸ This was important because communications with Iraqi and Syrian units were often imprecise, time-lagged, and prone to miscommunication, so RPAs provided U.S. JTACs with confidence as to the exact location of partners and helped avoid fratricide.

Despite the great pains taken by CJTF-OIR, friendly fire air strikes did occur, although such incidents were rare. In May 2016, for example, an errant air strike reportedly killed four to ten members of a U.S.-trained and -equipped Sunni Arab

²⁴⁵ RAND interview with Maj Gen (ret.) Scott Zobrist, December 2, 2019; Charles Q. Brown Jr., “Department of Defense Press Briefing by Lt. Gen. Brown via Teleconference from Southwest Asia,” transcript, U.S. Department of Defense, May 27, 2016.

²⁴⁶ Joint Publication 3-09.3, *Close Air Support*, Washington, D.C.: Joint Chiefs of Staff, November 25, 2014; see also Curtis E. LeMay Center for Doctrine Development and Education, Air University, *Counterland Operations*, Annex 3-03, Maxwell Air Force Base, Ala., February 5, 2019.

²⁴⁷ Maryann Lawlor, “Keeping Track of the Blue Force,” *Signal*, July 2003.

²⁴⁸ In wargames and planning, allies are referred to as *green forces*, while the U.S. is blue and the adversary is red.

brigade fighting against ISIS in northern Syria.²⁴⁹ As a result of these incidents, the CAOC revised its target-development and information-sharing processes with international partners and expanded the multinational Coalition Intelligence Fusion Cell.²⁵⁰

Typically, ground commanders' requests for ISR to support forces maneuvering or in contact with the enemy prevailed over the CFACC's requests for ISR assets to develop targets that were not an immediate threat. Some airmen believed that ground commanders were asking for more ISR assets than they really needed to safely execute CAS, especially when Iraqi and Syrian partners were not moving.²⁵¹ More RPAs were allocated to deliberate target development after LTG MacFarland issued the integrated campaign plan—but not as many as some airmen would have liked. The strike data show how the close fight in Iraq dominated this phase. Although the total number of CJTF-OIR strikes nearly doubled from June 2015 to March 2016, only 25 percent of those were in Syria (see Figures 2.11 and 2.12). This was particularly true in the seven-month lead-up to the Battle of Ramadi, although, as Figure 2.13 demonstrates, other areas that were a focus of air strikes were Baiji, Fallujah, Sinjar, Mosul, and Tal Afar. In August and September, nearly 80 percent of the strikes were focused on Iraq, and through the remainder of Phase I, that percentage dropped below 70 percent only once. The one exception was November 2014, which coincided with the beginning of Operation Tidal Wave II and the coalition response to the Paris attacks, which focused on ISIS strongholds in Syria.

The deep fight was frequently deprioritized, because these operations did not directly contribute to the defense or reclamation of territory.²⁵² In part, this was due to the government of Iraq's concerns. After the fall of Fallujah, Baghdad believed that it faced an existential threat and that its capital could fall at any moment, but this focus persisted throughout the first half of Phase I. Yet, because of this focus on the close fight, there reportedly were missed opportunities to keep pressure on ISIS with deep strikes when the ground offensive stalled, paused, or was between named offensive operations.²⁵³ Air component leadership argued that not targeting ISIS in the deep areas allowed the enemy to maneuver with impunity, reinforcing and supporting the close fight at will. Even with the improvements to the targeting process, the CJTF-OIR-run joint deliberate-targeting process was not able to generate deliberate targets against this elusive enemy without considerable preparatory work so that it could meet

²⁴⁹ Adam Entous and Gordon Lubold, "U.S. Says Friendly Fire Killed Syrian Allies," *Wall Street Journal*, June 10, 2016.

²⁵⁰ Email correspondence with USAF officer, July 31, 2020; R. Alex Durbin, "Coalition Intel Cell Breaks Down Boundaries," U.S. Air Forces Central, November 18, 2016.

²⁵¹ Email exchange with Maj Gen (ret.) Scott Zobrist, June 25, 2020.

²⁵² RAND interview with USAF official, December 3, 2019.

²⁵³ RAND interview with Gen Charles Q. Brown, February 20, 2020.

the CENTCOM collateral-damage-mitigation requirements, which included FMV and air-breathing ISR assets.²⁵⁴

One of the sources of tension surrounding ISR assets was the fact that AFCENT, as the theater CFACC and the supporting air component to CJTF-OIR, provided all its own RPAs to CJTF-OIR, which made decisions regarding allocation, while other components retained organic ISR assets, including such relatively long-range systems as the MQ-1C Gray Eagle. To some airmen, not considering component organic ISR assets introduced inefficiencies in how RPAs were allocated, given that organic assets with an operational capability, such as the Army's MQ-1Cs, were not initially considered by CJTF-OIR when it made its theater ISR allocation decision.²⁵⁵ The first step in improving the process occurred in early 2016, when AFCENT displayed the disparity of ISR allocation across the combined joint operating area. CJTF-OIR then attempted to account for component organic ISR assets, although components pushed back and attempted to hide their organic ISR from CJTF-OIR. In general, airmen repeatedly pointed to the fact that ground commanders demanded multiple RPAs even when Iraqi and Syrian forces were not engaged in combat as a wasteful allocation of scarce assets. We did not have enough information about ISR apportionment to assess the merits of these claims, but we are documenting areas of disagreement between the air and land components for future studies to assess. As a result of the frustration over securing from CJTF-OIR the use of its own RPAs for target development, AFCENT procured several of its own contractor-owned and -operated MQ-1 Predators.²⁵⁶ There were some in CENTCOM and CJTF-OIR who expected that AFCENT procured MQ-1s to be categorized as theater assets. However, AFCENT made the case that these MQ-1s were "CFACC organic," following the CENTCOM-established rule set for component-procured ISR.

The CFACC also tried to use CJTF-OIR's Future Operations Synchronization Board to highlight all the simultaneous activities that were ongoing in the AOR so that the command could see the amount of airpower dedicated to overwatch versus deliberate strikes for a period, with that goal of more evenly allocating RPAs. This process helped CJTF-OIR improve its long-term planning but was at best partially successful at wresting RPAs from the strike cells for deliberate-target development. Because of limitations on the target sets available, this might have been the right decision, as will be discussed further in the next section.

As a result of the simultaneous operations in the close and deep fights, there was a significant increase in combat air operations during the second part of Phase I (see Figure 2.8). The number of air-to-ground sorties nearly doubled, with just over 18,000 missions flown, with more aircraft engaging targets than in the first ten months of

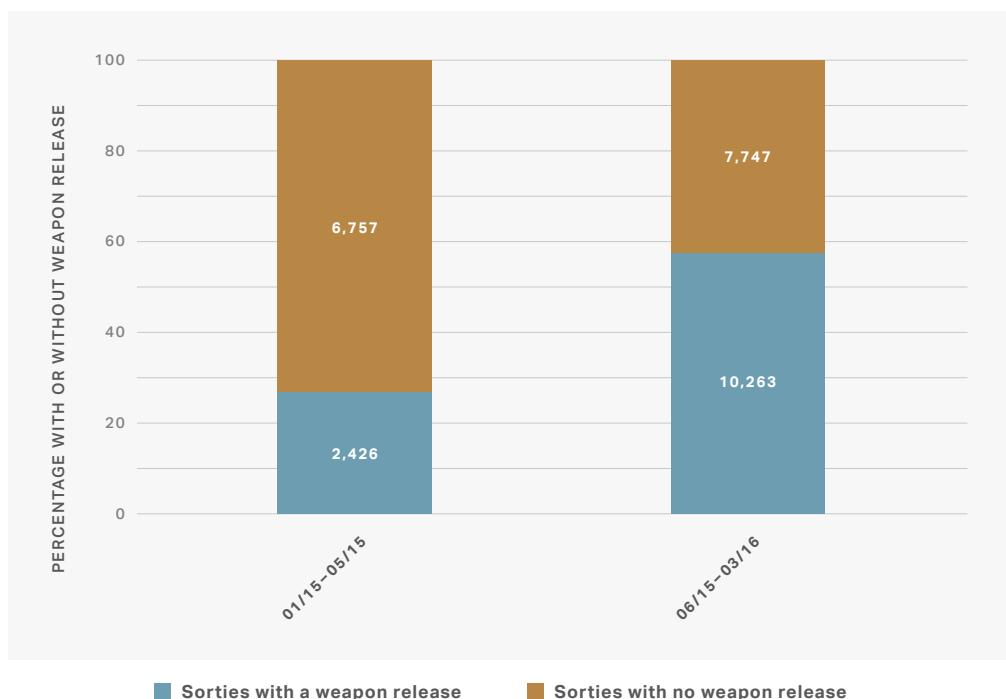
²⁵⁴ RAND interview with Gen Charles Q. Brown, February 20, 2020.

²⁵⁵ Email exchange with Maj Gen (ret.) Scott Zobrist, June 26, 2020.

²⁵⁶ Email exchange with Maj Gen (ret.) Scott Zobrist, June 25, 2020.

the operation. Figure 2.16 shows the number of sorties flown with at least one weapon release in the first 20 months of OIR. In the first ten months, 74 percent of the aircraft were returning from their missions without dropping a bomb. In the second ten months, only 43 percent of the aircraft returned to base with their full munition loads, a notable improvement in the efficiency of air strikes because of the improvements to the intelligence process and looser ROE. Efficiency is not the only metric by which air operations should be judged, nor does efficiency mean effectiveness. But it is one measure that provides some suggestive data about factors that may impinge on the effectiveness of airpower. The total number of weapons released also jumped from 15,248 to 25,421 over the same period. This dramatic turnaround in terms of the size and intensity of the air war was due to several factors—most notably, the beginning of significant ground operations and the development of deliberate-targeting operations. The administration also was willing to slightly relax some of the ROE when the situation warranted it, but in general the goal was an NCV of 0.²⁵⁷

Figure 2.16
Air-to-Ground Sortie Drop Rates



SOURCE: RAND AFCENT airpower summary data set.

²⁵⁷ RAND interview with Gen Charles Q. Brown, February 20, 2020; RAND interview with LTG Sean MacFarland, March 31, 2020.

Assessment of Phase I

Airpower succeeded at halting ISIS's expansion, for the most part, despite the limited number of air strikes at first. Because of their flexibility and speed, aircraft could quickly respond to ISIS attacks and move between distant locations as needed, as in Kobani.²⁵⁸ The most notable failure during this period was in Ramadi, when the coalition was taken by surprise by the ISIS assault and its aircraft were unable to operate because of a sandstorm. Nevertheless, in general, airpower severely hindered ISIS's ability to mass enough forces to go on the offensive because, as ISIS quickly learned at Kobani, coalition precision strikes were particularly effective at destroying large formations of troops. ISIS, therefore, had to shift its strategy from one premised on "lasting and expanding" to simply lasting.²⁵⁹ It did so by blending in with the population, dispersing its forces, and constructing an elaborate system of layered defenses that made offensives against it painful and prolonged in the hopes that Iraqi and Syrian forces or the coalition would simply give up.

Despite this, by the end of the Phase I of OIR, it was clear that momentum had shifted to the coalition and that ISIS was on the defensive. Figure 2.17 depicts ISIS versus partner territorial control at the end of Phase I and the number of coalition air strikes at major locations over this period. ISIS made a few small territorial gains, but these were far offset by its losses. With coalition air support, Iraqi and Syrian partners had reclaimed 40 percent of the territory once held by ISIS, mainly in Iraq, but also a strategic 98-kilometer stretch of territory in Syria, along the border with Turkey.²⁶⁰ In Iraq, Tikrit, Baiji, Sinjar, and Ramadi had been liberated, while the Syrian towns of Kobani, Tal Abyad, Al-Hawl, and Al Shadaddi had also been freed. As Special Envoy Brett McGurk observed, Ramadi's liberation in particular was significant "because it was really the first significant test for the Iraqi Security Forces that we have helped reorganize and retrain." Significant work needed to be done to clear Ramadi of improvised explosive devices (IEDs) and to stabilize, rebuild, and hold the town. Nevertheless, "Ramadi was a key test" that the ISF, with coalition air support, passed.²⁶¹ Addi-

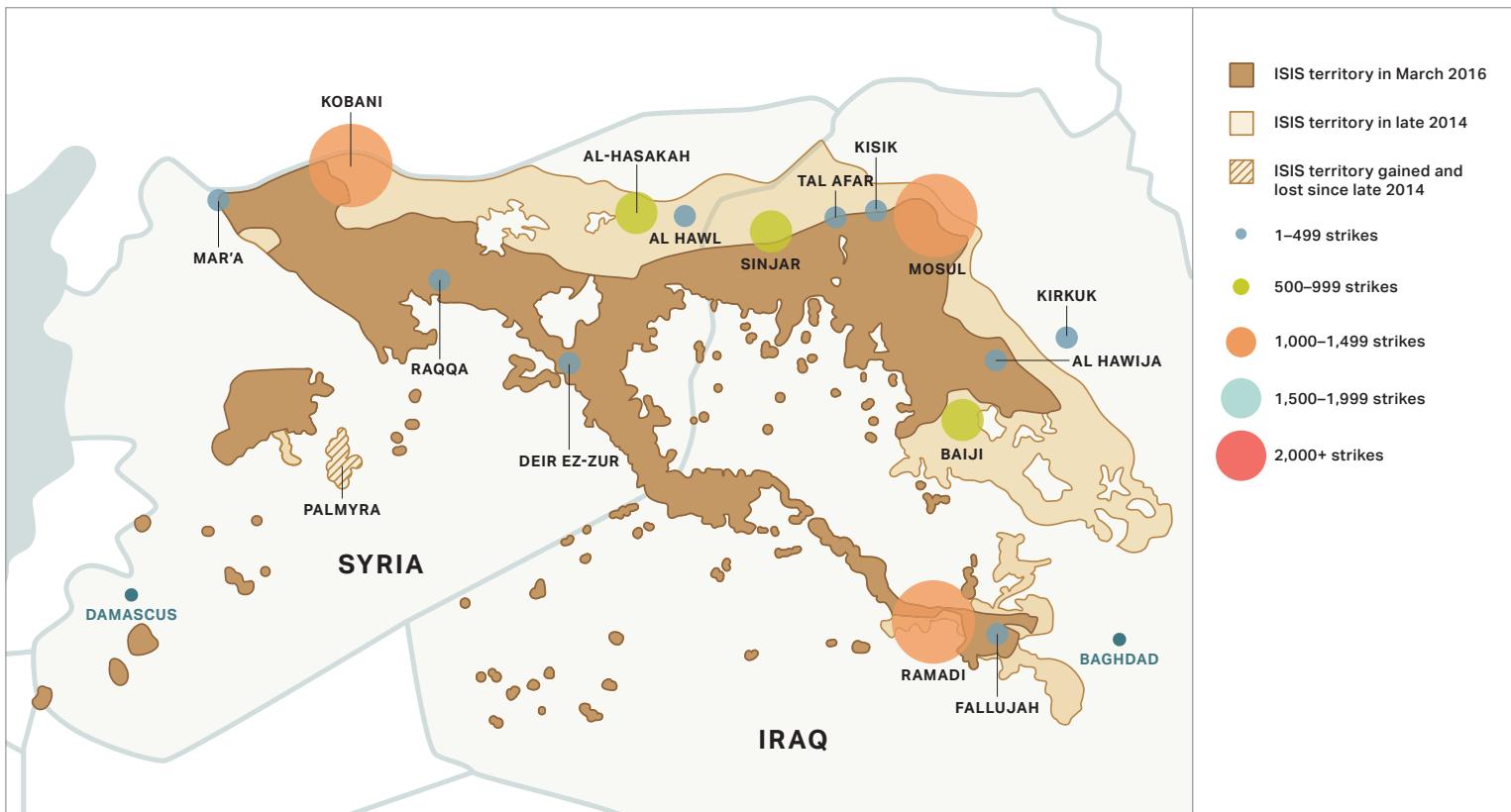
²⁵⁸ Robert A. Pape, Kevin Ruby, and Vincent Bauer, "Hammer and Anvil: How to Defeat ISIS," *Foreign Affairs*, January 2, 2015.

²⁵⁹ Lina Khatib, "The Islamic State's Strategy: Lasting and Expanding," Carnegie Middle East Center, June 29, 2015.

²⁶⁰ Brett McGurk, "Message to the Counter-ISIL Coalition," U.S. Department of State, March 25, 2016; Brett McGurk, "Remarks by Special Presidential Envoy to the Global Coalition to Counter ISIL Brett McGurk Before the Daily Press Briefing," transcript, U.S. Department of State, January 5, 2016.

²⁶¹ Brett McGurk, "Remarks by Special Presidential Envoy to the Global Coalition to Counter ISIL Brett McGurk Before the Daily Press Briefing," transcript, U.S. Department of State, January 5, 2016.

Figure 2.17
OIR Phase I: Territorial Shifts and Major CJTF Strikes



SOURCES: DoD, "Operation Inherent Resolve: Targeted Operations Against ISIL Terrorists," March 15, 2016; RAND CJTF-OIR strike release data set.

tionally, approximately 90 senior and mid-level ISIS leaders, including Abu Sayyaf and deputy ISIS leader Fadhil Ahmad al-Hayali, were killed in air strikes.²⁶²

To achieve these effects, coalition aircraft flew 33,787 air-to-ground sorties and launched 10,884 strikes, which resulted in 41,718 weapons being released during the first 20 months of the operation (see Table 2.4). Additionally, there were 14,004 ISR missions and 14,442 airlift and airdrop sorties. To enable all these air missions, tankers flew 22,725 sorties and refueled coalition aircraft 134,321 times. Aerial refueling missions peaked in the summer of 2015 as air operations also began to pick up in anticipation of the liberation of Ramadi—but thereafter declined as the coalition acquired access to closer air bases in Turkey and Iraq.²⁶³

In a February 2016 press conference, CFACC Lt Gen Brown noted that U.S. “air power effects have evolved” since the beginning of OIR. Because of intelligence collection efforts, the coalition had become “increasingly effective at targeting” ISIS’s “critical capabilities . . . over the last six months,” which was evident by the increasing “number of weapons released.” Moreover, coalition aircraft were now hitting “more lucrative targets to greater effect,” including dropping 519 weapons in 119 air strikes on ISIS cash, gas, and oil operations.²⁶⁴ ISIS, which was famously known as the wealthiest terrorist group in the world, now faced “considerable money problems.”²⁶⁵ According to a CJTF-OIR spokesperson, Operation Tidal Wave II was estimated to have reduced the approximately \$50 million per month that ISIS earned through oil revenue by 30 percent, while Operation Point Blank had destroyed hundreds of millions of dollars of currency reserves.²⁶⁶ Collectively, these deliberate-targeting operations stressed the once-wealthy terrorist organization’s finances and forced the group to cut the salary of its fighters by up to 50 percent and to scramble to develop new sources of revenue.²⁶⁷ Moreover, the strategic strikes and the partner ground maneuvers “complemented each other” and put pressure on ISIS from multiple directions.²⁶⁸ Because they overlapped, it is difficult to disentangle the effects of the ground operation from the strategic strikes against ISIS resources. Together, they certainly increased the pressure on ISIS from different directions. Available information about ISIS’s operations, however,

²⁶² Linda Robinson, *Assessment of the Politico-Military Campaign to Counter ISIL and Options for Adaptation*, Santa Monica, Calif.: RAND Corporation, RR-1290-OSD, 2016, p. 43.

²⁶³ Liz Sly and Karen DeYoung, “Turkey Agrees to Allow U.S. Military to Use Its Base to Attack Islamic State,” *Washington Post*, July 23, 2015.

²⁶⁴ Charles Q. Brown Jr., “Department of Defense Press Briefing by Lt. Gen. Brown via Teleconference from al-Udeid Air Base, Qatar,” transcript, U.S. Department of Defense, February 18, 2016.

²⁶⁵ Patrick B. Johnston, “The Islamic State’s Money Problems,” *USA Today*, March 4, 2016.

²⁶⁶ Herman Wang, “US Imposes Sanctions on Key Islamic State Oil Official,” S&P Global, February 11, 2016; Yeganeh Torbati, “Hundreds of Millions of ISIS Funds Destroyed in Airstrikes: US,” Reuters, February 17, 2016.

²⁶⁷ Herman Wang, “US Imposes Sanctions on Key Islamic State Oil Official,” S&P Global, February 11, 2016.

²⁶⁸ RAND interview with Gen Charles Q. Brown, February 20, 2020.

Table 2.4
OIR Airpower Statistics, by Phase

	Phase I: Degrade	Phase II: Counterattack	Phase III: Defeat	Total
Start date	August 8, 2014	April 1, 2016	August 8, 2017	August 8, 2014
End date	March 31, 2016	August 7, 2017	March 23, 2019	March 23, 2019
CJTF-OIR strikes				
Iraq	7,389	4,938	1,178	13,505
Syria	3,612	7,298	8,413	19,323
ISR sorties	14,004	18,601	16,296	48,901
Airlift and airdrop sorties	14,442	10,973	14,555	39,970
Airlift cargo (short tons)	111,355	92,973	81,465	285,793
Airlift passengers	68,100	72,624	130,967	271,691
Supplies air-dropped (lbs)	1,529,100	1,055,991	1,383,106	3,968,197
Tanker sorties	22,725	17,398	16,594	56,717
Fuel offloaded (millions of lbs)	1,388	1,043	1,125	3,556
Aircraft refueling	134,321	98,638	98,495	331,454
Weapons released	41,718	51,739	24,076	117,533
Sorties with one weapon release	14,696	16,288	4,997	35,981
CAS, escort, and interdiction sorties	33,787	26,501	28,334	88,622

SOURCE: RAND AFCENT airpower summary data set; RAND CJTF-OIR strike release data set.

NOTES: Except for the CJTF-OIR strikes, data are only reported by month. Accordingly, Phase I consists of August 2014–March 2016, Phase II consists of April 2016–July 2017, and Phase III consists of August 2017–March 2019. CJTF-OIR strike totals in Phases II and III include artillery strikes.

does clearly indicate that ISIS's largest and most important source of revenue was from taxation and extortion of the population under its control. The control of territory, and especially densely populated urban centers, therefore generated most of ISIS's wealth, not its oil and gas enterprise. The deep strikes were successful and effective, just not as important as they were initially made out to be.

Despite eventual successes, questions remain about why the air war did not have a more significant impact on ISIS sooner. Previously, critics had blamed the overwhelming pace of air strikes on controls imposed by the White House on how airpower

could be employed.²⁶⁹ These accusations have merit but are rooted in a number of factors, the most important of which was the Obama administration’s strategy, which prioritized an enduring victory over a quick one. The “by, with, and through” approach was chosen to minimize the risk to U.S. personnel and to produce a durable strategic outcome, but it also meant that Iraqi and Syrian partners’ ability and willingness to act dictated the pace of operations. In late 2014 and early 2015, there was not much of a ground fight for coalition aircraft to support, because Kurdish and Iraqi forces were not capable of or willing to go on the offensive (see Figure 2.8). As a result, most ISIS forces remained hidden in the cities they controlled and did not present many targets that aircraft could easily find and engage.

Additionally, because of this strategy, the rules of engagement for OIR were strict, the authority to approve air strikes was held at a high level, and the collateral-damage-mitigation intelligence requirements for deliberate-target development were stringent. Protecting innocent lives was a priority for moral and legal reasons and over the past several decades had become a principle that the USAF has embraced, but in OIR it was seen as necessary because of the chosen strategy.²⁷⁰ The United States needed to maintain the support of a large multinational coalition and its Iraqi and Kurdish partners, since the operation was being undertaken at the request of the government of Iraq, which could have rescinded this invitation at any time.²⁷¹ Iraqi and Kurdish regional government officials also had to approve of all strikes launched in their territory.

Because of these considerations, CENTCOM imposed an NCV of zero, meaning that if there was a risk that even one civilian could be killed in a strike, the operation needed senior-leader approval.²⁷² This, in essence, meant that senior leaders needed to review and sign off on a large number of air strikes, which was often a lengthy process that further reduced the potency of airpower and limited its ability to rapidly generate mass kinetic effects. It also meant that many strikes were called off because of developments on the ground that increased the risk of civilian casualties.

It is clear that the centralization of TEA, which at one point resided only with CJTF-OIR Commander LTG Terry,²⁷³ limited the effectiveness of airpower and forced it to be employed in a restrained manner, evidenced by the fact that 75 percent of the

²⁶⁹ David A. Deptula, “How to Defeat the Islamic State,” *Washington Post*, June 5, 2015; Kristina Wong, “US Aim for ‘Zero Civilian Casualties’ Draws Criticism,” *The Hill*, June 24, 2015; Mark Gunzinger and John Stillion, “The Unserious Air War Against ISIS,” *Wall Street Journal*, October 14, 2014.

²⁷⁰ For more on USAF efforts to reduce civilian casualties and how this principle has been embraced by the service, see Sarah B. Sewall, *Chasing Success: Air Force Efforts to Reduce Civilian Harm*, Maxwell Air Force Base, Ala.: Air University Press, 2016.

²⁷¹ RAND interview with VADM (ret.) John Miller, January 28, 2020.

²⁷² Sarah B. Sewall, *Chasing Success: Air Force Efforts to Reduce Civilian Harm*, Maxwell Air Force Base, Ala.: Air University Press, 2016, p. 183. Many officers attributed the NCV of zero to the White House, but senior Obama administration officials disputed these claims.

²⁷³ RAND interview with LTG (ret.) James L. Terry, March 27, 2020.

air-to-ground missions in the first ten months came back without dropping one bomb. During Phase I, TEA never devolved below the level of the one-star general who commanded a strike cell, which made it difficult for airpower to be employed “at the speed of war.”²⁷⁴ The NCV was raised slightly toward the end of this period, but the goal always remained zero.²⁷⁵ Relaxing the rules of engagement and pushing the TEA down, however, helped speed up the pace of operations and enabled aircraft to hit targets that otherwise would not have been possible, especially in an urban environment and targets related to ISIS’s oil business.

There were certainly missed opportunities to attrite ISIS forces during the first few weeks and months of OIR, when the militants were still operating in the open, but it is not clear that any tactical gains that could have been made would have had the desired strategic effect or that the United States could have obtained and maintained partner and coalition support for an aggressive air war. Moreover, as the former Chief of Staff of the Air Force Gen Mark Welsh explained, “the DoD approach is not to defeat ISIS from the air.” Instead, “the intent is to inhibit ISIS, to attrite ISIS, to slow ISIS down, to give a ground force time to be trained.”²⁷⁶

Another factor that influenced the shape and intensity of air operations was the ISR-allocation process, which was controlled by CENTCOM and then CJTF-OIR. ISR, especially FMV, was in high demand, because it played a critical role in enabling the close fight and the deep fight. In the absence of partner ground operations, airmen wanted to strike strategic ISIS targets, but CJTF-OIR initially did not establish clear priorities for deep-fight operations, which made it challenging to obtain ISR assets for strategic target development. Even after the CJTF-OIR Commander had issued clear guidance as a part of an integrated campaign plan, obtaining ISR assets for strategic strikes was a constant struggle because the ground commanders had a seemingly insatiable demand for FMV.

Many airmen that we spoke to believed that ground commanders were asking for and securing RPA assets in excess of what they objectively needed, especially when ground operations were paused or before they had begun. They argued that the ISR-allocation processes should take into account each component’s organic operational-level assets and needed to be more agile and able to quickly shift between different missions when the situation warranted it. At one point, there were reportedly six or seven RPAs over the relatively small city of Ramadi for multiple days while ground forces were static, which meant that there was little need for RPAs to serve as “green

²⁷⁴ RAND interview with LTG (ret.) James L. Terry, March 27, 2020; RAND interview with Lt Gen Scott Kindsvater, February 13, 2020.

²⁷⁵ RAND interview with Gen Charles Q. Brown, February 20, 2020; RAND interview with LTG (ret.) Sean MacFarland, March 27, 2020.

²⁷⁶ Deborah Lee James and Mark A. Welsh III, “State of the Air Force Press Briefing by Secretary James and General Welsh in the Pentagon Briefing Room,” transcript, U.S. Department of Defense, January 15, 2015.

force trackers.”²⁷⁷ There might have been times that the airspace over the close fight was oversaturated with ISR and that some of it could have been put to better use for other purposes, such as deliberate-target development. Conversely, if the close fight was kinetic and was the main effort, then perhaps it was appropriate and necessary to prioritize ISR to support the close fight and that redundancy (if there was any) was necessary to minimize risk. We do not have the evidence to adjudicate these issues but are raising them as questions for future analysis.

Finally, OIR got off to a slow start because of challenges associated with targeting ISIS. Although U.S. military planners had been monitoring ISIS and preparing in the event that they were called on to evacuate American citizens or intervene against the militants, the speed and extent of ISIS’s 2014 summer offensive took the United States by surprise. At the start of OIR, there was no off-the-shelf operational plan for countering ISIS, nor was there a list of validated targets that could be prosecuted by aircraft. It was not until a year later that AFCENT began to reform the target-development process in an effort to make it faster and deliberate strikes more effective.

The nature and flexibility of the enemy, however, continued to be a challenge. After combat aircraft began to drop bombs, ISIS quickly modified its tactics and stopped massing its forces and operating in the open. ISIS tried to blend in with the civilian population, and its forces and its military and economic operations became more distributed and mobile. Finding small, mobile targets has historically been extremely challenging, and this remained true in OIR.²⁷⁸

The absence of American boots on the ground also contributed to the challenge of locating and developing ISIS targets and required a nondoctrinal way of coordinating air strikes with ground partners who provided the forward intelligence. The strike cells allowed coalition airpower to be integrated with partner forces, which was absolutely central to the overarching strategy. The strike cells also provided an extra check on the information that the coalition received from ground partners, which was often a bit fuzzy, and provided a process for verifying and reformatting that information so that it could be used by coalition aircrew. With RPA FMV feeds, the strike cell’s commander could “accompany virtually” the Syrian and Iraqi ground forces.²⁷⁹ The USAF and coalition RPAs made a significant contribution to this fight and were the most in-demand asset, since hours of FMV were often required to discriminate between ISIS targets and civilians for targets engaged through the deliberate- and the dynamic-targeting processes. Yet, as discussed earlier, the strike cells and the close fight competed with the CFACC and the deep fight for ISR assets. Because the close fight normally took precedence, the dominance of the strike cells made it difficult for

²⁷⁷ Email exchange with Maj Gen (ret.) Scott Zobrist, June 26, 2020.

²⁷⁸ Alan J. Vick, Richard M. Moore, Bruce R. Pirnie, and John Stillion, *Aerospace Operations Against Elusive Ground Targets*, Santa Monica, Calif.: RAND Corporation, MR-1398-AF, 2001.

²⁷⁹ RAND interview with Gen Charles Q. Brown, February 20, 2020.

the CAOC to develop targets and execute a sustained deliberate-targeting operation against ISIS's centers of gravity.

Because the strategy prioritized the close fight, the majority of bombs that were dropped were against dynamic targets—that is, in response to immediate needs of partner ground forces.²⁸⁰ Air operations, therefore, tended to take the shape of a linear and tactical fight rather than a more diverse air operation, with a large number of deep strikes achieving strategic effect against ISIS.²⁸¹ In Phase I, however, when the close fight was ramping up, this meant that there also were not as many air strikes, because CAPs circling overhead often could not find targets without ground forces maneuvering and forcing the enemy to act.

Although OIR had a rocky start, ultimately, the operations in Phase I succeeded at degrading ISIS's capacity and set the path for the capture of the caliphate's two capitals in the next two phases.

²⁸⁰ RAND interview with Lt Gen Scott Kindsvater, February 13, 2020; RAND interview with Maj Gen (ret.) Scott Zobrist, December 3, 2019.

²⁸¹ RAND interview with Maj Gen (ret.) Scott Zobrist, December 3, 2019.

The Air War Against the Islamic State, Phases II and III, April 2016–March 2019

This chapter discusses the next two phases of OIR. In Phase II, Iraqi and Syrian forces began the counterattack on ISIS's two capitals—Mosul and then Raqqqa. This was the most intense period of ground operations—and, not surprisingly, also the most active period for air operations. After a prolonged battle in Phase II, Iraqi forces reclaimed Mosul, and the SDF began its counterattack on Raqqqa. It was not until Phase III that the coalition turned its full attention to eliminating ISIS-controlled territory in Syria—first by liberating Raqqqa and then clearing ISIS out of the MERV—the centrally located area near the border with Iraq around Deir ez-Zur where ISIS forces had taken refuge after the loss of their capitals.

Phase II: Counterattack, April 2016–August 2017

OIR shifted from the objective of degrading ISIS to a large counteroffensive in the spring of 2016. In Phase II, which spanned from April 2016 to August 8, 2017, Iraqi and Syrian ground partners began the counterattack to liberate Mosul and Raqqqa from ISIS.¹ Although Phase II was the shortest phase of OIR, it was also the period with the most-intense air and ground combat. In addition to the prolonged campaigns to isolate and emancipate ISIS's twin capitals, CJTF-OIR continued its deliberate-targeting campaigns against ISIS's finances and undertook one additional interdiction campaign around Mosul (see Figure 2.8). Nevertheless, aircraft during this period predominately engaged targets dynamically through the strike cells and in support of ground forces in the close fight. At the end of Phase II, Mosul was liberated and Raqqqa was on the precipice of falling.

The campaign plan that brought the coalition to this point had been developed at the end of 2015 by Secretary of Defense Ash Carter, Chairman of the Joint Chiefs of Staff Gen Joseph Dunford, and LTG Sean MacFarland. The military strategy was

¹ David R. Kogon, “The Coalition Military Campaign to Defeat the Islamic States in Iraq and Syria 21 Aug 2016–05 Sep 2017,” Combined Joint Task Force—Operation Inherent Resolve, 2017, pp. 13, 43.

an extension of the overall defeat-ISIS strategy of working “by, with, and through” Iraqi and Syrian partners to destroy the caliphate. The Pentagon had identified Mosul and Raqqa, ISIS’s capitals in Iraq and Syria, respectively, as ISIS’s “military, political, economic and ideological centers of gravity” and sequentially laid out how the ground campaign would unfold.² Carter’s shorthand way of describing the plan was “two red arrows,” referring to the simultaneous ground offensives toward Mosul and Raqqa, which are depicted in Figure 3.1.³ The coalition would pursue both objectives at the same time to force ISIS to divide its resources and attention as it was assaulted on two fronts.⁴ Moreover, using the lessons learned from Ramadi, MacFarland planned to conduct extensive shaping operations to facilitate the ground assault on each of ISIS’s capitals. CJTF-OIR expected that a two-front war would accelerate the overall campaign and hasten the defeat of ISIS. Although these offensives overlapped, the battle for Mosul was to culminate before the coalition turned its attention to completely eliminating ISIS’s strongholds in Syria.

Although President Barack Obama approved this plan and agreed to devote additional resources to execute it, Secretary Carter still needed to get Iraqi and Syrian partners to agree, along with the rest of the coalition. Doing so entailed bridging long-held tensions between the Iraqi central government and the Kurdish regional government. Moreover, the plan had to take into account the preferences of these partners. Despite the U.S. push to liberate Mosul first, the Iraqi government insisted on recovering Al Anbar and, in particular, Fallujah to reduce the number of terrorist attacks in Baghdad before moving on to Mosul.⁵ The dates that major towns were liberated from ISIS are noted in Figure 3.1. After retaking Al Anbar governorate, the Iraqi Army, Iraqi Police, CTS, and PMF moved north to conduct a challenging operation to cross the Tigris River, seize Qayyarah Airfield West (Q-West), isolate and encircle Mosul with the Peshmerga, and finally launch an assault on eastern Mosul in an attack called Operation Eagle Strike.⁶

² Ash Carter, “Remarks to the 101st Airborne Division on the Counter-ISIL Campaign Plan,” transcript, U.S. Department of Defense, January 13, 2016.

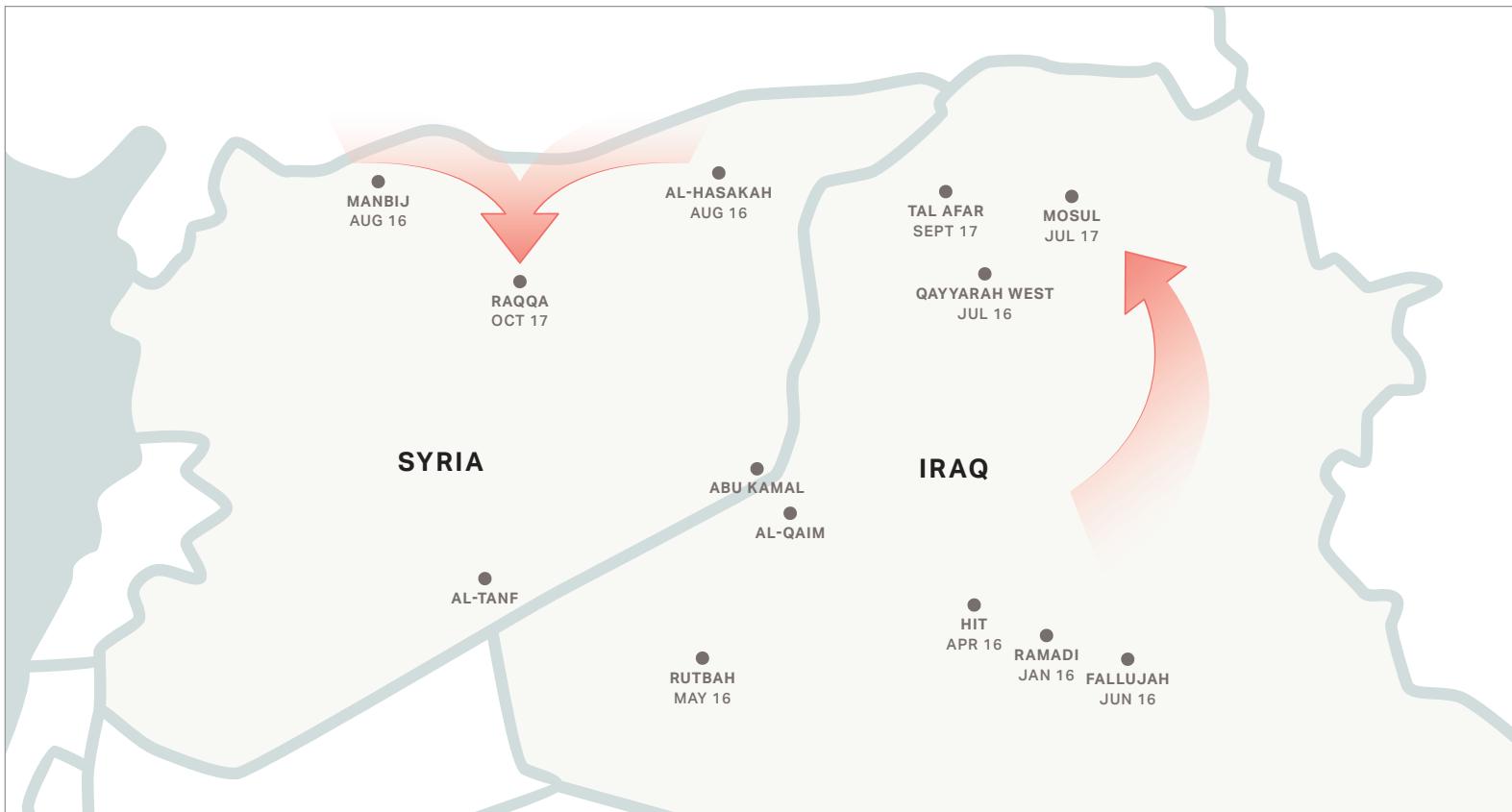
³ Ash Carter, “A Lasting Defeat: The Campaign to Destroy ISIS,” Belfer Center for Science and International Affairs, Harvard Kennedy School, October 2017. As Figure 3.1 shows, the actual progression of the Iraqi offensive did not follow the initial U.S. developed scheme of maneuver as Iraqi forces liberated major towns in Anbar before moving on to Mosul.

⁴ David R. Kogon, “The Coalition Military Campaign to Defeat the Islamic States in Iraq and Syria 21 Aug 2016–05 Sep 2017,” Combined Joint Task Force—Operation Inherent Resolve, 2017, p. 37; Stephen Townsend, “Department of Defense Press Briefing by Lt. Gen. Townsend Via Teleconference from Baghdad, Iraq,” transcript, U.S. Department of Defense, October 26, 2016.

⁵ Zana Gulmohamad, “Unseating the Caliphate: Contrasting the Challenges of Liberating Fallujah and Mosul,” *CTC Sentinel*, Vol. 9, No. 10, October 2016.

⁶ Ash Carter, “A Lasting Defeat: The Campaign to Destroy ISIS,” Belfer Center for Science and International Affairs, Harvard Kennedy School, October 2017; David R. Kogon, “The Coalition Military Campaign to Defeat

Figure 3.1
The Counterattack Plan and Liberation Dates of Major Towns



SOURCE: Ash Carter, "A Lasting Defeat: The Campaign to Destroy ISIS," Belfer Center for Science and International Affairs, Harvard Kennedy School, October 2017; also see Chapter Four and Appendix A.

NOTE: As is clear from the liberation dates of Iraqi towns, the plan did not unfold exactly as initially envisioned by the arrows.

Meanwhile in Syria, coalition forces would support the SDF—an umbrella organization that included Kurdish, Arab, Yazidi, and Christian fighters established by General Mustafa Mazloum in October 2015—to clear ISIS-held territory in northern Syria and isolate Raqqa before attacking the capital itself.⁷ Because the core of the SDF was the Kurdish YPG, which Turkey considered a terrorist organization, Ankara strongly objected to this plan.⁸ But the YPG had proven to be the only capable partner in Syria that also was willing to fight ISIS, so the United States decided to deepen its partnership with the group, although under the auspices of the SDF in an effort to assuage Ankara's concerns. The SDF pretext did not fool the Turkish government, which was quite aware that the SDF was basically a YPG-led militia by another name.

To support this plan, the United States asked for more from many of its allies and expanded its own commitment to the operation. In April, the Pentagon announced that it would send approximately 200 additional troops to Iraq, bringing the official number of troops in Iraq to 4,087.⁹ The United States also deployed 250 additional Americans to train Syrian forces and provided the Kurdish Peshmerga with \$415 million to support its operations. Additionally, U.S. advisers were authorized to move closer to the fight and accompany Iraqi brigades and battalions to improve coordination and bolster the Iraqis' confidence. Finally, DoD augmented U.S. Army fires in Iraq by deploying Apache attack helicopters and additional High Mobility Artillery Rocket System (HIMARS) rocket artillery in preparation for the assault on Mosul. Carter insisted that the U.S. strategy remained "enabling local forces—not substituting for them"—by "bringing to bear . . . some of our most unique and cutting-edge capabilities."¹⁰

In the spring of 2016, as partner offensives gained energy, coalition air operations shifted to supporting ground maneuvers by softening up targets before forces made contact with ISIS and providing overwatch or on-call CAS during an attack. Some of these shaping strikes were deliberate targets, focused on C2 nodes, logistics, and

the Islamic States in Iraq and Syria 21 Aug 2016–05 Sep 2017," Combined Joint Task Force—Operation Inherent Resolve, 2017, pp. 17–19.

⁷ Ash Carter, "A Lasting Defeat: The Campaign to Destroy ISIS," Belfer Center for Science and International Affairs, Harvard Kennedy School, October 2017; David R. Kogon, "The Coalition Military Campaign to Defeat the Islamic States in Iraq and Syria 21 Aug 2016–05 Sep 2017," Combined Joint Task Force—Operation Inherent Resolve, 2017, pp. 37–38.

⁸ Cameron Abadi, "Why Is Turkey Fighting Syria's Kurds?" *Foreign Policy*, October 17, 2019; "Turkey v Syria's Kurds: The Short, Medium and Long Story," BBC, October 23, 2019. For a longer treatment, see Aaron Stein, "Reconciling U.S.-Turkish Interests in Northern Syria," Council on Foreign Relations, February 2017.

⁹ Thomas Gibbons-Neff and Missy Ryan, "U.S. Approves Additional Troops, Artillery Systems and Helicopter Gunships for Iraq Fight," *Washington Post*, April 18, 2016.

¹⁰ Ash Carter, "Statement on Counter-ISIL Operations and U.S. Military Strategy in the Middle East Before the Senate Armed Services Committee," transcript, U.S. Department of Defense, April 28, 2016.

weapon caches, but once the ground assault began, the bulk of the strikes were tasked dynamically by the strike cells.

As Lt Gen Charles Brown explained, coalition aircraft tried to “strike ahead of the ground movement,” so that the ground forces could “maneuver with as little resistance as possible.¹¹ As shown in Figure 3.1, Iraqi forces moved through Al Anbar governorate in the spring and summer, expelling ISIS fighters from Hit in April, Rutbah in May, and Fallujah in June. In one strike, as Iraqi forces moved into Rutbah, dynamically tasked USAF F-16 fighters and French Mirage fighters destroyed an ISIS’s fighting position to keep the militants on the defensive and prevent them from placing IEDs or launching a counterattack.¹² Even when providing overwatch for ground offensives, the CAOC tried to prosecute the deep fight by having aircraft that had completed their time on station but had unused weapons to service nearby deliberate targets before returning to base.¹³

In the last month of the assault on Fallujah, coalition aircraft launched more than 100 air strikes.¹⁴ One particularly notable attack occurred on the last days of the Fallujah operation, when hundreds of ISIS fighters—recognizing that their defeat was imminent—tried to flee the city.¹⁵ Two large convoys of vehicles departed Fallujah, with the first leaving in the morning and heading south and the second leaving in the evening and heading north. The first convoy took CJFLCC by surprise, and the Baghdad strike cell could not positively identify the vehicles as ISIS targets before they rapidly dispersed. By the end of the day, however, the strike cell had found and destroyed the distributed ISIS vehicles from the first convoy. In contrast, CJFLCC was prepared for the evening convoy and waited until the caravan of ISIS vehicles had entered channelized terrain before interdicting the lead two vehicles, thus trapping the rest of the convoy. Passengers were allowed to flee before the U.S. and Iraqi aircraft destroyed the remaining vehicles, which numbered more than 150. A-10s were assigned to engage the front third of the convoy, AC-130s were responsible for the middle, and Iraqi Army helicopters were tasked with destroying the final third.¹⁶ This incident demonstrates the dilemmas that an enemy faces when presented with a combination of effective

¹¹ Charles Q. Brown Jr., “Department of Defense Press Briefing by Lt. Gen. Brown via Teleconference from Southwest Asia,” transcript, U.S. Department of Defense, May 27, 2016.

¹² Charles Q. Brown Jr., “Department of Defense Press Briefing by Lt. Gen. Brown via Teleconference from Southwest Asia,” transcript, U.S. Department of Defense, May 27, 2016.

¹³ Charles Q. Brown Jr., “Department of Defense Press Briefing by Lt. Gen. Brown via Teleconference from Southwest Asia,” transcript, U.S. Department of Defense, May 27, 2016; AFHRA interview with Maj Joe G. Biles, September 24, 2019.

¹⁴ Cheryl Pellerin, “Carter Hails Iraqi Success in Fallujah,” U.S. Department of Defense, June 28, 2016.

¹⁵ Mustafa Salim and Thomas Gibbons-Neff, “Iraqi, U.S. Aircraft Bomb Convoy of Islamic State Fighters Fleeing Fallujah with Their Families,” *Washington Post*, June 30, 2016.

¹⁶ RAND email correspondence with Brig Gen Matthew Isler, July 22, 2020.

air and ground power. If they concentrate, they are susceptible to attack from the air, but if they remain distributed, they will be rooted out and eliminated by capable ground forces.¹⁷ MacFarland noted that the ISIS convoys were a tactical mistake that made them an “easy target.”¹⁸ Although ISIS fighters tried to use civilians as shields, in this instance it appears as if ISIS fighters and their families were fleeing Fallujah in vehicle convoys. This highlights the challenge of distinguishing ISIS combatants from civilians.

After Fallujah, coalition aircraft supported the movement of Iraqi forces north along the Tigris River, clearing ISIS fighting positions ahead of the ground troops. For example, in June 2016, Brig Gen Daniel Orcutt, the Commander of the 380th Air Expeditionary Wing, was flying his final flight in an F-15E fighter over Iraq when he was dynamically tasked to try to locate an ISIS tank that was firing from a ridge onto a road below. The Iraqi forces refused to advance while the tank was firing, so Orcutt dropped a 2,000-pound satellite-guided Joint Direct Attack Munition (JDAM) (GBU-31), and “it was a shack,” literally blowing the main turret from the tank and propelling it 25 to 50 meters away.¹⁹

Coaxing the Iraqis into moving or attacking was often a prolonged process that involved what some Air Force pilots characterized as “morale strikes.” According to this view, these attacks were not primarily executed for tactical or operational reasons, but they were strategically important because they bolstered the confidence and drive of partner forces.²⁰ Reportedly, there were times that partners would not attack until they had visible proof that coalition aircraft were overhead and ready to provide air support. Some believed that many strikes officially characterized as *terrain-denial operations* were actually morale bombings whose real purpose was intended “to motivate” the SDF and Iraqis “to go take that Hill.”²¹ Although U.S. ground commanders also emphasized the importance of coalition aircraft overhead and responsive fires in encouraging the Iraqis to maneuver, some dispute the idea that morale strikes occurred and reject the notion that any bombs were dropped solely to boost the confidence of Iraqi forces. Then-MG Joseph Martin, the CJFLCC Commander during the western Mosul operation, for instance, “disagrees with the idea that there were morale bombing” and maintains that all of the air strikes had tactical goals and that terrain denial strikes affected enemy freedom of maneuver, enabled Iraqi forces to maneuver,

¹⁷ Robert A. Pape, Kevin Ruby, and Vincent Bauer, “Hammer and Anvil: How to Defeat ISIS,” *Foreign Affairs*, January 2, 2015.

¹⁸ Sean MacFarland, “Department of Defense Press Briefing by Lieutenant General Sean MacFarland, Commander, Combined Joint Task Force-Operation Inherent Resolve via Teleconference from Baghdad, Iraq,” transcript, U.S. Department of Defense, August 10, 2016.

¹⁹ AFHRA interview with Brig Gen Daniel J. Orcutt, September 25, 2019.

²⁰ RAND interview with USAF officials and coalition officials, March 3, 2020.

²¹ AFHRA interview with Maj Joe G. Biles, September 24, 2019.

and reinforced partner morale.²² Similarly, USAF Brig Gen Matthew Isler denies that strikes were authorized solely to boost morale and believes that this mistaken impression is born out of a lack of understanding of the full operational context and mission.²³

During Phase II of OIR, 8,803 strikes—25 percent of the total—were against terrain LOCs. Undoubtedly, many, if not all, of these had a tactical or operational purpose, especially since cratering roads and cutting LOCs made it difficult for ISIS to use VBIEDs, one of its weapons of choice, but some portion of these strikes might have been primarily intended to boost partner morale. According to two American soldiers deployed to Iraq as a part of a U.S. Army enable, advise, and assist (EAA) team and who supported the operation to take Q-West, “Often times, the ISF was hesitant to maneuver without the Coalition Force’s ISR or fires coverage.” The U.S. advisers observed that “knowing a UAV [unmanned aerial vehicle] was overhead” seemed to bring “a sense of comfort and resolve to Iraqi generals and soldiers.” The EAA and ISF termed certain strikes *motivational fires*, but at times these might have simply been various types of counterland strikes.²⁴ Most strikes probably served two purposes, but the need for motivational bombing that might have had questionable tactical effects might have contributed to the shortage of precision-guided weapons, which was particularly acute in 2016.²⁵ We do not have sufficient evidence to determine what percentage, if any, of the terrain denial strikes were really “morale strikes.”

In July 2016, the Iraqis seized a critical airfield, Q-West, 40 miles south of Mosul, that the coalition needed to serve logistics hub to support Operation Eagle Strike, the counterattack on Mosul. The Pentagon announced that it was deploying an additional 560 troops to improve the air base and support its operations.²⁶ The airfield had been heavily damaged during the two years it was controlled by ISIS, and the liberation of the air base resulted in further damage as coalition air strikes drove off most of the ISIS militants. The 821st Contingency Response Group led the effort to stand up airfield operations and began to advise the Iraqi airmen so that they eventually could take over operations for the base.²⁷ The 1st Expeditionary Civil Engineer Group succeeded at repairing the airfield and creating a minimum operating surface capable of supporting C-130 operations in three weeks, an achievement that Lt Gen Jeffrey Harrigian, who

²² RAND interview with GEN Joseph Martin, June 16, 2020.

²³ RAND email correspondence with Brig Gen Matthew Isler, July 22, 2020.

²⁴ Stu James and Andrew T. Kydes, “Lessons Future Security-Force Assistance Brigades Should Consider,” *Armor Magazine*, Winter–Spring 2018.

²⁵ Marcus Weisgerber, “The US Is Raiding Its Global Bomb Stockpiles to Fight ISIS,” Defense One, May 26, 2016; John A. Tirpak, “Climbing Out of the Munitions Hole,” *Air Force Magazine*, March 22, 2019.

²⁶ Dan Lamothe and Loveday Morris, “Pentagon Will Send Hundreds More Troops to Iraq Following Seizure of Key Airfield,” *Washington Post*, July 11, 2016.

²⁷ RAND email correspondence with Brig Gen Matthew Isler, July 22, 2020.

replaced Brown as AFCENT Commander and CFACC Commander in July 2016, called “remarkable.”²⁸

At the same time that the Iraqis were making strides toward Mosul, the SDF also was moving to isolate Raqqa with the support of SOF strike cells and coalition air support.²⁹ After a hard-fought 73-day battle, the SDF captured the strategically located town of Manbij in August 2016.³⁰ Manbij was a critical node in the ISIS network that linked the caliphate to its outside operations, serving as a gateway for foreign fighters coming to join the fight against the coalition. ISIS recruits were trained in the border town before being sent forward to fight in other locations in Syria and Iraq. Moreover, many of ISIS’s external operations were planned at Manbij. For these reasons, ISIS fighters fought tenaciously to repel the SDF attack, and when they retreated, they embedded women and children in their fleeing formations to prevent coalition aircraft from attacking them. Lt Gen Jeffrey Harrigian later described these tactics as “the definition of evil.”³¹ More positively, MacFarland explained that the victory at Manbij “set the stage for the eventual attack to seize Raqqa” and observed that OIR was clearly building momentum in both Syria and Iraq. “You don’t hear the word ‘stalemate’ anymore,” noted the CJTF-OIR Commander.³²

As the tempo of ground operations accelerated, CJTF-OIR continued to pressure ISIS with deep strikes that hurt its finances and made it difficult to continue to operate. Brown maintained that aircraft would “persistently strike targets in the deep fight” and that, “regardless of the pace of operation on the ground,” the air campaign would continue to keep pressure on ISIS “wherever they are. Whether there’s a ground force there or not.” This way, ISIS forces would not have “any respite or sanctuary in any location.”³³

The focus on the deep fight that began under Brown was continued by his successor, Harrigian. During a press conference, Harrigian affirmed that he would “continue to apply persistent pressure against this enemy” by “actively getting after their revenue

²⁸ Charles Rivezzo, “Air Force Engineers Restore Q-West to Support Mosul Offensive,” U.S. Air Forces Central, October 25, 2016.

²⁹ RAND interview with USAF officer, August 20, 2020.

³⁰ Jim Michaels, “ISIL Routed from Key Syrian City of Manbij,” *USA Today*, August 14, 2016.

³¹ Jeffrey Harrigian, “Crushing ISIS—Airpower Operations in a Complex Battlespace,” remarks to the Air Force Association Air Space and Cyber Conference, National Harbor, Md., September 18, 2017.

³² Sean MacFarland, “Department of Defense Press Briefing by Lieutenant General Sean MacFarland, Commander, Combined Joint Task Force-Operation Inherent Resolve via Teleconference from Baghdad, Iraq,” transcript, U.S. Department of Defense, August 10, 2016.

³³ Charles Q. Brown Jr., “Department of Defense Press Briefing by Lt. Gen. Brown via Teleconference from Southwest Asia,” transcript, U.S. Department of Defense, May 27, 2016.

streams and severing their ability to sustain their terrorist fighters.”³⁴ In August 2016, a strike involving multiple waves of coalition aircraft, including A-10 attack aircraft and F-16 fighters, destroyed 83 oil tanker trucks in Deir ez-Zur, Syria. Another air strike in September destroyed more than 110 oil tanker trucks in one blow.³⁵ Harrigian speculated that these concentrations of trucks indicated that ISIS was “having trouble commanding and controlling their forces.”³⁶ There were also deliberate strikes that directly attacked ISIS’s weapon production. For instance, in September 2016, the United States gained intelligence that showed that ISIS had converted a pharmaceutical plant into a chemical weapon factory that produced chlorine or mustard gas. On September 12, a package of a dozen aircraft, including F-15E fighters, F-16 fighters, A-10 attack aircraft, B-52 bombers, and USMC F/A-18D fighters, simultaneously serviced 50 aim-points to destroy the sprawling pharmaceutical complex near Mosul.³⁷

The Battle for Mosul, October 2016–July 2017

On October 17, 2016, Iraqi Prime Minister Haider al-Abadi announced the beginning of combat operations in Mosul. It was not until July 2017 that these operations culminated in the liberation of the second-largest city in Iraq from ISIS. During the two and half years of ISIS control, the militants had built an elaborate array of defenses, including underground tunnels, concrete barriers, and disabled vehicles with hidden IEDs. In October, there were approximately 1,500–2,500 ISIS fighters in an outer perimeter around the city and another 3,000–5,000 militants within the city prepared to fight to the death.³⁸ Mosul was a large and dense city, which favored the defenders, as it provided abundant places for ISIS to hide from the Iraqi forces and coalition aircraft. Moreover, as one pilot explained, in Mosul there was the “urban canyon effect where you don’t have great look angles for very long.”³⁹

Nevertheless, airpower played an essential role in this operation by enhancing the Iraqis’ situational awareness and providing intelligence on enemy locations and on-call fires to Iraqi partners working to clear ISIS fighters block by block.⁴⁰ Air strikes were

³⁴ Jeffrey Harrigian, “Department of Defense Press Briefing by Lt. Gen. Harrigian via Teleconference from Al Udeid Air Base, Qatar,” transcript, U.S. Department of Defense, September 13, 2016.

³⁵ Jeffrey Harrigian, “Department of Defense Press Briefing by Lt. Gen. Harrigian via Teleconference from Al Udeid Air Base, Qatar,” transcript, U.S. Department of Defense, September 13, 2016.

³⁶ Jim Michaels, “ISIL Oil Trucks, Worth \$11 Million, Destroyed in Massive Airstrike,” *USA Today*, August 9, 2016.

³⁷ Jeffrey Harrigian, “Department of Defense Press Briefing by Lt. Gen. Harrigian via Teleconference from Al Udeid Air Base, Qatar,” transcript, U.S. Department of Defense, September 13, 2016.

³⁸ David R. Kogon, “The Coalition Military Campaign to Defeat the Islamic States in Iraq and Syria 21 Aug 2016–05 Sep 2017,” Combined Joint Task Force—Operation Inherent Resolve, 2017, p. 15.

³⁹ AFHRA interview with Maj Joe G. Biles, September 24, 2019.

⁴⁰ More detail on the Mosul campaign can be found in Chapter Four.

used to target ISIS forces—but also its heavy equipment and unconventional weapons, such as armed bulldozers, VBIEDs, small UASs, pontoon bridges, and boats. Because of the “saturation of targets, density of air assets, and the close proximity of targets to the forward line of troops,” JTACs were essential for calling in fires and deconflicting air and ground-based fires.⁴¹ The CAS stacks orbiting above Mosul were congested with more than 40 aircraft, all trying to hit targets “in condensed, physical terrain.” For instance, in late November 2016, there were 43 coalition aircraft over Mosul simultaneously, including B-52 bombers, USMC AV-8B Harriers, F-15E fighters, stealthy F-22 fighters, and AH-64 Apaches, in addition to more than a dozen ISR aircraft, such as MQ-1 and MQ-9 RPAs.⁴²

The USAF also used nonkinetic weapons to attack ISIS. EC-130H Compass Call aircraft jammed the militants’ communications “to create massive confusion” and degrade “their ability to command and control their forces”⁴³—or, as Lt Col Christopher Wheaton quipped, the Compass Call “boxed the ears of the enemy so they couldn’t hear.”⁴⁴ EC-130Hs were also used to attack ISIS’s small UASs, which ISIS first employed in November 2016 and then used extensively in this battle.⁴⁵ At times, jamming created difficulties on the ground, since ISIS and the ISF used similar radio equipment and frequencies, and despite efforts to discriminately target ISIS, the jamming disrupted ISF operations. Eventually, the CJFLCC Commander halted jamming during the Mosul battle because it was deemed to be more of a hindrance than helpful.⁴⁶

Ground-based fires also played a large role in this fight, as CJFLCC employed U.S. M31 guided multiple launched rockets, French artillery, and mortars and cannon artillery, which were often cued by MQ-1 and MQ-9 RPAs loitering overhead.⁴⁷ As seen in Figure 3.2, which shows the percentage of days that different strike platforms were used to engage targets between August 2014 and February 2017, rockets were used, on average, 48 percent of the days between October 2016 and February 2017. CJFLCC assisted the Iraqis by providing joint fires to weaken ISIS before the Iraqis

⁴¹ Mosul Study Group, *What the Battle for Mosul Teaches the Force*, Washington, D.C.: U.S. Army, September 2017, p. 18.

⁴² Missy Ryan and Loveday Morris, “When Air Power Works, and When It Doesn’t: A Snapshot of U.S. Operations Against the Islamic State,” *Washington Post*, December 20, 2016.

⁴³ Stephen Losey, “If You Can’t Talk, You Can’t Fight: Compass Call Planes Confuse ISIS,” *Air Force Times*, February 6, 2017.

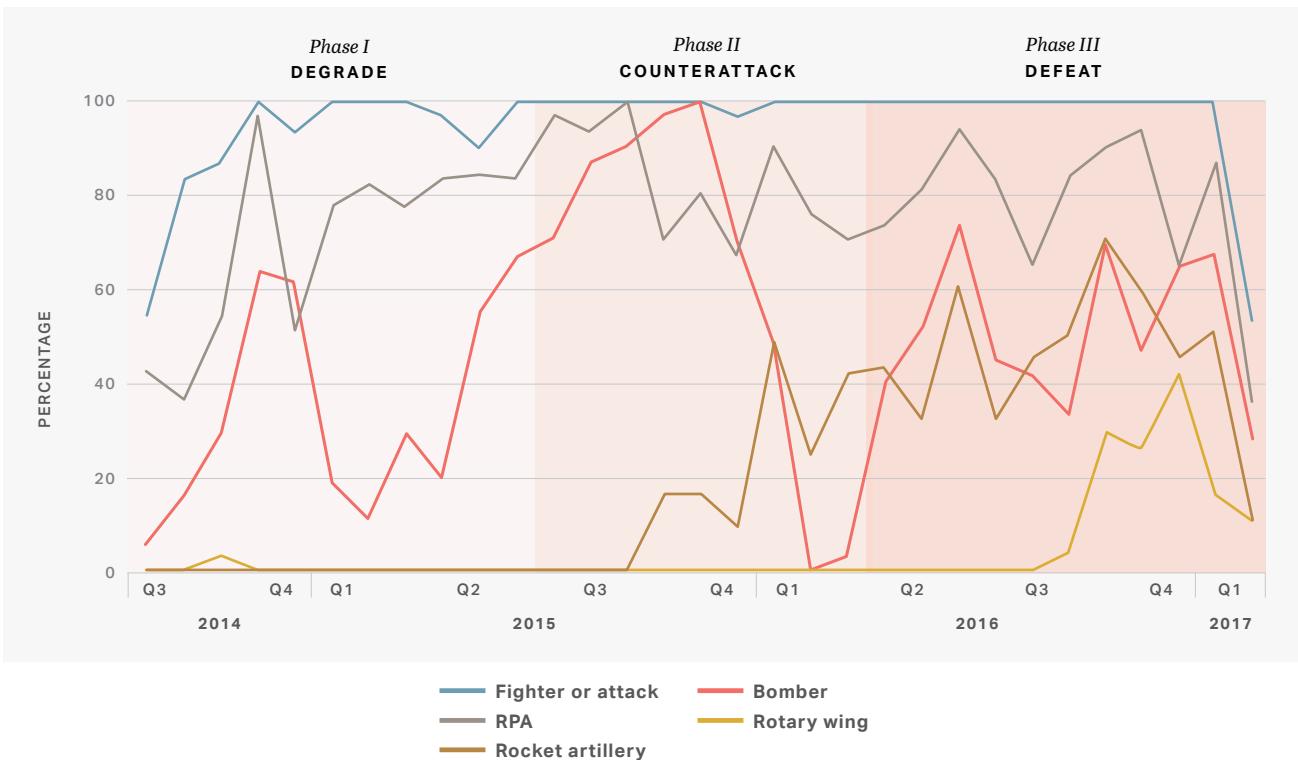
⁴⁴ AFHRA interview with Lt Col Christopher J. Weaton, September 17, 2019.

⁴⁵ AFHRA interview with Lt Col Christopher J. Weaton, September 17, 2019; David Axe, “The US Military’s Drone-Killing Planes Are Hunting ISIS’s Weaponized Quadcopters,” *Vice*, November 11, 2016.

⁴⁶ RAND email correspondence with Brig Gen Matthew Isler, July 22, 2020.

⁴⁷ Mosul Study Group, *What the Battle for Mosul Teaches the Force*, Washington, D.C.: U.S. Army, September 2017, p. 16.

Figure 3.2
Percentage of Days Different Fires Were Used in Iraq



SOURCE: RAND CJTF-OIR strike release data set.

moved and to support them while maneuvering. This task was challenging because of the density of buildings in Mosul and the fact that a low angle of fire was often necessary. ISIS leveraged buildings to mask its fires, which complicated the target-acquisition process. U.S. artillery also had to modify procedures for acquiring targets because of the dense urban environment.⁴⁸ Often, fire support could not be provided because the American soldiers did not have up-to-date intelligence on the location of Iraqi forces.⁴⁹ All these air and surface fires required extensive coordination and deconfliction, especially in a complicated battlespace in which the FLOT moved quickly.⁵⁰

VBIEDs proved to be a huge problem early in the attack on Mosul, with ISIS launching ten to 15 attacks a day.⁵¹ As the Iraqi forces maneuvered through the city, ISIS was able to use the cluttered urban environment to its advantage and launch VBIEDs in close proximity to the attacking forces, giving them little time to react. Moreover, approximately 80 percent of ISIS VBIEDs successfully killed or damaged Iraqi units, inflicting terrible casualties on Iraqi forces and threatening to grind the offensive to a halt. In the absence of Iraqi movement, ISIS was able to remain within its hideouts, presenting few targets for CJTF-OIR air and surface fires to hit, and the battle came close to being a stalemate. CJFLCC Commander MG Martin realized that he needed to counter ISIS's VBIED attacks to break the logjam and generate enough momentum that the Iraqi units would move and stimulate ISIS fighters to expose themselves.⁵²

In support of the operation to liberate Mosul, there was a deliberate-targeting operation, which aimed to further degrade ISIS capabilities and prevent it from resupplying or reinforcing its forces in Mosul. This operation focused on interdicting GLOCs running from Raqqa to Balaj, a small Iraqi town near the Syrian border, to Mosul. However, as is discussed in greater detail in Chapter Five, this effort was hindered by the frequent shifts in the FLOT and the FSCL, insufficient ISR to develop targets, and the lengthy timelines associated with developing target packages.⁵³ ISIS

⁴⁸ Mosul Study Group, *What the Battle for Mosul Teaches the Force*, Washington, D.C.: U.S. Army, September 2017, pp. 58–59; Task Force Black Falcon, “Lessons Learned Task Force Black Falcon 2-319th AFAR, 2BCT, 82d ABN DIV Deployment to Iraq in Support of Operation Inherent Resolve January–September 2017,” Fort Bragg, N.C.: 82D Airborne Division, October 11, 2017, p. iii.

⁴⁹ Mosul Study Group, *What the Battle for Mosul Teaches the Force*, Washington, D.C.: U.S. Army, September 2017, p. 16.

⁵⁰ Mosul Study Group, *What the Battle for Mosul Teaches the Force*, Washington, D.C.: U.S. Army, September 2017, p. 60.

⁵¹ For more on this tactic, see Aden Magee, “Lessons to Be Learned: The Employment of Suicide Vehicle Borne Improvised Explosive Devises [sic] in the Islamic State’s Defense of Mosul,” *Small Wars Journal*, January 12, 2018.

⁵² RAND interview with GEN Joseph Martin, June 16, 2020.

⁵³ RAND interview with Brig Gen Matthew Isler, December 6, 2019; Mosul Study Group, *What the Battle for Mosul Teaches the Force*, Washington, D.C.: U.S. Army, September 2017, pp. 55–56.

adapted to coalition deliberate-targeting efforts and learned that it could preserve its critical capabilities by moving facilities every two weeks in areas where it was being actively targeted. This movement meant that by the time the four- to six-week CAOC target development and approval process was complete, approved target packages were often irrelevant.⁵⁴

Moreover, the CJFLCC Commander desired to have deliberate strikes to prepare the battlefield before Iraqi forces maneuvered, but partner practices proved to be incompatible with the deliberate-targeting process. The Iraqis, in particular, commonly would develop more than five plans and decide which one they were going to execute only at the last minute.⁵⁵ The deliberate planning process was not flexible enough to keep up with the ISF's 11th-hour planning, nor was it responsive enough to keep up with speed of operations in an urban environment. In part, this was because the deliberate-targeting process had higher requirements for intelligence than dynamically tasked strikes, which greatly increased the time between target development and engagement. In particular, a specific number of hours of uninterrupted FMV over target areas was necessary to minimize the possibility of civilian casualties, and if there were any interruptions, the clock started over. This "platinum standard" was hard to meet at any time but particularly when RPAs were stretched extremely thin with concurrent offensives taking place in Mosul and around Raqqa.⁵⁶

Because "deliberate targeting efforts proved to be ineffective due to their lack of responsiveness to the changing operational environment and extensive vetting timelines," CJFLCC Commander MG Joseph Martin sought to find a way to deliver more-responsive preplanned fires to support the Iraqi scheme of maneuver.⁵⁷ To buy time to collect intelligence on ISIS VBIED operations in Mosul, Martin first used airpower to mitigate the damage of VBIED attacks, by preventively cratering the avenues of approach with a 500-pound GBU-38 that had a delayed fuse so that it exploded ten feet below the ground and caused little to no damage to nearby buildings but made the road impassable to VBIEDs. The Iraqis would use bulldozers to enable their movement through their cratered road of choice.⁵⁸

⁵⁴ RAND interview with Brig Gen Matthew Isler, December 6, 2019.

⁵⁵ Center for Army Lessons Learned, *Operation Eagle Strike, Phase I (Shape) and II (Isolate): Observations, Insights, and Lessons*, Fort Leavenworth, Kan., March 10, 2017; Task Force Black Falcon, "Lessons Learned Task Force Black Falcon 2-319th AFAR, 2BCT, 82d ABN DIV Deployment to Iraq in Support of Operation Inherent Resolve January–September 2017," Fort Bragg, N.C.: 82D Airborne Division, October 11, 2017, p. iii.

⁵⁶ RAND interview with USAF officer, January 29, 2020; for more on the targeting process, see Matthew Isler, "Department of Defense Press Briefing by Brig. Gen. Matthew Isler on Central Command's Targeting and Civilian Casualty Investigation Processes," transcript, U.S. Department of Defense, October 25, 2017.

⁵⁷ RAND interview with Brig Gen Matthew Isler, December 6, 2019.

⁵⁸ Matthew Isler, "Department of Defense Press Briefing by Brig. Gen. Matthew Isler on Central Command's Targeting and Civilian Casualty Investigation Processes," transcript, U.S. Department of Defense, October 25, 2017.

While cratering roads and encouraging the Iraqis to continue to press forward, CJFLCC used an array of organic ISR assets to conduct its own target systems analysis of ISIS's VBIED operations.⁵⁹ Martin then implemented a non doctrinal "deliberate-dynamic" targeting process to degrade ISIS critical capabilities in Mosul, including VBIED production.⁶⁰ This method of intelligence-driven targeting was able to generate targets in an operationally relevant timeline, between 24 and 48 hours, while still utilizing deliberate-targeting tactics, techniques, and procedures to generate the maximum "effects in support of the scheme of maneuver."⁶¹ These were precise preplanned strikes but were developed swiftly by CJFLCC to encourage the movement of Iraqi forces and proved to be responsive to shifting battlefield conditions.

In Mosul, the CJTF-run deliberate-targeting process proved unable to sufficiently reduce the time between target development and engagement to meaningfully interrupt ISIS resupply operations. But coalition aircraft provided critical air support to Iraqi forces through the strike-cell-run and CJFLCC-run dynamic-deliberate tasking processes that proved essential to eliminating ISIS in Mosul. The deliberate-dynamic targeting processes were aided by the delegation of engagement authorities and the placement of U.S. advisers on the front lines with Iraqi forces. When the advance into eastern Mosul began to stall in December 2016 and the Iraqi forces, especially CTS, were suffering heavy losses, CJTF-OIR Commander LTG Stephen Townsend modified U.S. military authorities with Tactical Directive 1. This order delegated TEA to American combat advisers with the organic ability to conduct terminal control in an effort to increase the responsiveness of surface and air fires and their coordination with Iraqi forces.⁶²

In a large, well-developed city such as Mosul, coupled with a quick-moving battle, it proved nearly impossible to service targets in a timely fashion with a more centralized process. Tactical Directive 1 empowered U.S. advisers who previously could not authorize fires, but the majority of the strikes still were coordinated and approved through the strike cells. U.S. combat advisers leveraged their newfound authority to launch counterbattery attacks against ISIS with tactical artillery, and, at times, they authorized air strikes. However, the strike cells managed the airspace and had more capacity to deconflict, coordinate, and approve air strikes, enabling them to deliver

⁵⁹ RAND interview with U.S. Army official, June 16, 2020.

⁶⁰ Mosul Study Group, *What the Battle for Mosul Teaches the Force*, Washington, D.C.: U.S. Army, September 2017, p. 55; RAND interview with Brig Gen Matthew Isler, December 6, 2019.

⁶¹ Mosul Study Group, *What the Battle for Mosul Teaches the Force*, Washington, D.C.: U.S. Army, September 2017, p. 55.

⁶² David R. Kogon, "The Coalition Military Campaign to Defeat the Islamic States in Iraq and Syria 21 Aug 2016–05 Sep 2017," Combined Joint Task Force—Operation Inherent Resolve, 2017, p. 24; Balint Szlanko and Susannah George, "U.S. Changes Rules of Engagement for Mosul Fight in Iraq," Military.com, February 24, 2017.

more-responsive air support than forward-positioned ground advisers.⁶³ This was particularly true of the strike cell in Erbil, which, unlike many of the other strike cells, was staffed by a fully trained JAGIC crew.⁶⁴ Thanks to this successful air-to-ground integration, the Iraqi forces cleared eastern Mosul in January 2017 and finally completed the liberation of the entire city in July 2017.

Driving Toward Raqqa, November 2016–August 2017

Like the attack on Mosul, the offensive on Raqqa—called Operation Eclipse—occurred in stages with Syrian Kurdish and Arab forces first clearing outer lying areas before moving into the capital itself.⁶⁵ Starting on November 5, 2016, the combined Kurdish-Arab SDF force moved toward Raqqa along three different axes, capturing towns along the way.⁶⁶ Similar to the operations in Iraq, coalition aircraft provided air support to partner forces—in this instance, the Kurdish-Arab SDF as that force systematically moved toward ISIS's capital, eliminating enemy strongholds along the way. These air strikes were controlled by SOF-run strike cells that were responsible for supporting the SDF's scheme of maneuver.⁶⁷ As Lt Gen Harrigian described, “As our ground forces maneuver, we’re finding that’s when the enemy is going to present themselves. And with the assets that we’ve had overhead, we’ve been able to be very effective any time the enemy shows themselves” at targeting and precisely hitting them.⁶⁸

As a part of the plan to secure the western approaches to Raqqa, the SDF executed a daring air assault across Lake Assad in U.S. helicopters and tiltrotor aircraft, supported by U.S. Army and USMC artillery. In the four months prior to this attack there were 300 air strikes around Tabqah Dam to soften up ISIS's defenses and U.S. SOF advisers engaged in extensive planning with the SDF to prepare to execute this airlift over the course of one evening. Surprise was critical to the operation's success to not only catch ISIS off guard but also to outmaneuver the nearby pro-Syrian regime forces and to deny them a foothold on Raqqa.⁶⁹ During the air assault, coalition aircraft provided overwatch of its Syrian partners as they executed this complicated maneuver.⁷⁰

⁶³ RAND interview with U.S. Army official, June 16, 2020.

⁶⁴ RAND email exchange with USAF officer, July 31, 2020.

⁶⁵ David R. Kogon, “The Coalition Military Campaign to Defeat the Islamic States in Iraq and Syria 21 Aug 2016–05 Sep 2017,” Combined Joint Task Force—Operation Inherent Resolve, 2017.

⁶⁶ Stephen Townsend, “Lt. Gen. Townsend Statement on SDF Advance to Isolate Raqqah,” press release, U.S. Central Command, November 7, 2016.

⁶⁷ RAND interview with USAF officer, August 20, 2020.

⁶⁸ Jeffrey Harrigian, “Department of Defense Press Briefing by General Harrigian via Teleconference,” transcript, U.S. Department of Defense, May 24, 2017.

⁶⁹ RAND interview with USAF officer, August 20, 2020.

⁷⁰ Michael R. Gordon and Anne Barnard, “U.S. Airlifts Hundreds of Militia Fighters in Attack to Cut Off Raqqa, Syria,” *New York Times*, March 22, 2017; David R. Kogon, “The Coalition Military Campaign to Defeat

There were two major factors that differentiated Operation Eclipse from Operation Eagle Strike: The airspace over Syria was “congested and contested,”⁷¹ and the SDF was a light infantry force. Since September 2015, Russian air strikes had enabled the resurgence of the Syrian regime, and by 2017 Syria’s forces, along with those of their Russian and Iranian backers, were pushing into northeastern Syria, where the SDF and coalition aircraft were fighting ISIS. Moreover, at the end of 2015, Moscow deployed long-range S-400 SAMs to protect its air base at Latakia that could range much of the country.⁷² Early in the campaign, the coalition believed that the Syrian regime had acquiesced to its air operations, but that became more of a question as Syrian forces and their Russian and Iranian allies increasingly came into contact on the ground with the SDF and competed for the same territory. Consequently, the airspace became more contested, and tensions increased because Russian, Syrian, and Iranian aircraft could pose a threat to coalition partners on the ground. This, in turn, raised concerns that Syrian and Russian air defenses might start to paint coalition aircraft with their targeting radars, and the CFACC explained, “in Raqqa, you are . . . right in the heart of the integrated air defense.”⁷³ This was particularly important after April 7, 2017, as the United States became further entangled in the Syrian civil war when two U.S. destroyers launched 59 cruise missiles at al-Shayrat air base after the Syrian regime used chemical weapons in an attack on a hospital.⁷⁴

Concerns about Syrian or Russian attacks on the SDF and coalition forces on the ground had two related effects on air operations. First, Russian aircraft overhead at times limited the supply of coalition aircraft able to support the SOF strike cells.⁷⁵ This was particularly problematic because the vast majority of the strike cell’s targets were mobile, so gaps in overhead coverage impeded their ability to respond to time-sensitive targets. Like in Mosul, a key target in Raqqa was VBIEDs that looked like “Mad Max vehicles” with disparate pieces of metal welded to them as a form of armor. The SOF JTACs needed to be able to call in fires in a matter of minutes to interdict the VBIEDs

the Islamic States in Iraq and Syria 21 Aug 2016–05 Sep 2017,” Combined Joint Task Force—Operation Inherent Resolve, 2017, p. 40; Jeffrey Harrigian, “Department of Defense Press Briefing by General Harrigian via Teleconference,” transcript, U.S. Department of Defense, May 24, 2017.

⁷¹ Jeffrey Harrigian, remarks during the “Global Operational Perspectives on MDO” panel, 2020 Air Warfare Symposium, Orlando, Fla., February 27, 2020.

⁷² Jonathan Marcus, “Russia S-400 Syria Missile Deployment Sends Robust Signal,” BBC, December 1, 2015.

⁷³ Quoted in Michael R. Gordon, “Inside the Air War over Syria: A High Altitude Poker Game,” *New York Times*, May 23, 2017.

⁷⁴ Gordon Lubold and Dion Nissenbaum, “U.S. Launches Cruise Missiles at Syrian Air Base in Response to Chemical Weapons Attack,” *Wall Street Journal*, April 7, 2017.

⁷⁵ RAND interview with USAF officer, August 20, 2020.

to protect the light SDF forces and enable them to maneuver. If the strike cells failed to do so, the rapport between the SDF fighters and U.S. SOF advisers suffered.⁷⁶

Second, to counter the air threat, the CFACC had to devote considerable assets to the air defense mission, which typically included F-22 fighters, E-3 Sentry Airborne Warning and Control System (AWACS) aircraft, and F-15E fighters, in stark contrast to Iraq, which was a completely permissive environment. The USAF fighters were armed with both air-to-ground and air-to-air munitions, so they were capable of responding in “minutes” to threats in the air or on the ground and able to “support troops in contact.”⁷⁷ There were several notable air-to-air incidents in the spring and summer of 2017, including the shootdown of two Iranian UASs by F-15E fighters and the shootdown of a Syrian Su-22 Fitter by an F/A-18E fighter.⁷⁸ Most of these air-to-air engagements were to protect SDF and coalition forces on the ground in Syria. The air defense mission is discussed in greater detail in Chapter Six.

The fight for Raqqa was challenging not only because of the additional threat posed by the Syrians, Russians, and Iranians but also because the coalition’s partner on the ground was a light infantry force that lacked the firepower, protection, and mobility of an armored or mechanized army.⁷⁹ As a result, the SDF and coalition could not use the tactics that worked with the heavier Iraqi force in Syria. Moreover, in general, the SDF required more air support to compensate for its lack of organic fires and defenses. For instance, during the liberation of Mosul, the coalition averaged only 189 strikes a month, compared with 704 strikes a month in Raqqa.⁸⁰ This difference in intensity is quite visible in Figure 2.14, which showed the number of strikes by location. In May 2017, President Donald Trump authorized providing the SDF with mortars, antitank weapons, armored cars, heavy machine guns, and engineering equipment over the strong objections of Turkey.⁸¹ Despite these enhancements, the SDF was not a heavy force that could execute complicated combined arms maneuvers, as parts of the ISF and Peshmerga could, by the time the assault on Mosul began. After the announcement, Turkish President Recep Tayyip Erdogan said: “I want to believe that Turkey’s allies will side with us, not with terrorist organizations,” and that he “hope[d]

⁷⁶ RAND interview with USAF officer, August 20, 2020.

⁷⁷ Michael R. Gordon, “Inside the Air War over Syria: A High Altitude Poker Game,” *New York Times*, May 23, 2017.

⁷⁸ Michael R. Gordon, “American Warplane Shoots Down Iranian-Made Drone over Syria,” *New York Times*, June 20, 2017; Michael R. Gordon and Thomas Erdbrink, “U.S. Fighter Jet Shoots Down Syrian Warplane,” *New York Times*, June 18, 2017; Geoff Ziegulewicz, “The Inside Story of How a US Navy Pilot Shot Down a Syrian Jet,” *Navy Times*, September 10, 2018.

⁷⁹ David R. Kogon, “The Coalition Military Campaign to Defeat the Islamic States in Iraq and Syria 21 Aug 2016–05 Sep 2017,” Combined Joint Task Force—Operation Inherent Resolve, 2017.

⁸⁰ RAND CJTF-OIR strike release data set.

⁸¹ Michael R. Gordon and Eric Schmitt, “Trump to Arm Syrian Kurds, Even as Turkey Strongly Objects,” *New York Times*, May 9, 2017.

this mistake will be reversed as soon as possible.”⁸² Trump’s decision to directly arm the SDF, however, did have large negative ramifications for the U.S.-Turkish relationship.⁸³

As the SDF closed in on Raqqa from three sides, control over the airspace became a source of tension between the SOF-run strike cells and the CFACC. Until that point, the CJTF-OIR Commander had delegated control of the airspace over Raqqa to the CFACC, which launched strikes in the city to soften up ISIS targets and keep pressure on the organization. CJSOTF was controlling the airspace in the territory outside Raqqa, because it was supporting the SDF’s ground maneuver and thus had the best situational awareness. As the SDF approached Raqqa city, the SOF strike cell commanders had discussions with the CFACC about assuming control over that airspace so that they could better support the SDF’s offensive. From the perspective of the strike cell, the CFACC was often using scarce air assets and weapons to hit valid ISIS targets, but ones that did not directly support the ground scheme of maneuver. The strike cell would have preferred to have control over that airspace and have those aircraft allocated to support the ground offensive.⁸⁴ Eventually, the strike cell was delegated control over the airspace over Raqqa, but this took longer than it would have liked.

After nearly 200 days of continuous operations to isolate Raqqa, on June 5, 2017, the SDF began its assault on the city. At this point, 3,000–4,000 ISIS fighters were thought to be defending the capital, and DoD expected the fight to be “long and difficult.”⁸⁵ Unlike Mosul, which, according to one pilot, was a “semblance of a functioning city” with people still residing there, Raqqa was a “ghost town” by the time that the SDF reached it.⁸⁶ On July 3, two F-15E fighters dropped weapons on the southeastern section of the old city wall, opening up two large breaches that SDF fighters were able to quickly exploit. With coalition CAS, the SDF established a lodgment inside the old city and began the slow process of clearing each block against strong resistance.⁸⁷

⁸² Anne Barnard and Patrick Kingsley, “Turkey Assails Decision to Arm Syrian Kurds,” *New York Times*, May 10, 2017.

⁸³ U.S.-Turkish relations became especially strained after Turkish forces moved into Syria and attacked the SDF in October 2019. As a result, President Trump briefly imposed sanctions against Turkish cabinet ministries and ministers, and Congress also threatened to impose sanctions if Turkey again attacked the SDF. Jim Zanotti and Clayton Thomas, *Turkey Background and U.S. Relations in Brief*, Washington, D.C.: Congressional Research Service, April 7, 2020, pp. 9–10.

⁸⁴ For instance, a CAOC-planned air strike hit an ISIS front loader that was assembling defenses along the southern part of Raqqa when the SDF was attacking the city from the north, east, and west. The SOF officer would have preferred that precision-guided munitions serviced a target that would have directly facilitated the SDF’s advance. RAND interview with USAF officer, August 20, 2020.

⁸⁵ Lisa Ferdinando, “Syrian Democratic Forces, Backed by Coalition, Launch Battle to Liberate Raqqa,” U.S. Department of Defense, June 6, 2017.

⁸⁶ RAND interview with U.S. Navy official, February 3, 2020.

⁸⁷ David R. Kogon, “The Coalition Military Campaign to Defeat the Islamic States in Iraq and Syria 21 Aug 2016–05 Sep 2017,” Combined Joint Task Force—Operation Inherent Resolve, 2017, p. 42.

In the fights for Raqqa and Mosul, USAF B-52 bombers were an important asset that provided overwatch for the Iraqis and the SDF. After a decade-long absence from the Middle East, the 20th Expeditionary Bomb Squadron was deployed to AUAB in April 2016, while the B-1B bombers were undergoing a maintenance overhaul.⁸⁸ As then-Lt Gen James Holmes explained, the B-52 offers “some missions for us that are hard to replicate, primarily the range and payload the airplane provides.”⁸⁹ The upgraded B-52s could now deliver precision-guided munitions “in close proximity of friendly troops who are under attack” according to USAF Chief of Staff Gen David Goldfein.⁹⁰

In addition to their long loiter time and capacity to carry a large and diverse number of weapons, the bombers were attractive because of their versatility and ability to be retasked midmission, which was in part due to the five-person crew and avionics systems that could plot hundreds of targets.⁹¹ The 96th Expeditionary Bomb Squadron had a modernized communications system, which improved its situational awareness and ability to provide CAS to troops in contact.⁹² Over Raqqa, the B-52 crews would get an update from the ground liaison officers daily on the FLOT, which was then inputted into Combat Network Communications Technology (CONECT), so it could be viewed seamlessly, which assisted in dropping weapons near friendly troops in contact.⁹³ Moreover, these B-52s could also carry GBU-54s, which had dual laser–GPS guidance systems, and improved their ability to launch precision strikes and minimize collateral damage.⁹⁴

In total, coalition aircraft launched 3,796 mainly dynamically tasked strikes to support the SDF as it liberated Raqqa, leaving “its streets a moonscape of shattered buildings and mountains of detritus.”⁹⁵ The battle did not culminate until the beginning of Phase III, in August, which was marked by the largest number of strikes and

⁸⁸ Lex Talamo, “Barksdale Airmen Return from Qatar Anti-Terrorist Operation,” *Shreveport Times*, September 19, 2016; Brian W. Everstine, “Old Bombers, Making History,” *Air Force Magazine*, June 27, 2018.

⁸⁹ Oriana Pawlyk, “B-52s Arrive in Qatar to Join Bombing Campaign Against ISIS,” *Air Force Times*, April 9, 2016.

⁹⁰ Brian W. Everstine, “Continuous Sandbox Presence,” *Air Force Magazine*, February 27, 2017.

⁹¹ RAND interviews with USAF officials and coalition officials, March 2, 2020. Later, the B-52s’ capacity to carry precision-guided munitions was increased with the 1760 Internal Weapons Bay Upgrade, which added eight internal weapons on a conventional rotary launcher in addition to the 16 precision-guided munitions mounted on pylons under its wings. See Patrick Everson, “B-52 Upgrade Arrives in the Middle East,” U.S. Air Forces Central, December 22, 2017.

⁹² Curt Beach, “Barksdale Airmen Deploy to Qatar to Combat ISIS,” Barksdale Air Force Base, September 15, 2016.

⁹³ AFHRA interview with Maj Joe G. Biles, September 24, 2019.

⁹⁴ David Cenciotti, “Watch Bombs Being Dropped on ISIS from the Cockpit of a B-52,” *Business Insider*, June 5, 2017.

⁹⁵ Jared Malsin, “Raqqa Is in Ruins and ISIS in Retreat,” *Time*, November 6, 2017.

weapon releases of OIR. Raqqa fell more quickly than CJTF-OIR expected, propelling OIR into Phase III, in which it sought to eliminate remaining pockets of ISIS in the MERV and to begin the enormous task of rebuilding and stabilizing the areas that had been liberated.⁹⁶

Assessment of Phase II

By the end of Phase II, ISIS had lost its Iraqi capital, Mosul, after a grueling seven-month battle, and was on the verge of losing its Syrian capital, Raqqa, which was completely surrounded by the SDF. CJTF-OIR Commander LTG Townsend commended the Iraqis for prevailing in Mosul “in the most extended and brutal combat I have ever witnessed, while making extraordinary efforts to safeguard civilian lives, even at the cost of their own.”⁹⁷ As part of these operations, ISIS had been driven out of much of the territory that it once controlled. By June 26, 2017, ISIS possessed only 36,200 square kilometers of land in Iraq and Syria, which was a 40 percent reduction since the beginning of 2017, when the caliphate had spanned 90,800 square kilometers of land. See Figure 3.3.

Phase II consisted of active ground offensives in Iraq and Syria and three deliberate-targeting operations that were intended to deprive ISIS of resources and to impede the movement of its forces between Iraq and Syria. By one estimate, these territorial losses, which meant significantly less income extracted from the population, combined with the attacks on its banks and oil business, had caused ISIS revenue to decline by 80 percent since 2015.⁹⁸ We do not have enough data to precisely measure the separate effects of each of these operations. Yet ISIS’s records indicate that the ratio of revenue that was derived from taxation, which is tied to territorial control, and the sale of oil was six to one.⁹⁹ This suggests that the physical caliphate was ISIS’s center of gravity, which was destroyed by the close fight. Applying pressure to ISIS in its rear areas through strategic air strikes certainly contributed to the financial pressure on the organization and might have significantly hastened its demise, but we are not able to isolate these effects. Nevertheless, the combination of both the ground fight and deliberate-targeting operations collectively weakened ISIS by depriving it of territory and resources.

Table 3.1 details low, medium, and high estimates of ISIS’s resources between 2014 and 2017. There is considerable uncertainty associated with the specific amount of money that ISIS had, but the general trends are quite clear, and it was during 2015 and 2017 that the organization’s finances declined significantly.

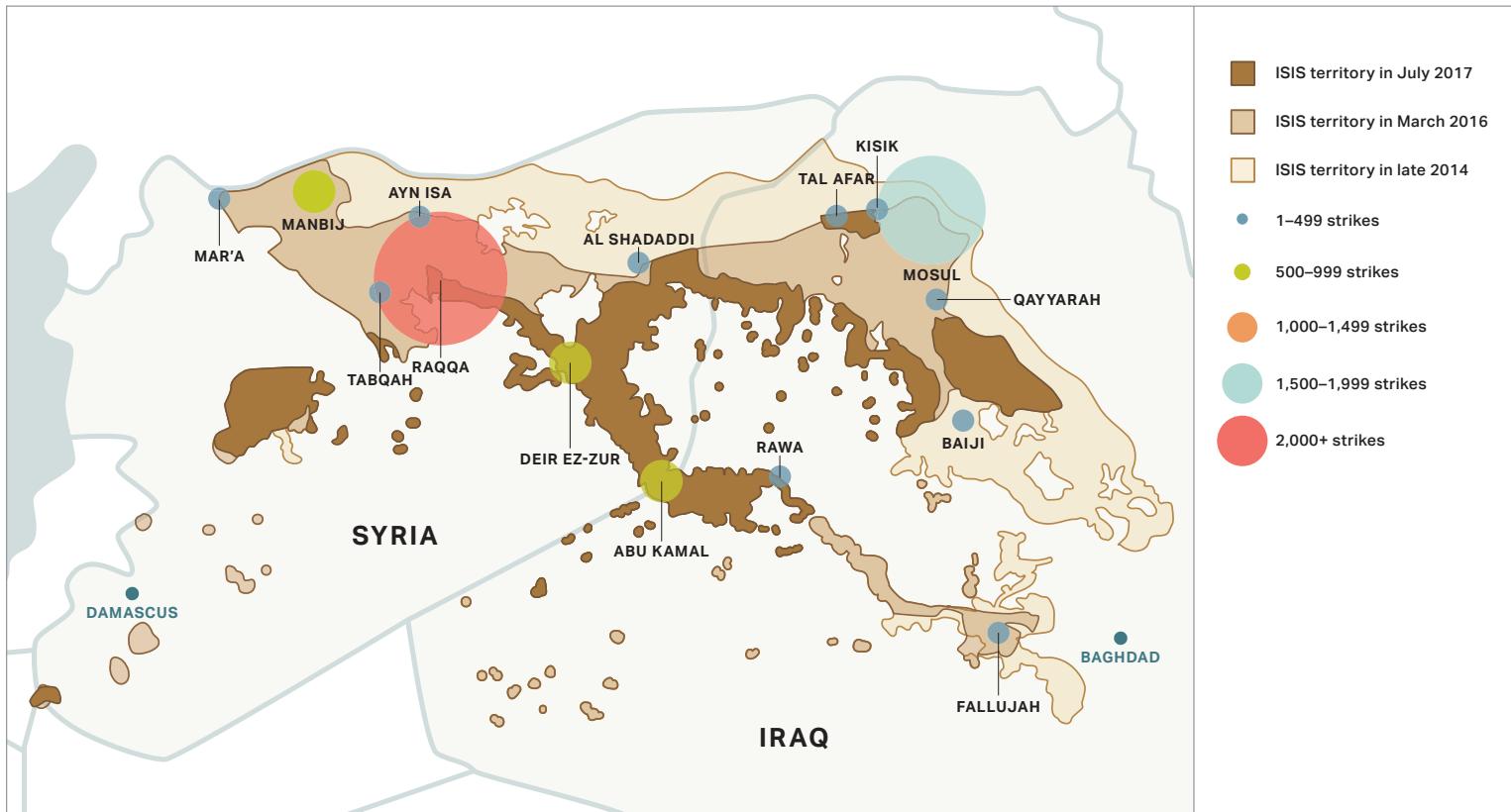
⁹⁶ RAND interviews with USAF officials and coalition officials, March 3, 2020.

⁹⁷ Stephen Townsend, “Remarks by General Townsend in a Media Availability in Baghdad, Iraq,” transcript, U.S. Department of Defense, July 11, 2017.

⁹⁸ IHS Markit, “Islamic State Territory Down 60% and Revenue Down 80% on Caliphate’s Third Anniversary,” June 29, 2017.

⁹⁹ Rukmini Callimachi, “The ISIS Files,” *New York Times*, April 4, 2018.

Figure 3.3
OIR Phase II: ISIS Territorial Holdings and Locations of Major Coalition Air Strikes



SOURCES: Global Coalition, "Daesh Areas of Influence—July 2017 Update," August 24, 2017; RAND CJTF-OIR strike release data set.

Table 3.1
Estimates of ISIS Revenue from 2014 to 2017, U.S. \$ Millions

Year	Low Estimate	Medium Estimate	High Estimate
2014	970	1,890	2,900
2015	1,035	1,700	2,400
2016	520	870	870
2017	192	192	192

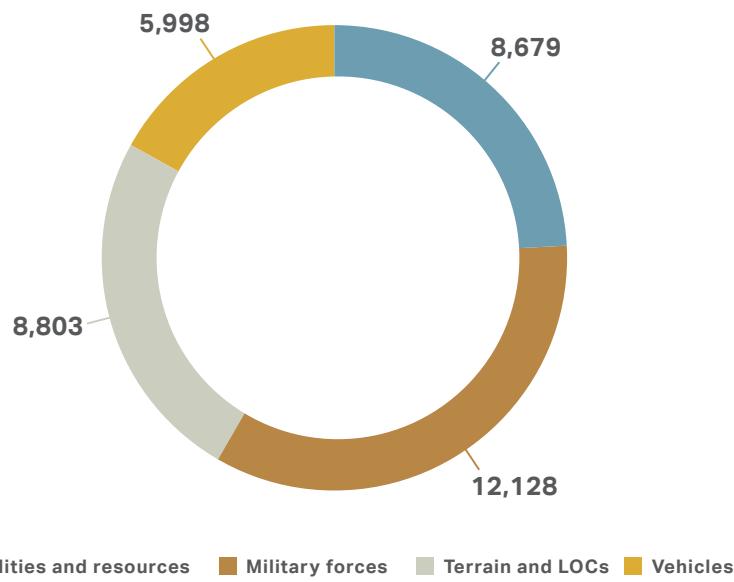
SOURCE: Patrick B. Johnston, Mona Alami, Colin P. Clarke, and Howard J. Shatz, *Return and Expand? The Finances and Prospects of the Islamic State After the Caliphate*, Santa Monica, Calif.: RAND Corporation, RR-3046, 2019, p. 43.

During this phase, the coalition launched 12,236 strikes and released 51,739 weapons; of these strikes, 4,938 (40 percent) were in Iraq and 7,298 were in Syria (60 percent). Phase II was the most intense period of kinetic air activity during OIR, with more strikes and weapon releases, in spite of fewer counterland sorties, over a shorter period than Phase I or Phase III (see Table 2.4).¹⁰⁰ Over the period, the proportion of targets engaged in Iraq steadily declined relative to the number serviced in Syria (see Figure 2.11). As the Raqqa campaign ramped up in 2017, more air strikes were devoted to supporting the lighter SDF than the heavier Iraqi forces fighting in Mosul. For the entire phase, the coalition averaged 306 targets per month engaged in Iraq, while hitting an average of 441 targets in Syria. But, isolating 2017, those figures tilt dramatically toward Syria; on average, only 253 targets per month were serviced in Iraq, while 637 were serviced in Syria between January and July. In the first two quarters of 2017, 37 to 38 percent of the total CJTF-OIR strikes were located in Raqqa, while only 17 to 19 percent were in Mosul.

As displayed in Figure 3.4, 34 percent of the targets engaged were ISIS forces, which remained the largest category. In addition, terrain and facilities were nearly equal, at 25 percent and 24 percent weight of effort, respectively. Finally, vehicles continued to be the least-serviced target, making up only 17 percent of the strikes. These proportions remained relatively consistent with the averages from Phase I. However, if one examines the monthly breakdowns, there is a large jump in the number of strikes against terrain and LOCs starting in May 2017, to more than 1,000 engagements, equaling 33 percent of the total number of strikes that month. The terrain strikes hit their peak in June, when 1,434 targets were serviced, making them 36 percent of the total targets engaged. The number of strikes targeting facilities steadily increased over the last three months of this phase, peaking in July, when 1,166 targets (32 percent) were engaged. The uptick in terrain targets may be due to the deliberate-dynamic

¹⁰⁰ CJTF-OIR changed its reporting criteria in February and April 2017 to include different surface fires in the overall strike data. See Appendix D for more information.

Figure 3.4
Proportion of Targets Engaged, by Type, During Phase II



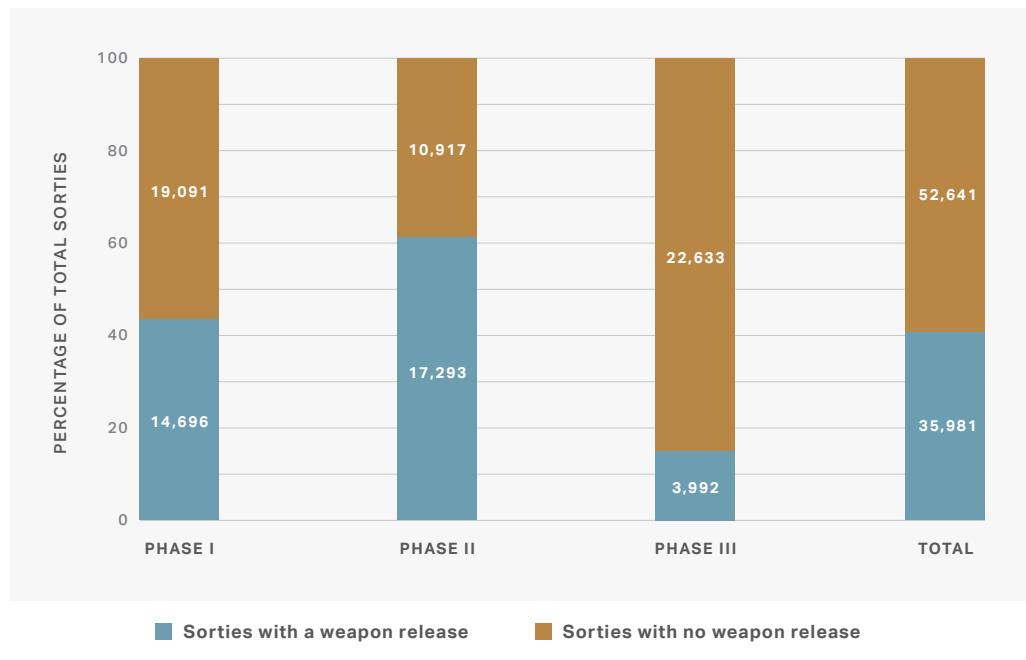
SOURCE: RAND CJTF-OIR strike release data set.

strikes in Mosul, a surge in efforts to isolate ISIS forces in both cities, or a large number of morale bombings. The growth in the number of facilities targeted coincides with the SDF's advance into Raqqa, during which many buildings were destroyed.

Figure 3.5 shows the proportion of counterland sorties with one weapon release and those in which no weapons were released, by phase. There was a notable increase in the efficiency of air-to-ground sorties in Phase II. During Phase II, only 39 percent of the aircraft sent on counterland missions came back without releasing a weapon, while in Phase I 56 percent returned to base with a full weapon load. These trends were corroborated by pilots' accounts, who all agreed that Phase II—while there were concurrent battles going on for Mosul and Raqqa—was the period in which they engaged the most targets. This increase in weapon usage is due to several factors. First, Phase II included two of the largest ground battles, along with several deliberate-targeting campaigns. Because partner forces were in contact with the enemy, ISIS fighters were forced to expose themselves, increasing the number of dynamically tasked strikes that were executed. MG Martin estimated that, “of the 16,500 we did over the course” of the Mosul campaign, “90 percent or more were dynamic” because of “the nature of the fight.”¹⁰¹ Second, TEA was pushed to lower echelons twice during this phase—initially

¹⁰¹ ARCENT, “The ‘By, With, and Through’ Approach: An Army Service Component Command Perspective,” white paper, Shaw Air Force Base, S.C., September 7, 2017, p. 7.

Figure 3.5
Counterland Sortie Utilization, by Phase



SOURCE: RAND CJTF-OIR strike release data set.

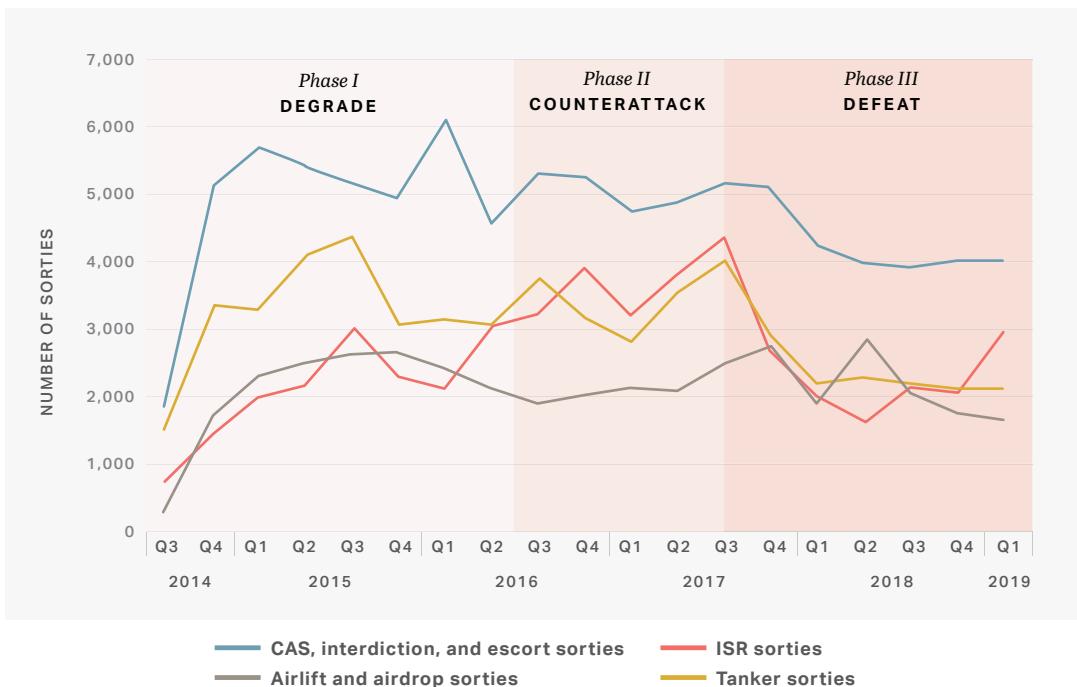
when LTG Townsend issued Tactical Directive 1 and then again in May 2017, when Secretary of Defense James Mattis further delegated authorities.¹⁰² The number of weapon releases did jump appreciably between December 2016 and January 2017, and in general they continued to increase over this period, with another significant jump occurring in the summer of 2017 (see Figure 2.8).

Figure 3.6 displays the number of counterland, ISR, airlift, and tanker sorties during OIR by phase. Given the simultaneous attacks on ISIS's capitals, the demand for ISR surged during Phase II, with 18,601 sorties being flown. This still did not meet the full demand, as the CAOC continued to complain that it did not have sufficient ISR assets for target development. Somewhat surprisingly given this level of air activity, there were fewer (17,398) tanker sorties than in Phase I. This drop in tanker sorties is tied to the coalition's growing access, as it benefited from operating from closer bases in Turkey and Iraq.

Despite the many successes, Phase II was not without its problems—notably, the failed deliberately planned interdiction campaign in Mosul and a growing number of

¹⁰² Jim Mattis, Joseph F. Dunford, and Brett McGurk, “Department of Defense Press Briefing by Secretary Mattis, General Dunford and Special Envoy McGurk on the Campaign to Defeat ISIS in the Pentagon Press Briefing Room,” transcript, U.S. Department of Defense, May 19, 2017.

Figure 3.6
AFCENT Data on Counterland, ISR, Airlift, and Tanker Sorties



SOURCE: RAND AFCENT airpower summary data set.

air strikes that resulted in civilian casualties. Even with the improvements made in 2015, the deliberate target-development process proved incapable of keeping up with the pace of partner ground operations, whose detailed planning was rarely completed until hours before execution.¹⁰³ As a result, CJFLCC circumvented the CJTF-OIR deliberate-targeting process and established its own expedited process for developing deliberate-dynamic strikes to degrade ISIS critical capabilities, including neutralizing the VBIED threat and allowing partner ground forces to maneuver. Nevertheless, given the pull of concurrent operations in Raqqa, “CJFLCC did not always have as many assets as [it] wanted.”¹⁰⁴ More research needs to be devoted to understanding what, if anything, could have been done to reduce the time between target development

¹⁰³ Task Force Black Falcon, “Lessons Learned Task Force Black Falcon 2-319th AFAR, 2BCT, 82d ABN DIV Deployment to Iraq in Support of Operation Inherent Resolve January-September 2017,” Fort Bragg, N.C.: 82d Airborne Division, October 11, 2017, p. iii.

¹⁰⁴ Center for Army Lessons Learned, *Operation Eagle Strike, Phase I (Shape) and II (Isolate): Observations, Insights, and Lessons*, Fort Leavenworth, Kan., March 10, 2017, p. 12.

and target engagement, in this case, and to identify the trade-offs associated with the deliberate-dynamic process, compared with doctrinal deliberate-targeting processes.

According to Airwars, a nonprofit organization that monitors civilian deaths, there was a surge in the number of civilian casualties during the Battles of Mosul and Raqqa. In Iraq, the reported number of civilian deaths peaked in March 2017, with more than 1,400, while in Syria the estimated number of deaths nearly reached 800 in June 2017.¹⁰⁵ One of the most deadly incidents occurred in March 2017, when an air strike that was called in to take out snipers on the roof of a building in Mosul inadvertently resulted in the deaths of more than 100 civilians who were hiding in the basement. According to Brig Gen Matthew Isler, the Pentagon’s “investigation determined that ISIS deliberately staged explosives and snipers to harm civilians.”¹⁰⁶ According to the coalition, the jump in the number of civilian casualties, especially in Mosul, which was still inhabited, was an unfortunate and unintended effect of large-scale urban combat operations. As the intensity of the war increased, authorities to approve fires were delegated to lower levels, and combat took place in cities. Despite all the efforts of the coalition to avoid civilian deaths, they still occurred. DoD’s FY 2018 annual report on civilian casualties similarly concluded that this uptick in casualties was due to combat in urban areas against adversaries “whose tactics include intentionally endangering the lives of innocents” and the use of dynamic strikes in support of partner forces in contact with the enemy.¹⁰⁷ In a press conference in July 2017, LTG Townsend responded strongly to the accusation that the coalition had been launching inaccurate bombs that resulted in massive civilian casualties: “I reject the—any notion that coalition fires were any—in any way imprecise, unlawful, or excessively targeted civilians.” Townsend went on to assert, “[W]e have gone to extraordinary measures to safeguard civilian lives,” but “there are civilians that have been killed and injured in the battle of Mosul. It’s a horrible part of war.”¹⁰⁸

An additional *New York Times* investigation into the civilian casualties caused by coalition air strikes in northern Iraq between April 2016 and June 2017 raised further questions about CJTF-OIR’s reporting on the issue.¹⁰⁹ In a sample of nearly 150 air strikes, the *New York Times* determined that one out of five strikes resulted in civilian deaths and that the coalition failed to sufficiently investigate these incidents. In the course of reporting, the newspaper found that the coalition rarely dispatched investi-

¹⁰⁵ Airwars, “US-Led Coalition in Iraq and Syria,” webpage, undated.

¹⁰⁶ Michael R. Gordon, “Pentagon Inquiry Blames ISIS for Civilian Deaths in Mosul Strike,” *New York Times*, May 25, 2017.

¹⁰⁷ DoD, *Annual Report on Civilian Casualties in Connection with United States Military Operations*, Washington, D.C., May 2, 2019, pp. 12–13.

¹⁰⁸ Stephen Townsend, “Remarks by General Townsend in a Media Availability in Baghdad, Iraq,” transcript, U.S. Department of Defense, July 11, 2017.

¹⁰⁹ Azmat Khan and Anand Gopal, “The Uncounted,” *New York Times*, November 16, 2017.

gators on the ground and that its strike records were incomplete, which raises broader questions about the coalition’s civilian casualty reporting and the transparency of this effort. Although some of the civilian fatalities appeared to be a product of proximity to ISIS targets, many appear to be a result of flawed or outdated intelligence that mistakenly identified a purely civilian location with that of ISIS.

Similarly, Amnesty International, in partnership with Airwars, has alleged that coalition air strikes in Raqqa between June and October 2017 “failed to distinguish between military targets and civilians” and caused “excessive harm to civilians.”¹¹⁰ Amnesty International acknowledged the challenges of urban combat and the fact that ISIS exacerbated these issues by using human shields but maintained that the coalition needed to conduct additional surveillance before strikes.¹¹¹

Although it is beyond the scope of this report to assess the issue of CJTF-OIR civilian casualties, it is important to acknowledge that there is a significant debate about how transparent and precise the coalition’s air strikes were. Such deaths may be unavoidable in war and especially in urban combat against a hybrid adversary, like ISIS, that tries to blend into the civilian population. Some of this may be inherent to the chosen “by, with, and through” strategy, which increased the coalition’s reliance on Iraqi and Syrian partners for intelligence and raised risks of faulty or outdated intelligence. Alternatively, the number of civilian casualties might have risen as a result of policy decisions, including Tactical Directive 1 in December 2016, and then the Trump administration’s attempt to accelerate the campaign by further delegating authority to lower command levels and shifting tactics.¹¹² Former Secretary of Defense James Mattis described the new approach as moving “from shoving ISIS out of safe locations in an attrition fight to surrounding the enemy strongholds, so we can annihilate ISIS.”¹¹³ It remains to be seen whether these inadvertent deaths will generate additional support for ISIS or another radical organization that espouses an anti-U.S. and anti-Western ideology, which could indicate that the blowback from air operations undermined the coalition’s strategy. More research needs to be done to explore the discrepancies between coalition reporting and that of other organizations and to assess what the strategic ramifications of civilian casualties are for the United States and the region as a whole.

During Phase II, the coalition launched two large, successful counterattacks and put itself in a position to move to the next stage, in which it would defeat ISIS by eliminating the caliphate.

¹¹⁰ Amnesty International and Airwars, “War in Raqqa: Rhetoric Versus Reality,” website, undated.

¹¹¹ Amnesty International, “Syria Unprecedented Investigation Reveals US-Led Coalition Killed More Than 1,600 Civilians in Raqqa ‘Death Trap,’” April 25, 2019.

¹¹² Kevin Baron and Marcus Weisgerber, “New Tactics, Quicker Decisions Are Helping to ‘Annihilate’ ISIS, Pentagon Says,” *Defense One*, May 19, 2017.

¹¹³ Jim Garamone, “Mattis, Dunford, McGurk Cite Coalition Progress to Annihilate ISIS,” U.S. Department of Defense, May 19, 2017.

Phase III: Defeating ISIS and Rounding Up Stragglers in the MERV, August 2017–March 2019

Phase III of OIR resulted in the destruction of ISIS's physical caliphate and forced its remaining fighters to operate clandestinely. Partner forces often had to overcome fierce ISIS fighter resistance to root the organization out of its last territorial strongholds and required significant air support to do so, although, in some locations, ISIS's defenses quickly collapsed as the militants tactically retreated. As the caliphate shrunk, ISIS was relegated to the MERV—an area in eastern Syria and western Iraq where most of the remaining ground operations took place. After the final months in Raqqa, when air operations reached their peak in terms of the number of weapons released in one month (5,075), weapon releases dropped precipitously. By December 2017, only 584 bombs were expended. From then on, counterland air sorties continued, but coalition aircraft spent far more of their time on overwatch missions without dropping bombs (see Figure 2.8). Deliberately planned strikes dwindled over this period as ISIS forces and its businesses operated in an increasingly covert and agile manner.

The ISF recovered quickly from the Battle of Mosul and sought to press its advantage by continuing its offensive to liberate the final Iraqi cities from ISIS control in 2017. This effort began with an unexpectedly swift victory in Tal Afar in August 2017, in which the city was liberated in less than two weeks.¹¹⁴ Brig Gen Isler attributed this outcome in part to the coalition's deliberate shaping operations that used "layered ISR" and "networked targeting," so that when the Iraqis reached the city line, "everything that was targetable had been analyzed and hit with precision-guided munitions."¹¹⁵ Between July and September of 2017, CJTF-OIR launched 167 air strikes in support of Iraqi forces in Tal Afar.

The ISF made similarly quick work of ISIS in Al-Qaim, where there were believed to be 1,500 ISIS fighters, claiming victory by November 3.¹¹⁶ To prepare the battle-ground and support this operation, coalition aircraft serviced 212 targets in the second half of 2017 around Al-Qaim and 189 around the nearby town of Rawa. Two weeks later, the ISF seized Rawa, the last urban area controlled by ISIS in Iraq.¹¹⁷ By Novem-

¹¹⁴ Hamdi Alkhshali, "Iraqi Prime Minister: Tal Afar 'Liberated' from ISIS," CNN, August 31, 2017; Ali A. Nabhan, "Iraq Says It Is Close to Taking Full Control of Tal Afar from ISIS," *Wall Street Journal*, August 26, 2017.

¹¹⁵ Matthew Isler, "Department of Defense Press Briefing by Brig. Gen. Matthew Isler on Central Command's Targeting and Civilian Casualty Investigation Processes," transcript, U.S. Department of Defense, October 25, 2017.

¹¹⁶ "ISIL Loses al-Qaim in Iraq and Deir Az Zor in Syria," Al Jazeera, November 3, 2017; "Iraqi Forces Launch Assault on Last IS Bastion of al-Qaim," BBC, October 26, 2017.

¹¹⁷ Shawn Snow, "Last Urban Area in Iraq Liberated from ISIS," *Military Times*, November 17, 2017.

ber, any ISIS fighters who remained in Iraq had gone underground, retreating to “caves [and] tunnels, in austere, tough desert terrain,” where they were difficult to weed out.¹¹⁸

After Raqqa was liberated in October 2017, there was still a reasonable amount of fighting left to be done to eliminate ISIS holdouts in the Syrian part of the MERV, but these ground battles were smaller than those in Phase II, although ISIS fighters tenaciously defended their last scraps of territory. Before the coalition could go on the offensive in the MERV, there was a relatively long lull in ground operations and a concomitant decline in air strikes as the SDF regrouped and consolidated its hold over Raqqa, and some its fighters were pulled north to fight Turkey in Afrin.¹¹⁹

According to Lt Gen Harrigian, by early 2018, “[m]ore than 7.7 million people and 98 percent of territory formerly controlled by ISIS [had] been liberated.” Consequently, the coalition announced that it was shifting from supporting combat operations to “sustaining military gains” in Iraq.¹²⁰ CJTF-OIR claimed that it used airpower to keep pressure on ISIS during this break in ground operations, but the amount of force applied from the air was at best modest. For instance, between November 2017 and April 2018, there were only 1,493 CJTF-OIR strikes in Syria, an average of 249 strikes a month, while in Iraq, the coalition engaged only 449 targets, an average of 75 a month. Although coalition aircraft kept watch on suspected ISIS activities, the number of ISR sorties fell below 2,000 for the first time since the beginning of 2015, as seen in Figure 3.6. The number of air-to-ground overwatch missions declined less dramatically: An average of 1,300 sorties were completed a month between January and May 2018. These reductions were expected, because combat operations had ended in Iraq and were paused in Syria.

U.S. encounters in the air with pro-Syrian regime forces were less frequent than in Phase II, but there were still incidents on the ground. The most notable was in February 2018, when U.S. aircraft bombed Russian mercenaries that attacked an SDF outpost in the Deir ez-Zur region to support the defense of SDF and American troops on the ground. The Wagner Group—Russian private military contractors—had been fighting on behalf of the Syrian regime and been supporting its offensive. On February 7, around 400 Russian Wagner Group mercenaries armed with tanks and artillery crossed the deconfliction line and assaulted an SDF outpost in Khasham, forcing the American and SDF troops to respond in self-defense. The Pentagon spokesperson said that the United States used the deconfliction phone line at the CAOC “before,

¹¹⁸ Jonathan Byrom, “Joint Operations Command—Iraq Briefing,” transcript, U.S. Department of Defense, December 11, 2018.

¹¹⁹ “Turkey Targets Kurdish Forces in Afrin: The Short, Medium, and Long Story,” BBC, January 22, 2018; Ryan Dillon, “Department of Defense Press Briefing by Colonel Dillon via Teleconference from Baghdad, Iraq,” transcript, U.S. Department of Defense, April 17, 2018.

¹²⁰ Jeffrey Harrigian, “Department of Defense Briefing by Lieutenant General Harrigian via Teleconference from Al Udeid Airbase, Qatar,” transcript, U.S. Department of Defense, February 13, 2018.

during, and after the strike,”¹²¹ and, according to Secretary of Defense Jim Mattis, “the Russian high command in Syria assured us it was not their people.”¹²² Evidence later proved that these claims were false, with some estimates suggesting that as many as 300 to 600 Russians died in the attack.¹²³ Rumors about the reasons for the Wagner Group attack and Russia’s odd response abound: It occurred without knowledge of the Kremlin, it was sanctioned by Moscow as an effort to deniably test the United States’ willingness to defend the SDF, or the attack was evidence of infighting between the Russian Ministry of Defence and the mercenaries.¹²⁴

At the beginning of the attack, “coalition aircraft, including F-22s and MQ-9s, were overhead providing protective overwatch, defensive counter-air, and ISR support,” according to Lt Gen Harrigian.¹²⁵ As U.S. JTACs called for air support, additional aircraft, including F-15Es fighters, B-52 bombers, AC-130U gunships, and AH-64 helicopters “release[d] multiple precision fire munitions and conduct[ed] strafing runs against the advancing aggressor force, stopping their advance and destroying multiple artillery pieces and tanks,” while the Marines fired rocket artillery.¹²⁶ With coalition air and ground fires support, this attack was repelled by SDF forces and their SOF advisers.

Additional territorial gains, however, were not made until May 2018, when Operation Roundup—the SDF’s offensive in the MERV—began. As the SDF resumed operations against ISIS, British Maj. Gen. Felix Gedney, CJTF-OIR’s deputy commander for strategy and support, pledged that “the Coalition will continue to support the Syrian Democratic Forces, compacting what’s left of ISIS in Syria as we deal the final blow.”¹²⁷ The SDF, which CJTF-OIR praised as “reliable, effective combat soldiers who abide by the law of armed conflict,” proceeded to systematically expel ISIS from Syria. Baghuz was cleared on May 15 and Dashisha on July 20. In August, coalition aircraft began shaping operations for the attack on Hajin and the other ISIS

¹²¹ Mike Eckel, “Pentagon Says U.S. Was Told No Russians Involved in Syria Attack,” Radio Free Europe, February 23, 2018.

¹²² Thomas Gibbons-Neff, “How a 4-Hour Battle Between Russian Mercenaries and U.S. Commandos Unfolded in Syria,” *New York Times*, May 24, 2018.

¹²³ Neil Hauer, “The Rise and Fall of a Russian Mercenary Army,” *Foreign Policy*, October 6, 2019.

¹²⁴ Kimberly Marten, “The Puzzle of Russian Behavior in Deir al-Zour,” *War on the Rocks*, July 5, 2018; Neil Hauer, “The Rise and Fall of a Russian Mercenary Army,” *Foreign Policy*, October 6, 2019.

¹²⁵ Jeffrey Harrigian, “Department of Defense Briefing by Lieutenant General Harrigian via Teleconference from Al Udeid Airbase, Qatar,” transcript, U.S. Department of Defense, February 13, 2018.

¹²⁶ Jeffrey Harrigian, “Department of Defense Briefing by Lieutenant General Harrigian via Teleconference from Al Udeid Airbase, Qatar,” transcript, U.S. Department of Defense, February 13, 2018; Thomas Gibbons-Neff, “How a 4-Hour Battle Between Russian Mercenaries and U.S. Commandos Unfolded in Syria,” *New York Times*, May 24, 2018.

¹²⁷ Quoted in Lisa Ferdinando, “Coalition, Partner Forces Look to Deal Final Blow to ISIS in Syria,” U.S. Department of Defense, May 8, 2018.

holdouts in Deir ez-Zur.¹²⁸ LTG Paul Funk II, Commander of CJTF-OIR, praised the operation as a “well-coordinated, powerful offensive to annihilate Daesh remnants in northeastern Syria.”¹²⁹ There was a notable, but still relatively small, uptick in coalition air strikes in May, as coalition aircraft targeted ISIS C2, weapon production, storage facilities, and safe houses as a part of Operation Roundup. The MERV was relatively distant from most of the coalition air bases, meaning that most of the counterland sorties were around nine hours and pushed the endurance of coalition fighter aircraft.¹³⁰ In May, the coalition engaged 242 strikes in Syria, compared with 159 strikes the prior month, while there were 87 targets engaged in Iraq, as coalition aircraft targeted “a lot of tunnel complexes and underground storage sites, where Daesh are hiding,” according to Funk.¹³¹

By September 2018, ISIS continued to cling to its last 200 square miles of territory in northeastern Syria, near the border with Iraq, 1 percent of the total it had once controlled.¹³² The ISIS fighters put up a ferocious defense of Hajin and the nearby village of Baghuz, and, as in other towns, they had established a formidable defense in depth. It took SDF four months with heavy U.S. air support to clear Hajin. After that, the SDF turned to Baghuz, the last 1.5 square miles of ISIS territory, but it was not until March 2019 that this last village fell. As seen in Figures 2.8 and 2.9, the number of CJTF-OIR air strikes spiked, and coalition aircraft dropped a total of 8,784 weapons between September 2018 and March 2019. In December 2018 alone, coalition aircraft delivered 2,214 weapons—the most that had been serviced in one month since the end of the Battle of Raqqa. As a result of the heavy bombardment and ISIS use of VBIEDs, a 19-mile stretch of road between Hajin and Baghuz was “a scene of catastrophic destruction. Nearly every building [was] crushed or scarred.”¹³³

Figures 2.11 and 2.12 clearly show that, during Phase III, coalition air strikes were largely prosecuted in Syria. Within Syria, coalition aircraft most frequently serviced targets (see Figures 2.12 and 2.13) in Abu Kamal, which was targeted 1,572 times, al-Shaddadi and Deir ez-Zur, each of which was hit 153 times, and Hajin, which was targeted 1,195 times, between October 2018 and March 2019. In Hajin, nearly all the strikes occurred in the last quarter of 2018.

¹²⁸ CJTF-OIR, “Phase 3 of Operation Roundup Starts in Syria,” September 11, 2018.

¹²⁹ CENTCOM, “Coalition Forces, Partners Initiate Second Phase of Operation Roundup,” June 3, 2018. *Daesh* is the Arabic acronym for *ISIS* and a common nickname.

¹³⁰ RAND interview with USAF officer, January 29, 2020.

¹³¹ CENTCOM, “Coalition Forces, Partners Initiate Second Phase of Operation Roundup,” June 3, 2018.

¹³² Rukmini Callimachi, “ISIS Caliphate Crumbles as Last Village in Syria Falls,” *New York Times*, March 23, 2019.

¹³³ Rukmini Callimachi, “ISIS Caliphate Crumbles as Last Village in Syria Falls,” *New York Times*, March 23, 2019.

In February, President Trump announced that “we just took over 100 percent” of the caliphate, even while fighting continued in Baghuz.¹³⁴ CENTCOM Commander GEN Joseph Votel noted that “the president’s statement that ISIS is defeated may be premature.” Votel also warned that intelligence had indicated that ISIS was likely to continue to try to launch terrorist attacks outside of the Middle East and asserted that “ISIS probably still is more capable than al-Qaeda in Iraq at its peak, suggesting it is well-positioned to reemerge if pressure on the group is relieved.”¹³⁵ Similarly, U.S. Special Envoy McGurk cautioned, “We have always said this will not be the end of ISIS.”¹³⁶ But after these victories, ISIS had been deprived of all its territory and destroyed as a hybrid fighting force, even though some of its fighters had blended back into the local populations and it continued to exist as a covert terrorist organization. Then-CJTF-OIR Commander LTG Paul LaCamera observed that this was “not the surrender of an army, but the repositioning of an army,” as ISIS’s fighters retreated underground.¹³⁷ In March 2019, OIR shifted to Phase IV, which was focused on stabilizing Iraq and Syria by building up partner forces so that they could provide security on their own.

One event that occurred outside the scope of this study but is worth mentioning is the U.S. SOF raid that killed ISIS’s founder and leader, Abu Bakr al-Baghdadi. This raid had symbolic significance, as it marked the successful end to a five-year manhunt, but it is also notable because it highlights the role that airpower played in this operation.¹³⁸ In this attack on October 26, 2019, 50 to 70 members of U.S. Army SOF were infiltrated by helicopter about four miles from the Turkish border into the Idlib governorate in Syria, where al-Baghdadi had been hiding.¹³⁹ American SOF troops and dogs pursued al-Baghdadi into a tunnel, where he detonated a suicide vest, killing himself and two of his children. After the raid, U.S. aircraft, which had been providing overwatch, destroyed al-Baghdadi’s compound with multiple AGM-158B Joint Air-to-Surface Standoff Missiles (JASSMs), along with other precision-guided munitions.¹⁴⁰

¹³⁴ Katie Rogers, Rukmini Callimachi, and Helene Cooper, “Trump Declares ISIS 100% Defeated in Syria; ‘100% Not True,’ Ground Reports Say,” *New York Times*, February 28, 2019.

¹³⁵ Joseph L. Votel, “General Joseph Votel Senate Armed Service Committee Hearing on U.S. Central Command,” transcript, U.S. Department of Defense, February 11, 2019.

¹³⁶ Rukmini Callimachi, “Fight to Retake Last ISIS Territory Begins,” *New York Times*, September 11, 2018.

¹³⁷ RAND interview with GEN Paul LaCamera, April 24, 2020.

¹³⁸ Its effect on ISIS’s operations, however, is unclear. Glenn A. Fine, Steve A. Linick, and Ann Calvaresi Barr, *Operation Inherent Resolve: Lead Inspector General Report to the United States Congress, October 1, 2019–December 31, 2019*, Washington, D.C.: U.S. Department of Defense, February 4, 2020, p. 7.

¹³⁹ Eyal Tsir Cohen and Eliora Katz, “What We Can Learn About US Intelligence from the Baghdadi Raid,” *Order from Chaos* (Brookings Institution), November 6, 2019.

¹⁴⁰ Mark T. Esper and Mark Milley, “Department of Defense Press Briefing by Secretary Esper and General Milley in the Pentagon Briefing Room,” transcript, U.S. Department of Defense, October 28, 2019.

Assessment of Phase III

Figure 3.7 depicts the location of coalition air strikes during Phase III and indicates the territory that ISIS once held. CJTF-OIR had established several conditions to establish that ISIS had been defeated: ISIS could not hold on to territory or govern, it did not have the ability to fight as a conventional force, it could not conduct outside operations, and indigenous forces could independently contain the threat.¹⁴¹ By the end of Phase III, the coalition had eliminated ISIS's ability to fight as a hybrid force, dispossessed ISIS of all of its land, and deprived it of its subjects whom it could govern and exploit.

Phase III of OIR saw a steep decline in the amount of aerial combat as ground operations slowed and the remaining ISIS fighters went underground. CJTF-OIR strikes in Iraq plummeted to 1,178, while coalition aircraft engaged 8,413 targets in Syria (see Table 2.4). Also, there was an absence of deliberate-targeting operations. Somewhat surprisingly, the number of air-to-ground sorties increased from Phase II, from 26,501 to 28,334. This increase is probably due to the attempt to overwatch large areas in the MERV while also providing air cover and morale support to Iraqi troops conducting stability operations. Additionally, Phase III was three months longer than Phase II.

Although the number of counterland sorties increased, most of these were overwatch missions in which an aircraft flew to its assigned 30-by-30-mile kill box but did not engage any targets in its time on station.¹⁴² As seen in Figure 3.5, only 15 percent of the air-to-ground missions resulted in at least one weapon release. This is not surprising, given the infrequency of ground operations. Moreover, as ISIS forces retreated, they moved into caves and tunnels in very remote areas or blended in with the civilian population, making it harder to find targets worth attacking. Many air strikes that were launched at ISIS weapon caches were reportedly craters in the ground made from a prior bomb that ISIS filled with small arms and covered with a tarp.¹⁴³ Other times, coalition aircraft were reportedly dropping weapons on abandoned buildings that ISIS would occasionally use as a meeting spot. Some believed that these strikes were really a confidence-building measure intended to bolster the ISF while it conducted its patrols.¹⁴⁴ In Phase III, aircraft launched fewer weapons than any other point in the operation, 24,076. Despite these reductions, airpower provided essential ISR and CAS, enabling the ISF and SDF to clear out the remaining ISIS strongholds during this period, and helped to maintain the gains made in Iraq.

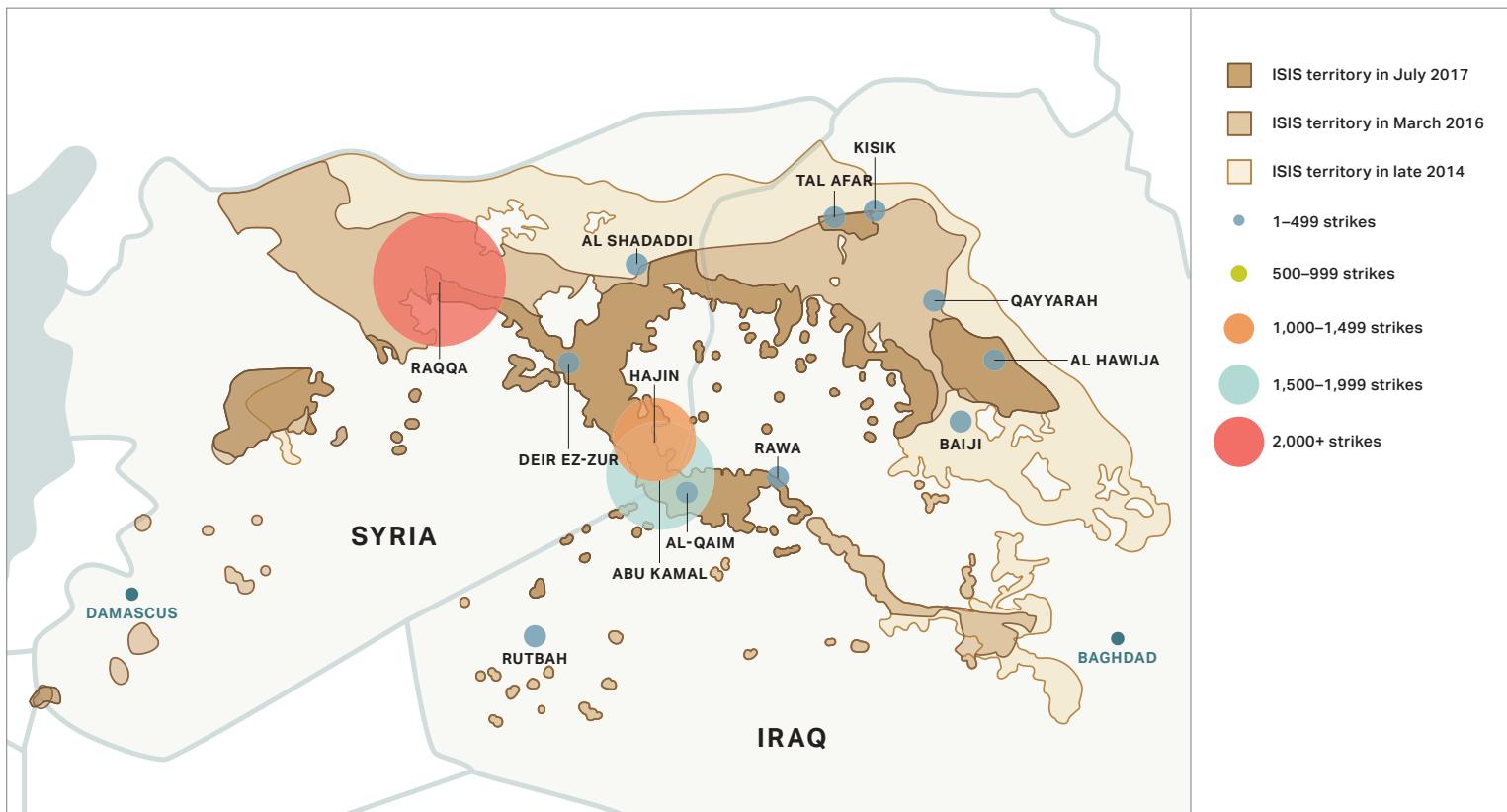
¹⁴¹ RAND interviews with USAF officials and coalition officials, March 3, 2020.

¹⁴² A kill box is a three-dimensional fire support coordination measure with an airspace-coordinating measure to enable the integration of joint fires. See Curtis E. LeMay Center for Doctrine Development and Education, Air University, *Counterland Operations*, Annex 3-03, Maxwell Air Force Base, Ala., February 5, 2019.

¹⁴³ RAND interviews with USAF officials and coalition officials, March 3, 2020.

¹⁴⁴ RAND interviews with USAF officials and coalition officials, March 3, 2020.

Figure 3.7
ISIS Territorial Holdings and Locations of Major Coalition Air Strikes in March 2019



SOURCE: RAND CJTF-OIR strike release data set.

Conclusion

In many respects, air operations in OIR are similar to many other post–Cold War U.S. operations. U.S. policymakers elected to use airpower because it limited the risk to the few U.S. ground forces employed in the conflict and could be employed precisely and discriminately. These attributes have made airpower the military instrument of choice in Bosnia, Kosovo, Afghanistan, Iraq, and Libya. Because these were limited conflicts, strict rules of engagement were put in place to protect civilians, and high-ranking U.S. officials were involved in the process of selecting and approving targets.

In other ways, however, OIR was fundamentally different from these other operations. First, the United States tried to coordinate its air operations with partner ground forces initially in the absence of embedded American JTACs, which required different forms of coordination and C2, most notably the strike cell. Second, U.S. aircraft operated in a complex, divided, and at times contested battlespace. In Iraq, U.S. forces were operating at the invitation of a host nation, which meant that there were procedures put in place to preserve Iraqi sovereignty. In Syria, U.S. forces were operating with the tacit approval of a potentially hostile regime that was fighting a civil war and supported by Russian forces. As the war progressed, Syrian forces and their allies increasingly threatened coalition and partner forces, increasing the importance of the air defense mission. Third, ISIS was a challenging and brutal hybrid adversary that transitioned between combined arms warfare, guerrilla operations, and terrorist attacks. ISIS's protean nature made it difficult to eradicate and exacerbated the target-discrimination problem and stressed the deliberate-targeting process.

Despite these challenges, airpower was critical in defeating ISIS and, when coupled with capable partner forces, was quite effective at eliminating ISIS as a conventional fighting force and liberating territory. Whether these gains become the “lasting defeat” that the Obama administration sought, however, is an open question.

Subsequent to the period examined in this study, several developments have led some to conclude that “ISIS is already rising from the ashes.”¹⁴⁵ First, President Trump ordered the United States to partially withdraw from Syria in October 2019, freeing up Turkey to launch an offensive against the SDF, weakening a U.S. ally and the group that was supposed to stabilize northeastern Syria. In the months after the fighting in the MERV ended, thousands of ISIS fighters who had fled to rural sanctuaries began to reorganize and began to ambush SDF patrols, while clandestine operatives in cities began to prepare campaigns of terror.¹⁴⁶ Second, the Trump administration stressed the United States' relationship with the Iraqi government when it unilaterally assas-

¹⁴⁵ Brian Katz and Michael Carpenter, “ISIS Is Already Rising from the Ashes: Turkey’s Invasion of Syria Will Fuel a Jihadi Resurgence,” *Foreign Affairs*, October 16, 2019.

¹⁴⁶ Brian Katz and Michael Carpenter, “ISIS Is Already Rising from the Ashes: Turkey’s Invasion of Syria Will Fuel a Jihadi Resurgence,” *Foreign Affairs*, October 16, 2019.

sinated Iranian General Qassim Soleimani and the leader of Iraq's Popular Mobilization Forces, Abu Mahdi al-Muhandis, in January 2020. This operation was independent of OIR, but it had implications for the U.S.-Iraqi relationship and ongoing OIR operations to rebuild and stabilize Iraq to prevent an ISIS resurgence. As a result, Iraq's military capability has diminished as security cooperation activities have waned.¹⁴⁷ Moreover, U.S. and coalition forces withdrew from bases in western Iraq, citing security concerns.¹⁴⁸ Third, there have been numerous reports of ISIS's reconstitution as a partisan force, and it has demonstrated an ability to launch limited attacks in Iraq and Syria.¹⁴⁹ It remains to be seen, therefore, whether OIR achieved more than an ephemeral victory.

¹⁴⁷ "Grounded Jets and Political Spats as the Islamic State Regroups," Iraq Oil Report, May 15, 2020.

¹⁴⁸ Samya Kullab, "U.S. Pulls Out of a Third Base in Iraq," Associated Press, March 29, 2020.

¹⁴⁹ Louisa Loveluck and Mustafa Salim, "In Iraq, ISIS Exploits Coronavirus Lockdown to Launch Attacks," *Washington Post*, May 8, 2020.

PART II

The Application of Airpower in Operation Inherent Resolve

The Close Fight: Air-to-Ground Coordination

Part II of this report examines in greater detail the use of airpower in air-to-ground coordination (otherwise known as the *close fight*) against deep targets (referred to as the *deep fight*) and to enable other air operations. The following chapters will explore each of these central applications of airpower through case studies of specific battles and operations.

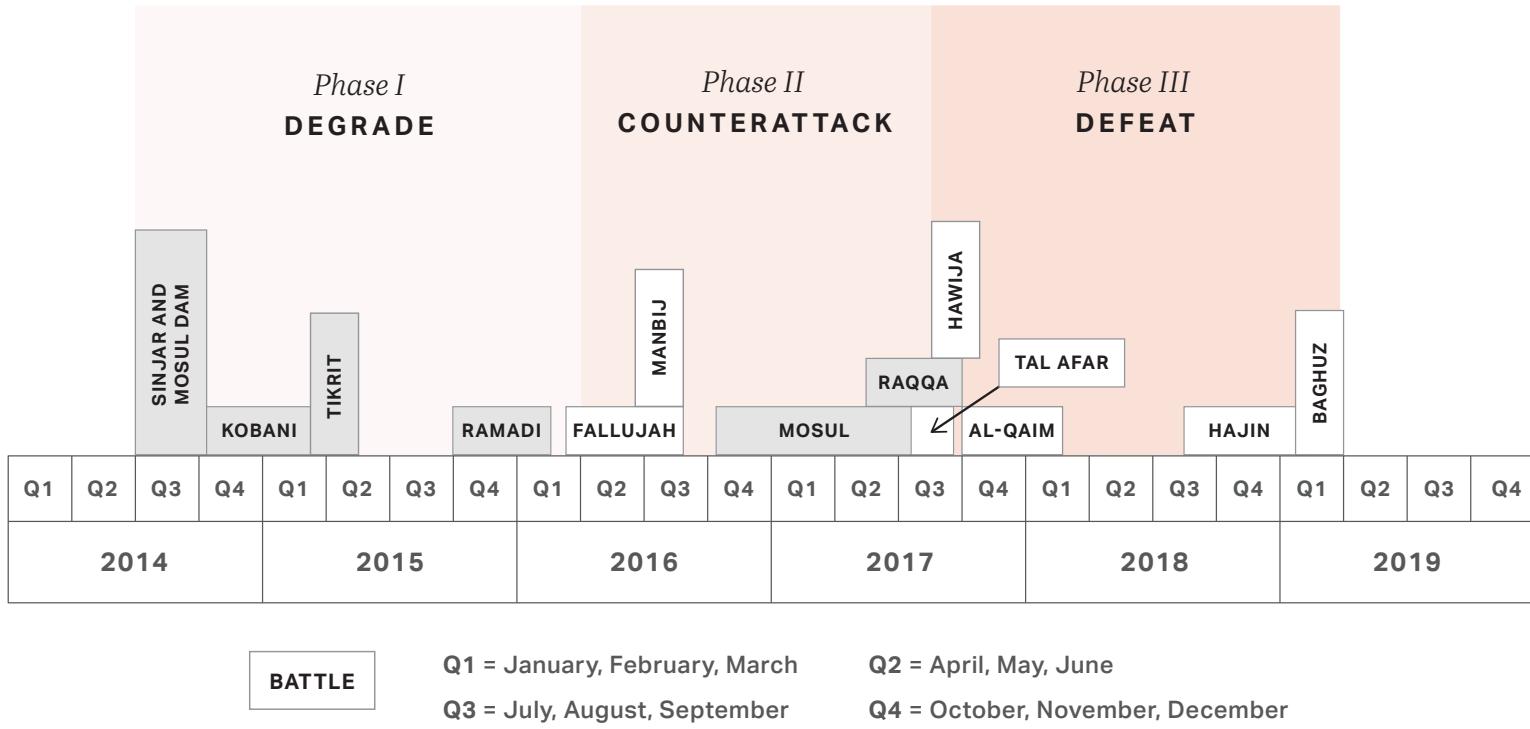
This chapter addresses air-ground coordination during the liberation of Iraqi and Syrian territory from ISIS control. Specifically, it focuses on the United States' and its coalition partners' use of airpower to provide CAS for troops in contact with enemy forces and to interdict ISIS forces flowing to the front lines. The chapter focuses on these missions (i.e., CAS and interdiction) in support of the close fight rather than addressing the deep fight, in which airpower was used to strike ISIS well behind the FLOT or to target ISIS's financial resources (e.g., the Tidal Wave II strikes) and logistical networks. Those aspects of air operations are treated in Chapter Five. The role that ISR, DCA, and lift played in enabling airpower is treated in Chapter Six.

At the height of its advance, ISIS controlled territory roughly the size of Great Britain, encompassing dozens of population centers straddling Iraq and Syria. These population centers ranged from villages to Iraq's second most populous city, Mosul, which had more than 1 million inhabitants prior to ISIS's assault on it. The coalition military campaign to liberate this territory lasted roughly four and a half years, from late 2014 to early 2019 (see Figure 4.1). Over this period, the coalition conducted nearly 33,000 strikes at more than 100 locations in Iraq and Syria (see Figures 4.2a and 4.2b). Given the length of the campaign and the number of operations, it would be repetitive to cover all clearing operations in this report. Therefore, we focus our narrative on a smaller number of operations that are emblematic of important aspects of air-ground coordination or represent a strategic turning point in the campaign.

Case Study Selection

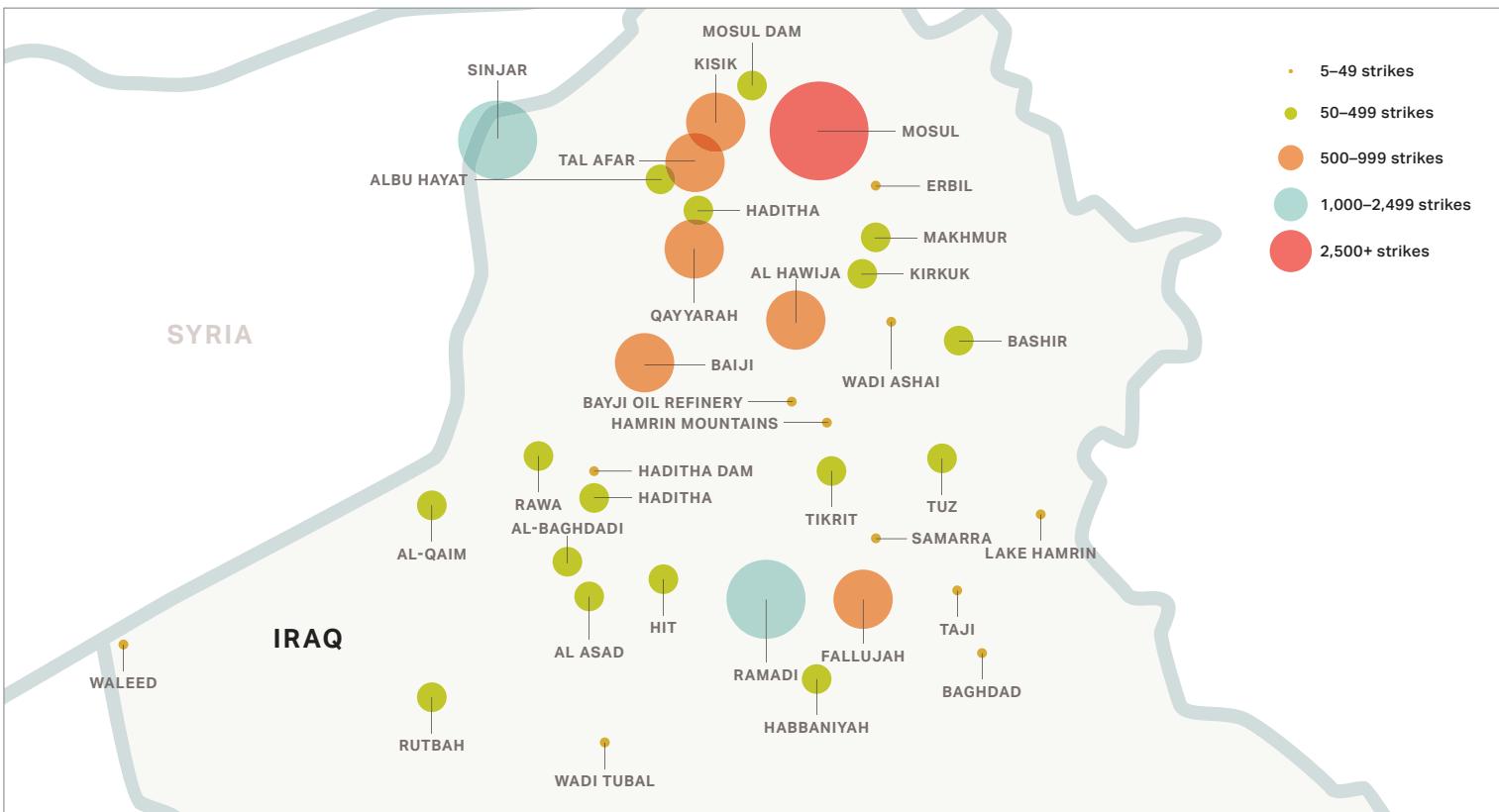
Our analysis focuses on four broad categories of operations. Table 4.1 displays how our case studies aligned with the categories of operations.

Figure 4.1
Timeline of Major Liberation Operations



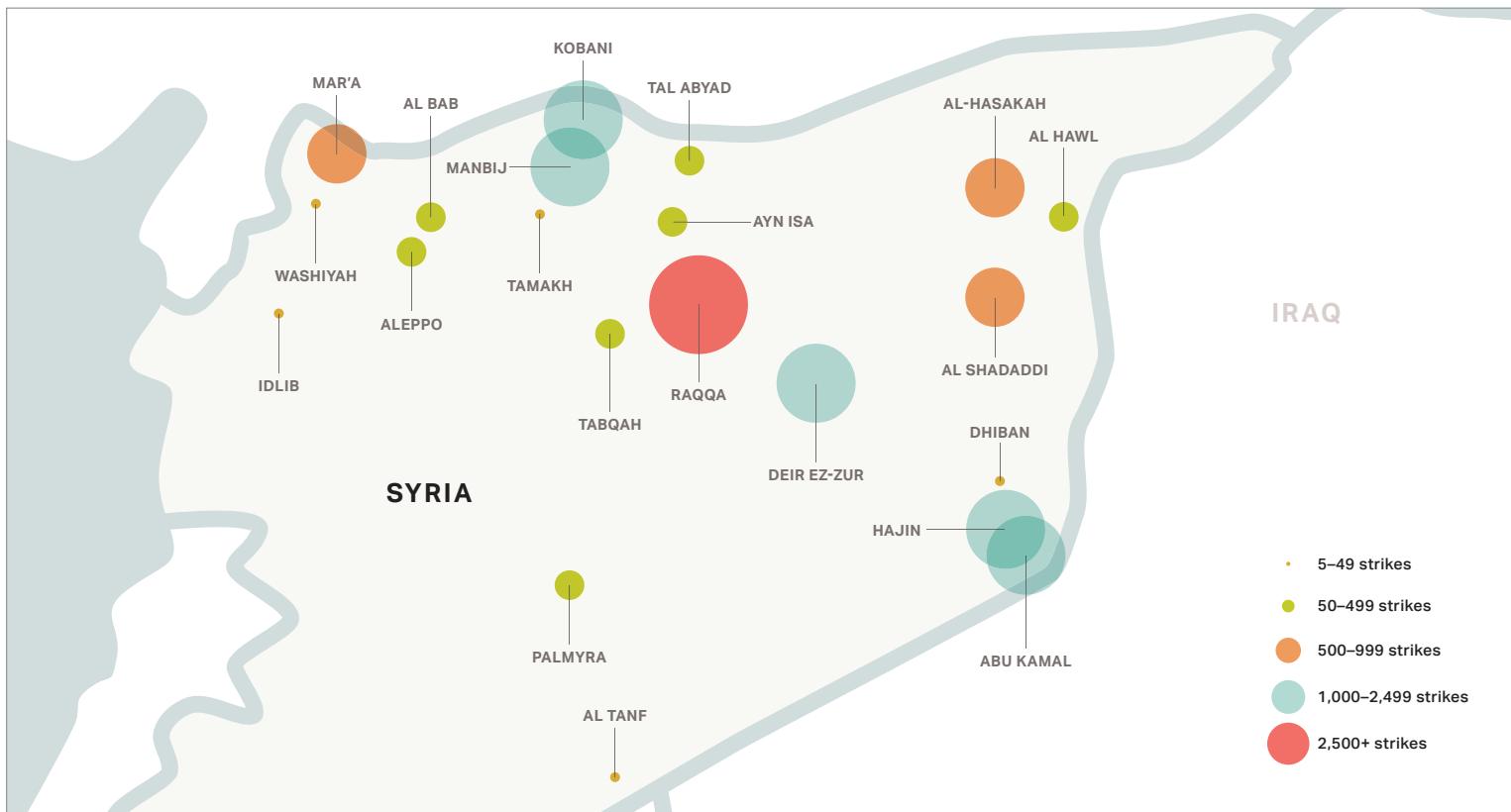
SOURCE: Timeline constructed from various sources cited in this chapter.

Figure 4.2a
CJTF-OIR's Significant Strike Targets in Iraq



SOURCE: RAND CJTF-OIR strike release data set.

Figure 4.2b
CJTF-OIR's Significant Strike Targets in Syria



SOURCE: RAND CJTF-OIR strike release data set.

Table 4.1
Close-Fight Case Studies

Case Study	Phase of OIR	Category of Operation
Mosul Dam	Phase I (August 2014)	Averting humanitarian crises
Kobani	Phase I (October 2014–January 2015)	Stopping ISIS's momentum in Syria
Tikrit	Phase I (March 2015–April 2015)	Defense of Baghdad and reclaiming territory in the Tigris and Euphrates River Valleys
Ramadi	Phase I (July 2015–January 2016)	Defense of Baghdad and reclaiming territory in the Tigris and Euphrates River Valleys
Mosul	Phases II–III (October 2016–July 2017)	Culminating battles
Raqqa	Phases II–III (October 2016–July 2017)	Culminating battles

The first were those operations designed to stem an ISIS advance that threatened to create a humanitarian crisis. For this category, we profile the use of airpower to retake Mosul Dam in August 2014. The Mosul Dam operation refers to U.S. air support to the ISF and Kurdish Peshmerga that recaptured Mosul Dam from ISIS after the group briefly held the complex in the summer of 2014. This category of operations merits treatment because airpower was used several times in OIR to prevent or mitigate a humanitarian crisis (e.g., Mosul Dam, discussed in this chapter, and Mount Sinjar, discussed in Chapter Six). Indeed, airpower was used numerous times in the specific context of breaking ISIS's control of water resources (e.g., Tabqah Dam, Fallujah Dam) or to prevent water resources from falling under ISIS control (e.g., Haditha Dam). The stakes of these operations were higher than water alone in that dams are often used to generate hydroelectric power, so control of the dam provided both leverage over water flows and the ability to provide or withhold electricity.

The second category of operations profiled are those that stemmed ISIS's advance at the Syrian-Turkish border and provided space for the coalition's Syrian ground partner, the YPG—which later became the nucleus of the SDF—to develop its capabilities and prepare for its eventual advance on ISIS's Syrian stronghold, Raqqa. In this category, we analyze the October 2014–January 2015 battle for Kobani, which was the first major battle to halt ISIS's advance in northeast Syria. Eventually, this operation was followed up with the retaking of other strategic towns (e.g., Al Shadadi, Tal Abyad, Manbij) in the area. That swath of territory would become secure enough to host up to 2,000 mainly U.S. SOF, as well as smaller contingents of special operators from coalition partners.¹ The territory served as a staging ground for the SDF's push down the Euphrates River Valley that culminated in the retaking of Raqqa in 2017.

¹ The USMC also operated in Eastern Syria. Marines provided all weather fires and security at bases.

The third category of operations was those that contributed to the defense of Baghdad and began to claw back territory in the Euphrates and Tigris River Valleys. The operations were designed to push the FLOT away from the city, thereby reducing the threat to Baghdad.² They also provided a foothold for the ISF in these river valleys from which forces could eventually maneuver north toward Mosul and west toward the Iraqi-Syrian border. For this category of operations, we profile the liberations of Tikrit and Ramadi, two strategically important towns situated outside Baghdad on the Tigris and Euphrates Rivers, respectively. These operations are best viewed in juxtaposition, as the Ramadi operation was designed to address many of the challenges encountered in the earlier battle for Tikrit. The ground partners for these operations encompass the CTS, Iraqi conventional forces, federal and local police, and tribal militias. The popular mobilization units, while not a recipient of coalition airpower, were heavily involved in the Tikrit operation during the period directly prior and after the provision of airpower.

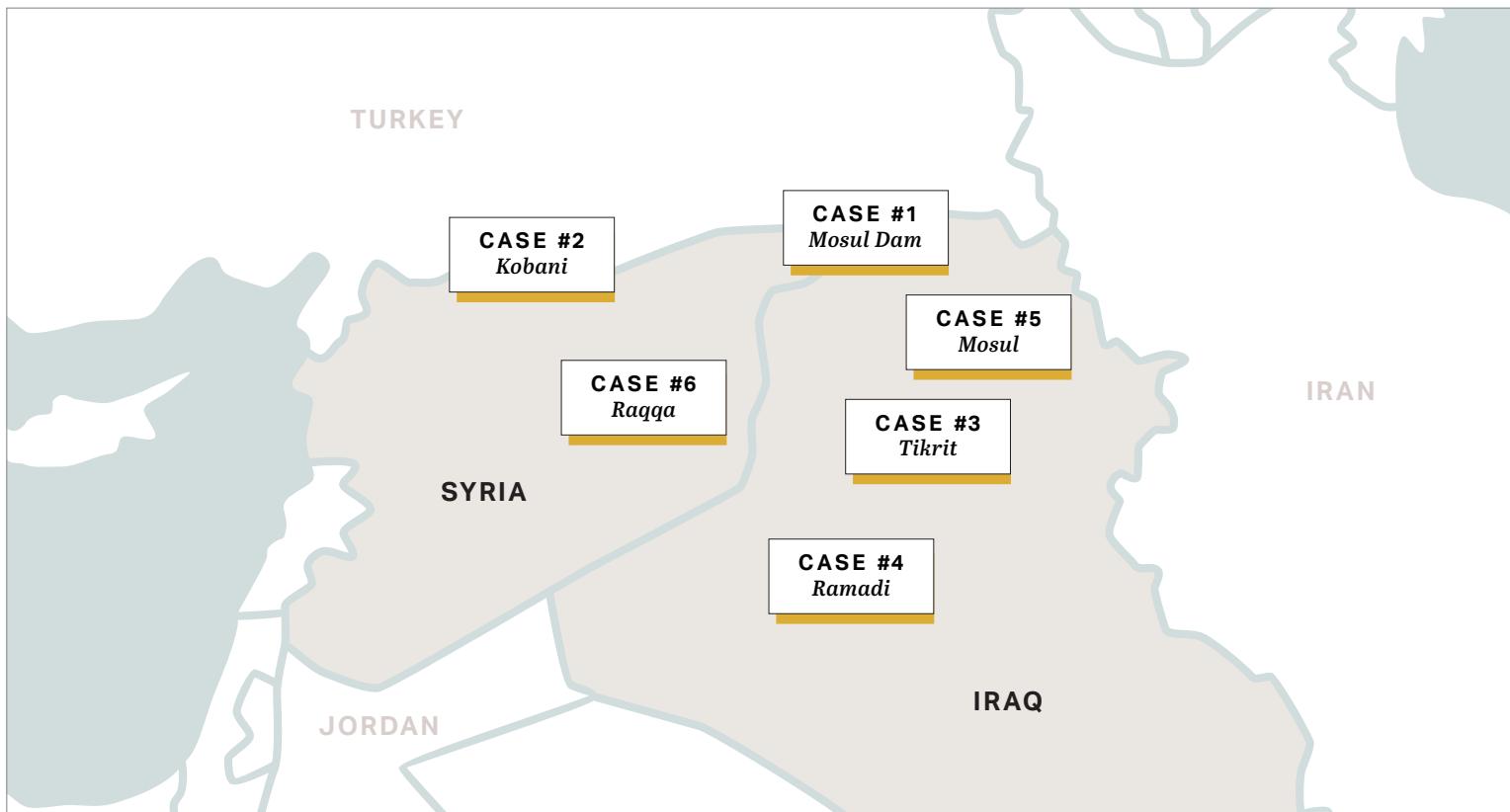
The final category of operations encompasses the two culminating battles of Mosul and Raqqa. These cities effectively operated as twin capitals of the ISIS “caliphate” and were the largest population centers that the group occupied. Because of the scope of the operations, they also involved the most diverse set of ground partners. Although critical cleanup operations occurred after these battles (e.g., Baghuz), the defeat of ISIS in Mosul and Raqqa signaled the group’s demise as a protostate. Figure 4.3 provides a geographic lay-down of the six cases across Iraq and Syria.

The case study selection meets the criteria of treating all the major providers of airpower (USAF, U.S. Navy, USMC, Army aviation, coalition contributions) in OIR and the ground partners that were the recipients of it. The ground partners include the CTS, conventional Iraqi forces (e.g., the 9th Iraqi Armored Division), Iraqi police (federal and local), the Iraqi Kurdish Peshmerga, and the SDF. All these forces were eligible to receive CAS when their units were in contact with ISIS fighters. In contrast, the Iraqi PMF and other tribal irregulars were able to benefit indirectly from CAS, but only when operating subordinate to Iraqi state-controlled forces in an authorized operation.³ Therefore, these forces realized the benefit indirectly via their participation in

² Fallujah was a prominent exception to the early sequencing of operations to push ISIS away from the capital. Fallujah is situated to the east of Ramadi (i.e., closer to Baghdad), but the Fallujah liberation operation was deferred until later in the campaign. This had to do with the perceived strength of ISIS in the city and the higher risk of civilian casualties, given the city’s layout.

³ See Special Envoy McGurk’s clarification: “We have a principle when we support Iraqi forces in the military campaign, we will only support forces operating strictly under Iraqi command and control. That means going from the ground up an Iraqi chain of command into a Joint Operations Center where we’re working with Iraqi commanders. If there is a unit not operating under that structure, it doesn’t get any support from us.” Brett McGurk, “Global Efforts to Defeat ISIS,” testimony before the Senate Foreign Relations Committee, June 28, 2016.

Figure 4.3
Geographic Location of Case Studies



government-led military operations.⁴ There was no direct coordination between U.S. forces and the PMF, some of which were aligned with Iran.

One study approach that enables analysis of airpower effects is to include treatment of different cases in which airpower was and was not applied. This variation allows the analyst to better isolate airpower's effect on the outcome of the battle. Unfortunately, it is not possible to design an evaluation of airpower effects in OIR around this research strategy because the coalition consistently provided airpower to support ground maneuver from late 2014 on. The one prominent exception in which airpower was withheld is Tikrit, which provides some variation to explore the impact of providing and withholding airpower in support of ground forces. Specifically, the coalition initially withheld airpower in the early stages of the ISF's operation before delivering airpower after the Iraqi government met the coalition's conditions for receiving it—the withdrawal of the PMF. Although the coalition's application of airpower was brief, it broke what was a stalled operation prior to coalition strikes. This validates the general correlation between the application of airpower and the gain of territory by local ground partners.

Evolution in Coalition Processes and Capabilities

Strike cells were the fundamental concept used for the application of airpower in the close fight. As described in Chapter Two, they were a means to fuse the information available on targets into one cell, expediting the delivery of dynamic strikes to support partners' ground offensives and rebuff attacks by ISIS, while deconflicting strikes with friendly forces. The strike cells were manned by JTACs, among other specialists, but the JTACs in strike cells were operating at secure bases behind the front lines.

Although the strike cells were geographically removed from the ground fight, the strike cells were particularly important to support operations near the FLOT or, to use a related doctrinal term, the FSCL.⁵ This is because the strike cells were used to coordinate CAS to the ground forces operating at the FLOT. Several interviewees noted that a defining characteristic of this conflict, in contrast to recent prior U.S. military interventions, was the presence of a fairly well-defined FLOT.⁶ This was particularly so in the early stages of the campaign, when the ISF counterattacks against ISIS included linear movements toward the group's Iraqi capital, Mosul. This also

⁴ Barbara Opall-Rome, "Commander: US-Led Assault in Iraq 'Incidentally' Benefits Iran-Backed Militias," *Defense News*, August 25, 2017.

⁵ For a discussion of how the FSCL is treated in doctrine and other issues related to air-ground coordination, see Bruce R. Pirnie, Alan J. Vick, Adam R. Grissom, Karl P. Mueller, and David T. Orletsky, *Beyond Close Air Support: Forging a New Air-Ground Partnership*, Santa Monica, Calif.: RAND Corporation, MG-301-AF, 2005.

⁶ RAND interview with U.S. Army officer, December 2, 2019; RAND interview with Maj Gen (ret.) Scott Zobrist, December 3, 2019; RAND interview with LTG (ret.) Sean MacFarland March 31, 2020.

helps explain why such a large share of strikes in OIR were dynamic rather than deliberate, preplanned targets.

Strike cells were a constant in the sense that they were employed to coordinate the delivery of CAS in all six operations profiled in this chapter. However, there were important differences in how strike cells operated in Syria versus in Iraq. The strike cells used for operations in Syria were run by the Combined Joint Special Operations Task Force—Syria on the basis of the predominant role played by SOF in this battlespace. In Iraq, the two main strike cells were an extension of CJOCs based in Baghdad and Erbil (CJOC-B and CJOC-E, respectively), although Combined Joint Special Operations Task Force—Iraq also operated strike cells to support Iraqi forces they were paired with in what was called a *federated* structure.⁷ In Syria, there were also strike cells, but these were run by SOF units and tended to be much smaller than the ones located in Iraq. In contrast to the CJOC strike cells, which were staffed by about 50 people, the SOF strike cells were able to maintain around-the-clock operations providing air support to the SDF with a staff of just 20.⁸

Another important difference was the devolution of TEA over time. The main shift, enshrined in Tactical Directive 1, issued late in 2016, was to devolve TEA to lower echelons when appropriate. Practically, that meant that any commander of an advisory element with the organic ability to conduct terminal control was able to approve strikes that previously required sign-off by a one-star or even a three-star general at earlier points in the campaign.⁹ MG Joseph Martin, the CJFLCC Commander when the directive was issued, described the effects as follows: “Tactical Directive #1 empowered the ground force commander and released some unrealized advising potential. Under certain conditions, they had the ability to deliver joint coalition fires without having a one star approve the strike, as was the policy previously. . . . The resultant responsiveness was tremendous and enabled a higher ISF tempo in the fight.”¹⁰ The ground force commander liberally used this newfound authority in the battle for Mosul to deliver responsive counterbattery fire against ISIS attacks, but overall the vast majority of the air strikes were still deconflicted and approved by the strike cells because they were generally able to approve air strikes faster than ground commanders could.¹¹ The devolution of TEA also enabled the SDF’s assaults on Tabqah and Raqqa. One JTAC

⁷ In this case, *federated* means that a strike cell was synced with a particular partner ground force element. For instance, in general, Baghdad International Airport worked with the CTS, while other strike cells coordinated with Iraqi conventional units. The Union III strike cell was above the others, responsible for airspace deconfliction and as the ultimate TEA.

⁸ RAND interview with USAF officer, August 20, 2020.

⁹ In cases of defensive strikes, for example, responding to a troops in contact situation, an O-5 could clear.

¹⁰ Joseph Martin, *Commander’s Perspective: CJFLCC Operations in Iraq*, Fort Leavenworth, Kan.: Center for Army Lessons Learned, October 26, 2017.

¹¹ RAND interview with U.S. Army officer, June 16, 2020.

maintained that, without this shift, the liberation of these cities would not have been possible because the coalition could not quickly mass enough fires to enable the SDF's offensives to succeed.¹²

The third shift is the introduction of coalition surface fires (e.g., U.S. artillery and HIMARS, French howitzers), which were also coordinated, similar to air strikes, through the strike cells. The use of surface fires provided the coalition an additional all-weather tool but also created additional complexity in delivering fires, since surface fires needed to be deconflicted with aircraft when both were employed in the same operation (e.g., Ramadi, Mosul, and Raqqa). That consideration was particularly important when the U.S. Army fired the Army Tactical Missile System (ATACMS), whose missiles have a longer range and travel in a higher arc than other surface fires.¹³ These differences (i.e., battlespace ownership, TEA, integration of surface fires into strike cells) are called out when they affect the prosecution of the close fight in our six case studies.

Averting Humanitarian Crises: Mosul Dam, August 2014

Background of the Mosul Dam Operation

Described by the U.S. Army Corps of Engineers as “the most dangerous dam in the world,”¹⁴ Mosul Dam is located 25 miles north of the city and stretches across the Tigris River. The dam regulates the flow of water, fuels the compound’s hydroelectric plant, and provides agricultural irrigation throughout the region. The foundation of the concrete structure requires daily maintenance to stave off erosion, maintain its structural integrity, and prevent a collapse, which could release a wave down the Tigris River Valley. The resulting flood would engulf Mosul within two hours and reach Baghdad, 210 miles away, within days, endangering more than 6 million people en route.¹⁵

ISIS’s seizure of Mosul Dam on August 7, 2014, therefore prompted significant alarm.¹⁶ Four months earlier, ISIS fighters had purposefully shut down a smaller facility in Fallujah, creating a surge in neighboring irrigation channels that triggered

¹² RAND interview with USAF officer, August 20, 2020.

¹³ RAND interview with U.S. Army officer, November 26, 2019.

¹⁴ “The Mosul Dam: A Watery Time-Bomb,” *The Economist*, February 13, 2016.

¹⁵ Alessandro Annunziato, Ioannis Andredakis, and Pamela Probst, *Impact of Flood by a Possible Failure of the Mosul Dam*, Brussels: Joint Research Centre, European Commission, Institute the Protection and Security of the Citizen, 2016.

¹⁶ Tim Arango, “Jihadists Rout Kurds in North and Seize Strategic Iraqi Dam,” *New York Times*, August 8, 2014.

widespread flooding.¹⁷ Even if the worst case—in which ISIS purposefully collapsed the dam to trigger a massive flood—could be averted, control of a critical source of water and electricity provided the militants leverage.¹⁸ In a telephone call on August 8, U.S. Vice President Joe Biden urged Masoud Barzani, then-president of the Kurdistan Regional Government, to retake the facility as quickly as possible.¹⁹ But as ISIS advanced toward Erbil, the Iraqi Peshmerga, outgunned and confronting the prospect of a direct attack on their capital, ceded the territory and retreated.²⁰

On August 14, 2014, President Barack Obama authorized limited air strikes “to support operations by Iraqi forces to recapture the Mosul Dam . . . and establish control of this critical infrastructure site.”²¹ White House and Pentagon officials stressed that the decision marked a continuation of the administration’s existing policy and did not prefigure a wider combat role for the United States.²² “The failure of the Mosul Dam could threaten the lives of large numbers of civilians, threaten U.S. personnel and facilities—including the U.S. embassy in Baghdad—and prevent the Iraqi government from providing critical services to the Iraqi populace,” the White House clarified in a statement, aligning the operation with the administration’s stated objective to protect American personnel and lessen the humanitarian crisis.²³

Although the administration had yet to announce a shift to an expanded phase of its intervention, in hindsight Mosul Dam was an initial step toward a larger, more aggressive air campaign. From August to September 2014, air strikes would triple, and from September to October, they would double again.²⁴ The shift was less about Mosul Dam per se than that the operation coincided with Prime Minister Nouri al-Maliki’s decision to step aside as head of state. Until that point, the United States was limiting military assistance to press for more-inclusive leadership in Baghdad. With al-Maliki departing in favor or a less sectarian replacement, the United States began to increase the scope of the military intervention.

¹⁷ “Iraq Insurgents Use Water as Weapon After Seizing Dam,” Reuters, April 11, 2014.

¹⁸ Jethro Mullen and Susanna Capelouto, “U.S. Airstrikes Critical in Mosul Dam Capture,” CNN, August 19, 2014.

¹⁹ Dexter Filkins, “A Bigger Problem Than ISIS?” *New Yorker*, December 26, 2016.

²⁰ Adam Entous and Joe Parkinson, “How Kurds Came to Play Key Role in U.S. Plans to Combat Islamic State,” *Wall Street Journal*, September 8, 2014.

²¹ White House, “Letter from the President—War Powers Resolution Regarding Iraq,” press release, August 17, 2014.

²² John Kirby, “Department of Defense Press Briefing by Rear Adm. Kirby in the Pentagon Briefing Room,” transcript, U.S. Department of Defense, August 19, 2014.

²³ White House, “Letter from the President—War Powers Resolution Regarding Iraq,” press release, August 17, 2014.

²⁴ RAND CJTF-OIR strike release data set.

The Application of Airpower at Mosul Dam

The ground operation to regain control of Mosul Dam was completed within three days. However, the overall operation included three weeks of air strikes following the retaking of the dam, which were used to push ISIS forces away from the dam to hedge against reversals. The timing of the strikes coincided with the main ground maneuver by the Kurdish Peshmerga and Iraqi CTS and then continued into the initial weeks after these forces secured the facility. By disrupting ISIS operations, averting a potential environmental and humanitarian catastrophe, and easing the threat to Erbil, the offensive buoyed faltering local forces. Mosul Dam also demonstrated that the United States could deliver precision strikes without putting U.S. ground forces forward.

At the point when ISIS overran Mosul Dam, U.S. air strikes against the group were limited. The operation against ISIS had yet to be designated as OIR, and the coalition was still forming, meaning that the air strikes against ISIS during this time were not multilateral. The White House had made a decision that, until al-Maliki stepped down and an agreement on more-inclusive leadership was in place, only certain triggering events would lead to a response that included air strikes.²⁵ One of those contingencies was ISIS seizing Mosul Dam, so the United States developed a concept of operations for Mosul Dam prior to ISIS moving on the facility.²⁶ Because airpower was consciously being withheld except for these specific contingencies, when the United States decided to use airpower in earnest at Mosul Dam, it became the largest employment of airpower at that stage in the campaign. In the last three weeks of August, the United States launched 105 strikes in support of operations in Syria and Iraq. Of that total, 85 strikes (81 percent) were in support of the Mosul Dam fight (see Figure 4.4).

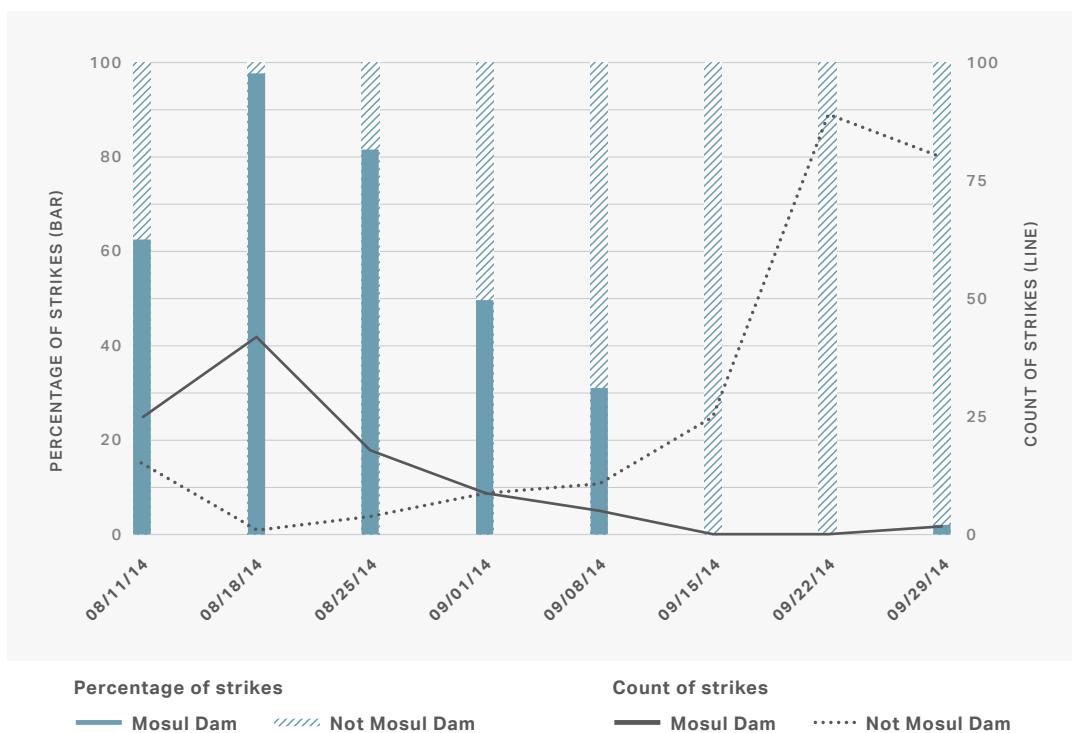
The Mosul Dam operation began on August 16, when B-1B bombers based at AUAB and F/A-18 fighters launched from USS *George H.W. Bush* and flew missions to target ISIS positions in Rabia Crossing, Mahmudiyah, Telskuf, Zummar, and Tel Kaif in an effort to slow the militant group's operational tempo, disrupt its advance, and grant Kurdish forces time to fortify their positions, and mobilize a counteroffensive.²⁷ Given that the coalition was still emerging and access and basing for the operation had yet to be formalized, the use of U.S. Navy assets launched from the carrier was the most expedient option, as discussed briefly in Chapter Two. In addition to naval air assets and the B-1B bombers, the USAF also employed RPAs in both an ISR and

²⁵ RAND interview with LTG (ret.) James L. Terry, March 27, 2020.

²⁶ RAND interview with LTG (ret.) James L. Terry, March 27, 2020.

²⁷ J. C. Finley, "U.S. Airstrikes Hit Islamic State Positions Near Mosul Dam," *UPI*, August 16, 2014; "Iraq Crisis: US Strikes Aid Kurdish Bid to Retake Dam," BBC, August 16, 2014; Jomana Karadsheh, Barbara Starr, and Chelsea J. Carter, "U.S. Airstrikes on ISIS Part of Operation to Retake Key Iraqi Dam," CNN Wire, August 17, 2014; William Mayville, "Department of Defense Press Briefing by Lt. Gen. Mayville in the Pentagon Briefing Room," transcript, U.S. Department of Defense, August 11, 2014; Joe Pappalardo, "Year One: Inside the Air War Against ISIS," *Popular Mechanics*, September 21, 2015.

Figure 4.4
Level of Effort in Mosul Dam



SOURCE: RAND CJTF-OIR strike release data set.

a strike capacity.²⁸ By softening ISIS defenses and preventing the arrival of reinforcements, COL Steven Warren, a spokesperson for the Pentagon, explained, the attacks were intended to “allow [the ISF] to conduct maneuvers around the dam.”²⁹ In a press statement, CENTCOM confirmed that four armored personnel carriers, seven armed vehicles, and two Humvees were destroyed or damaged in the day’s air strikes.³⁰

²⁸ DoD has not publicly released the basing used to support strikes at Mosul Dam beyond acknowledging the USS *George H.W. Bush* as a critical asset in supporting the operation. The USAF had aircraft forward postured in the Gulf Cooperation Council states and Jordan that were capable of conducting strikes, but it is not clear whether those aircraft were utilized for the Mosul Dam operation or whether all fighters were launched from the carrier.

²⁹ Claudette Roulo, “Security of Mosul Dam Critical to Iraq’s Infrastructure,” U.S. Department of Defense, August 18, 2014.

³⁰ CENTCOM, “US Military Conducts Airstrikes Against ISIL Near Irbil, the Mosul Dam,” press release, August 16, 2014.

A second bombardment, which took place the next morning, paved the path for the Iraqi ground offensive to begin.³¹ The Iraqi CTS and Peshmerga fighters advanced toward the dam on August 17.³² During more than 12 hours of fighting, Iraqi forces cleared a 24-kilometer stretch of land approaching the facility and recaptured three nearby towns, encircling roughly 80 percent of the dam's perimeter.³³ On August 18, air strikes from U.S. RPAs, fighters, and attack aircraft enabled these ground forces to seize and begin to clear the compound despite extensive ISIS efforts to mine and booby-trap the area.³⁴ Additionally, bombers—B-1s based at AUAB in Qatar—participated in the offensive on August 17 and 18 for the first time since the U.S. military effort in Iraq began.³⁵

Among the four target categories we examine—facilities and resources (e.g., buildings, supply caches), military forces (e.g., tactical units, weapon systems), terrain and LOCs (e.g., fighting positions, supply routes), and vehicles—the preponderance of attacks were against ISIS military forces during the Mosul Dam operation (see Figure 4.4). As will become clear from our review of subsequent cases in the close fight, typically, ISIS's military forces composed a much smaller share of targets engaged. Interviewees noted that because ISIS was not yet anticipating a concerted air campaign, its military forces were operating in a way that presented direct targets of opportunity for air strikes at this early stage in the campaign.³⁶ In the Mosul Dam operation, roughly 78 percent of targets engaged were ISIS military forces, compared with typically 25 percent–35 percent of the targets hit in other operations.³⁷ It is also worth

³¹ Karen DeYoung, Liz Sly, and Loveday Morris, "Obama Says Iraqi, Kurdish Forces Have Reclaimed Strategic Mosul Dam," *Washington Post*, August 18, 2014.

³² In recognition of the complexity of ISIS traps, IEDs, and other defenses, the CTS led operations closest to the dam, while the Peshmerga concentrated on clearing surrounding villages. Matt Bradley, Tamer El-Ghobashy, and Felicia Schwartz, "U.S. Widens Air Campaign in Northern Iraq: Washington Sends Bombers for the First Time in Support of Drive to Take Back Positions Near the Cities of Mosul and Erbil," *Wall Street Journal*, August 18, 2014.

³³ Erika Solomon, "Kurdish Peshmerga Forces Encircle Isis-Held Mosul Dam," *Financial Times*, August 17, 2014; Matt Bradley, Tamer El-Ghobashy, and Felicia Schwartz, "U.S. Widens Air Campaign in Northern Iraq: Washington Sends Bombers for the First Time in Support of Drive to Take Back Positions Near the Cities of Mosul and Erbil," *Wall Street Journal*, August 18, 2014; Humeyra Pamuk, "Kurds Push to Drive Militants from Mosul Dam with U.S. Air Support," *Reuters*, August 17, 2014.

³⁴ Karen DeYoung, Liz Sly, and Loveday Morris, "Obama Says Iraqi, Kurdish Forces Have Reclaimed Strategic Mosul Dam," *Washington Post*, August 18, 2014; Azam Ahmed, "In Retaking of Iraqi Dam, Evidence of American Impact," *New York Times*, August 19, 2014.

³⁵ Ben Watson, "U.S. Escalates Iraq Campaign with Barrage of Weekend Strikes for Mosul Dam," *Defense One*, August 17, 2014; Joe Pappalardo, "Year One: Inside the Air War Against ISIS," *Popular Mechanics*, September 21, 2015.

³⁶ RAND interview with U.S. Army officer, December 2, 2019.

³⁷ RAND CJTF-OIR strike release data set.

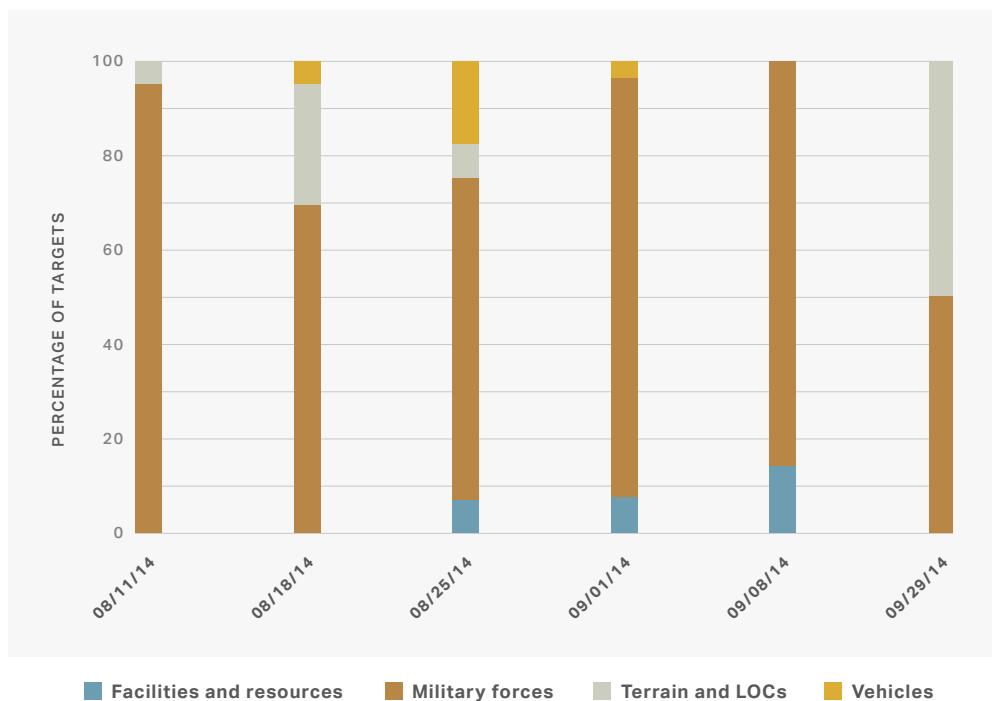
noting that, while the total number of strikes in the Mosul Dam operation is significant, at 85 strikes, some weekly totals reflect very small sample sizes (see Figure 4.5).

Although sporadic fighting would continue through the week's end, the Iraqi Army announced the dam's recapture on the afternoon of August 18. This marked the first time in operations against ISIS in which U.S. air strikes enabled Iraqi forces to retake critical infrastructure and to evict ISIS from territory seized during the group's prior surge. "This is the first time that ISIL has really been defeated," Deputy Secretary of Defense Bob Work ventured during comments made to the press.³⁸

Coordination with Ground Partners in the Mosul Dam Operation

The Mosul Dam operation provided an opportunity to build Iraqi ground forces' trust in American airpower, laying the foundation for closer coordination during later offensives. The operation's success and speed demonstrated the value of targeted air strikes, a point both Iraqi and Kurdish commanders underscored in comments assessing the

Figure 4.5
Targets Engaged in Mosul Dam Operation



SOURCE: RAND CJTF-OIR strike release data set.

³⁸ Bob Work, "Remarks at Osan Air Force Base Troop Call in the Republic of Korea," U.S. Department of Defense, August 22, 2014.

effort.³⁹ The continued U.S. air presence around the dam, as well as periodic strikes against militants in its vicinity, buoyed Iraqi fighters' confidence and facilitated efforts to repel subsequent attacks.⁴⁰ "When I came here three weeks ago, [ISIS fighters] were moving fast and easy with armored vehicles," General Mansour Barzani, commander of the Kurdish forces who reclaimed the dam, observed to reporters. "Now, they don't dare to move anymore."⁴¹

Mosul Dam was different from the air strikes that preceded it because the Mosul Dam strikes were in support of Iraqi and Kurdish partners' ground operations. On August 14, when the President made the decision to authorize U.S. air support for the Iraqi counteroffensive, the USAF had conducted limited air strikes around Mount Sinjar and Erbil but had yet to provide direct support for a major ground operation. Because the United States did not have forces on the ground, the USAF was without JTACs in forward positions to direct aircraft. In lieu of JTACs, Iraqi ground forces, translators, and American pilots were connected through a strike cell based at CJOC-E, which cleared and deconflicted calls for air support.⁴² "On the ground, we had the Peshmerga, and we had the counterterrorist service from the Iraqi security forces, and then, in an operation center in Erbil, we had our own folks, using predator feeds and a . . . ROVER [Remote Operated Video Enhanced Receiver] to be able to help the Iraqis manage the battle on the ground," explained Chairman of the Joint Chiefs GEN Martin Dempsey during later congressional testimony.⁴³ Despite initial concerns about Iraqi forces' capacity to coordinate air support and the challenge of

³⁹ See, for instance, comments in Karen DeYoung, Liz Sly, and Loveday Morris, "Obama Says Iraqi, Kurdish Forces Have Reclaimed Strategic Mosul Dam," *Washington Post*, August 18, 2014; Azam Ahmed and Ben Hubbard, "Buoyed Kurds Try to Retake Strategic Dam," *Boston Globe*, August 18, 2014.

⁴⁰ On later U.S. efforts to assist Iraqi efforts to repel ISIS attacks, see John Kirby, "Department of Defense Press Briefing by Rear Adm. Kirby in the Pentagon Briefing Room," transcript, U.S. Department of Defense, August 29, 2014.

⁴¹ Quoted in Azam Ahmed, "In Retaking of Iraqi Dam, Evidence of American Impact," *New York Times*, August 19, 2014.

⁴² The Pentagon press secretary disputed press reports of U.S. ground support, clarifying that no U.S. personnel operated "on the ground in conjunction with the operations around Mosul dam." See John Kirby, "Department of Defense Press Briefing by Rear Adm. Kirby in the Pentagon Briefing Room," transcript, U.S. Department of Defense, August 29, 2014; Deborah Lee James, "State of the Air Force," speech delivered at the Air and Space Conference and Technology Exposition, Arlington, Va., September 15, 2014; James L. Terry, "Department of Defense Press Briefing by Lt. Gen. Terry in the Pentagon Briefing Room," transcript, U.S. Department of Defense, December 18, 2014.

⁴³ A ROVER is a laptop receiver for aircraft video feeds, showing high-definition FMV and GPS coordinates, with two-way communications between aircraft and receiver. Rebecca Grant, "The ROVER," *Air Force Magazine*, August 2013.

communicating efficiently among English, Kurdish, and Arabic speakers, “we pulled that mission off,” Dempsey concluded, adding, “I think it’s a good template for future operations.”⁴⁴

Once Iraqi ground forces engaged ISIS fighters, coordinating CAS proved to be a challenge. “In very beginning, we had to show them how to do close air support. They hadn’t had this training or the background with CAS. It was not integrated the way we do it,” one interviewee commented.⁴⁵ Although the ROVER system, which allowed U.S. advisers to view potential targets from sensors mounted under drones and aircraft flying over the compound, proved effective in Mosul Dam, some military officials continued to express concern that U.S. tactical operators would be needed to call in strikes during campaigns in denser urban areas.⁴⁶

Conclusion for the Mosul Dam Case

Mosul Dam was important for demonstrating that the United States could effectively deliver airpower in the context of a light-footprint strategy and in conjunction with partner forces. The successful operation also boosted the confidence of Iraqi forces. Two weeks earlier, the ISF appeared to be teetering on the edge of collapse, unable or unwilling to stem the tide of ISIS fighters through Iraq. The Mosul Dam operation, along with concurrent operations near Sinjar and Erbil, had “stalled [ISIS’s] momentum and enabled Iraqi and Kurdish forces to regain their footing and take the initiative,” Secretary of Defense Chuck Hagel told reporters during a press briefing.⁴⁷ Because the operation coincided with Prime Minister al-Maliki stepping aside, it also signaled the start of a shift to expanded military operations in Iraq. Although the operation’s scale and complexity pales in comparison to the prolonged Battles of Mosul and Raqqa, “Mosul Dam [was] really [the] first big operation” of the U.S.-led campaign against ISIS, as one interviewee noted.⁴⁸

That said, the operation’s significance should not be overstated. Even after being defeated at Mosul Dam, ISIS continued to expand its territorial control elsewhere. Moreover, the United States enjoyed favorable circumstances in the Mosul Dam operation that it could not easily replicate across the theater. Specifically, the two most significant ground partners in the Mosul Dam operation, Iraqi CTS and Kurdish Pesh-

⁴⁴ Martin Dempsey, “Testimony on US Policy Towards Iraq and Syria and the Threat Posed by the Islamic State of Iraq and the Levant (ISIL),” testimony before the U.S. Senate Committee on Armed Services, September 16, 2014, p. 18.

⁴⁵ RAND interview with Maj Gen (ret.) Bruce Miller, January 8, 2020.

⁴⁶ Helene Cooper, David D. Kirkpatrick, and Rick Gladstone, “Top U.S. General Says He’s Open to Using Ground Troops to Retake Mosul,” *New York Times*, November 13, 2014.

⁴⁷ Chuck Hagel and Martin E. Dempsey, “Department of Defense Press Briefing by Secretary Hagel and General Dempsey in the Pentagon Briefing Room,” transcript, U.S. Department of Defense, August 21, 2014.

⁴⁸ RAND interview with VADM (ret.) John Miller, January 28, 2020.

merga, were arguably the two most disciplined forces the United States had available to work with.

The Mosul Dam operation also foreshadowed several challenges that would complicate U.S. efforts to execute the campaign against ISIS. Although one interviewee recalled that a USAF B-1 bomber executed a deliberate strike to destroy an adjacent ISIS-constructed dam designed to redirect water, a shortage of reliable intelligence meant that the majority of U.S. air strikes was against targets of opportunity.⁴⁹ Even then, ISIS forces' mobility limited the number of air strikes executed. "We didn't drop many . . . weapons because a lot of it was . . . building [situational awareness]," one interviewee explained. "So did we drop any ordnance in Iraq in those early weeks? We did . . . [just] not very much."⁵⁰

Stopping ISIS's Momentum in Syria: Kobani, October 2014–January 2015

Background of the Battle for Kobani

As ISIS advanced on the small town of Kobani, located on the Syrian-Turkish border, in September and October 2014, the jihadist group still conveyed an air of invincibility. On the Iraqi side of the border, ISIS had overrun security forces in both the Euphrates River Valley and the Tigris River Valley. On the Syrian side of the border, the regime was bogged down countering opposition forces in the western portions of the country, largely vacating areas east of the Euphrates to local authorities or ISIS. The absence of Syrian forces in the east meant that ISIS was the most capable military force with advanced weaponry in the area. This was true at Kobani, where an estimated 4,000 ISIS fighters advanced on the city with tanks, technicals (i.e., pickups mounted with large-caliber weapons), towed artillery, and other heavy weapons, while Kobani's mostly Kurdish defenders possessed only small arms.⁵¹

Like the Sinjar operation, in which Yazidis were besieged by ISIS, the terror group's assault on Kobani generated significant international media attention.⁵² This was due to the scope of the crisis, as thousands of Syrian civilians fled ISIS's assault, with many seeking refuge over the Turkish border. Media outlets covered the events firsthand from Sanliurfa, Turkey, adding to the frenzy. There were two intriguing storylines feeding public interest. The first was that ISIS was once again targeting a minority group (Syrian Kurds), and the second was Turkey's hesitancy to assist coalition

⁴⁹ RAND interview with VADM (ret.) John Miller, January 28, 2020.

⁵⁰ AFHRA interview with Col Jose E. Sumangil, September 23, 2019.

⁵¹ Derek Henry Flood, "The Battle for Kobani Comes to the Fore," *CTC Sentinel*, Vol. 7, No. 11, November–December 2014; Rebecca Grant, "The Siege of Kobani," *Air Force Magazine*, August 29, 2018.

⁵² Tim Arango, "More Than a Battle, Kobani Is a Publicity War," *New York Times*, November 19, 2014.

efforts to prevent ISIS from seizing Kobani.⁵³ Turkey joined the coalition in October 2014, after its parliament ratified strikes against ISIS.⁵⁴ Ankara's reticence was driven by its disapproval of the Syrian Kurdish forces in Kobani, the YPG, which it viewed as part and parcel of PKK, a terrorist group that had targeted the Turkish government.

The U.S.-led coalition responded to ISIS's siege of Kobani by launching air strikes on ISIS targets and air-dropping materiel to YPG fighters holding off the attack. Media attention put these coalition efforts under the microscope, with DoD questioned on how Kobani fit into the overall campaign strategy. Some experts argued that Kobani did not fit an "Iraq first" blueprint, which was a prominent characteristic of the administration's strategy,⁵⁵ and that it risked becoming a distraction from the effort against more-strategic areas.⁵⁶ Skeptics of the allocation of airpower to Kobani used the historical case of Khe Sanh, Vietnam, to describe a scenario in which Kobani would consume disproportionate effort relative to its strategic value.⁵⁷ On the other hand, there were also questions of whether the coalition was doing enough to avert ISIS's march on Kobani—with the implication that the United States had conceded Kobani's fall or waited too long to intervene, leading to ineffective use of airpower.⁵⁸ Fortunately, neither of these fears proved accurate.

The coalition adjusted its strategy to surge airpower to Kobani, making it a short-term focus of activity without becoming a long-term diversion from the broader campaign strategy. As soon as Kobani was complete, the coalition returned to intensifying and prioritizing operations in Iraq, turning its attention specifically to pushing the FLOT away from the Iraqi capital. As senior U.S. officials stressed, the decision to surge effort to Kobani was opportunistic, because roughly 1,000 ISIS fighters pre-

⁵³ On ISIS targeting of the Kurds specifically, refer to Special Envoy Allen's comment that "it was clear that the Islamic State wanted to wipe out the Kurdish population in Kobani, there's no question about that. And it was the president's intention that that's not going to happen, and the coalition agreed to that." Susan Glasser, John R. Allen, Lise Grande, and Brett McGurk, "The Counter-ISIS Coalition: Diplomacy and Security in Action," panel, Washington, D.C., Brookings Institution, September 10, 2019.

⁵⁴ Isabel Hunter, "War Against ISIS: Turkey Joins Western Coalition in Fight to Stop Militants," *The Independent*, October 2, 2014.

⁵⁵ Christopher Blanchard and Carla E. Humud, *The "Islamic State" Crisis and U.S. Policy*, Washington, D.C.: Congressional Research Service, May 27, 2015.

⁵⁶ Refer to the questions posed to CENTCOM Commander Austin; Lloyd J. Austin III, "Department of Defense Press Briefing by General Austin in the Pentagon Briefing Room," transcript, U.S. Department of Defense, October 17, 2014.

⁵⁷ Max Boot, "The War on ISIS: More Than One Battle," *Wall Street Journal*, October 22, 2014; Tim Arango, "More Than a Battle, Kobani Is a Publicity War," *New York Times*, November 19, 2014.

⁵⁸ Zalmay Khalilzad, "Bombs Away: Time to Escalate the Air War Against ISIL," *National Interest*, October 23, 2014.

sented themselves as targets.⁵⁹ The United States took on the preponderance of the effort, as most coalition member caveats prohibited operating in Syria. ISIS flowed forces to the battlefield even as U.S. aircraft attrited them.⁶⁰

Fears that ISIS would prevail also proved wrong. Although the initial U.S. assessments were that Kobani would likely fall to ISIS,⁶¹ U.S. air operations, combined with a committed ground force, dealt ISIS a defeat at Kobani, halting its Syrian momentum and raising the profile of the YPG, which in time would evolve into a primary recipient of the U.S. train-and-equip program inside Syria.

The Application of Airpower in Kobani

The U.S. military, with very limited support from coalition partners, conducted 663 air strikes in and around Kobani over four months during the height of ISIS's attempt to seize the city.⁶² Coalition partners that provided some air support for the Kobani operation consisted of several Arab air forces, along with the United Kingdom.⁶³ The operation arguably got off to a slow start in that ISIS began advancing on Kobani in mid-September 2014, but the first air strikes were not delivered until the week of September 26.⁶⁴ The greatest volume of strikes—more than 250—occurred at the end of the fight, in January 2015, when ISIS was finally pushed out of the city. The middle portion of the fight, in November and December 2014, when the city's defenders were slowly wresting back neighborhoods around the city, coincided with a slightly lower volume of strikes—an average of 116 per month. Surprisingly, given that the city was

⁵⁹ Special Envoy Brett McGurk commented, “So in Syria we tried a number of things but when the battle of Kobani happened in the fall of 2014 we took advantage of an opportunity that we didn’t envision when we drew the plan out.” Susan Glasser, John R. Allen, Lise Grande, and Brett McGurk, “The Counter-ISIS Coalition: Diplomacy and Security in Action,” panel, Washington, D.C., Brookings Institution, September 10, 2019.

⁶⁰ Alison Meuse, “Backed by U.S.-Led Coalition, Kurds Take Kobani from ISIS,” NPR, January 26, 2015.

⁶¹ Refer to RADM Kirby’s comment: “The last point I want to make here—and this is a really important one—is that airstrikes alone are not going to do this. They’re not going to fix this. They’re not going to save the town of Kobani. We know that. And we’ve been saying that over and over again. And yet we continue to get questions of, well, why aren’t you doing more? And how come they aren’t more effective? But what we’ve been very honest about, the limits of airpower here. The ground forces that have to—that matter the most are indigenous ground forces. And we don’t have a willing, capable, effective partner on the ground inside Syria right now. It’s just a fact. I can’t change that.” John Kirby, “Department of Defense Press Briefing by Rear Adm. Kirby in the Pentagon Briefing Room,” transcript, U.S. Department of Defense, August 14, 2014.

⁶² This count includes strikes conducted from October 2014 through January 2015.

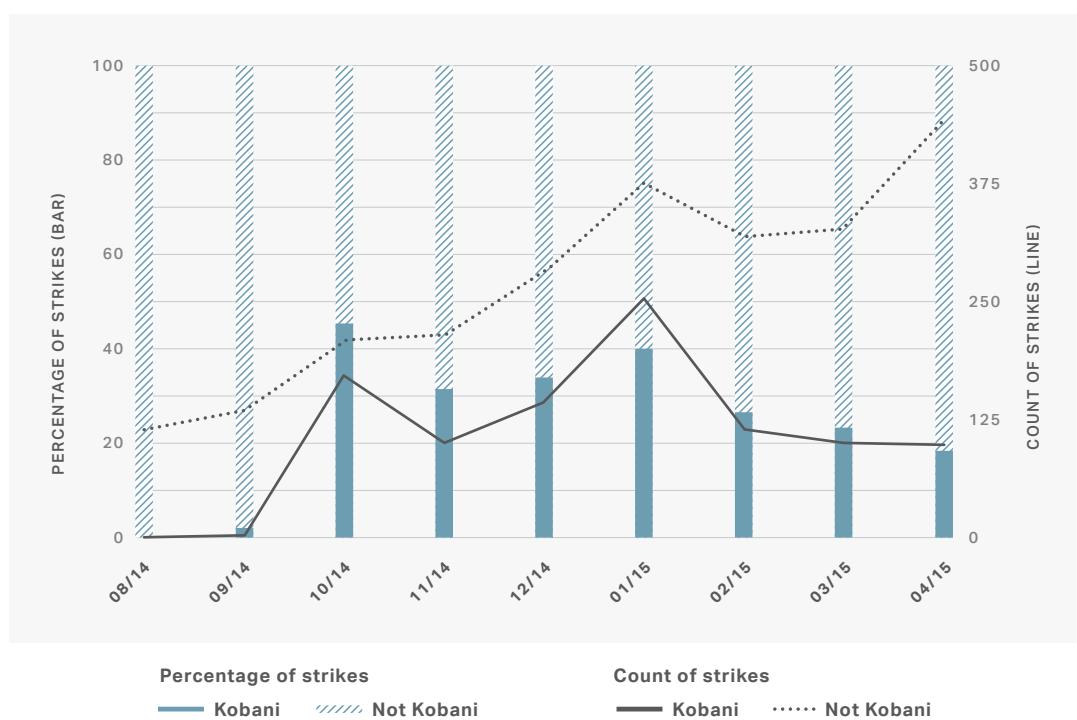
⁶³ These were Bahrain, Jordan, Qatar, Saudi Arabia, and the United Arab Emirates. Rebecca Grant, “The Siege of Kobani,” *Air Force Magazine*, August 29, 2018; DoD, “U.S., Saudi Arabia Conduct Airstrikes Against ISIL in Syria,” October 13, 2014.

⁶⁴ It may be that the delay was owed to the need for diplomatic engagement with Turkey. See Ambassador McGurk’s description of the meeting he and Gen Allen had with Turkish Prime Minister Davutoğlu during that period. Susan Glasser, John R. Allen, Lise Grande, and Brett McGurk, “The Counter-ISIS Coalition: Diplomacy and Security in Action,” panel, Washington, D.C., Brookings Institution, September 10, 2019.

largely liberated in late January 2015, air strikes continued apace through April 2015 as ISIS remnants in the city were targeted, as well as ISIS fighters located in the territory around Kobani (see Figure 4.6).

In the most intense months of the fight, from October 2014 through January 2015, Kobani accounted for just under 40 percent of all coalition air strikes in Iraq and Syria. No single town in either Iraq or Syria was targeted more frequently than Kobani during these four months. When compared with total air operations in Syria, the weight of effort in Kobani was even more pronounced. Over that same period of October 2014 through January 2015, Kobani strikes amounted to nearly 80 percent of total strikes in Syria. As acknowledged by senior U.S. military commanders, the defense of Kobani became the primary air operation during this period in the OIR campaign. CENTCOM Commander GEN Lloyd Austin noted, “And again, I believe that [ISIS] made a decision several days ago that Kobani was going to be his main effort. And as long as [ISIS] pours . . . legions of forces there into that area, we’ll stay focused on taking [them] out.”⁶⁵

Figure 4.6
Level of Effort in Kobani

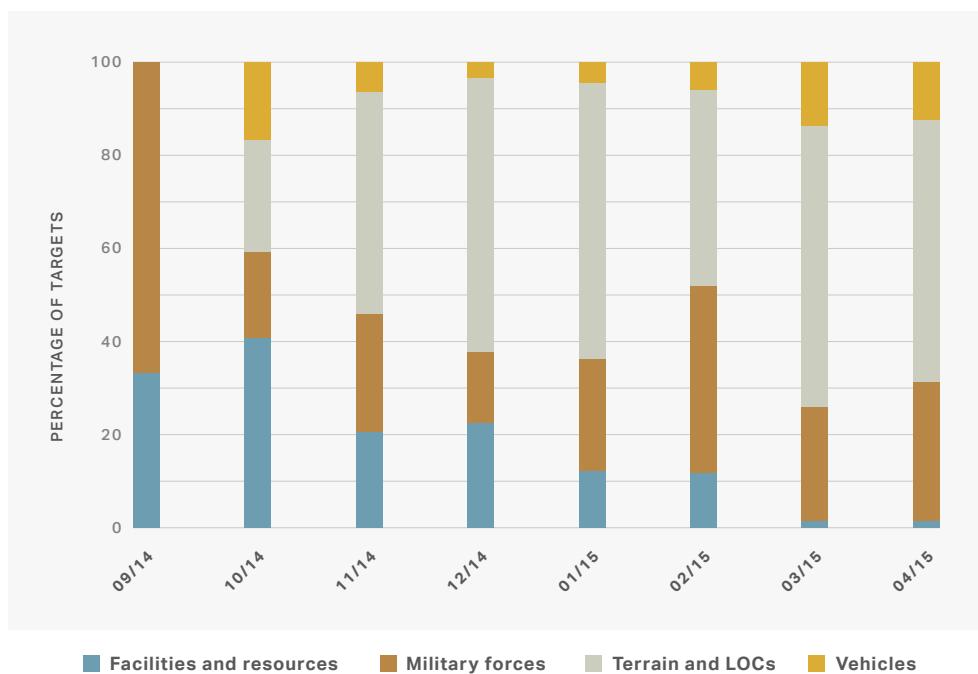


SOURCE: RAND CJTF-OIR strike release data set.

⁶⁵ Lloyd J. Austin III, “Department of Defense Press Briefing by General Austin in the Pentagon Briefing Room,” transcript, U.S. Department of Defense, October 17, 2014.

The initial strikes in Kobani were roughly equally divided among the four target categories—facilities and resources, military forces, terrain and LOCs, and vehicles (see Figure 4.7). Over time, however, terrain and LOCs, which were almost exclusively defensive or fighting positions during this operation, were increasingly targeted by coalition aircraft.⁶⁶ In January 2015, roughly 60 percent of the 253 strikes (the peak of this battle) were against terrain and LOCs. As for facilities and resources, the target set declined as a share of total strikes over time. These trends in targeting were likely driven by multiple factors, including ISIS's loss of physical infrastructure around the city, which may explain the drop-off in facilities and resources struck. The coalition's heavy use of B-1 bombers in the operation, which have a large payload and thus might have been used to strike defensive positions rather than returned to base with unspent munitions,⁶⁷ may explain the increase in targeting of terrain and LOCs. In stark contrast to Mosul Dam, the proportion of ISIS military forces was just 25 percent of the overall target set.

Figure 4.7
Targets Engaged in Kobani



SOURCE: RAND CJTF-OIR strike release data set.

⁶⁶ Defensive or fighting positions might not have had ISIS forces currently occupying them. For more on the categorization of the CJTF-OIR strike data, see Appendix D.

⁶⁷ RAND interview with U.S. Army officer, December 2, 2019.

Several airframes were employed in the Kobani strikes, primarily F-15E fighters, F-16 fighters, F-22 fighters, and B-1B bombers. By all accounts, the B-1Bs were the workhorse of the mission. Those aircraft, flown by the USAF 9th Bomb Squadron, dropped 1,700 guided bombs on Kobani during a six-month rotation to AUAB in Qatar.⁶⁸ It is not possible to say precisely what percentage of munitions were dropped by B-1Bs of total ordnance released over Kobani, but there are several clues to indicate it is the overwhelming share. For example, official sources note that the 9th Bomb Squadron dropped roughly 85 percent of all ordnance on Kobani of the total munitions it delivered during its deployment.⁶⁹ As characterized by then-Commander of the 9th Bomb Squadron, Col Jose E. Sumangil, “We got a lot of work when we were out there [i.e., in Kobani]. It was just the nature, especially when you went up to Kobani. . . . [V]ery rarely [did] you come home with no weapons dropped.”⁷⁰ Separately, the USAF also noted that from the start of OIR to 2016, B-1s dropped 40 percent of all ordnance delivered as part of OIR, the most of any airframe.⁷¹ Those clues suggest that B-1Bs, because of their long loiter time and large payloads,⁷² delivered the greatest share of munitions in the Kobani fight. That said, F-15Es and F-16s were also major contributors in Kobani, and F-22s were used to “quarterback” the strikes (coordinate the strike packages).⁷³

Kobani was the “combat debut” for the F-22, the Air Force’s advanced fifth-generation air superiority fighter.⁷⁴ In addition to the quarterbacking role, the F-22s provided DCA capabilities, freeing up the other platforms to focus on air-to-ground strikes.⁷⁵ At this point in the campaign, Russia had yet to become deeply involved in the conflict; that escalation occurred roughly a year later, with its introduction of air-power in support of regime offensives in the western portion of Syria. However, even absent Russian air operations, the Syrian regime possessed an Integrated Air Defense System (IADS) that placed U.S. airframes operating in eastern Syria inside a potentially hostile weapon engagement zone. U.S. officials noted that at that time the Syrian

⁶⁸ Joe Pappalardo, “Year One: Inside the Air War Against ISIS,” *Popular Mechanics*, September 21, 2015; Rebecca Grant, “The Siege of Kobani,” *Air Force Magazine*, August 29, 2018.

⁶⁹ Oriana Pawlyk, “B-1B Lancer’s Evolving Mission Includes More Close-Air Support,” Military.com, January 14, 2018.

⁷⁰ AFHRA interview with Col Jose E. Sumangil, September 23, 2019.

⁷¹ Oriana Pawlyk, “Air Force F-16s Fly the Most Sorties Against ISIS, B-1s Drop Most Bombs,” *Air Force Times*, March 24, 2016.

⁷² RAND interview with coalition officers, March 2, 2020.

⁷³ Rebecca Grant, “The Siege of Kobani,” *Air Force Magazine*, August 29, 2018.

⁷⁴ Kristina Wong, “F-22 Makes Its Debut Against ISIS,” *The Hill*, September 23, 2014.

⁷⁵ Rebecca Grant, “The Siege of Kobani,” *Air Force Magazine*, August 29, 2018.

IADS was in a “passive” mode,⁷⁶ signaling the regime’s tacit acquiescence to coalition air operations. Then-Lt Gen Charles Q. Brown, who would become CFACC shortly after the operation, noted, “We were flying permissively in a nonpermissive environment. They had all the capability, but not the intent, to shoot down our aircraft—and we were flying close enough that they could.”⁷⁷ To mitigate that risk, the F-22 was employed in the event Syrian regime aircraft or IADS threatened coalition aircraft.

Although air strikes in support of a committed ground partner achieved the intended effect in Kobani, the operation revealed a chronic challenge for the campaign. Specifically, most coalition aircraft were not permitted to fly from the most-proximate air bases to northern Syria and Iraq. Consequently, they had long transit flights from more-distant Gulf bases, which limited their time on station. In the case of Kobani, the Turkish air bases of Incirlik and Diyarbakir are roughly 200 miles from the border town. However, at the time of the Kobani operation, Ankara permitted the United States to fly only unmanned and manned aircraft for ISR, rather than for conducting lethal strikes.⁷⁸ Ultimately, the greater range and ample payload of the B-1B provided a workaround, but Turkish restrictions effectively limited the utility of fighter and attack aircraft with less endurance and smaller payloads. Furthermore, the operation suffered from dwindling coalition partner support as it wore on. Although the contribution of non-U.S. air strikes to Kobani was limited to begin with, it nearly evaporated as the operation continued. This was in part due to the exhaustion of fixed targets, leaving targets too difficult for less advanced coalition air forces to strike.⁷⁹

Coordination with Ground Partners in Kobani

Airpower was used in Kobani to support a ground force primarily composed of Syrian Kurdish YPG fighters, although some elements of the vetted Syrian opposition (VSO) and Iraqi Peshmerga fighters also participated in the operation.⁸⁰ Coalition support to the YPG was significant for several reasons, the most important of which was Turkey’s opposition to partnering with this particular force, given its ties to PKK. This led

⁷⁶ John Kirby, “Department of Defense Press Briefing by Rear Adm. Kirby in the Pentagon Briefing Room,” transcript, U.S. Department of Defense, August 14, 2014.

⁷⁷ RAND interview with Gen Charles Q. Brown, February 20, 2020.

⁷⁸ Phil Stewart and Tulay Karadeniz, “U.S. Drone Hits Syria in First Lethal Strike Launched from Turkey,” Reuters, August 5, 2015.

⁷⁹ Phil Stewart and Yara Baymouy, “Exclusive: As Easy Targets Thin, Syria Air Strikes by U.S. Allies Plunge,” Reuters, December 17, 2014.

⁸⁰ For a video of fighters from the Fajr Al-Hurriya (Dawn of Freedom) group operating in Kobani, see servan derwisch, “Hamlat Tahrir Kobani wa Musharaka Fa’ala li Kata’ib Shams Al-Shamal Alwiya Fajr Al-Hurriya” [“The Campaign to Liberate Kobani with the Active Participation of the Northern Sun Battalions of the Dawn of Freedom Brigades”], YouTube video, January 26, 2015. For more on the Kurdish Regional Government’s decision to send Peshmerga fighters to Kobani, see Al-Arabiya, “Peshmerga Al-Iraq ila Suriya Difa’an ‘an Kobani” [“Peshmerga of Iraq to Syria in Defense of Kobani”], October 23, 2014.

the coalition to adopt several workarounds aimed at assuaging Ankara's sensitivities, although none of these strategies realized its goal. The first was that initial material support to the YPG during the siege of Kobani was actually procured by Iraqi Kurds that Turkey has a working relationship with. The Iraqi Kurds assembled lethal and nonlethal aid, which the USAF delivered to the Syrian Kurds via C-130 airdrops. However, the aid itself was provided in kind by the Kurdistan Regional Government and not by the coalition.⁸¹ This avoided the coalition adopting a policy of direct material support to the YPG, which would have further alienated Turkey.

In total, 28 pallets consisting of 24 tons of small arms and ammunition and ten tons of medical supplies were air-dropped by the coalition to the YPG on October 20, 2014.⁸² As a measure of the accuracy of the drops, 27 of the pallets were received by the intended recipients, while one pallet was captured by ISIS. The coalition subsequently struck the diverted pallet in an air strike.⁸³

The precise details of how the coalition conducted strikes with YPG input during the defense of Kobani are not public. Some reporting suggested that YPG fighters had contact details of JTACs at the CAOC, who received coordinates passed on to them by the YPG.⁸⁴ U.S. defense officials denied having American JTACs inside Kobani or possessing close coordination with the YPG at that point in time.⁸⁵ For its part, the YPG claimed high-level coordination with the coalition and further coordination through "intermediaries,"⁸⁶ which may be a reference to the other VSOs or the Peshmerga reinforcements who could have been used as a go-between to pass target information to the coalition. U.S. airmen acknowledged that munitions were dropped "danger close"—that is, in close proximity to friendly forces—to Peshmerga forces, which could imply coordination between the Peshmerga forces and the coalition.⁸⁷ That said, another possibility is that the coalition simply relied on ISR generated from RPAs and manned aircraft, as well as U.S. forces observing ISIS positions from Turk-

⁸¹ Derek Henry Flood, "The Battle for Kobani Comes to the Fore," *CTC Sentinel*, Vol. 7, No. 11, November–December 2014.

⁸² Rebecca Grant, "The Siege of Kobani," *Air Force Magazine*, August 29, 2018.

⁸³ John Kirby, "Department of Defense Press Briefing by Admiral Kirby in the Pentagon Briefing Room," transcript, U.S. Department of Defense, October 21, 2014.

⁸⁴ Joe Pappalardo, "Year One: Inside the Air War Against ISIS," *Popular Mechanics*, September 21, 2015.

⁸⁵ Refer to RADM Kirby's clarification: "No, we're not in active communication or coordination with the Syrian Kurds. One of the challenges, quite frankly, in Syria—and I addressed this—is that there is no opposition force, no recognized military organization with which we can work." John Kirby, "Statement by Pentagon Press Secretary Rear Admiral John Kirby on Airstrikes in Iraq," transcript, U.S. Department of Defense, August 8, 2014; Dan De Luce, "Here's What the Battle for Kobane Was Really Like," *Business Insider*, February 14, 2015.

⁸⁶ "Akrad Kobani Yasta'idun Tawazunihim 'Aqb al-Tansiq ma' Quwat al-Tahaluf" ["The Kurds of Kobani Regain Their Balance After Coordinating with Coalition Forces"], *Middle East Online*, October 15, 2014; Tom Perry, "Syrian Kurds See Deeper Coordination with U.S.-Led Alliance," *Reuters*, March 4, 2015.

⁸⁷ Rebecca Grant, "The Siege of Kobani," *Air Force Magazine*, August 29, 2018.

ish territory. This could have been a viable option given the capabilities of the Battlefield Airborne Communication Node, which would allow strike aircraft to communicate with JTACs in a remote strike cell.

Whatever the coordination mechanism, airpower proved effective in enabling YPG ground maneuver. Initial strikes focused on stemming ISIS's advance on the city from the east and from the south. Over time, the YPG was able to take the offensive. Particularly important was the YPG expelling ISIS from the high ground around the perimeter of the city center. By mid-October 2014, the YPG had recovered Tal Shair, the high ground in northern Kobani on the Turkish border.⁸⁸ The YPG would recover the town's other high point, Mistenour Hill, in January 2015, signaling ISIS's defeat at Kobani.⁸⁹

Conclusion for the Kobani Case

The Kobani operation revealed a willingness by Washington to employ airpower to a greater degree than previous operations. An oft-cited anecdote from Kobani is that the B-1Bs went "Winchester"—delivering their entire weapon loads—more than 30 times in the course of the Kobani fight.⁹⁰ This suggests a more aggressive use of airpower than observed at earlier points in the campaign. Because civilian populations had fled the city and the Kurds consolidated their defense in easily identified sectors, the intensified use of airpower was likely owed to the coalition's ability to more easily identify enemy positions and the lower risk of civilian casualties and collateral damage.

Like in the Mosul Dam operation, airpower during the Kobani operation also underscored that the United States had the ability to deliver airpower, including in situations "danger close" to partner ground forces, without placing U.S. JTACs at the FLOT. Confirming the ability to operate in this manner on the Syrian side of the theater was important because, unlike in Iraq, where U.S. forces could rely on the CTS and Peshmerga (whom they had considerable experience with), in Syria, U.S. airpower was supporting a local actor that American forces had no prior history with. Indeed, the CTS even has U.S.-qualified JTACs, a stark contrast to the YPG, which had never been the recipient of airpower prior to the Kobani fight.

At a strategic level, the important takeaway from this case is that the YPG's commitment and performance in the Kobani operation raised its profile as a potential ground partner. At this early stage in the OIR campaign, defense planners were still considering a broad swath of VSOs as potential partners, with the YPG just one of many under consideration. The YPG's commitment to the fight at Kobani, and its

⁸⁸ "Islamic State Crisis: Kurds 'Recapture Key Kobane Hill,'" BBC, October 14, 2014.

⁸⁹ "Al-Kurd Yusaytirun 'ala Kamil Talla Mashtanur bi Kobani" ["The Kurds Control All of Mistenour Hill in Kobani"], Rudaw, January 19, 2015.

⁹⁰ Brian Everstine, "Inside the B-1 Crew That Pounded ISIS with 1,800 Bombs," *Air Force Times*, August 23, 2015.

more singular military focus on defeating ISIS—as opposed to combating the Syrian regime—eventually made it a more attractive partner to Washington than other VSOs. By late 2015, the United States was shifting toward the establishment of the SDF, which the YPG would become the backbone of, as the primary partner for its Syria train-and-equip program.

However, Kobani also surfaced tensions within the coalition that would bedevil the campaign going forward. In the case of Kobani, those tensions manifested in the types of air operations Turkey allowed the coalition to launch from its air bases. Turkey's policy created challenges in efficiently delivering strike capability from farther-flung bases, but the challenge could be managed. Over time, coalition support for the YPG led to direct military interventions from Turkey, including Ankara establishing several zones of control inside Syria to limit the prospects of Kurdish autonomy. This posed a more serious risk to ensuring ISIS's enduring defeat.

Warning Signs in Tikrit, March–April 2015

Background of the Tikrit Liberation

Tikrit is best known for being the hometown of Iraq's previously deposed leader, Saddam Hussein. Given that Saddam favored this area in his management of state affairs and many local notables had leadership positions in his regime, the town of roughly 160,000 people has been restive since his ouster and a source of suspicion among the new Shia-led order.⁹¹ Located on the west bank of the Tigris River, the city is also a waypoint to Baiji, where the country's largest oil refinery and power plant are located, and Samarra, a city of deep religious importance to Iraqi Shia that has also been a flash point in the country's sectarian conflict.

ISIS captured Tikrit in June 2014, during its offensive in northern Iraq that threatened Baghdad. Initial attempts to stave off ISIS's advance failed, as did subsequent attempts by Iraqi forces to retake the city.⁹² Tikrit has outsized strategic importance for its modest size, in part because of its location and history. According to reporting, "Tikrit [was] seen as an important precursor to an operation to retake Mosul, which lies farther north. Success in Tikrit could push up the timetable for a Mosul campaign, while failure would most likely mean more delays."⁹³ That is owed to Tikrit's position at the intersection of major LOCs—specifically, it is where Highway 1 branches off to

⁹¹ Iraq's last official census was completed in 1997, so researchers have imputed the numbers since. For the Tikrit figure, see Tara Vishwanath, Dhiraj Sharma, Nandini Krishnan, and Brian Blankespoor, *Where Are Iraq's Poor? Mapping Poverty in Iraq*, Washington, D.C.: World Bank, 2015.

⁹² Loveday Morris, "Iraq Reports Major Effort to Recapture Tikrit," *Washington Post*, June 28, 2014; "Iraqi Effort to Recapture Tikrit Said to Stall," *Washington Post*, August 19, 2014.

⁹³ Omar Al-Jawoshy and Tim Arango, "Iraqi Offensive to Retake Tikrit from ISIS Begins," *New York Times*, March 3, 2015.

Highway 24, the latter falling outside ISIS's main strongholds. As explained by former CJTF-OIR Commander LTG James Terry, "Tikrit for us was an essential place to get ISIS out of, because we wanted to do protected movement of the ISF, not through the throat of ISIS on Highway 1."⁹⁴ Tikrit also hosts Camp Speicher, the site of the Iraqi Air Force's main training program, and where ISIS perpetrated perhaps its most notorious massacre during its early advance.⁹⁵

The liberation of Tikrit was one of the most sensitive and problematic operations in OIR. The fundamental issue was that Iranian-backed militias, the so-called PMF, provided the bulk of the manpower for the operation.⁹⁶ Early signs from villages "liberated" on Tikrit's outskirts revealed these militias' excesses, including looting and revenge killings.⁹⁷ Because the U.S. strategy was predicated on helping the Abadi government build a more inclusive Iraq, Tikrit was widely feared by the Obama administration as a potential setback that would fan sectarianism and push Iraq's Sunni Arab population against OIR.⁹⁸

Iran, which backed the PMF, was also attempting to use Tikrit to bolster its narrative that Iran was the most important counterterrorism partner of Iraq. Qasem Soleimani, the commander of the Islamic Revolutionary Guard Corps–Quds Force, who would be later killed in an unrelated U.S. drone strike in January 2020, was seen operating in the vicinity of Tikrit.⁹⁹ The most visible Iraqi in the operation was arguably Hadi al-Ameri, the leader of the Badr Corps, who was providing the largest contingent of forces, along with Muqtada al-Sadr's "Peace Brigades," Harakat al-Nujaba, Asa'ib Ahl al-Haqq, and Kata'ib Hezbollah.¹⁰⁰ Al-Ameri used the operation as a platform to warn against U.S. involvement in the campaign. He noted, "Do not trust U.S. forces; they are not able to liberate one village of Iraqi territory. Today it is our sons

⁹⁴ RAND interview with LTG (ret.) James L. Terry, March 27, 2020.

⁹⁵ Tim Arango, "Escaping Death in Northern Iraq," *New York Times*, September 3, 2014.

⁹⁶ Refer to Chairman Martin Dempsey's assessment: "There are approximately a thousand Sunni tribal folks. There is one brigade of the Iraqi Security Forces, which numbers approximately 3,000, a couple hundred of their CTS, their counterterrorist service. Those are the [Ministry of Defence]–sponsored forces. And there are approximately 20,000 of the popular mobilization forces, which are the Shia militia." U.S. Senate Committee on Foreign Relations, "The President's Request for Authorization to Use Force Against ISIS: Military and Diplomatic Efforts," hearing, March 11, 2015.

⁹⁷ Erica Gaston and Frauke Maas, "Iraq After ISIL: Tikrit and Surrounding Areas," Global Public Policy Institute, August 29, 2017.

⁹⁸ See comments by Secretary of Defense Ash Carter and National Security Council Director Andrew Kim in Martin Smith, "Confronting ISIS," *Frontline*, October 11, 2016.

⁹⁹ The assassination of Soleimani was not a part of OIR. Calen Weiss, "Iranian General at the Forefront of the Tikrit Offensive," *Long War Journal*, March 5, 2015.

¹⁰⁰ Rod Nordland and Helene Cooper, "U.S. Airstrikes on Tikrit Prompt Boycott, and Threats, by Shiite Fighters," *New York Times*, March 27, 2015.

who are able to liberate territory from [ISIS] with the advising of the Islamic Republic [of Iran].”¹⁰¹

Given this backdrop, the United States initially opted to withhold airpower until the Shia militias could be sidelined. When the United States decided to launch air strikes after securing Prime Minister al-Abadi’s promise to withdraw the PMF, its participation was short-lived. Despite taking heavy casualties, Iraqi forces that included the PMF reclaimed the city in April 2015. The operation was highly controversial, with many residents in Tikrit reporting that they feared the liberating force as much as ISIS.¹⁰² Washington was also concerned and, in reaction, imposed a much greater measure of control in the Ramadi operation that followed.

The Application of Airpower in Tikrit

Although the Iraqi operation to retake Tikrit lasted six weeks—spanning early March to mid-April 2015—the coalition provided air strikes only during a one-week period in late March. Prior to that, the coalition deployed remotely piloted aircraft to Tikrit and shared some of the FMV feeds with Baghdad.¹⁰³ However, the coalition did not engage in strikes against ISIS in Tikrit during the first three weeks of the operation.

As noted in the “Background of the Tikrit Liberation” section, the limited use of airpower was due to the prominence of Iranian-backed militias in leading and executing the operation. In March, the coalition conducted 268 strikes in Iraq, 37 of which were in Tikrit and occurred during the week of March 23. This is a small figure in absolute and in relative terms (see Figure 4.8). For comparison, the coalition provided more than 250 air strikes in one month alone during the height of the Kobani operation.

Because so few strikes were delivered, it is challenging to surmise what airframes the coalition employed in the operation. B-1Bs from the USAF 37th Bomb Squadron, which relieved the 9th Bomb Squadron that supported the Kobani operation, delivered at least a portion of the 37 strikes.¹⁰⁴ Coalition bomber aircraft flew on three of the five days of the operation when the coalition struck ISIS in Tikrit. Most notably, bombers flew on the first day of strikes around Tikrit, which delivered 70 percent of the total strikes in Iraq on that date.¹⁰⁵ Although bombers clearly played a major role

¹⁰¹ Munaf Al-Abidi, “Hadi Al-‘Ameri: Law La Wujud Al-Mustasharin Al-Iraniyin La Kana Da‘ish Ihtala Al-‘Iraq” [“Hadi Al-Ameri: If Not for the Presence of Iranian Advisors, ISIS Would Have Occupied Iraq”], *Ashraq Al-Awsat*, March 13, 2015.

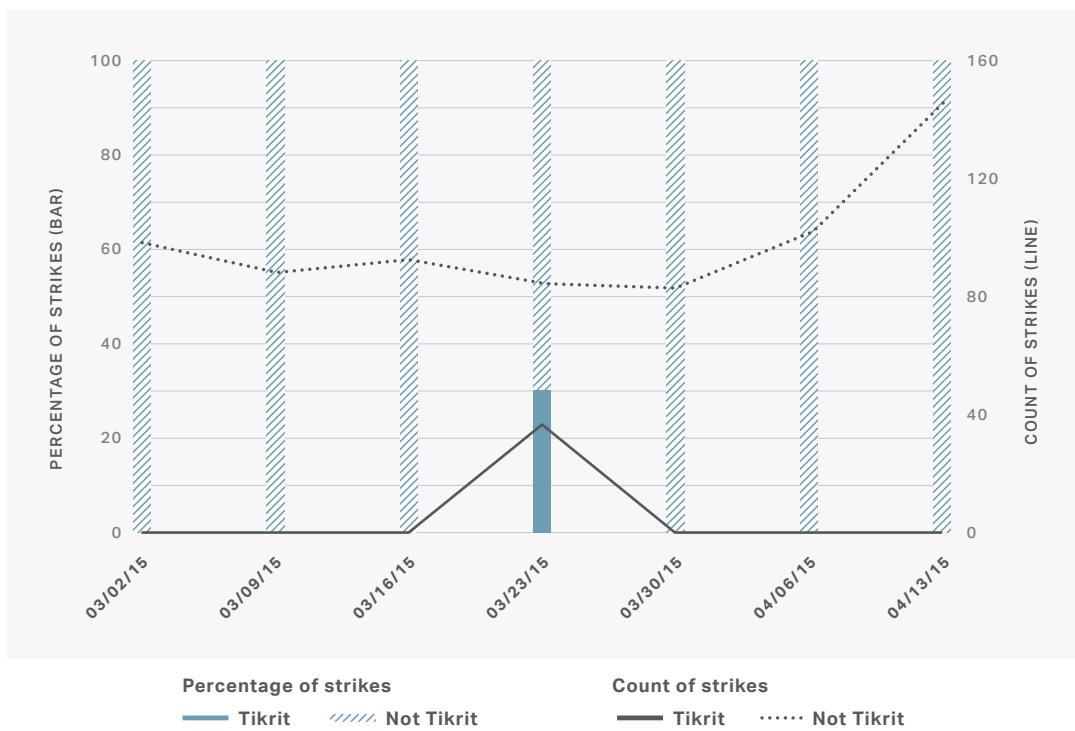
¹⁰² Erica Gaston and Frauke Maas, “Iraq After ISIL: Tikrit and Surrounding Areas,” Global Public Policy Institute, August 29, 2017.

¹⁰³ RAND interview with USAF officer, April 1, 2020.

¹⁰⁴ Wesley Morgan, “The B-1 Bomber: The Underappreciated Workhorse of America’s Air Wars: If the U.S. Air Force’s Supersonic B-1 Bomber Is One Other Thing, It’s Misunderstood,” *Washington Post*, December 30, 2015.

¹⁰⁵ RAND CJTF-OIR strike release data set.

Figure 4.8
Level of Effort in Tikrit



SOURCE: RAND CJTF-OIR strike release data set.

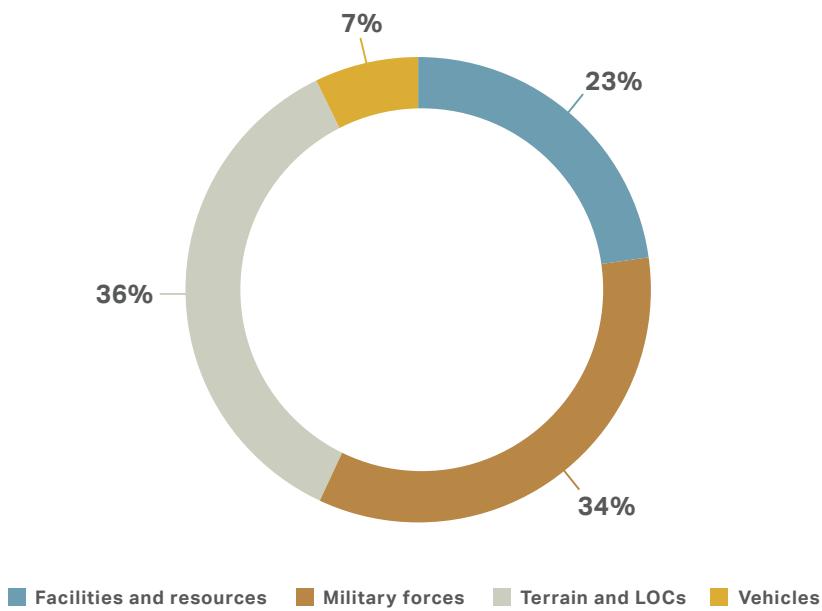
in this operation, it is unclear whether the B-1Bs were again the predominant platform. Coalition partners were also involved in the Tikrit strikes. For example, the United Kingdom executed two of the 37 strikes using Tornados, and were supported by the United Kingdom's Voyager aerial refueling tanker during the operation.¹⁰⁶

As shown in Figure 4.9, coalition strikes in Tikrit were distributed across the four categories. Because all strikes occurred within a single week and there were only 37 strikes in total, we do not analyze change over time. As observed in Kobani and other cases examined in this chapter, terrain and LOCs were the most frequent target engaged, followed by ISIS military forces, facilities and resources, and, finally, vehicles. Because of the small number of strikes, this distribution should not be overinterpreted, as even the largest category (terrain and LOCs) has just 16 targets.

Perhaps because of the absence of coalition air support for most of the operation, Iraq used some of its own aircraft in the Tikrit operation. The quantity of Iraqi

¹⁰⁶ UK Ministry of Defence, "RAF Air Strikes in Iraq and Syria: March 2015," webpage, updated September 5, 2018.

Figure 4.9
Targets Engaged in Tikrit



SOURCE: RAND CJTF-OIR strike release data set.

air strikes cannot be determined from reporting, but given the small size of the Iraqi fleet, it is likely to have been modest. The effects of the Iraqi air force strikes on Tikrit, apparently launched by Iraq's Su-25s, are also an open question.¹⁰⁷ One Iraqi strike resulted in a friendly-fire incident with an errant bomb hitting an Iraqi operations headquarters building.¹⁰⁸

Coordination with Ground Partners in Tikrit

The coalition intervened with airpower in the Tikrit operation only when Shia militias were briefly sidelined by Prime Minister al-Abadi.¹⁰⁹ At that point, al-Abadi made a

¹⁰⁷ Loveday Morris, "Iraqi Army Weighs Cost of U.S.-Led Strikes in Tikrit as Militiamen Leave," *Washington Post*, March 29, 2015.

¹⁰⁸ Rod Nordland, "Iraq Forces, Pushing ISIS Out of Tikrit, Give Few Thanks for U.S. Airstrikes," *New York Times*, April 2, 2015.

¹⁰⁹ CENTCOM Commander Lloyd Austin stated, "[What] we have done, number one, [is] highlighted a number of preconditions that must be present before we provide ISR or employ fires. Once those conditions were met, which included the Shia militia not being involved, we could proceed." U.S. Senate Committee on Armed Services, "U.S. Central Command, U.S. Africa Command and U.S. Special Operations Command Programs and Budget," hearing, March 26, 2015.

formal request for air assistance, and the coalition consented to provide the requested support.¹¹⁰ In coordinating strikes, the coalition appears to have worked primarily through the Iraqi CTS.¹¹¹ Tikrit followed the pattern of other operations, meaning that the targets identified by Iraqi forces would have been vetted and coordinated through the coalition's Baghdad-based strike cell. That said, Pentagon officials noted that the initial air strikes on Tikrit were preplanned deliberate targets, which might have obviated the need for close coordination at the very outset.¹¹²

Given the limited nature of the coalition's air intervention, which lasted only one week, Tikrit is more emblematic of a lack of coalition coordination with the predominant ground force. The Shia militias that temporarily withdrew from the operation so that Iraqi government forces would be eligible to receive air support complained about what they portrayed as efforts by the United States to position itself for credit. Some PMF supporters argued that the introduction of airpower actually hurt the operation, as it led to a loss of manpower at the front.¹¹³ Al-Ameri, a PMF commander, noted that coalition air strikes meant his forces would need to remove their own UASs from the skies of Tikrit, since his forces had no channel to deconflict with coalition air forces.¹¹⁴ The PMF employed UASs for ISR and even possessed thermal-imaging UASs for nighttime surveillance.¹¹⁵

Ultimately, the Shia militias did participate in the final ground assault on Tikrit's city center, as coalition air strikes ceased several days before the final ground maneuver. Some of those militia groups, along with members of the ISF, were observed committing extrajudicial killings against captured ISIS fighters, in addition to looting and destroying property.¹¹⁶

¹¹⁰ CENTCOM, "At the Request of PM al-Abadi, Coalition Operations Commence in Tikrit," press release, March 25, 2015.

¹¹¹ Loveday Morris, "Iraqi Army Weighs Cost of U.S.-Led Strikes in Tikrit as Militiamen Leave," *Washington Post*, March 29, 2015.

¹¹² Loveday Morris, Karen DeYoung, and Missy Ryan, "U.S. Forces Begin Airstrikes in Tikrit, Where Iran-Backed Militias Are in Lead," *Washington Post*, March 25, 2015.

¹¹³ Rod Nordland, "Iraq Forces, Pushing ISIS Out of Tikrit, Give Few Thanks for U.S. Airstrikes," *New York Times*, April 2, 2015.

¹¹⁴ Throughout this report, we use *UASs* to refer to partner and adversary unmanned aircraft, as they are less advanced than USAF and coalition RPAs. Alsumaria, "Hadi Al-'Ameri: 'Musharakan Al-Tahaluf Al-Dawli bi Tikrit Satamna'na min Nashr Ta'iratina Al-Masira'" ["Hadi Al-Ameri: The International Coalition's Participation in Tikrit Will Prevent Us from Deploying Our Drones"], March 25, 2015.

¹¹⁵ Alsumaria, "Kayf Tusa'id Al-Ta'irat Al-Musayra Al-Hashd Al-Sha'bi li Rasd Taharkat Da'ish" ["How Do Drones Help the PMFs Track ISIS's Movements"], YouTube video, January 16, 2017.

¹¹⁶ Ned Parker, "After Iraqi Forces Take Tikrit, a Wave of Looting and Lynching," Reuters, April 3, 2015.

Conclusion for the Tikrit Case

The Tikrit case underscores the difficult choices that the coalition faced in countering ISIS from the air when trusted and capable ground partners were not available. On the one hand, U.S. aircraft could not directly support Iranian-backed militias, and withholding airpower could be used as leverage in an attempt to change the approach of Baghdad toward ground operations. On the other hand, the presence of the PMF and its commitment to fight even when facing high casualties provided the government of Iraq a pool of manpower it could not easily cast away, given the poor state of government-controlled forces, especially in the early phases of the fight against ISIS. In Tikrit, the result was an uneasy balance in which Shia militias were temporarily sidelined from the fight, enabling coalition air strikes, but returned for the final assault on Tikrit, operating in precisely the manner that the coalition feared.

That said, Tikrit was a particularly difficult case for reining in the PMF. Tikrit was the first large population center—more than 100,000 inhabitants—liberated in the campaign and was the site of a recent ISIS-perpetrated massacre against mainly Shia air force cadets. Indeed, the militias called the operation “Revenge for the Martyrs of Speicher,” in reference to the massacre.¹¹⁷ The government had just begun retraining its forces that collapsed so suddenly in Mosul less than a year prior, so there were few alternatives to the PMF. All of these factors meant that reining in the Shia militias would be even more difficult during the Tikrit operation. The coalition applied these lessons learned to its next major operation, the liberation of Ramadi, which occurred just ten months later and proved to be the counterpoint to Tikrit.

Regaining Lost Ground: The Ramadi Liberation, July 2015–January 2016

Background of the Ramadi Liberation

Ramadi serves as a transit point and administrative center between Iraq’s Sunni Arab heartland and Baghdad, from which Ramadi sits only 120 kilometers to the west. Ramadi’s proximity to the capital and position on the major GLOC that connects Iraq’s western territory to its capital city means that an insurgent force holding Ramadi represents a threat to Baghdad.¹¹⁸ Conversely, government control of Sunni majority Ramadi provides a foothold to project force into a restive region in post-2014 Iraq. A Euphrates River Valley town, Ramadi was fertile territory for the rise of al-Qaeda in Iraq in the mid-2000s and fell under ISIS control during the group’s 2014–2015

¹¹⁷ Al-Masalah, “Intilaq ‘Amaliyat Tha’r Shuhada’ Speicher” [“Kick Off of the Revenge for the Martyrs of Speicher Operation”], March 10, 2015.

¹¹⁸ Ramadi also sits on the road connecting western Iraq to the holy city of Karbala. Therefore, a Sunni insurgent force in Ramadi posed a threat to Iraqi Shia access to this shrine city, as well as a threat to religious sites in the city itself.

advance.¹¹⁹ As the provincial capital of Al Anbar, Ramadi contains large government buildings that can be used for administrative purposes or to muster forces. Additionally, one of Iraq's military air bases, At-Taqaddum (TQ),¹²⁰ is located just 25 kilometers to the city's east. Indeed, TQ was a site American forces used to plan and assist in Ramadi's liberation.¹²¹

When Ramadi fell to ISIS in May 2015, the city became synonymous with the endemic weakness of the Iraqi military, which "drove out of Ramadi."¹²² A sandstorm prevented coalition aircraft from intervening in support of the ISF, which might have contributed to the forces' sense of panic. An interviewee for this project described with frustration watching the ISF abandon equipment, including U.S.-provided armor, when confronted by a much smaller ISIS assault force.¹²³ The fall of Ramadi was the backdrop for Secretary of Defense Ash Carter's remark that the Iraqi military lacked "the will to fight,"¹²⁴ and President Obama himself termed it a "tactical setback."¹²⁵

Ramadi also caused consternation, as it showed that ISIS could still go on the offensive, nearly ten months after coalition operations to defeat ISIS began. Therefore, the fall of the city was widely covered in both Western and regional media as a setback for the defeat-ISIS campaign.¹²⁶ These atmospherics did not improve when initial ISF efforts to liberate the city failed to drive out ISIS, despite the fact that the ISF enjoyed a substantial numerical advantage and superior equipment.¹²⁷

¹¹⁹ Patrick B. Johnston, Jacob N. Shapiro, Howard J. Shatz, Benjamin Bahney, Danielle F. Jung, Patrick Ryan, and Jonathan Wallace, *Foundations of the Islamic State: Management, Money, and Terror in Iraq, 2005–2010*, Santa Monica, Calif.: RAND Corporation, RR-1192-DARPA, 2016, pp. 16, 33.

¹²⁰ Some readers may be more familiar with the name Camp Manion than TQ. Camp Manion is the portion of TQ where coalition forces operate, whereas the broader base (i.e., TQ) is Iraqi-operated. See Thomas Gibbons-Neff, "Behind the Scenes in the Marine Corps Mission Against the Islamic State," *Washington Post*, December 22, 2015.

¹²¹ COL Steven Warren, an OIR spokesperson, clarified that "U.S. forces are only at Taqaddum." Steven Warren, "Military Operations in Iraq and Syria," briefing, C-SPAN, December 29, 2015; David Alexander, "US Troops at Taqaddum to Help Iraqis Plan Fight for Ramadi," Reuters, June 12, 2015.

¹²² Jim Garamone, "Dempsey: Iraqi Forces Not Driven from Ramadi, They Drove out of Ramadi," U.S. Department of Defense, May 20, 2015.

¹²³ RAND interview with Maj Gen (ret.) Bruce Miller, January 8, 2020.

¹²⁴ Ash Carter, "A Lasting Defeat: The Campaign to Destroy ISIS," Belfer Center for Science and International Affairs, Harvard Kennedy School, October 2017.

¹²⁵ Jeffrey Goldberg, "Look . . . It's My Name on This: Obama Defends the Iran Nuclear Deal," *The Atlantic*, May 21, 2015.

¹²⁶ David Ignatius, "Fall of Ramadi Highlights 'Fundamental Failure' of U.S. Strategy in Iraq," interview by Robert Siegel, *All Things Considered*, NPR, May 20, 2015; "Hal Haqqal Tanzhim al-Dawla Shi'arihi Baqiya wa Tatamadad?" [Has the Islamic State Achieved Its Slogan of Remain and Expand?], *The Opposite Direction*, aired May 22, 2015.

¹²⁷ Kenneth M. Pollack, "What the Liberation of Ramadi Means for Iraq, Iran, and the U.S.," Brookings Institution, December 29, 2015.

As the coalition considered how to reverse this negative trajectory, it settled on an approach that elevated civilian security in operational planning, even if that introduced a delay in the ultimate counterattack on Ramadi. The planning of the Ramadi operation was intended to correct some of the problematic aspects of the Tikrit operation discussed previously, particularly the Iraqis' overreliance on the PMF as an assault force. Thus, Ramadi became a test case for the United States' ability to use airpower and other military assistance as leverage to get Iraqi forces to improve their planning and execution of counterattacks on ISIS-controlled population centers to sideline the PMF.

The U.S. decision to condition enablers for the Ramadi operation on Iraqi government forces operating in the lead helped persuade Prime Minister al-Abadi to rely more heavily on the CTS, along with the Iraqi Army and Federal Police. U.S. planners were also able to persuade their Iraqi counterparts to prioritize civilian security in their operational planning, which was in line with U.S. efforts to reduce collateral damage during operations. Finally, Ramadi was part of a string of operations in which coalition and Iraqi ground forces consciously left routes of egress for fleeing ISIS forces, which was a ploy intended to bomb ISIS in open spaces outside the city, thereby reducing the risk of civilian casualties.¹²⁸ Collectively, these decisions helped reduce the risk of future reversals following liberation. Once the coalition's conditions were met by the al-Abadi government, air operations significantly contributed to the liberation of Ramadi, with one CJTF-OIR spokesperson crediting 80 percent of the operation's success to air strikes.¹²⁹

The Application of Airpower in Ramadi

Before Iraqi forces began the ground offensive to liberate Ramadi in December 2015, coalition aircraft softened ISIS defenses in Ramadi and the surrounding areas. Although the exact participation of coalition members in this operation is not known, the United States, United Kingdom, Australia, and Canada all confirmed air strikes in or near the vicinity of Ramadi during the time frame of the operation.¹³⁰ From July 2015 until late November 2015, the coalition carried out more than 500 strikes—including both air strikes and artillery strikes—in and around Ramadi.¹³¹ This constituted 20 percent of total strikes the coalition undertook in Iraq and Syria during this period (see Figure 4.10). Air strikes were highly distributed across the theater during this period and included concerted attacks in Mosul, Sinjar, and Al-Hasakah, in addi-

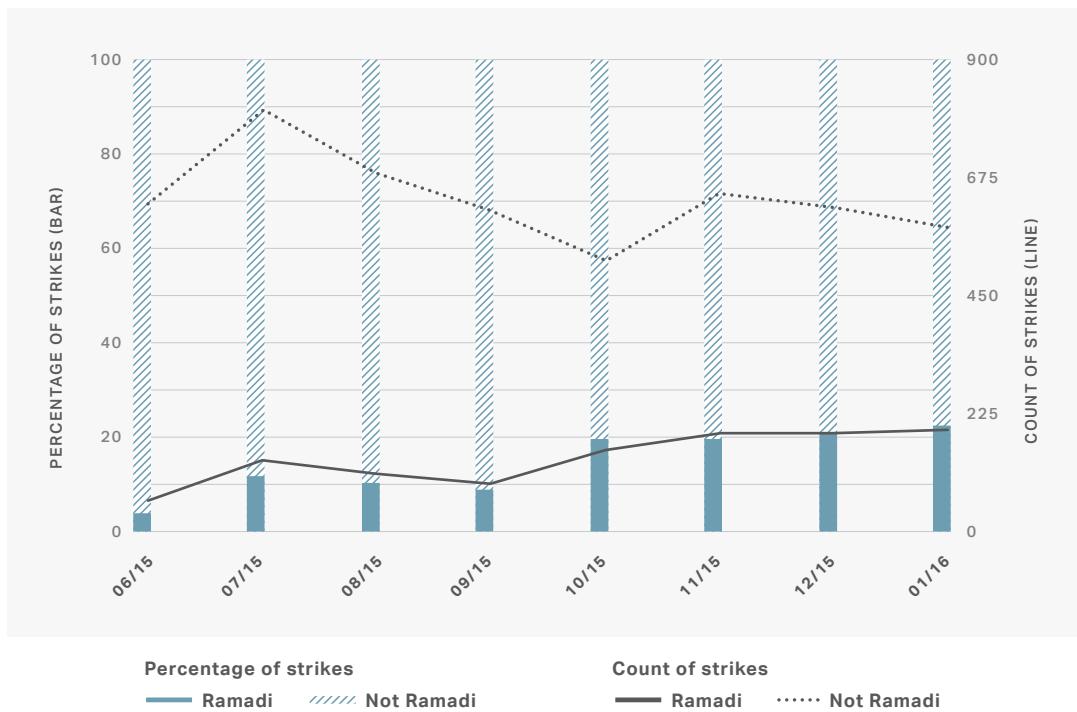
¹²⁸ RAND interview with Gen Charles Q. Brown, February 20, 2020.

¹²⁹ Nancy Youssef and Shane Harris, "How ISIS Actually Lost Ramadi," *Daily Beast*, December 30, 2015.

¹³⁰ Ewen MacAskill, "UK Provides Air Support as Iraqi Army Moves to Retake Ramadi from ISIS," *The Guardian*, December 23, 2015; Government of Canada, "Operation IMPACT," webpage, undated.

¹³¹ Rocket-propelled artillery was introduced into CJTF-OIR strike counts in October 2015. All data cited in this section are drawn from the RAND CJTF-OIR strike release data set.

Figure 4.10
Level of Effort in Ramadi



SOURCE: RAND CJTF-OIR strike release data set.

tion to Ramadi.¹³² This was partly a result of several active battle fronts, although the coalition also made a conscious decision to broadly keep pressure on ISIS and thereby avoided a myopic focus on supporting a single operation.¹³³

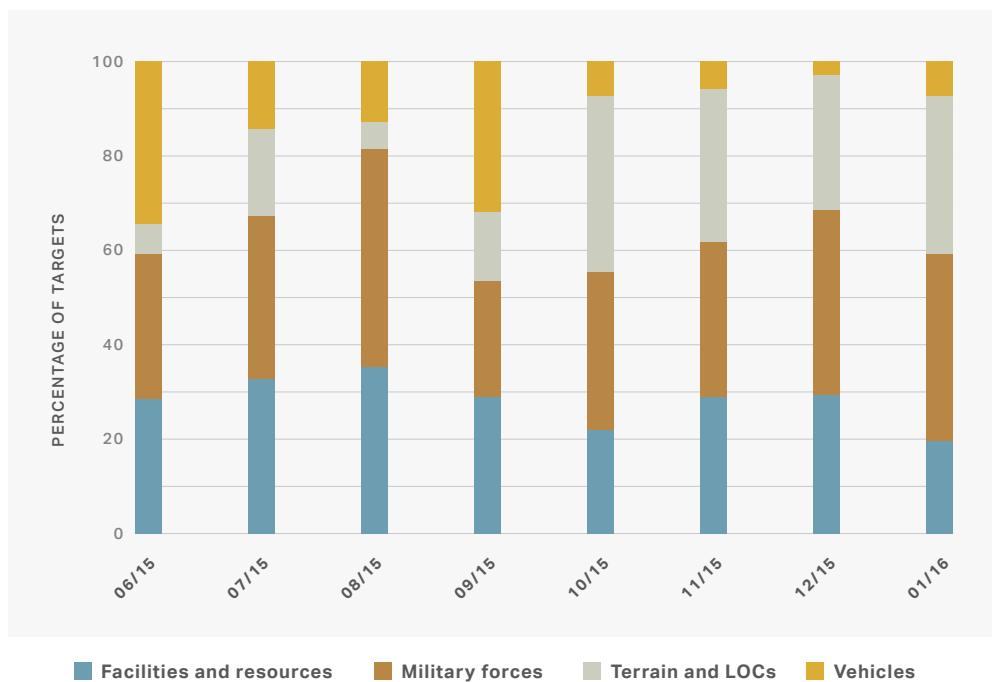
The most common targets engaged in Ramadi were ISIS's military forces (36 percent), followed by terrain and LOCs (28 percent), followed closely by facilities and resources (27 percent), and rounded out by vehicles (9 percent) (see Figure 4.11). Although there was some change over time—the proportion of strikes on vehicles declined, whereas the proportion of strikes on terrain and LOCs rose—the distribution across target types remained fairly stable over the course of the operation.

After five months of air strikes, as well as advising and equipping efforts to rebuild the Iraqi military, in late November 2015, the ISF began its ground assault on Ramadi in earnest. Efforts to discourage the use of the PMF in favor of Iraqi Ministry of Defence and Ministry of Interior forces also had an effect, as the Shia militias played a

¹³² RAND CJTF-OIR strike release data set.

¹³³ RAND interview with Maj Gen (ret.) Bruce Miller, January 8, 2020.

Figure 4.11
Targets Engaged in Ramadi



SOURCE: RAND CJTF-OIR strike release data set.

less prominent role in this operation. ISIS mined the perimeter of the city to slow the ISF's advance and employed direct and indirect fire to attrite Iraqi forces that were sent to disable the mines.¹³⁴ Although the mines proved to be a formidable obstacle, with air support, Iraqi forces were eventually able to surround the city, a step that was completed when the ISF captured the Palestine Bridge, a major gateway into Ramadi.¹³⁵ At that point, the Iraqi CTS and Federal Police secured one side of the city outskirts and the 9th Division of the Iraqi Army secured the opposite side.¹³⁶

In late November 2015, coinciding with the ISF's assault on the city,¹³⁷ coalition aircraft shifted from shaping strikes to providing CAS to troops in contact with

¹³⁴ RAND interview with LTG (ret.) Sean MacFarland, March 31, 2020.

¹³⁵ “Al-Jaysh Al-‘Iraqi Yasta‘id Mintaqa Muhimma fi Ar-Ramadi min Saytarat Tanzhim Al-Dawla Al-Islamiya” [“The Iraqi Army ‘Retakes an Important Area’ in Ramadi from the Control of the ‘Islamic State’”], BBC Arabic, December 8, 2015.

¹³⁶ “Iraqi Forces Cut Last IS Supply Line to Ramadi by Retaking Bridge,” Reuters, November 26, 2015.

¹³⁷ This report takes November 25, 2015, as the start of a new phase in the Ramadi campaign, focused on clearing operations with ground forces in close contact with the enemy. “Iraqis Launch Offensive to Retake Ramadi

the enemy through dynamic strikes.¹³⁸ Over the next two months, Iraqi forces fought to liberate the city center from remaining ISIS fighters. This led to a spike in U.S. strikes around Ramadi, which jumped from an average of just more than 100 per month to more than 150 per month during the final stages when ISF members were actively clearing the city. During the last two months of the offensive, a full 44 percent of strikes launched by the coalition were in the Ramadi area. The primary target types remained similar to the earlier period, with ISIS's defensive positions (terrain and LOCs), ISIS tactical units (military forces), and the group's physical infrastructure (facilities and resources) still focal points of strikes (see to Figure 4.11).

Reflecting back on the operation, then-Lt Gen Charles Q. Brown, the CFACC during Ramadi, noted that it reminded him of the "Battle of Britain. . . . [There were] a lot of assets overhead a single location, limiting a lot of things we could do before [the ISF] got to Ramadi or other locations."¹³⁹ He explained that Ramadi revealed the need to improve target development for deliberate strikes so that the coalition was "looking to hit before we had troops in contact."

Although the precise breakdown of airframes used to support the Iraqi ground maneuver has not been publicly reported, the U.S. military has confirmed that bombers (B-1Bs), fighters (e.g., F-15Es, F-16s), ground attack aircraft (e.g., A-10s), and remote piloted aircraft (e.g., MQ-9s) were all employed in the operation.¹⁴⁰ The UK Ministry of Defence acknowledged the participation of Tornados, Typhoons, and MQ-9 Reapers in the operation, employing Hellfires, Paveway IV laser-guided munitions, and GPS-guided bombs.¹⁴¹ Although UK strike release data are not structured in the same way as the CJTF-OIR strike release data, and thus not strictly comparable, UK strike releases suggest significant UK participation in the Ramadi operation. For example, in November 2015, the United Kingdom delivered strikes in Ramadi on at least nine different days during that month.¹⁴² Canadian CF-18s and Australian F/A-18A Hornets from its Air Task Group also participated in air strikes on Ramadi.¹⁴³

from ISIS," *Military Times*, November 26, 2015.

¹³⁸ For readers interested in viewing video footage of coalition air strikes supporting Iraq ground force maneuvers in Ramadi, see John_Nap, "Iraqis Advance in Ramadi," Military.com video, December 16, 2015; John_Nap, "Airstrikes in Ramadi," Military.com video, November 30, 2015.

¹³⁹ RAND interview with Gen Charles Q. Brown, February 20, 2020.

¹⁴⁰ "Iraqis Launch Offensive to Retake Ramadi from ISIS," *Military Times*, November 26, 2015.

¹⁴¹ UK Ministry of Defence, "RAF Air Strikes in Iraq and Syria: September 2015," webpage, updated September 5, 2018; UK Ministry of Defence, "RAF Air Strikes in Iraq and Syria: October 2015," webpage, updated September 5, 2018; UK Ministry of Defence, "RAF Air Strikes in Iraq and Syria: December 2015," webpage, updated September 5, 2018.

¹⁴² UK Ministry of Defence, "RAF Air Strikes in Iraq and Syria: November 2015," webpage, updated September 5, 2018 (the days are November 1, 5, 11, 12, 13, 17, 26, 27, and 29).

¹⁴³ Government of Canada, "Operation IMPACT," webpage, undated; "Australian Military Praised for 'Vital' Role in Iraqi Recapture of Ramadi from Isis," *The Guardian*, December 30, 2015.

In terms of USAF assets, interviewees suggested that A-10s played an outsized role at the outset of the operation, but the contributions of B-1s and fighter aircraft rose over time.¹⁴⁴ The A-10s flew from Kuwait, which among the Gulf Cooperation Council basing locations was the closest to Ramadi.¹⁴⁵ Unlike Kobani, DCA capabilities were not needed, since the coalition was operating in a permissive environment—at the request of the government—in Iraq.

Ramadi was advantageous from a basing perspective in that the main air corridor, or “highway,” being used by coalition aircraft that launched from the Gulf Cooperation Council states crossed Baghdad to its west, near Ramadi.¹⁴⁶ UK strike assets—in particular, Tornado GR4s—flew from RAF Akrotiri, a sovereign UK base located in Cyprus.

Coordination with Ground Partners in Ramadi

During the battle for Ramadi, the main coalition strike cell for central Iraq operations was located at Union III, a facility just outside the U.S. Embassy compound in Baghdad but still within the Green Zone. That strike cell was colocated at CJOC-B, with the latter serving as an important mechanism for getting required Iraqi approvals of coalition strikes.¹⁴⁷ CJOC-B encompassed multiple functions, including coalition coordination with Iraqi partners and operations planning. The strike cell was one function within the broader mandate of CJOC-B and one in which Iraqis did not directly participate. In addition to CJOC-B, U.S. special operators were using a facility on the grounds of the Baghdad International Airport (BIAP) as the location of their coordination cell. Finally, U.S. personnel were conducting advise-and-assist efforts at the brigade level in two locations—the Anbar Operations Command and TQ, closer to the fight.¹⁴⁸

At this point in the campaign, the strike coordination process had evolved into a federated structure, meaning that each of these locations—BIAP, the Anbar Operations Command, and TQ—was liaising with different parts of the ISF. In general, BIAP was supporting the CTS, whereas the other locations were coordinating CAS with Iraqi conventional units. The strike cell at Union III sat above these entities, conducting the airspace deconfliction for dynamic strikes and serving as the ultimate TEA.

¹⁴⁴ RAND interview with Maj Gen (ret.) Bruce Miller, January 8, 2020; USAF officer, April 1, 2020.

¹⁴⁵ Eric Schmitt, “U.S. Adds Planes to Bolster Drive to Wipe Out ISIS,” *New York Times*, November 26, 2014.

¹⁴⁶ RAND interview with coalition personnel, March 4, 2020.

¹⁴⁷ RAND interview with LTG (ret.) Sean MacFarland, March 31, 2020.

¹⁴⁸ The Anbar Operations Command moved to TQ after ISIS was expelled from Ramadi. See Rick Hurtado, “The Role of U.S. Troops During Operations in Anbar Province,” Combined Joint Task Force—Operation Inherent Resolve, February 6, 2016.

A firsthand account written by one of the senior JTACs and the dynamic TEA includes treatment of strikes in Ramadi coordinated from BIAP.¹⁴⁹ That account notes that during one of the ISF's early assaults on Ramadi, an Iraqi ground unit requested air support when taking machine gun and sniper fire inside the city. The unit under fire initiated the request by calling back to the rear base, where its commanders were located. U.S. SOF advisers were embedded with the Iraqis at this location, enabling a SOF representative to relay the message to the BIAP strike cell. The strike cell then began the process of validating the targets through use of manned and unmanned ISR assets and gaining the approvals. At that stage, coalition assets were used to strike the targets. Although the ISF often did initiate the request for air support, the decision to execute a strike—or choosing not to—was very much the purview of the coalition.¹⁵⁰

Ramadi was also the first operation in which the U.S. Army employed surface fires using HIMARS.¹⁵¹ Although surface fires added another tool to the coalition's repertoire, they introduced the complexity of deconflicting long-range artillery salvos with air strikes, since rockets or missiles launched from HIMARS needed to use airspace over Ramadi, where there were aircraft circling in the CAS stack. The Baghdad-based strike cells that managed air-ground coordination in this area of Iraq were the mechanism used to coordinate both air and surface fires in Ramadi, although coalition forces operating from TQ, where the surface fires were based, had input in this process.¹⁵²

Although the Iraqi government was solicitous of U.S. airpower for the Ramadi fight—and indeed acquiesced to U.S. preferences in prosecuting ground operations to receive it—the Iraqis still had a preference for less visible airframes. For example, Washington offered the U.S. Army's AH-64 Apache attack helicopters armed with Hellfire missiles to Prime Minister al-Abadi for the Ramadi operation.¹⁵³ However, al-Abadi declined, presumably because low-flying helicopters were more visible than fixed-wing aircraft and smaller RPAs and brought back memories of the 2003–2011 U.S. intervention, which was still a sensitive topic.¹⁵⁴ Thus, “fast movers” and RPAs flying at medium and high altitudes were deemed more palatable.

¹⁴⁹ Dana Pittard and Wes Bryant, *Hunting the Caliphate: America's War on ISIS and the Dawn of the Strike Cell*, New York: Post Hill Press, 2019.

¹⁵⁰ RAND interview with USAF officer, February 4, 2020.

¹⁵¹ An Army battery that operated HIMARS deployed as a part of Operation Spartan Shield in May 2015. Wesley Morgan, “How the U.S. Campaign in Iraq Has Escalated with a New Weapon: Rocket Artillery,” *Washington Post*, November 24, 2015; Christopher Rossi, “1-14th FA Bid Deployment Farewell,” U.S. Army, May 28, 2015.

¹⁵² RAND interview with USMC officer, January 15, 2020.

¹⁵³ Ash Carter, “A Lasting Defeat: The Campaign to Destroy ISIS,” Belfer Center for Science and International Affairs, Harvard Kennedy School, October 2017.

¹⁵⁴ Richard Sisk, “Mission to Retake Fallujah from ISIS Delayed as Forces Focus on Mosul,” *Military Times*, May 16, 2016.

Iraqi military commanders were also quick to cite their role in approving and directing coalition air strikes. For instance, once the battle culminated in close-quarter force-on-force engagements, Iraqi commanders maintain that they had significant influence over which targets were struck. An Iraqi SOF Division commander who led operations in the city noted, “Sometimes we locate the targets, and sometimes it’s the Americans, but they don’t hit it until they get our permission.”¹⁵⁵ Similar accounts were relayed by Iraqi conventional forces, with a member of the ISF’s 7th Infantry Division noting that “the International Coalitions’ planes, in coordination with the 7th Division, struck Daesh’s main headquarters [West of Ramadi], killing twenty-two members of the organization and destroying the facilities.”¹⁵⁶

Conclusion for the Ramadi Case

In retrospect, Ramadi can be seen as the start of a string of successful ground offensives that would culminate in the defeat of the physical caliphate. However, many Western analysts and policymakers remained skeptical of the value of the victory at the time. A prominent American analyst noted that the ISF enjoyed between a ten to one and 20 to one numerical advantage over remaining ISIS forces during the final ground assault, implying that realizing those conditions for other operations would be difficult to replicate.¹⁵⁷ Iraqi analysts were similarly cautious, noting that it appeared ISIS orchestrated a withdrawal of forces from Ramadi to preserve its fighting power.¹⁵⁸ But even skeptics of the value of retaking Ramadi had to concede that the outcome was a major improvement over the grim prognostications made after the Iraqi Army lost Ramadi in May 2015. That setback prompted forecasts that perhaps the Iraqi government would simply cede some restive areas of Al Anbar, of which Ramadi is the provincial capital, to ISIS’s control.¹⁵⁹

The Ramadi operation also demonstrated that the United States had the leverage to influence how the ISF planned and executed operations. Specifically, the United States and its coalition partners persuaded Baghdad to use Iraqi conventional and Iraqi SOF under its C2 rather than relying on the manpower of the PMF. That led to

¹⁵⁵ Jane Arraf, “How Iraqi Forces Drove ISIS from Ramadi,” *Newsweek*, February 25, 2016.

¹⁵⁶ Shafaqna, “Al-Quwat al-Amniya Tuharir Mintaqat Hasiba Al-Sharqiya wa Taftah Tariq Baghdad-Ramadi” [“The Security Forces Liberate the Hasiba Sharqiya Area and Open the Baghdad-to-Ramadi Road”], February 9, 2016.

¹⁵⁷ Kenneth M. Pollack, “What the Liberation of Ramadi Means for Iraq, Iran, and the U.S.,” Brookings Institution, December 29, 2015; see also John Ford, “The Long Road to Fallujah and Mosul,” *National Interest*, January 26, 2016.

¹⁵⁸ Raid al-Hamad, “Ma’rakat Al-Ramadi: Makasib Al-Tahaluf wa Taktikat Tanzhim Al-Dawla” [“The Battle of Ramadi: The Coalition’s Gains and the Islamic State’s Tactics”], Al Jazeera Centre for Studies, February 13, 2016.

¹⁵⁹ Michael Knights, “Anbar First, Mosul Never? Iraq’s Strategy for Defeating ISIS,” *Foreign Affairs*, May 27, 2015.

fewer excesses than the problematic Tikrit operation that preceded Ramadi, suggesting a more sustainable outcome in Ramadi. It did, however, lead to high attrition rates among the Iraqi government's most-capable force, the CTS. To give an indication of how intense the fighting was to reach the city limits in the early part of the operation, ISIS destroyed more than 200 CTS Humvees between August and November 2015 alone.¹⁶⁰

In the delivery CAS to the ISF in Ramadi, the coalition successfully employed a federated strike cell model. This allowed for coalition forces that had formed strong relationships with particular ISF units (e.g., U.S. SOF with the Iraqi CTS) to remain the trusted conduit for coordinating air support, albeit with the strike cell at CJOC-B operating as the ultimate coordination body sitting above these individual cells. Ramadi was also a further demonstration of the reassurance and confidence Iraqi forces derived from the promise of airpower. Looking back at the operation, CJFLCC Commander MG Gary Volesky noted, "the [ISF] needed some confidence. They had no confidence. Ramadi started it."¹⁶¹

With Ramadi eventually liberated in early 2016, CJTF-OIR was at a decision point of whether to advance further to the west or focus on pushing north toward Mosul, using the progress made on the Baghdad-to-Baiji highway as a staging ground. Clearing west had the advantage of putting ISIS's supply lines in jeopardy, since ISIS was using the border crossing between Abu Kamal and Al-Qaim as a key route for flowing fighters and material to the Iraqi front.¹⁶² On the other hand, pushing up the Tigris was necessary for an eventual multipronged assault on Mosul. The coalition decided to focus on the latter, designating upper Anbar as an economy-of-force mission.¹⁶³ Liberation of these areas would be sequenced after the taking of Mosul.

Reclaiming ISIS's Iraqi Capital: Mosul, October 2016–July 2017

Background of the Battle of Mosul

When ISIS militants seized Mosul in early June 2014, it signaled a much larger threat than the group was previously believed to pose. Although ISIS had occupied smaller towns in Al Anbar governorate months earlier, there was hope that it could be contained as a local insurgency rather than the transnational threat it would become—

¹⁶⁰ David Witty, *Iraq's Post-2014 Counterterrorism Service*, Washington, D.C.: Washington Institute, October 2018, p. 54.

¹⁶¹ Gary J. Volesky, "Department of Defense Press Briefing by Army Maj. Gen. Gary J. Volesky via Teleconference from Baghdad, Iraq," transcript, U.S. Department of Defense, October 19, 2016.

¹⁶² RAND interview with U.S. Army officer, December 2, 2019.

¹⁶³ RAND interview with USMC officer, January 17, 2020.

until it overran Mosul.¹⁶⁴ ISIS's earlier advance into Al Anbar in January 2014 coincided with Russia's seizure of Crimea in February, likely contributing to Washington's early tendency to downplay the ISIS threat so as to focus on the larger geopolitical threat.¹⁶⁵ The fall of Mosul elevated the ISIS threat and put the United States and its international partners on the path to the military intervention that followed.

ISIS's ability to overrun Mosul was significant for several reasons. First, it illustrated that the group possessed enough military capability to seize and hold a major urban area. Second, it revealed that Iraqi conventional forces were poorly organized and led and exhibited very little commitment to defend state territory—as would be seen in later cases, such as Ramadi. Third, Mosul afforded ISIS a large, populated area where it could showcase its governance model and build up economic resources.¹⁶⁶ Specifically, ISIS seized currency from Mosul's banks, and the city is adjacent to the Nineveh Plains, a rich agricultural area that would provide ISIS an agricultural tax base. Lastly, Mosul operated as one of ISIS's twin capitals and was the site where ISIS's leader, Abu Bakr al-Baghdadi, introduced himself as the “caliph” at a Friday sermon from Mosul's iconic Great Mosque of al-Nuri.

Because of Mosul's strategic significance, the eventual liberation of the city was thought of as a major culminating point of the defeat-ISIS campaign on the Iraqi side of the border. Many of the preceding steps in the campaign were carefully orchestrated to establish staging grounds for the counterattack on Mosul. For example, the ISF's push up the Tigris (code-named Valley Wolf), which included a contested river crossing that moved forces to the west side of the river, was designed with the goal of establishing a staging ground for Mosul at Q-West airfield.¹⁶⁷ Similarly, the coalition worked with the Kurdish Peshmerga to painstakingly move the Kurdish defensive line, an actual physical line of berms and trenches visible from the air,¹⁶⁸ east to west until the coalition was in possession of the high ground above eastern Mosul from which it could bring indirect fire to bear.¹⁶⁹

Once Iraqi forces breached Mosul's perimeter, they cleared the city from east to west. This approach leveraged the existing Kurdish defensive line and allowed the ISF to freely stage in Peshmerga-controlled territory prior to the assault, instead of having

¹⁶⁴ Lynn E. Davis, Jeffrey Martini, and Kim Cragin, *A Strategy to Counter ISIL as a Transregional Threat*, Santa Monica, Calif.: RAND Corporation, PE-228-RC, July 2017.

¹⁶⁵ AFHRA interview with Maj John S. Graham, August 8, 2018.

¹⁶⁶ Eric Robinson, Daniel Egel, Patrick B. Johnston, Sean Mann, Alexander D. Rothenberg, and David Stebbins, *When the Islamic State Comes to Town: The Economic Impact of Islamic State Governance in Iraq and Syria*, Santa Monica, Calif.: RAND Corporation, RR-1970-RC, 2017, pp. 73–99.

¹⁶⁷ Ryan Wylie, Aaron Childers, and Brett Sylvia, “Expeditionary Advising: Enabling Iraqi Operations from the Gates of Baghdad Through Eastern Mosul,” *Small Wars Journal*, February 22, 2018.

¹⁶⁸ RAND interview with U.S. Army officer, December 2, 2019.

¹⁶⁹ RAND interview with U.S. Army official, February 18, 2020.

to fight north from Q-West.¹⁷⁰ This also had the advantage of facilitating the egress of civilians from the city and isolating ISIS in ever-smaller sections until the final assault. The two sides of the city—east and west—are separated by the Tigris. Mosul’s Old City is located in the easternmost stretch of western Mosul, overlooking the river. Western Mosul proved to be some of the most intense and destructive fighting of the operation. It also posed challenges for employing airpower, primarily because of civilian casualty concerns but also because the urban planning produced difficult-to-navigate angles in delivering strikes.¹⁷¹

The Application of Airpower in Mosul

During the liberation of Mosul, the coalition launched the largest number of air strikes in OIR at that time. In total, the coalition conducted more than 1,500 strikes in a roughly 12-month period, beginning in the late summer of 2016 with shaping operations, which then progressed to support the Iraqi ground maneuver into eastern Mosul in late 2016 and in west Mosul in 2017.¹⁷² Although those involved in the operation are quick to note the different scale of the operation relative to other battles that preceded it,¹⁷³ USAF Brig Gen Matthew Isler, then—deputy commanding general for air at CJFLCC, affirmed, “You measure [air strikes’] success not by what you hit, but by what the effect was on the enemy.”¹⁷⁴ By that measure, airpower paired with a ground force composed of the conventional Iraqi Army, the Iraqi CTS, Federal Police, and Kurdish Peshmerga was able to leverage these strikes to liberate the largest population center that fell under ISIS control. The force succeeded despite ISIS investing a large portion of its remaining manpower in defending Mosul, estimated at 3,000–5,000 fighters.¹⁷⁵ ISIS also had the advantage of operating in dense urban areas that aided in its concealment and limited coalition air and ground fires out of concern for civilian casualties.

The fight to retake Mosul was grinding, taking months to complete and inflicted heavy casualties on the combined liberation force. The CTS suffered an estimated 40 percent to 60 percent attrition rate among its forces involved in the Mosul opera-

¹⁷⁰ It also prevented inadvertent ISF-Peshmerga friendly fire incidents because both sides were firing from the same direction. RAND correspondence with Brig Gen Matthew Isler, July 22, 2020.

¹⁷¹ AFHRA interview with Maj Joe Biles, September 24, 2019.

¹⁷² The official kickoff date for the Mosul operation was October 17, 2016; however, as demonstrated in our presentation of strike data in Appendix D, shaping operations were already under way. For CJTF-OIR Commander Townsend’s announcement of the start of operations, see DoD, “Operation Inherent Resolve Commander Announces Mosul Counteroffensive,” YouTube video, October 17, 2016.

¹⁷³ RAND interview with U.S. Navy officer, February 3, 2020.

¹⁷⁴ Stephen Losey, “With 500 Bombs a Week, Mosul Airstrikes Mark ‘the Most Kinetic’ Phase of ISIS Air War So Far,” *Air Force Times*, March 28, 2017.

¹⁷⁵ Mosul Study Group, *What the Battle for Mosul Teaches the Force*, Washington, D.C.: U.S. Army, September 2017, p. 5.

tion.¹⁷⁶ In the first six months of the operation, it is estimated that 774 Iraqi troops were killed and 4,600 were wounded.¹⁷⁷ Western Mosul, including the Old City, was heavily damaged in the fighting,¹⁷⁸ although it is not possible to parse what share of the destruction was due to ISIS and ISF employment of fires vice coalition strikes based on publicly available data.

Despite the coalition adhering to involved processes for avoiding civilian casualties, ISIS's intentional use of civilians as human shields contributed to significant civilian harm. DoD internal investigations suggest that 305 civilians were inadvertently killed in coalition air strikes supporting the Mosul operation in 2017 alone.¹⁷⁹ In the deadliest of these incidents, more than 100 civilians were killed in a single March 2017 strike in which it is believed that ISIS consciously attracted a coalition strike by positioning snipers on a roof but then packed lower floors with explosives, which collapsed the building and killed residents sheltering from the fighting in the floors below.¹⁸⁰ Airwars estimated that between 1,066 and 1,579 civilians are likely to have died as a result of coalition strikes in Mosul.¹⁸¹ Prime Minister al-Abadi similarly stated that 1,260 civilians—at most—were killed during the fight to liberate Mosul.¹⁸²

Figure 4.12 shows the number of air strikes launched by the coalition in Mosul. The figure confirms that, cumulatively, Mosul was the largest use of airpower in OIR until it was eclipsed by Raqqa. However, the figure also reveals that Mosul was less of an all-encompassing fight than often portrayed in journalistic accounts. Indeed, the Mosul operation never exceeded one-third of total strikes executed by the coalition in any given month. That is because Mosul's liberation overlapped with shaping operations in Raqqa and the taking of smaller Syrian cities (e.g., Tal Abyad, Ayn Issa) that operated as staging grounds for the SDF's ultimate assault on Raqqa. When the geographic distribution of strikes is compared monthly, the coalition's concurrent use of airpower to support operations in Syria was often on par with or even eclipsed the level of effort expended in Mosul.

¹⁷⁶ These estimates refer to both killed and wounded. David Witty, *Iraq's Post-2014 Counterterrorism Service*, Washington, D.C.: Washington Institute, October 2018, p. 54.

¹⁷⁷ Shelly Culbertson and Linda Robinson, *Making Victory Count After Defeating ISIS: Stabilization Challenges in Mosul and Beyond*, Santa Monica, Calif.: RAND Corporation, RR-2076-RC, 2017.

¹⁷⁸ Susannah George, "Liberation from Militants Leaves Devastation in Mosul" Associated Press, July 14, 2017.

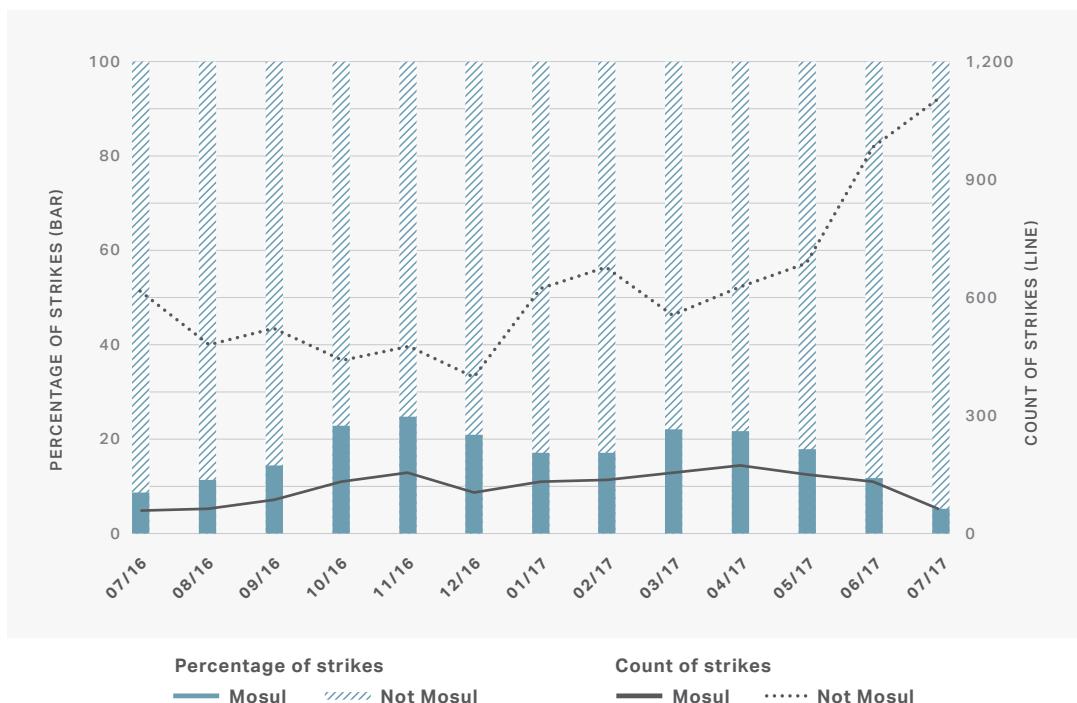
¹⁷⁹ DoD, *Annual Report on Civilian Casualties in Connection with United States Military Operations*, Washington, D.C., May 2, 2019.

¹⁸⁰ Joseph Martin, Matthew Isler, and Jeff Davis, "Department of Defense News Briefing on the Findings of an Investigation into a March 17 Coalition Air Strike in West Mosul," transcript, U.S. Department of Defense, May 25, 2017.

¹⁸¹ Cited in Samuel Oakford, "Counting the Dead in Mosul," *The Atlantic*, April 5, 2018.

¹⁸² Susannah George, "Mosul Is a Graveyard: Final IS Battle Kills 9,000 Civilians," Associated Press, December 20, 2017.

Figure 4.12
Level of Effort in Mosul



SOURCE: RAND CJTF-OIR strike release data set.

The large number of strikes in Mosul was driven more by the duration of the campaign than its intensity. Among the cases analyzed in this chapter, Kobani featured six continuous months of at least 100 strikes, making it comparable in intensity to the Mosul operation, just of shorter duration. In fact, the high point of strikes in Kobani—253 strikes in January 2015—far exceeded any monthly total in Mosul. Ramadi also surpassed the 100-strike threshold for a four-month period. From a level-of-effort standpoint, what made Mosul unique was not the number of strikes in a given month but the lengthy nature of the operation.

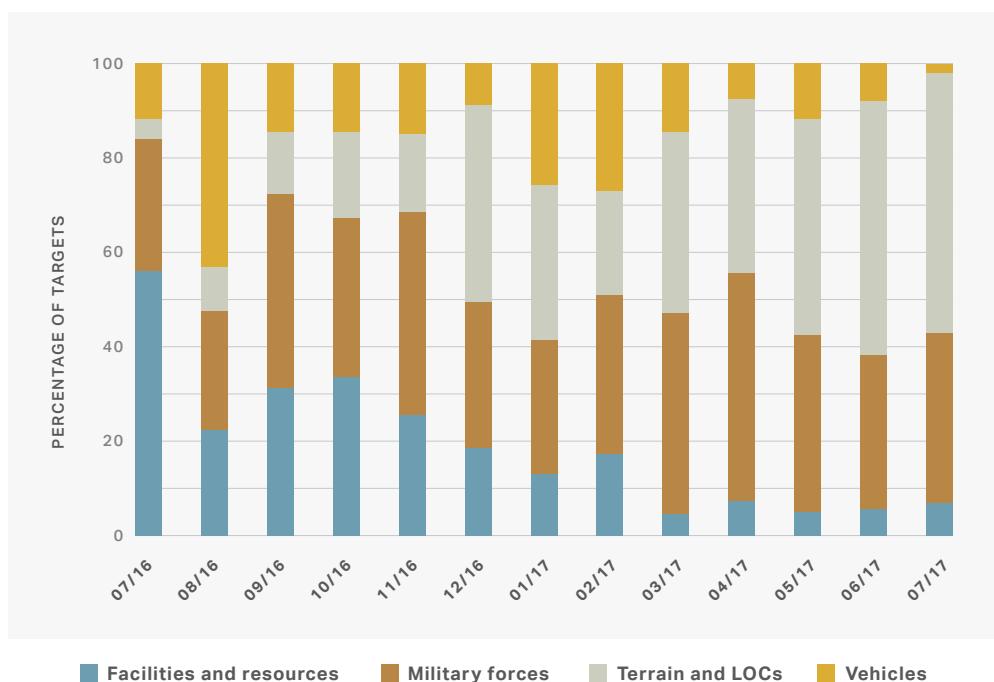
At the same time, the intensity of the operation should not be underestimated. Between October 2016 and April 2017, 57 percent of weapons released from coalition aircraft supported efforts to retake Mosul. Although the coalition distributed its assets across the theater over the course of the Mosul campaign in terms of individual strikes, the intensity of the strikes at Mosul eclipsed those of any other operation at the time.¹⁸³

¹⁸³ Publicly available data on weapon releases are not available for earlier operations to compare with Mosul. RAND CJTF-OIR strike release data set.

In terms of targets, Mosul follows the general pattern established by the earlier cases reviewed in this chapter (see Figure 4.13). Specifically, ISIS's facilities and resources, which are some of the more identifiable targets at the start of an operation, compose a heavy share of the initial targets engaged. It is likely that some of these targets, such as ISIS C2 facilities, were part of the deliberate strikes executed on the ATO. However, that target set declined over time, while the share of terrain and LOC targets rose.

ISIS's military forces composed 36 percent of the targets, a comparable share to several of the other cases profiled. Unique to Mosul, however, is the number of VBIED targets engaged, even months into the operation. The coalition engaged 283 VBIEDs and 115 VBIED facilities near Mosul, nearly seven times as many VBIED targets as were engaged near Ramadi. That corroborates qualitative accounts that VBIEDs were a large part of ISIS's attempt to halt the ISF maneuver in Mosul.¹⁸⁴ The relatively large proportion of vehicles targeted during the operation coincides with an interdiction

Figure 4.13
Targets Engaged in Mosul



SOURCE: RAND CJTF-OIR strike release data set.

¹⁸⁴ Michael Knights and Alexander Mello, "Defeat by Annihilation: Mobility and Attrition in the Islamic State's Defense of Mosul," *CTC Sentinel*, April 2017.

campaign intended to halt the flow of weapons—including VBIEDs—and ISIS fighters to the front lines. Some of these VBIED air strikes were planned by the CJFLCC Commander as a part of a “middle fight” operation that is discussed in greater detail in Chapter Five.

One of the surprising insights from the data—whether in reference to the level of effort over time or the targets engaged—is the relative continuity during the periods when airpower was being used to support the liberations of eastern and western Mosul. The clearing of eastern Mosul occurred roughly over the initial 100 days of the overall operation, finishing up in January 2017.¹⁸⁵ By all accounts, east Mosul was a more difficult fight, given that there was no obvious line of retreat for ISIS fighters, the urban development on the west side of the river was denser, and the demographic composition of the city, in which western Mosul has a greater preponderance of Sunni Arabs, was believed to favor ISIS’s ability to embed in the local population.¹⁸⁶ Indeed, liberation of this section of the city required twice as much time as eastern Mosul. Yet there are not stark breaks in the pattern of strikes between these periods (i.e., before and after January 2017) in either level of effort or target composition. During the height of the fighting on both sides of the river, strikes tended to cluster at between 100 and 150 per month, and although there was some change in targets, the only major shift in trend lines when the operation moved to western Mosul was that strikes against ISIS vehicles rose significantly. Nor do these data suggest that the issuing of Tactical Directive 1, which delegated TEA down to the appropriate ground-commander level, had an appreciable impact on the scale of air strikes.

In terms of the airframes employed, Mosul included strikes from a variety of platforms. After a ten-year hiatus from combat, B-52 bombers were used as a CAS platform for the Mosul operation. As with the B-1s used in earlier phases of the operation, these platforms had the advantage of being able to service a large number of targets in a single sortie. One member of a B-52 crew noted that, during the height of the Mosul operation, it was common to receive two or three “9 lines” (of which the grid coordinates for a strike are one of the nine lines) an hour and that the bombers in his squadron frequently expended their entire munitions in a single mission.¹⁸⁷ Deploying in roughly six-month rotations at AUAB, the 96th Expeditionary Bomb Squadron (EBS), the 23rd EBS, and the 69th EBS were all employed in the lead-up or during the Mosul counterattack.¹⁸⁸ There are no definitive public-source data to ascertain which

¹⁸⁵ Michael Knights and Alexander Mello, “Defeat by Annihilation: Mobility and Attrition in the Islamic State’s Defense of Mosul,” *CTC Sentinel*, April 2017.

¹⁸⁶ RAND interview with U.S. Army officer, November 26, 2019.

¹⁸⁷ AFHRA interview with Lt Col Marc R. Bradle, August 15, 2019.

¹⁸⁸ Patrick Evenson, “The BUFF Passes Bomber Torch After Two Years Pummeling ISIS, Taliban Targets,” U.S. Air Forces Central, April 12, 2018.

strike platform launched the most sorties or dropped the most munitions in Mosul, but qualitative reporting suggests that the B-52s were one of the workhorses of the operation.¹⁸⁹ In addition, interviewees noted that the F-15E was a major contributor in Mosul,¹⁹⁰ and overall strike data released by the CFACC suggest that, for OIR as a whole, the F-15E fighters (closely followed by A-10s) were the airframe most utilized.¹⁹¹

Broadly, U.S. pilots were flying B-52s, A-10s, F-15Es, F/A-18s, and AV-8B Harrier jets during Mosul, while coalition partners fielded a variety of airframes, including F-16s.¹⁹² The United States maintained a carrier presence in the Persian Gulf during the Mosul operation, initially in the form of the USS *Eisenhower*, followed by the USS *George H.W. Bush* CSG. The F/A-18E/F Super Hornets, the most frequently used air platform for OIR from the U.S. Navy,¹⁹³ executed strikes in Mosul, launching from these CSGs.¹⁹⁴

Other coalition members contributed to air strikes. Initially, France flew Rafales outfitted with four 250-kilogram laser-guided bombs from the carrier USS *Charles de Gaulle*.¹⁹⁵ When the carrier rotated out, the French flew Rafales from Al Dhafra Air Base in the United Arab Emirates and Mirage 2000s from Prince Hassan Air Base in Jordan.¹⁹⁶ The United Kingdom continued to fly MQ-9 Reapers, Tornados, and Typhoons in strike and armed reconnaissance missions, primarily from RAF Akrotiri, employing Hellfires, Paveway IIs and IVs, and Brimstones.¹⁹⁷ These were supported by Voyager tankers, while British Airseeker and Sentinel surveillance aircraft also gath-

¹⁸⁹ Stephen Losey, "Air Force B-52s Shatter Vietnam-Era Records During Two-Year ISIS Deployment," *Air Force Times*, April 16, 2018.

¹⁹⁰ RAND interview with Gen Jeffrey Harrigian, December 17, 2019.

¹⁹¹ Oriana Pawlyk, "F-15Es, A-10s Leading Air War Against ISIS," Military.com, June 2, 2017.

¹⁹² Stephen Losey, "With 500 Bombs a Week, Mosul Airstrikes Mark 'the Most Kinetic' Phase of ISIS Air War So Far," *Air Force Times*, March 28, 2017.

¹⁹³ Oriana Pawlyk, "F-15Es, A-10s Leading Air War Against ISIS," Military.com, June 2, 2017.

¹⁹⁴ Lisa Ferdinando, "Pentagon Hails Progress, Momentum in Mosul Fight," U.S. Department of Defense, October 31, 2016.

¹⁹⁵ "France 'Conducts Operations Against IS,'" BBC, September 30, 2016.

¹⁹⁶ "French Jet Fighters Launch Mission Against IS in Mosul," Radio France Internationale, September 30, 2016.

¹⁹⁷ UK Ministry of Defence, "RAF Air Strikes in Iraq and Syria: October 2016," webpage, updated September 5, 2018; UK Ministry of Defence, "RAF Air Strikes in Iraq and Syria: November 2016," webpage, updated September 5, 2018; UK Ministry of Defence, "RAF Air Strikes in Iraq and Syria: December 2016," webpage, updated September 5, 2018; UK Ministry of Defence, "RAF Air Strikes in Iraq and Syria: January 2017," webpage, updated September 5, 2018; UK Ministry of Defence, "RAF Air Strikes in Iraq and Syria: February 2017," webpage, updated September 5, 2018; UK Ministry of Defence, "RAF Air Strikes in Iraq and Syria: March 2017," webpage, updated September 5, 2018; UK Ministry of Defence, "RAF Air Strikes in Iraq and Syria: April 2017," webpage, updated September 5, 2018; UK Ministry of Defence, "RAF Air Strikes in Iraq and Syria: May 2017," webpage, updated September 5, 2018; UK Ministry of Defence, "RAF Air Strikes in Iraq and Syria: June 2017," webpage, updated September 5, 2018; UK Ministry of Defence, "RAF Air Strikes in Iraq and Syria: July 2017," webpage, updated September 5, 2018.

ered intelligence over Mosul.¹⁹⁸ Australia has released some biweekly reporting on its strikes in Iraq and Syria; however, the reporting does not cover the entirety of the Mosul operation. According to a review of the biweekly reporting that does overlap with the operation, it appears that Australia flew F/A-18s near daily in support of the Mosul operation.¹⁹⁹ Canada, on the other hand, had ceased conducting air strikes in Syria and Iraq in the year prior to the Mosul operation.²⁰⁰

Because Mosul was a dense urban environment and ISIS was intentionally using civilians as human shields, the coalition demonstrated a preference for GBU-39/B Small Diameter Bomb (a 250-pound precision glide bomb) and the employment of delayed fuses (i.e., letting the bomb bury below the ground before detonating to reduce the yield).²⁰¹ Weaponeering was supplemented by other process measures, such as requiring FMV to confirm no civilian presence at the target site and strict use of collateral damage estimates. As DoD investigations and independent reporting show, these approaches could not eliminate civilian casualties in the operation.²⁰² However, these approaches—along with required collateral-damage estimates—did mitigate civilian casualties, a goal that was a point of emphasis in almost every interview conducted for this study.

Mosul was also a site where Army AH-64 attack helicopters were used to strike ISIS targets, primarily with Hellfire missiles. As noted in the Ramadi case, the introduction of that capability was offered by U.S. officials to the al-Abadi government in late 2015 but ultimately not requested. Subsequent to Ramadi, the United States did introduce Apaches and used them to aid the ISF's operation up the Tigris River that culminated in the seizing of Q-West airfield, a key staging ground for the ultim-

¹⁹⁸ UK Ministry of Defence, “RAF Air Strikes in Iraq and Syria: April 2017,” webpage, updated September 5, 2018; UK Ministry of Defence, “RAF Air Strikes in Iraq and Syria: October 2016,” webpage, updated September 5, 2018.

¹⁹⁹ Australian Chief of Joint Operations, “Operation OKRA—ADF Airstrikes for the Period 18–30 April 2017,” Canberra, May 8, 2017; Australian Chief of Joint Operations, “Operation OKRA—ADF Airstrikes for the Period 01–18 May 2017,” Canberra, May 23, 2017; Australian Chief of Joint Operations, “Operation OKRA—ADF Airstrikes for the Period 19 May–01 June 2017,” Canberra, June 6, 2017; Australian Chief of Joint Operations, “Operation OKRA—ADF Airstrikes for the Period 02–15 June 2017,” Canberra, June 20, 2017; Australian Chief of Joint Operations, “Operation OKRA—ADF Airstrikes for the Period 15 Jun–28 Jun 2017,” Canberra, July 4, 2017; Australian Chief of Joint Operations, “Operation OKRA—ADF Airstrikes for the Period of June 29–July 13 2017,” Canberra, July 18, 2017.

²⁰⁰ Government of Canada, “Operation IMPACT,” webpage, undated.

²⁰¹ RAND interview with USAF officer, April 15, 2020.

²⁰² DoD, *Annual Report on Civilian Casualties in Connection with United States Military Operations*, Washington, D.C., May 2, 2019; Joseph Martin, Matthew Isler, and Jeff Davis, “Department of Defense News Briefing on the Findings of an Investigation into a March 17 Coalition Air Strike in West Mosul,” transcript, U.S. Department of Defense, May 25, 2017; Samuel Oakford, “Counting the Dead in Mosul,” *The Atlantic*, April 5, 2018.

mate assault on Mosul.²⁰³ The AH-64s, which flew in two-ship formations, were also employed during urban combat operations in both eastern and western Mosul.

AH-64 pilots interviewed for the study noted the use of “man-unmanned” teaming in executing their mission.²⁰⁴ The reference was to reliance on RPAs, generally U.S. Army MQ-1Cs (Gray Eagles) and RQ-7s (Shadows), flying higher in the air stack than the attack helicopters to identify prospective targets that were then validated with additional sources of information available to the strike cell operating in Erbil.²⁰⁵ Because the rotary-wing assets were launching from Erbil, which is only a 30-minute flight to Mosul, most of the Apaches’ gas could be used to loiter above the city. That said, in contrast to other assets, the Apaches’ loiter time was relatively short—roughly two and a half hours.²⁰⁶

In addition to CAS, the USAF also provided nonkinetic capabilities to the Mosul fight. To degrade ISIS’s ability to sustain C2 over forces in Mosul, the coalition employed EC-130H Compass Call aircraft.²⁰⁷ Among other tools, the aircraft were able to use electronic warfare to jam the cellphone networks that ISIS relied on for communication.²⁰⁸ These aircraft were also able to use electronic warfare to limit the effectiveness of ISIS’s UAS capability. The 43rd Expeditionary Electronic Combat Squadron provided these nonkinetic options to CFACC during the height of the Mosul operation.²⁰⁹

One of the advantages the coalition had at this stage in the campaign was the more-extensive basing options to support air operations. This pertained both to regional basing and facilities within Iraq itself. Outside Iraq, Incirlik was opened to strike aircraft in October 2015. That enabled, for example, contributions from A-10s that were based there for the Mosul operation and the Raqqa operation, profiled subsequently.²¹⁰ By the time Mosul started, RPAs could be launched within Iraq from Al Asad Air Base, where the U.S. Army had RQ-7 Shadows and MQ-1C Gray Eagles, while attack helicopters could be launched from Erbil, where U.S. Army aviation units

²⁰³ RAND interview with U.S. Army officer, November 26, 2019.

²⁰⁴ Mosul Study Group, *What the Battle for Mosul Teaches the Force*, Washington, D.C.: U.S. Army, September 2017, p. 19.

²⁰⁵ RAND interview with U.S. Army officer, November 12, 2019.

²⁰⁶ RAND interview with U.S. Army officer, December 2, 2019.

²⁰⁷ Jonathan Hehnly, “Electronic Warfare Aircraft Contribute to Defeat ISIS,” U.S. Department of Defense, August 31, 2017.

²⁰⁸ AFHRA interview with Lt Col Christopher J. Weaton, September 17, 2019.

²⁰⁹ Jonathan Hehnly, “Compass Call Dominates OIR with Electronic Warfare,” U.S. Air Force, August 31, 2017.

²¹⁰ Cheryl Pellerin, “U.S. A-10s, Tankers Fly Syria Missions 24/7 from Incirlik,” U.S. Central Command, May 27, 2016.

eventually moved their in-country headquarters.²¹¹ This extended platforms' time on station, enhancing their utility. That said, most of the sorties to support the Mosul counterattack were still being generated from bases outside Iraq—for example, from the Gulf Cooperation Council states.

Finally, Iraqi aircraft participated modestly in both kinetic and nonkinetic air operations over Mosul. The Iraqi Air Force dropped leaflets over Mosul with instructions for residents to stay away from known ISIS installations and explaining how to assist Iraqi government forces with liberation.²¹² Iraq also carried out limited air strikes during the Mosul operation,²¹³ including with its small fleet of new F-16 aircraft.

Coordination with Ground Partners in Mosul

A defining feature of the Mosul operation (named Eagle Strike), was the congested nature of the battlespace. Iraqi forces launched attacks from several directions, although the primary offensives were the southern and eastern axes. Among the conventional Iraqi military units involved, the 9th Iraqi Armored Division and the 15th Iraqi Army Division were key components of the counterattack. The CTS and Emergency Response Division within the Federal Police were also critical ground elements. These Iraqi government forces were supported by tribal militias (both Sunni and Shia), as well as by the Kurdish Peshmerga.²¹⁴ There were nearly 95,000 Iraqi forces staged at tactical assembly areas to initiate the attack.²¹⁵ The airspace, while carefully deconflicted, was also congested with large stacks of aircraft deployed to provide on-call close air support (X-CAS). It was not atypical to have 40 aircraft in the Mosul CAS stack.²¹⁶

The saturation of Mosul's airspace with RPAs for ISR and targeting enhanced the responsiveness of the coalition's X-CAS. However, it presented a challenge for deconflicting, with fighter aircraft and A-10s operating at higher altitudes than these RPAs. Because the manned strike platforms were higher in the air stack, the deconfliction would theoretically be enabled by this separation. However, the precision of strikes could be improved if the strike aircraft dropped to lower altitudes. For example, the A-10 could employ laser-guided rockets or 30 mm cannons, its most precise munitions,

²¹¹ RAND interview with U.S. Army officer, December 5, 2019.

²¹² Al Aan TV, “Ta’irat ‘Iraqiya Tulqi Manshourat Gharbi Mosul” [“Iraqi Planes Drop Leaflets in Western Mosul”], YouTube video, January 31, 2017.

²¹³ “Darbat Jawiya ‘Iraqiya Dad Da‘ish fi Al-Mosul wa Tal ‘Afar” [“Iraqi Air Strikes on Mosul and Tal Afar”], *Basnews*, April 12, 2017.

²¹⁴ Mosul Study Group, *What the Battle for Mosul Teaches the Force*, Washington, D.C.: U.S. Army, September 2017, pp. 7–8.

²¹⁵ Mosul Study Group, *What the Battle for Mosul Teaches the Force*, Washington, D.C.: U.S. Army, September 2017, p. 6.

²¹⁶ AFHRA interview with Col Paul Birch, August 7, 2019; Missy Ryan and Loveday Morris, “When Air Power Works, and When It Doesn’t: A Snapshot of U.S. Operations Against the Islamic State,” *Washington Post*, December 20, 2016.

at lower altitudes to prosecute targets.²¹⁷ But the presence of so many RPAs at that altitude complicated executing these *diving deliveries*.

In addition to the congested nature of partner forces and airframes on station, the role of U.S. ground forces was expanded beyond the limited advise-and-assist activities previously allowed. Specifically, a few U.S. personnel were allowed to accompany Iraqi forces up to the front lines because of Tactical Directive 1, which changed the rules of engagement for U.S. forces.²¹⁸ This meant that U.S. JTACs were now embedded with some partner forces close to the FLOT. In addition to these JTACs who forward observed from the field rather than at CJOCs, U.S. advisers could operate at lower echelons, interfacing with their Iraqi counterparts in tactical operation centers. U.S. Army and USMC units were also providing different types of surface fires (tube artillery, rockets, and missiles).

All of these capabilities meant that the coalition could create “multiple dilemmas” for ISIS but also required that the coalition execute more-challenging air-ground coordination than in the previous cases reviewed in this chapter. To do so, the CJTF-OIR command, the CFACC at AUAB in Qatar, and the relevant CJOC (in this case, CJOC-E) built on the template used in other operations. Specifically, strike cells were still employed to coordinate dynamic strikes in support of Iraqi ground maneuver in Mosul. What changed, however, was that a limited number of JTACs operated near the line of contact with ISIS. Commenting on that change for the Mosul operation, CJTF-OIR spokesperson Col John Dorrian noted, “[We] use joint terminal attack controllers, people on the ground that are a part of the advise and assist teams. And they have the ability to call in airstrikes with a tremendous amount of precision and to do so in a manner that’s very responsive, probably more responsive than by doing that in some of the strike cells.”²¹⁹ Yet, in practice, while forward advisers called in some air strikes, the bulk of the fires that they authorized were surface fires. The vast majority of the air strikes were still executed through the strike cells, which, because of their capacity, could more quickly deconflict and authorize air strikes than ground advisers on the FLOT.²²⁰

Another change was that the battle-space geometry (i.e., the division of the joint operations area into territory assigned to different commands) was conducted at a more microlevel for Mosul and its immediate environs. In Mosul, the division of battlespace was done within this single operation. Air assets were given primary responsibility for strikes in support of ground operations in eastern Mosul, while U.S. Army units

²¹⁷ RAND interview with USAF officer, April 15, 2020.

²¹⁸ Balint Szlanko and Susannah George, “U.S. Changes Rules of Engagement for Mosul Fight in Iraq,” Military.com, February 24, 2017.

²¹⁹ John Dorrian, “Department of Defense Press Briefing by Col. Dorrian via Teleconference from Baghdad, Iraq,” transcript, U.S. Department of Defense, February 22, 2017.

²²⁰ RAND interview with U.S. Army officer, June 16, 2020.

were given primary responsibility—using surface fires—for early shaping operations in western Mosul.²²¹

Although processes evolved to address the more congested environment, at times, second-best solutions were adopted to make do. An AH-64 pilot described one such approach, which he called “hot walls,” to overcome the congestion of having dozens of aircraft in a CAS stack.²²² The concept was to divide Mosul into pie-shaped slices, with the platform operating at the tip (i.e., narrow edge) of the slice apportioned primary responsibility for strikes out to the wide edge of the slice. U.S. Army artillerymen conceded that another solution was simply to institute pauses in surface fires to clear the space for air strikes.²²³ Summarizing the issue, Col Paul Birch noted,

You've got a lot of ISR assets. . . . You have at least three sectors of artillery that are able to provide fires into that fight. You have at least three . . . ground commanders. You'd have the [coalition partners] and maybe an Iraqi division is on scene. And then . . . some sort of third party, Kurdish or someone else, involved in the fight. And you're making these calls for fires that the ground commander wants deconflicted in a matter of minutes or seconds. . . . It made for a very interesting physics problem, which became a command and control problem.²²⁴

Although coalition and joint coordination were challenges, even more difficult was the coordination with local ground forces. A positive evolution in air-ground coordination employed in Mosul was the use of the so-called Android Tactical Advise Kit (ATAK).²²⁵ ATAKs often took the form of Samsung tablets that were provided to partner forces to relay information to the coalition on potential targets for strikes (e.g., GPS coordinates, imagery), as well as the position of the partner forces to deconflict strikes with friendly forces. Two partner forces that fielded ATAKs in the Mosul fight were the CTS and Peshmerga. Isler, deputy commanding general–air for CJFLCC, noted:

ATAKs were the main mechanism for coordinating strikes along the Kurdish FLOT for Mosul. I had high confidence in the [positive identification] and strike coordinates provided by Peshmerga observers based on the training they received and their demonstrated performance using ATAK. For other partner forces that didn't have similar training and ATAK, I took partner targeting requests and position reports as important inputs, but not as decisive ones.²²⁶

²²¹ RAND interview with coalition personnel, February 13, 2020.

²²² RAND interview with U.S. Army officer, December 2, 2019.

²²³ RAND interview with U.S. Army official, February 18, 2020.

²²⁴ AFHRA interview with Col Paul Birch, August 7, 2019.

²²⁵ Mosul Study Group, *What the Battle for Mosul Teaches the Force*, Washington, D.C.: U.S. Army, September 2017, p. 48.

²²⁶ RAND interview with Brig Gen Matthew Isler, March 26, 2020.

Another interviewee noted that the CTS had U.S.-trained forward air controllers, which increased coalition trust in the inputs received from that specific partner force.²²⁷

In developing, nominating, and vetting targets, the coalition had many assets that went far beyond the technical capabilities of the ATAKs. Those assets included unmanned (e.g., MQ-1s, MQ-9s, RQ-4s) and manned ISR aircraft (e.g., U-2s), intelligence streams, and sensors on strike aircraft operating as ISR. What the ATAKs provided was an easy-to-use technological solution to integrate the input of partner forces that were observing ISIS activity absent U.S. advisers embedded with them.

Another important aspect of air-ground coordination for the Mosul operation was receiving Iraqi approval of offensive strikes; however, the coalition did not require host-country approval when operating in self-defense of coalition or partner forces.²²⁸ Just as for strikes executed in central Iraq, in which CJOC-B at Union III served as the TEA and interlocutor with Iraqi representatives, a similar arrangement was in place at CJOC-E. In both locations, Iraqi general officers were located next door to the strike cells to expedite host-nation approvals for nondefensive strikes. What had to evolve for the Mosul operation, however, is that those approvals would need to be granted by ISF commanders. At earlier stages in the fight, when CJOC-E was presiding over the liberation of areas in the Kurdistan region of Iraq, the approvals came from Peshmerga commanders.²²⁹ Now, as that operations center became the focal point for Mosul liberation, with Mosul located in Nineveh governorate outside the Kurdistan Regional Government, the approvals needed to come from the ISF proper. Indeed, the concept of operations for retaking Mosul deliberately limited the role of the Peshmerga²³⁰—and the PMF—to avoid Mosul becoming a flash point for ethnic or sectarian conflict.

Conclusion for the Mosul Case

When western Mosul was liberated in July 2017, the coalition and its local ground partners reached a major milestone in the campaign. Although the coalition immediately turned its attention to Raqqa and ISIS's remaining redoubts in Iraq (e.g., Tal Afar, Hawija, Al-Qaim), ISIS was nearly finished as a protostate in Iraq. By the end of the calendar year, Prime Minister al-Abadi had declared the complete defeat of ISIS.²³¹

In Mosul, there were more air strikes than at any other point in the campaign to date. However, our analysis of strike data shows that the intensity of strikes was not unprecedented, as often is portrayed in journalistic accounts. Rather, the defining

²²⁷ RAND interview with a USAF officer, April 15, 2020.

²²⁸ RAND interview with Brig Gen Matthew Isler, March 4, 2020.

²²⁹ RAND interview with a USAF officer, April 1, 2020.

²³⁰ Mosul Study Group, *What the Battle for Mosul Teaches the Force*, Washington, D.C.: U.S. Army, September 2017.

²³¹ Tamer El-Ghobashy, "Iraq Declares Complete Victory in the War Against Islamic State," *Washington Post*, December 9, 2017.

feature of Mosul was the long duration of the operation, which cumulatively led to large strike totals after months of shaping operations followed by nine months of CAS to local ground forces. The data also confirm that ISIS relied heavily on VBIEDs to slow ISF maneuver and degrade morale, and airpower was successful in attacking the networks that produced and employed VBIEDs, mitigating their effects through road cratering, and taking many of these vehicles off the battlefield, among other targets engaged in the operations.

Air-ground coordination was made more challenging in Mosul because of the number of partner forces, the dense urban environment, and the congested airspace. CJTF-OIR evolved its processes to mitigate these issues. Specifically, JTACs were introduced forward and allowed to accompany some partner forces close to the FLOT, which added an additional resource for coordinating strikes. Time-space deconfliction was aided by apportioning primary responsibility over sections of Mosul to different commands. Additionally, having some partner forces field ATAKs—particularly the CTS and the Peshmerga—provided a tool for better integrating their input into targeting selection and better ensuring the deconfliction of strikes with friendly ground forces.

It is clear from taking a broader view of the efficacy of airpower in Mosul that ISR, shaping strikes, CAS, and electronic warfare were key factors in enabling the Iraqis' ground assault. Absent these enablers, it is doubtful that these forces would have had the will and capability to retake the largest population center under ISIS control. But even with high levels of support from the air, the fight was grinding and the performance was variable. A much smaller adversary force attrited the ISF, including its most capable element, the CTS, at an alarming rate, while the operation took nine months even if initial shaping operations are not factored into the timeline.

Taking Down the Heart of the “Caliphate”: Raqqa, June 2017–October 2017

Background on the Battle of Raqqa

Situated in northeast Syria on the Euphrates River, Raqqa was the first Syrian provincial capital to fall to antigovernment rebels when a coalition of Free Syria Army, Ahrar al-Sham, and al-Qaeda-linked Jabhat al-Nusra fighters seized the city in early March 2013. A nearly homogeneous Sunni Arab town, many Raqqawis welcomed the militants' arrival in hopes that the city might become a “capital of liberation.”²³² Instead, ISIS exploited tensions among the occupying forces and launched a systematic campaign to assassinate, blackmail, or otherwise coerce its opponents. In November 2013,

²³² Nate Rosenblatt and David Kilcullen, *How Raqqa Became the Capital of ISIS: A Proxy Warfare Case Study*, Washington, D.C.: New America, 2019, pp. 15–17; Hassan Hassan, “The Battle for Raqqa and the Challenges After Liberation,” *CTC Sentinel*, Vol. 10, No. 6, June–July 2017.

representatives of the 14 Raqqa tribes pledged allegiance to al-Baghdadi. After a brief rebellion, during which ISIS fighters were expelled, the group declared its control of the city in January 2014. By that summer, ISIS had seized major military bases throughout the governorate, “extending its control throughout the eastern half of Syria.”²³³

After the declaration of its self-proclaimed caliphate, Raqqa emerged, along with Mosul, as one of ISIS’s twin capitals. The city’s proximity to the major highways linking Syria to Iraq—and its relative distance from the front lines in Aleppo and Damascus—made it a convenient stronghold, and ISIS soon centralized its administrative apparatus within the city. Raqqa’s proximity to the Turkish border also made it a frequent way station for foreign fighters entering Syria and a place where ISIS plotted external operations.²³⁴ From the safety of Raqqa, ISIS oversaw the distribution of food and services, levied taxes, plotted overseas terrorist attacks, and directed the movement of fighters, materiel, and other goods to frontline operations elsewhere in Syria and Iraq.²³⁵ As a model for the envisioned Islamic State, the city became the hub of ISIS’s international propaganda machine, pumping out pamphlets, videos, and other materials extolling life in the caliphate and attracting recruits from across the world.²³⁶

Once the air campaign began in Syria in 2014, the coalition regularly executed strategic strikes against ISIS targets in the city, destroying or severely damaging approximately 1,000 buildings by the fall of 2015.²³⁷ Yet proposals to capture the city were delayed by the absence of a capable and reliable ground partner. “When our operators came out of Syria saying, ‘We can work with these guys,’ it opened a whole new set of possibilities for collapsing ISIS’s control over northern Syria and, eventually, its capital,” Secretary of Defense Ash Carter later explained.²³⁸ During a National Security Council meeting on December 14, Carter and Chairman of the Joint Chiefs of Staff Joseph Dunford outlined a plan to enable the SDF to evict ISIS from Raqqa by clear-

²³³ Eric Robinson, Daniel Egel, Patrick B. Johnston, Sean Mann, Alexander D. Rothenberg, and David Stebbins, *When the Islamic State Comes to Town: The Economic Impact of Islamic State Governance in Iraq and Syria*, Santa Monica, Calif.: RAND Corporation, RR-1970-RC, 2017, pp. 101–102.

²³⁴ “US Commander: ISIS Plotting External Attacks from Raqqa,” CNN, October 26, 2016.

²³⁵ Eric Robinson, Daniel Egel, Patrick B. Johnston, Sean Mann, Alexander D. Rothenberg, and David Stebbins, *When the Islamic State Comes to Town: The Economic Impact of Islamic State Governance in Iraq and Syria*, Santa Monica, Calif.: RAND Corporation, RR-1970-RC, 2017, p. 103; Jim Mattis, “Remarks by Secretary Mattis at an Honor Cordon Welcoming Florence Parly, Minister for the Armed Forces, France, to the Pentagon,” transcript, U.S. Department of Defense, October 20, 2017; Aymenn al-Tamimi, “The Evolution in Islamic State Administration: The Documentary Evidence,” in “Special Issue on the Islamic State,” *Perspectives on Terrorism*, Vol. 9, No. 4, August 2015.

²³⁶ Greg Miller and Souad Mekhennet, “Inside the Surreal World of the Islamic State’s Propaganda Machine,” *Washington Post*, November 20, 2015.

²³⁷ United Nations Institute for Training and Research, “Damage Assessment of ar Raqqa, ar Raqqa Governorate, Syria,” July 21, 2015.

²³⁸ Ash Carter, “Behind the Plan to Defeat ISIS,” *The Atlantic*, October 31, 2017.

ing the surrounding territory, cutting off the tap of foreign fighters streaming into Syria through Turkey, and isolating the capital city.²³⁹

Turkish concerns about growing Kurdish influence in northern Syria, Arab fears of a Kurdish occupation of a predominantly Arab city, and competing demands in Iraq complicated efforts to finalize operational planning. With the start of the Mosul offensive in October 2016, however, U.S. military commanders urged efforts to accelerate the Raqqa operation's start.²⁴⁰ "We want to pressure Raqqa" so that militants escaping Mosul do not "have a convenient place to go," then-CJTF-OIR Commander LTG Stephen Townsend explained.²⁴¹ In repeat meetings with members of the coalition, including with Turkish officials and Kurdish leaders in Syria, senior U.S. officials negotiated an agreement to launch an offensive to "isolate the extremists in the Syrian city, limit their ability to reinforce its satellite strongholds across Iraq and Syria and seal off escape routes."²⁴² On November 6, with the details of the ground force still under debate, the SDF announced the start Operation Euphrates Wrath to "isolate and then topple the capital of international terrorism."²⁴³

In contrast to Mosul, where coalition airpower supported well-equipped and capable Iraqi CTS forces, the battle to liberate Raqqa would be led by a fragile alliance of nonstate fighters.²⁴⁴ The presence of Syrian regime, Russian, and Iranian forces in the city's vicinity further complicated the battlespace and at times limited the availability of coalition strike aircraft.²⁴⁵ "It's also going to be done with a lot lighter coalition footprint. We'll have fewer coalition troops there, less combat capability there," Townsend cautioned. "We'll have to apply coalition combat support in a different way than we're doing here in Iraq. . . [I]t's probably fair to say with the complexity and the fact that we haven't really got it underway yet that it'll probably take longer than Mosul."²⁴⁶

²³⁹ Ash Carter, "Behind the Plan to Defeat ISIS," *The Atlantic*, October 31, 2017.

²⁴⁰ Ash Carter and Stephen Townsend, "Media Availability with Secretary Carter and Lt. Gen. Stephen Townsend in Irbil, Iraq," transcript, U.S. Department of Defense, October 23, 2016.

²⁴¹ Missy Ryan and Karen DeYoung, "'We're Not in Perfect Control': U.S. Plans Operation Against Islamic State in Syria Despite Obstacles," *Washington Post*, October 31, 2016.

²⁴² Maria Abi-Habib and Dion Nissenbaum, "U.S. Builds Force to Retake Islamic State's Syrian Headquarters," *Wall Street Journal*, October 19, 2016.

²⁴³ Rodi Said, "U.S.-Backed Syrian Alliance Declares Attack on Islamic State in Raqqa," Reuters, November 6, 2016.

²⁴⁴ Maria Abi-Habib and Dion Nissenbaum, "U.S. Builds Force to Retake Islamic State's Syrian Headquarters," *Wall Street Journal*, October 19, 2016.

²⁴⁵ RAND interview with USAF officer, August 20, 2020.

²⁴⁶ Stephen Townsend, "Department of Defense Press Briefing by Lt. Gen. Townsend Via Teleconference from Baghdad, Iraq," transcript, U.S. Department of Defense, October 26, 2017.

The resulting campaign would become one of the largest air campaigns of OIR. Over the next 11 and a half months, the coalition would deliver almost 5,700 strikes, killing an estimated 6,000 ISIS fighters. From June to October 2017 alone, U.S. Marines fired 30,000 artillery rounds—their highest volume since the Vietnam War. As U.S. Army SGM John Wayne Troxell summarized, “Every minute of every hour we were putting some kind of fire on ISIS in Raqqa, whether it was mortars, artillery, rockets, Hellfires, armed drones, you name it.”²⁴⁷

The Application of Airpower

The assault on Raqqa was preceded by seven months of staging operations to isolate the city and limit ISIS’s ability to move fighters and equipment.²⁴⁸ The SDF cleared the surrounding area in phases: north (November–December 2016), west (December 2016–February 2017), and east (February–April 2017). During these staging operations, coalition airpower provided ISR, CAS, and deliberate air strikes to degrade ISIS’s ability to maneuver.²⁴⁹ Meanwhile, preparatory air strikes in and around Raqqa battered the city’s defenses, knocked out C2 centers, and severed the major routes into and out of the city. “They [ISIS] don’t have the ability to move large troop formations, large convoys, but they do have the ability to move into and out of the area,” OIR spokesperson Col John Dorrian told reporters shortly after the offensive began. “What we’ve done to try to limit that is we’ve conducted a lot of strikes on their favored supply routes and infiltration routes.”²⁵⁰

The number of air strikes in Raqqa and its surroundings climbed as the encirclement of the city progressed (see Figure 4.14). Between November 2016 and January 2017, when the Trump administration entered office, U.S. strikes near Raqqa averaged 42 per week. Despite public statements from the incoming administration indicating that it would intensify the air campaign against ISIS and ease the ROE, strikes in both Raqqa and Syria writ large declined over February 2017.²⁵¹ In part, this was due to the ongoing operations to liberate Mosul. The SOF-run strike cells controlling operations in Syria found that they often could not get the number or type of aircraft that they requested for CAS. Because Mosul was still the priority, it was allocated the

²⁴⁷ Shawn Snow, “Marine Artillery Barrage of Raqqa Was So Intense Two Howitzers Burned Out,” *Marine Corps Times*, November 2, 2017.

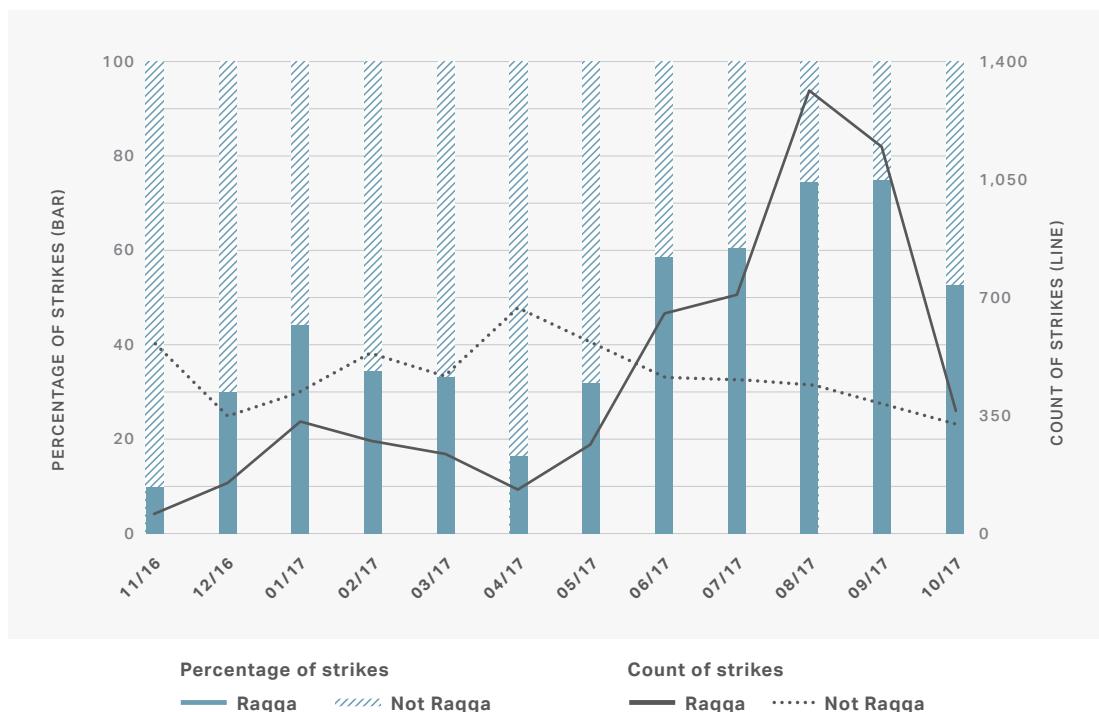
²⁴⁸ John Dorrian, “Department of Defense Press Briefing by Col. Dorrian via Teleconference from Baghdad, Iraq,” transcript, U.S. Department of Defense, February 22, 2017.

²⁴⁹ Terri Moon Cronk, “US-Led Coalition Airstrikes Eliminate Key ISIL Leaders in Syria, Iraq,” U.S. Department of Defense, January 5, 2017.

²⁵⁰ Eric Schmitt, “U.S.-Backed Militia Opens Drive on ISIS Capital in Syria,” *New York Times*, November 6, 2016.

²⁵¹ Loveday Morris and Liz Sly, “Panic Spreads in Iraq, Syria as Record Numbers of Civilians Are Reported Killed in U.S. Strikes,” *Washington Post*, March 28, 2017.

Figure 4.14
Level of Effort in Raqqa



SOURCE: RAND CJTF-OIR strike release data set.

bulk of the assets.²⁵² By April 2017, however, refinements in the targeting process and improved intelligence on ISIS movements generated a steady increase in the number and precision of air strikes. “We have . . . become more efficient in layering our ISR to uncover targets that have made themselves available to us, which also has facilitated the number of weapons we’ve been able to deliver,” Lt Gen Jeffrey Harrigian, Commander of AFCENT, noted. “I think it’s a combination of those two specific points that have facilitated and allowed us to be more aggressive with getting after the enemy, and at the same time, remain true to the precision targeting and target development that we’ve used over time.”²⁵³ Additionally, Tactical Directive 1 and the devolution of TEA to lower levels significantly increased the speed of approvals and thus the number of air strikes that the SOF strike cells were able to authorize to support the SDF. Because most of these strikes were authorized under the collective-defense ROE, the delegation

²⁵² RAND interview with USAF officer, August, 20, 2020.

²⁵³ Jeffrey Harrigian, “Department of Defense Press Briefing by General Harrigian via Teleconference,” transcript, U.S. Department of Defense, May 24, 2017.

of authority empowered lower echelons to be more responsive to SDF calls for fires when its forces were in contact with ISIS troops.²⁵⁴

On June 6, 2017, the SDF's ground assault on Raqqa began. The number of strikes—including air strikes and surface fires—in the city averaged 154 per a week over the month, composing 75 percent of all strikes in Syria and 59 percent of all OIR strikes in June.²⁵⁵ Coalition air support enabled the SDF to wage coordinated assaults from the east, west, and north, completing the city's encirclement and breaching the centrally located Old City by July 3.²⁵⁶ As the SDF tightened the noose around Raqqa, the airspace became more and more limited until operations were needed in a four- to five-nautical-mile cylinder around the city. The SOF-run strike cells had to deviate from normal practices for airspace control to be able to generate enough air and surface fires to support the SDF's advance. Instead of using procedural controls to restrict half the airspace, the SOF JTACs resorted to positive control and provided pilots with very precise instructions over the radio so that they could execute three to four strikes at a time. Many pilots were not accustomed to this extremely active management of such a small piece of airspace, and they required additional briefs and preparation to execute their mission under these taxing conditions. The SOF JTACs skillfully orchestrated a mix of air and surface fires, including long-range rockets (e.g., HIMARS), to support the SDF's offensive on three sides of the city.²⁵⁷ The volume of strikes increased further in July, enabling the SDF to break through walls of the old city. Although Raqqa had become the primary air operation in Syria in early June, the liberation of western Mosul on July 10 allowed additional assets to be redirected from Iraq, facilitating a rapid increase in the overall number of strikes in August. That month, Raqqa amounted to more than 90 percent of strikes in Syria and nearly 75 percent of total strikes during this period in the OIR campaign.²⁵⁸ According to AFCENT, in August 2017, one-third of all coalition combat sorties and one-half of all weapons released supported the Raqqa operation.²⁵⁹

That said, CJTF-OIR adjusted its reporting criteria for strikes in both February and April 2017, which coincides with our period of analysis. The changes amounted to the inclusion of different surface fires in the overall strike data. Those changes make the analysis of strikes in Raqqa not strictly comparable to the previous cases reviewed,

²⁵⁴ RAND interview with USAF officer, August, 20, 2020.

²⁵⁵ All data cited in this section are drawn from the RAND CJTF-OIR strike release data set.

²⁵⁶ Sarah El Deeb, "A Fraction of Mosul, Syria's Raqqa No Less Challenging," Fox News, July 9, 2017; CENTCOM, "SDF Breaches Old City of Raqqah," press release, July 4, 2017.

²⁵⁷ RAND interview with USAF officer, August 20, 2020.

²⁵⁸ RAND CJTF-OIR strike release data set.

²⁵⁹ RAND AFCENT airpower summary data set.

as Raqqa data include deliberately planned surface fires from February 2017 on and an even broader swath of surface fires from April 2017 on.

In August 2017, at least 2,500 out of 5,004 munitions dropped—roughly 50 percent of munitions dropped that month by coalition aircraft—were released in Raqqa. This is slightly below but comparable to the 57 percent of weapons released in Mosul during the main effort to retake the city. At the same time, the coalition released roughly the same number of, or even slightly fewer, munitions on Mosul as it did Raqqa during the height of their respective operations. By these measures, the coalition’s weight of effort via airpower was likely comparable between Raqqa and Mosul.²⁶⁰

Coalition targets in Raqqa shifted over time (see Figure 4.15).²⁶¹ During the initial staging operations, strikes in and near the city tended to target facilities and resources (e.g., weapon caches) and ISIS’s military forces. These two categories made up roughly two-thirds of targets during the first four months of the operation. Over time, and consistent with other cases reviewed in this chapter, terrain and LOCs rose as a proportion of the target set. By the time the operation concluded in the early fall of 2017, roughly one-half of targets in Raqqa were drawn from this category. Similar to other battles reviewed in this chapter, the proportion of strikes on ISIS’s military forces made up roughly one-third of the targets engaged.

Although the coalition has not reported publicly the precise breakdown of airframes used to support the Raqqa offensive, the U.S. military has confirmed that bombers, fighters, attack aircraft, and RPAs were all employed in the operation. Approximately 20 percent of coalition strikes were conducted by MQ-1 and MQ-9 RPAs, which provided CAS, tactical reconnaissance, and overwatch. In Raqqa’s crowded environment, RPAs were called on to hunt snipers and look for concealed explosive devices and other threats through the city’s narrow streets.²⁶² MQ-1 and MQ-9 capabilities also allowed aircrews to maintain timely information about the location of friendly forces and to provide visual contact before, during, and after strikes. In some instances, aircrews employed a tactic known as *buddy lasing* to guide weapons from another aircraft with improved precision.²⁶³ “What our aircraft brought that was unique to the fight was

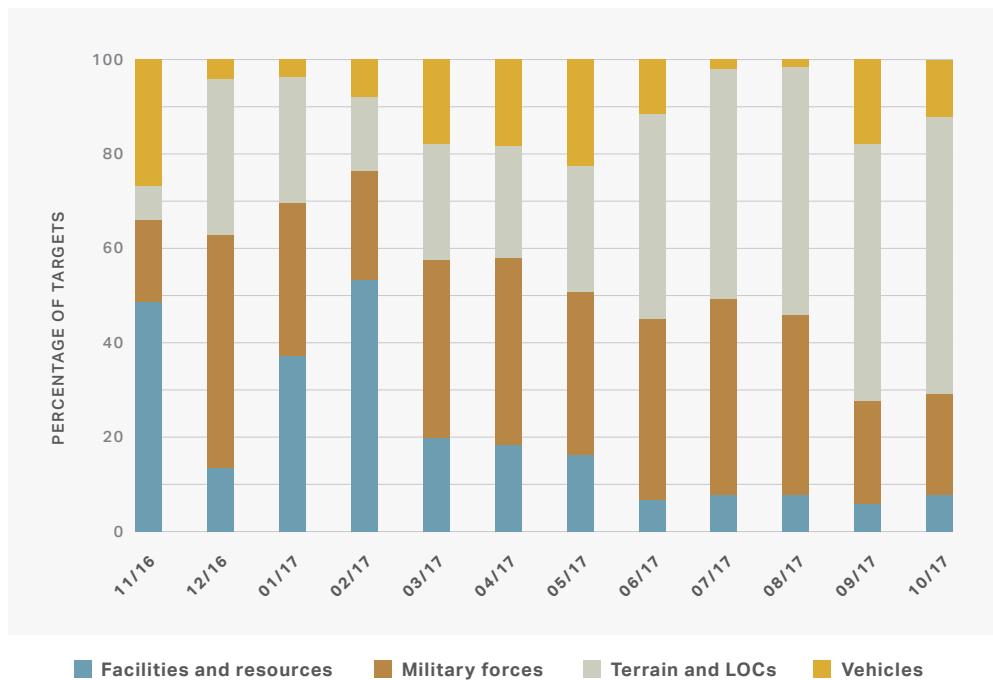
²⁶⁰ Although CJTF-OIR strike data for Raqqa are not comparable to previous cases because of reporting changes and the introduction of surface fires, Raqqa is comparable to Mosul in terms of weapons released from coalition aircraft. RAND AFCENT airpower summary data set; Stephen Losey, “With 500 Bombs a Week, Mosul Air-strikes Mark ‘the Most Kinetic’ Phase of ISIS Air War So Far,” *Air Force Times*, March 28, 2017.

²⁶¹ All data cited in this section are drawn from the RAND CJTF-OIR strike release data set.

²⁶² Adam J. Hebert, “In Case You Missed It: Airpower Killed ISIS,” *Air Force Magazine*, January 29, 2018; W. J. Hennigan, “US Leans on Risky Drone Strikes in Urban Syrian Fight,” *Stars and Stripes*, August 19, 2017.

²⁶³ Christian Clausman, “Combat RPAs Integral in Defeating ISIS,” *Air Force News Service*, December 5, 2017.

Figure 4.15
Targets Engaged in Raqqa



SOURCE: RAND CJTF-OIR strike release data set.

persistence,” one squadron commander noted. Flying around the clock, RPA aircrews logged more than 44,000 hours in Raqqa.²⁶⁴

In contrast to when the SDF was maneuvering toward Raqqa and most of the A-10 sorties were tied up over Mosul, A-10 attack aircraft, the SOF strike cell’s preferred CAS platform, were available to support the SDF’s assault on the city.²⁶⁵ A-10 attack aircraft flying out of Incirlik Air Base also provided CAS, delivering 20 hours of support a day and what one commander described as “an overwhelming majority of the kinetic operations” for the fight.²⁶⁶ The fixed-wing aircraft’s capacity to carry a combination of munitions—including 30 mm high-explosive rounds, AGR-20 Advanced Precision Kill Weapons System laser-guided rockets, 2,000-pound GBU-31 bunker busters, and multiple JDAM variants—made it a popular airframe, particularly among the special

²⁶⁴ Brian W. Everstine, “Predators, Reapers Kept Persistent Watch as ISIS Lost Raqqa,” *Air Force Magazine*, December 5, 2017.

²⁶⁵ RAND interview with USAF officer, August 20, 2020.

²⁶⁶ Jennifer Hlad, “Punching Above Their Weight,” *Air Force Magazine*, November 21, 2017.

operations community that coordinated strikes in the Raqqa operation.²⁶⁷ A-10 pilots, however, found that the dense urban environment and nonlinear fight stretched their training.²⁶⁸ “We were trying to strike these snipers that were in this dense urban city and we didn’t have tactics for it,” one squadron commander explained.²⁶⁹ “Danger-close engagements, typically a rarity, were the daily norm,” another added. Echoing the challenge, one pilot described “getting 9-lines that are like, ‘Hey, I need you to drop this four-story building in a city,’ which is fundamentally different from what . . . I expected.”²⁷⁰ Department of Defense spokesmen confirmed that AH-64 Apache helicopters also operated in a CAS role, enabling, as one interviewee described, “the ground maneuver of U.S. forces and U.S. friendly forces during the fight in and clearance of ISIS from the city.”²⁷¹

Other coalition members also contributed to air strikes in Raqqa, notably the United Kingdom. UK Typhoons, Tornados, and Reapers contributed to CAS for the SDF, as well as armed reconnaissance missions and dynamic strikes on ISIS targets, employing Paveway IVs, Brimstones, and Hellfire missiles.²⁷² Australia suspended its air operations in Syria after the June 2017 U.S. shootdown of a Syrian fighter jet (profiled in Chapter Six). The step was described as a “precaution” during a tense period when coalition assets were flying in congested airspace with Russian and Syrian regime assets.²⁷³ The freeze was temporary, lasting only a few days. However, a review of biweekly reporting from Australia’s Air Task Group suggests that Australia conducted air operations in Iraq only during the period of the Raqqa operation, with the exception of a single strike in the MERV on June 23, 2017.²⁷⁴

The coalition CAS stacks were guarded by F/A-18s, F-15Es, and F-22s flying DCA patrols.²⁷⁵ A June 18 incident in which a U.S. F/A-18E, flying with three other fighters on a CAS mission southwest of Raqqa, downed a Syrian Air Force Su-22

²⁶⁷ AFHRA interview with Maj Joe Biles, September 24, 2019.

²⁶⁸ RAND interview with USAF officer, January 29, 2020; Chad Garland, “A-10 Warthog Drops 2K Pound Bunker-Buster on ISIS Sniper Nest in Raqqa,” Military.com, August 31, 2017.

²⁶⁹ Quoted in Kyle Rempfer, “Dropping Sniper Nests in Four Story Buildings: A-10 Warthogs Earn Gallantry Award in Syria,” *Air Force Times*, April 4, 2019.

²⁷⁰ Quoted in Kyle Rempfer, “Dropping Sniper Nests in Four Story Buildings: A-10 Warthogs Earn Gallantry Award in Syria,” *Air Force Times*, April 4, 2019; quoted in Trevor Rhynes, “A-10s Bring Thunder, Lightning During Fight Against ISIS,” press release, U.S. Air Forces Central, January 10, 2018.

²⁷¹ RAND interview with U.S. Army officer, December 12, 2019.

²⁷² UK Ministry of Defence, “RAF Air Strikes in Iraq and Syria: June 2017,” webpage, updated September 5, 2018.

²⁷³ “Australia Halts Syria Air Strikes After Russia Warning,” Al Jazeera, June 20, 2017.

²⁷⁴ See the Australian Department of Defence’s fortnightly reports for June 15–October 19, 2017; Australian Department of Defence, “Air Task Group (ATG)—Fortnightly Reports,” webpage, undated.

²⁷⁵ RAND interview with USAF officer, January 29, 2020.

attack jet, underscored the potential dangers. Although Russian and American commanders negotiated a new deconfliction line running from Lake Assad to a small town west of Raqqa, the crowded environment produced what one pilot interviewed for this project described as a “a very dirty electromagnetic spectrum environment” in which “systems that were up and functional in other environments were degraded. Situational awareness wasn’t the greatest, lots of fog and friction.”²⁷⁶ To ensure that U.S. aircraft could defend against an integrated air defense missile, F-22s and F-15Es were ordered to maintain a 24-hour patrol through northeast Syria, and a U.S. AWACS radar surveillance plane was deployed to the Syria-Iraq border.²⁷⁷ In contrast to Mosul, “the difference here was that not all the aircraft that were airborne were friendlies,” noted one F/A-18 pilot. “They weren’t necessarily enemies, but we certainly were not on the same side. So you didn’t know what they would do.”²⁷⁸ The presence of potentially hostile aircraft meant that coalition aircraft could not loiter indefinitely over the battlespace, and they were not always available to service the SOF strike cell’s requests for air support in a timely fashion. For instance, there were times when coalition aircraft left the area or limited their time on station as a result of the presence of Russian aircraft. The introduction of surface fires helped meet some of this unfulfilled demand, as did the deployment of DCA aircraft to provide additional protection.²⁷⁹

The volume of munitions and the diversity of airframes employed in Raqqa was a testament to the expansion of coalition air operations in Syria since the battle for Kobani in 2014–2015. In anticipation of a lengthy fight, the USAF and USMC opened new FOBs east of the Euphrates, established an additional staging operation east of the city, and modified an air base near Kobani to accommodate C-130s, C-17s, and other heavy aircraft that require a hardened runway.²⁸⁰ “There are pretty significant parallels between the landing strip near Kobani for the Raqqa battlespace and [Q-West] for Mosul,” CENTCOM spokesperson Col John Thomas said, noting that both bases are “out of enemy range but close to the fight. It helps.”²⁸¹ Still, the dispersal of assets and the limited infrastructure within Syria presented chronic challenges for the cam-

²⁷⁶ RAND interview with USAF officer, January 29, 2020.

²⁷⁷ Jennifer Hlad, “Punching Above Their Weight,” *Air Force Magazine*, November 21, 2017; John Dorrian, “Department of Defense Press Briefing by Col. Dorrian via Teleconference from Baghdad, Iraq,” transcript, U.S. Department of Defense, April 26, 2017; RAND interview with Lt Gen David Nahom, December 19, 2019.

²⁷⁸ “Eight Minutes over Syria,” *Naval Aviation News*, March 21, 2018.

²⁷⁹ RAND interview with USAF officer, August 20, 2020.

²⁸⁰ RAND interview with USAF officer, March 3, 2020; RAND interview with U.S. Army officer, December 12, 2019.

²⁸¹ Tara Copp, “US Expands Air Base in Northern Syria for Use in Battle for Raqqa,” *Stars and Stripes*, April 2, 2017.

paign.²⁸² Sustaining flight hours required maintenance teams to devise “creative solutions” to track and transport spare parts between locations. Even then, “we burned through the flight hours for an Apache a lot faster than normal,” one interviewee noted.²⁸³

Coordination with Ground Partners

The lack of an acceptable government partner in Syria complicated both the planning and the execution of the Raqqa campaign. By the fall of 2016, the Obama administration determined that the SDF was the only ground force capable of ousting ISIS from Raqqa, but proposals to begin training and equipping fighters were stymied by Turkish opposition to the YPG’s inclusion. U.S. efforts to highlight Arab contributions and the SDF’s pledge to hand retaken areas over to local councils did little to assuage Ankara’s concerns, and the debate over alternative ground partners stretched into the spring.²⁸⁴ Only in May 2017, once it became evident that Turkey’s preferred plan would require as many as 20,000 U.S. ground forces, did the Trump administration ultimately choose to directly arm the YPG, ensuring that it was equipped to launch the planned assault on Raqqa a month later.²⁸⁵

Although U.S. officials praised the SDF’s performance during the staging operations, the group’s ability to seize Raqqa depended on its capacity to coordinate its maneuvers with coalition air and fire support. “You have to remember that the Syrian Democratic Forces are not the Iraqi Security Forces,” LTG Townsend told reporters. “They are really an irregular light infantry force with a comparative handful of light armored vehicles and heavy weapons, who, with coalition assistance, are fighting well above [their] weight class.”²⁸⁶ In a nod to Turkish concerns, the United States limited

²⁸² Joseph L. Votel, “Military Assessment of the Security Challenges in the Greater Middle East,” hearing before the House Committee on Armed Services, March 29, 2017.

²⁸³ RAND interview with U.S. Army officer, December 2, 2019. A similar issue arose during a subsequent RAND interview with another U.S. Army officer on December 12, 2019.

²⁸⁴ Proposed alternates included a Turkish-led or -supported coalition of Free Syrian Army fighters and a direct Turkish intervention. Russia, Saudi Arabia, and Jordan also hinted at a potential ground role, but no concrete proposals were reported. Tensions reached a tipping point in April 2017, when Turkey launched air strikes on the SDF, heightening fears of an imminent move against the SDF stronghold in Manbij that would divert YPG forces from the Raqqa campaign. James Jeffrey, “The Plan to Defeat ISIS: Key Decisions and Considerations,” hearing before the U.S. Senate Committee on Foreign Relations, February 7, 2017.

²⁸⁵ Brett McGurk, “Hard Truths in Syria: America Can’t Do More with Less, and It Shouldn’t Try,” *Foreign Affairs*, May–June 2019; Joseph Dunford and Brett McGurk, “CHOD Conference Press Briefing with Chairman of the Joint Chiefs of Staff General Joseph F. Dunford, Jr., and Brett McGurk, Special Presidential Envoy for the Global Coalition to Counter ISIS, Department of State at Fort Belvoir, Virginia,” transcript, U.S. Department of Defense, October 24, 2017.

²⁸⁶ Stephen Townsend, “Department of Defense Press Briefing by General Townsend via Teleconference from Baghdad, Iraq,” transcript, U.S. Department of Defense, August 31, 2017.

its military aid to the SDF, which had few heavy weapons when the assault on Raqqa began on June 6, 2017.²⁸⁷

ISIS's extensive tunnels and other defensive systems magnified the need for close ground-air coordination. Adapting lessons learned from the Mosul fight, ISIS dug long tunnels through the Old City and laid fields of landmines through Raqqa's narrow streets, "forcing the SDF to try and match its mobility by constantly moving its front lines to avoid a surprise attack."²⁸⁸ The militants also leveraged superior knowledge of Raqqa's urban geography to ambush the SDF fighters with waves of suicide attacks, as well as heavy machine guns, rocket-propelled grenades, explosive-laden drones, and snipers concealed in civilian buildings.²⁸⁹ Pentagon officials confirmed that neutralizing these threats required the coalition to "routinely" launch missiles, including some of the bunker buster armaments mentioned above, at "danger-close" proximity to ground forces. "Ideally you don't want to accept that level of risk unless you have to," said Col Julian C. Cheater, commander of the 432nd Air Expeditionary Wing at Creech Air Force Base. "But in an urban fight—like you're now seeing in Raqqa—options might not be available to you."²⁹⁰

As in Ramadi, the coalition's use of surface fires introduced additional deconfliction challenges. A USMC artillery unit deployed to northeastern Syria in March 2017 to provide all-weather fire support to SDF forces. The Marines were armed with M777 howitzers and HIMARS rocket launchers, whose fire needed to be coordinated around or through open slots in the CAS stack.²⁹¹ To harmonize air and ground fires, the battlespace "was really sliced and diced," explained one interviewee familiar with the Raqqa fight:

CTJTF-OIR was the primary owner of fires and effects. There were partitions of airspace carved out for SOJTF-OIR operations, and there were areas that required DCA or to respond and react, where force protection was a primary concern. Depending on where you were operating, there were different shelves and different allocations of ownership. A continual emphasis was trying to carve out airspace

²⁸⁷ Brett McGurk, "Hard Truths in Syria: America Can't Do More with Less, and It Shouldn't Try," *Foreign Affairs*, May–June 2019.

²⁸⁸ Abdullah al-Ghadawi, "The Battle for Raqqa: A War of Tactics and Caution," Atlantic Council, August 22, 2017.

²⁸⁹ Louisa Loveluck and Thomas Gibbons-Neff, "Islamic State Is 'Fighting to the Death' in Raqqa," *Washington Post*, August 9, 2017; John Dorrian, "Department of Defense Press Briefing by Col. Dorrian via Teleconference from Baghdad, Iraq," transcript, U.S. Department of Defense, May 3, 2017.

²⁹⁰ W. J. Hennigan, "US Leans on Risky Drone Strikes in Urban Syrian Fight," *Stars and Stripes*, August 19, 2017.

²⁹¹ Jamie Dettmer, "US Marines Deploy to Syria as Agreement on Raqqa Assault Eludes Allies," *Voice of America*, March 9, 2017; Amnesty International, "*I Won't Forget This Carnage*: Civilians Trapped in Battle for Raqqa—Syria," London, 2017, p. 11.

to deliberately target or target with less coordination required through other battlespace owners.²⁹²

USAF JTACs and U.S. and coalition SOF called in strikes for Syrian forces fighting within Raqqa.²⁹³ U.S. airmen reported exchanging chat messages on mIRC—a relay chat program—with spotters on the ground or at a command center, in addition to encrypted phone conversations with intelligence analysts, in an effort to minimize risk and avoid errors. The coalition also provided some SDF personnel with the ATAKs described in the Mosul case. Those tablets came preloaded with an application for recording GPS coordinates and imagery that could assist in identifying ISIS targets.²⁹⁴ Similar tablets were carried in the aircraft executing strikes. A B-1 pilot who conducted strikes in the MERV after the Raqqa operation noted,

We would be given iPads to fly with. Every single building here in that area in the MERV had a numeric number placed on it. . . . So you would have, you know, building 31 alpha, building 32 alpha, and that's how targets were relayed to us. . . . [The SDF] would be on the ground talking to JTACs in a separate location through a translator. And they would say . . . I'm receiving effective fire from this building, you know, 32 alpha is what we'll call it. And then that was translated. And then the American JTAC would actually be the one to control us.²⁹⁵

Reflecting on the battle, pilots described steady improvements in targeting, precision, and coordination across the stack. “If you have three-story buildings on either side, I can shoot down an alleyway,” a Reaper pilot and operations commander told *Stars and Stripes*. “If there’s a sniper in one of the windows, I can hit that. . . . [W]e have a lesson learned on how to pair with those ground forces and take the city and those civilian centers back.”²⁹⁶ Moreover, the range of available munitions allowed targeting teams to tailor strikes to limit collateral damage, whether by using low-yield weapons, such as the GBU-39 Small Diameter Bomb, or low-fragmentation weapons, such as

²⁹² RAND interview with USAF officer, January 29, 2020.

²⁹³ RAND interview, with U.S. Army officer, November 12, 2019. In December 2016, the Obama administration announced the deployment of an additional 200 U.S. forces, including SOF advisers, bringing the total number to 500. The Trump administration announced additional increases to assist the SDF push into Raqqa, although the exact number of U.S. forces in Syria during this period is not publicly known. Ash Carter, “Remarks by Secretary Carter at the 2016 IISS Manama Dialogue, Manama, Bahrain,” U.S. Department of Defense, December 6, 2016; Borzou Daragahi, “The US Is Far More Deeply Involved in Syria Than You Know,” *BuzzFeed*, August 6, 2017.

²⁹⁴ RAND interview with Brig Gen Matthew Isler, March 26, 2020.

²⁹⁵ AFHRA interview with Lt Col Benjamin C. Bergren, September 24, 2019.

²⁹⁶ W. J. Hennigan, “US Leans on Risky Drone Strikes in Urban Syrian Fight,” *Stars and Stripes*, August 19, 2017.

the GBU-54(V)5, in heavily populated areas.²⁹⁷ “My perspective from the air was it was incredibly different than anything we’ve ever done,” suggested one interviewee. “Unmanned ISR, all the things the mil-industrial complex, was designed to do was enacted in Raqqa and in this fight.”²⁹⁸

Despite the precautions, the effect on Raqqa’s civilian populace was substantial. International watchdogs, local organizations, and foreign observers expressed concern over the destruction of civilian infrastructure, including hospitals, schools, and residences.²⁹⁹ DoD internal investigations found that 231 civilians were killed in coalition air strikes on the city.³⁰⁰ Although many of those interviewed for this project credited improvements in unmanned ISR systems, some questioned whether the technology was sufficient to mitigate the intrinsic difficulties associated with operating in a highly populated urban environment. “Our ISR doesn’t see civilians hiding inside buildings. Furthermore, canyoning effects between buildings made civilian movement and pattern of life hard to see. CIVCAS [civilian casualty] risk is highest in urban operations, in structures, especially during dynamic targeting,” one commander explained, adding that the lack of reliable human intelligence (HUMINT) limited the utility of other information sources.³⁰¹

Conclusion for the Raqqa Case

The coalition declared Raqqa’s liberation on October 20, 2017. With ISIS’s loss of its stronghold, just four months after its expulsion from Mosul, the group ceded the remnants of its administrative infrastructure and any remaining aspirations for a territorial caliphate.³⁰² The loss of its safe haven weakened the group’s capacity to publish propaganda, recruit foreign forces, and plot attacks.³⁰³

²⁹⁷ Matthew Isler, “Department of Defense Press Briefing by Brig. Gen. Matthew Isler on Central Command’s Targeting and Civilian Casualty Investigation Processes,” transcript, U.S. Department of Defense, October 25, 2017.

²⁹⁸ RAND interview with U.S. Navy officer, February 3, 2020.

²⁹⁹ See, for instance, Amnesty International, “*War of Annihilation*: Devastating Toll on Civilians, Raqqa—Syria, London, June 5, 2018; Amnesty International and Airwars, “War in Raqqa: Rhetoric Versus Reality,” website, undated; Airwars, *Credibility Gap: United Kingdom Civilian Harm Assessments for the Battles of Mosul and Raqqa*, Exeter, UK, September 2018.

³⁰⁰ DoD, *Annual Report on Civilian Casualties in Connection with United States Military Operations*, Washington, D.C., May 2, 2019.

³⁰¹ Interview with Brig Gen Matthew Isler, December 6, 2019.

³⁰² Louisa Loveluck and Liz Sly, “The Defeat of ISIS in Raqqa Tests U.S. Commitment to Syrian Kurds,” *Washington Post*, October 17, 2017.

³⁰³ Joseph Dunford and Brett McGurk, “CHOD Conference Press Briefing with Chairman of the Joint Chiefs of Staff General Joseph F. Dunford, Jr., and Brett McGurk, Special Presidential Envoy for the Global Coalition to Counter ISIS, Department of State at Fort Belvoir, Virginia,” transcript, U.S. Department of Defense, October 24, 2017.

To execute the operation, the coalition evolved its approach in two main ways. First, RPAs were used as a much more frequent strike platform in Raqqa than in previous operations. RPAs were in high demand in earlier operations but primarily for their FMV capabilities. Perhaps owing to SOF's predominant role in the operation and these forces' experience with using RPAs for lethal effects, RPAs played a larger kinetic role in Raqqa than in earlier operations. Second, the coalition used more surface fires as a complement to air strikes in Raqqa. Although surface fires were introduced by the coalition in late 2015, Raqqa was the high point of their employment in the campaign. These adaptations, along with the continued application of airpower from manned assets, defeated ISIS in a shorter period than anticipated. The battle for Raqqa city lasted roughly four and a half months, or less than half the time required for the clearing of eastern and western Mosul.³⁰⁴

Nonetheless, coalition military commanders cautioned that ISIS was not yet defeated. "Even with the fall of Mosul and Raqqa, we're at an inflection point in the global campaign, not an end point," Chairman of the Joint Chiefs of Staff Gen Joseph Dunford told reporters.³⁰⁵ An estimated 3,500–5,500 militants sheltered in towns along the Euphrates River, while a few hundred commanders and administrative personnel were believed to have retreated south to the neighboring governorate of Deir ez-Zur, taking heavy equipment with them.³⁰⁶ Observers cautioned that the group, sheltered within disaffected Sunni communities in the region and further abroad, might resurge as an insurgency or shift its attentions to disaffected populations around the globe.³⁰⁷

³⁰⁴ Readers should not necessarily conclude, however, that the Raqqa operation was therefore better planned or executed than the Mosul operation. Raqqa city is roughly one-quarter of the size of Mosul. Moreover, there is no simple way to measure the strength of ISIS's forces that remained to fight at each location.

³⁰⁵ Joseph Dunford, "Department of Defense Press Briefing by General Dunford in the Pentagon Briefing Room," U.S. Department of Defense, October 23, 2017. For similar statements, see Joseph Dunford and Brett McGurk, "CHOD Conference Press Briefing with Chairman of the Joint Chiefs of Staff General Joseph F. Dunford, Jr., and Brett McGurk, Special Presidential Envoy for the Global Coalition to Counter ISIS, Department of State at Fort Belvoir, Virginia," transcript, U.S. Department of Defense, October 24, 2017; and Jim Mattis, "Remarks by Secretary Mattis at D-ISIS Event at NATO Headquarters, Brussels, Belgium," transcript, U.S. Department of Defense, November 9, 2017.

³⁰⁶ Jared Malsin, "Raqqa Is in Ruins, and ISIS in Retreat," *Time*, November 6, 2017; Robin Wright, "The Ignominious End of the ISIS Caliphate," *New Yorker*, October 18, 2017; Anne Barnard and Hwaida Saad, "Raqqa, ISIS 'Capital,' Is Captured, U.S.-Backed Forces Say," *New York Times*, October 17, 2017.

³⁰⁷ Anne Barnard and Hwaida Saad, "Raqqa, ISIS 'Capital,' Is Captured, U.S.-Backed Forces Say," *New York Times*, October 17, 2017; Hassan Hassan, "Insurgents Again: The Islamic State's Calculated Reversion to Attrition in the Syria-Iraq Border Region and Beyond," *CTC Sentinel*, Vol. 10, No. 11, December 2017.

The Close Fight: Conclusions

Airpower as Reassurance

The most important insight from the close fight is the critical role that airpower played in bolstering the confidence and motivation of partner forces to advance. LTG James Terry, the first three-star commander of OIR, noted that “U.S. airpower put steel in the backbone of the Iraqi forces.”³⁰⁸ Although this created a high demand for X-CAS, it was judged necessary to avoid Iraqi forces getting “a case of the slows” that occurred when they were not assured of the availability of air support.³⁰⁹ This might have resulted in the dropping of munitions on tactically insignificant targets, such as defensive positions and terrain, but these targets were strategically significant in that they galvanized partner ground forces, which were needed to defeat ISIS.³¹⁰

Compensating for Ground Force Quality

In addition to increasing demand for CAS, the uneven quality of ground force partners also slowed the pace of operations. Even among interviewees who were relatively complimentary of partner ground forces, it was conceded that “they do it on their own time” and that “setting times for them did not work well. But they did well on their own with our enablers.”³¹¹ Among the case studies reviewed, this was most evident in the Mosul operation. Coalition advisers anticipated that the ISF would be ready for that operation long before October 2016, which was roughly the two-year point of the campaign. However, readying forces and completing the smaller operations necessary to establish intermediate staging bases and tactical assembly areas proved slow going, pushing back the timelines for the operation beyond initial expectations.

The variable quality of ground forces also drove demand for RPAs, which were perceived as the “coin of the realm” in the fight. There were several reasons for this high demand for RPAs. First, these assets could deliver X-CAS when partner forces were imperiled or provide ISR to manned strike platforms higher in the CAS stack. A second reason for RPA demand, and one that created inefficiencies in allocating these assets, was that RPAs were used as a “green-force tracker”—that is, tracking locations of partner ground forces to improve situational awareness and reduce the chance of fratricide incidents.³¹² Finally, RPAs were preferentially used to positively identify targets nominated by partner forces. This generated frustration by some and in particular senior airmen who have experience delivering airpower without the benefit of RPAs,

³⁰⁸ RAND interview with LTG (ret.) James L. Terry, March 27, 2020.

³⁰⁹ RAND interview with LTG (ret.) James L. Terry, March 27, 2020.

³¹⁰ Some Army officers disagree that any air strikes were ever called in that did not have tactical and morale purposes. RAND interview with GEN Joseph Martin, June 16, 2020.

³¹¹ RAND interview with USMC officer, January 17, 2020.

³¹² RAND interview with U.S. Army officer, December 2, 2019.

with the singular focus on this tool. A frequent limitation cited was the “soda straw” vantage point that the RPAs provide,³¹³ which, while useful in monitoring a small area, is not well suited to target development in a broader territory. Others noted that employing this capability is limited by weather and that deliberate-target development needed to occur when the weather was favorable, while the strikes could be executed anytime using all-weather weapons, such as JDAMs.³¹⁴

A Template for the Liberations of Population Centers

Another important conclusion from the close fight is that, while the coalition improved its processes for delivering strikes over time, there was a fairly standard template followed for the liberation of large towns and cities. Our review of the six case studies examined in this chapter, with particular emphasis on the four larger-scale air operations (Kobani, Ramadi, Mosul, and Raqqa), revealed a strong pattern in how airpower was employed in the close fight. The coalition typically provided between 100 and 200 strikes a month in support of ground maneuver during the height of an operation to liberate a large population center.³¹⁵ The only sustained exception to this pattern was the end of the Raqqa operation, when strikes exceeded 200 per month. This, however, coincided with changes in the reporting of strikes, and so the larger numbers in Raqqa may simply be a reflection of the inclusion of more surface fires in the strike count rather than indicating an increase in strikes from the air.

Just as monthly strike totals tended to cluster in a band, there were also patterns in target selection. Facilities and resources tended to make up a greater share of targets engaged at the outset of an operation, whereas the category of terrain and LOCs tended to rise as a proportion of strikes over time. That pattern held for all four of the larger operations reviewed, although the decline of facility and resource targets over time is not as stark in the Ramadi case as in the others. It may be that the trends in targeting over time are driven by the coalition exhausting fixed targets at the outset of an operation that are included in the facilities and resource category. It may also be that the increase in targeting of terrain and LOCs over time is driven by the need to deny ISIS resupply or paths of escape, although that trend could also capture some “morale bombing,” in which ISIS berms and trenches were struck to embolden the partner ground force as much as to achieve a military effect.

Another pattern in the strike data across the cases is the remarkable consistency in the share of ISIS military forces relative to overall targets engaged. Exempting Mosul Dam, which was an early outlier in the campaign, the share of ISIS military forces to total targets was 25 percent in Kobani, 34 percent in Tikrit, 36 percent in Ramadi,

³¹³ RAND interview with USAF officer, April 1, 2020.

³¹⁴ RAND interview with LTG (ret.) Sean MacFarland, March 31, 2020.

³¹⁵ To be clear, the 100–200 figure is in support of a single counter attack on a city. In any given month, the coalition might be conducting liberations of several cities, as well as shaping operations for others.

36 percent in Mosul, and 34 percent in Raqqa. Those well versed in airpower might have anticipated that ISIS military forces would constitute the minority of targets, as once ISIS stopped flying flags and openly convoying on roads, it became much harder to identify these targets. Given the challenge of identifying military forces to target, airpower was used against the facilities and resources, equipment, and terrain and LOCs that ISIS relied on. This provides a good example of how airpower is used to destroy not just the adversary's fighters but also the broader support structure around those fighters.

Adaptation to Meet Requirements of Mosul and Raqqa

Although the cases do reveal considerable consistency in the scope of air support provided and patterns in the target types engaged over time, our review of cases reveals a clear evolution in the coalition's processes and the capabilities it employed. These evolutions appear to be driven by the reality of meeting requirements for the two big tests of the campaign: the liberation of Mosul and Raqqa.

From a process standpoint, there were significant changes in the way close-fight strikes were delivered. Throughout the campaign, the strike cell is the basic feature of air-ground coordination in the close fight. However, what a strike cell means changes over time. At the outset, the strike cell was physically distant from the fight. Indeed, the first strike cell for OIR was actually at a site outside Iraq or Syria. Later, the strike cell migrated into the joint operations area, but U.S. JTACs were receiving feeds from ISR assets rather than having the ability to directly observe the fight. That would change at Mosul, when a limited number of U.S. JTACs did operate forward, following the establishment of Tactical Directive 1. There was also a significant devolution of TEA over time. When OIR began, the three-star commanding general was the typical TEA for strikes. By the time the operation culminated, any appropriate U.S. ground commander could operate as the TEA for some strikes,³¹⁶ and the one-star commander of a CJOC was a typical echelon for sign-off.

The capabilities that the coalition deployed also changed over time. In early fights, such as Mosul Dam, Kobani, and Tikrit, the coalition relied exclusively on air strikes. In Ramadi, surface fires were introduced, albeit at a modest level. Given the sheer number of strikes needed for Mosul and Raqqa, surface fires became a larger and more integrated complement to air strikes. This required even greater air-ground coordination but also gave the coalition new tools to create multiple dilemmas for ISIS. The capabilities of ground partner forces also grew. With coalition training and such tools as ATAKs, advanced partner ground forces in both Iraq and Syria could contribute to the building of a common operating picture and the nomination of specific targets. To be clear, the coalition was not relying solely on these inputs when selecting and vetting targets, but, over time, ground forces had increased means of contributing.

³¹⁶ An O-6 is a colonel in the USAF, Army, and USMC or a captain in the Navy.

Conclusion

Taken together, the case studies and interviewees' overarching reflections suggest that airpower was crucial to the success of the close fight. Air strikes attrited ISIS's military forces, but, equally important, airpower destroyed ISIS's support infrastructure and emboldened local partner forces to launch ground operations against the group. Although there are significant debates about how the campaign could have been accelerated and how civilian harm might have been further limited, the employment of airpower clearly corresponded with territorial gains by partner ground forces. The capability was also in high demand from partner forces; indeed, their willingness to advance was often conditional on having X-CAS overhead. As the USAF and other services take stock of their contributions to the close fight, the question is not whether the capability achieved the intended effect—it did—but what tweaks in strategy and implementation could have improved the results in terms of speed, efficiency, and minimizing unintended consequences.

The Deep Fight: Deliberate-Targeting Operations

This chapter addresses air attacks prosecuted as deliberately planned targets in support of OIR’s goal of defeating ISIS. It focuses in particular on the United States and its coalition partners’ use of airpower against ISIS’s financial resources and logistical networks. Unlike the CAS missions described in the previous chapter, these operations occurred beyond the front lines, where Iraqi and Syrian partners faced off against ISIS in the close fight. Figure 5.1 provides an overview of the deep-fight operations examined in this chapter.

ISIS posed a vexing challenge, as it was neither a true state nor solely a terrorist organization but possessed attributes of both.¹ Although ISIS was an irregular fighting force that employed terrorist attacks against civilians and military targets, it operated like a guerrilla force at other times. Moreover, it was highly bureaucratized, like a regular army, and had heavy weapons and the ability to conduct traditional combined-arms warfare. ISIS also demonstrated state-like attributes in relation to its control of large swaths of territory in Iraq and Syria, including the extraction of resources, such as oil, and the system of governance and taxation that it implemented in these areas. Consequently, ISIS’s hybrid nature made it difficult for the coalition to immediately discern its key pillars of strength, which presented a challenge to the deliberate-strike process.² Because of ISIS’s rapid expansion in 2014, the United States did not have a preexisting set of targets for ISIS that it could take off the shelf and begin to prosecute. As a result, there were relatively few strategic air strikes early in the operation.³

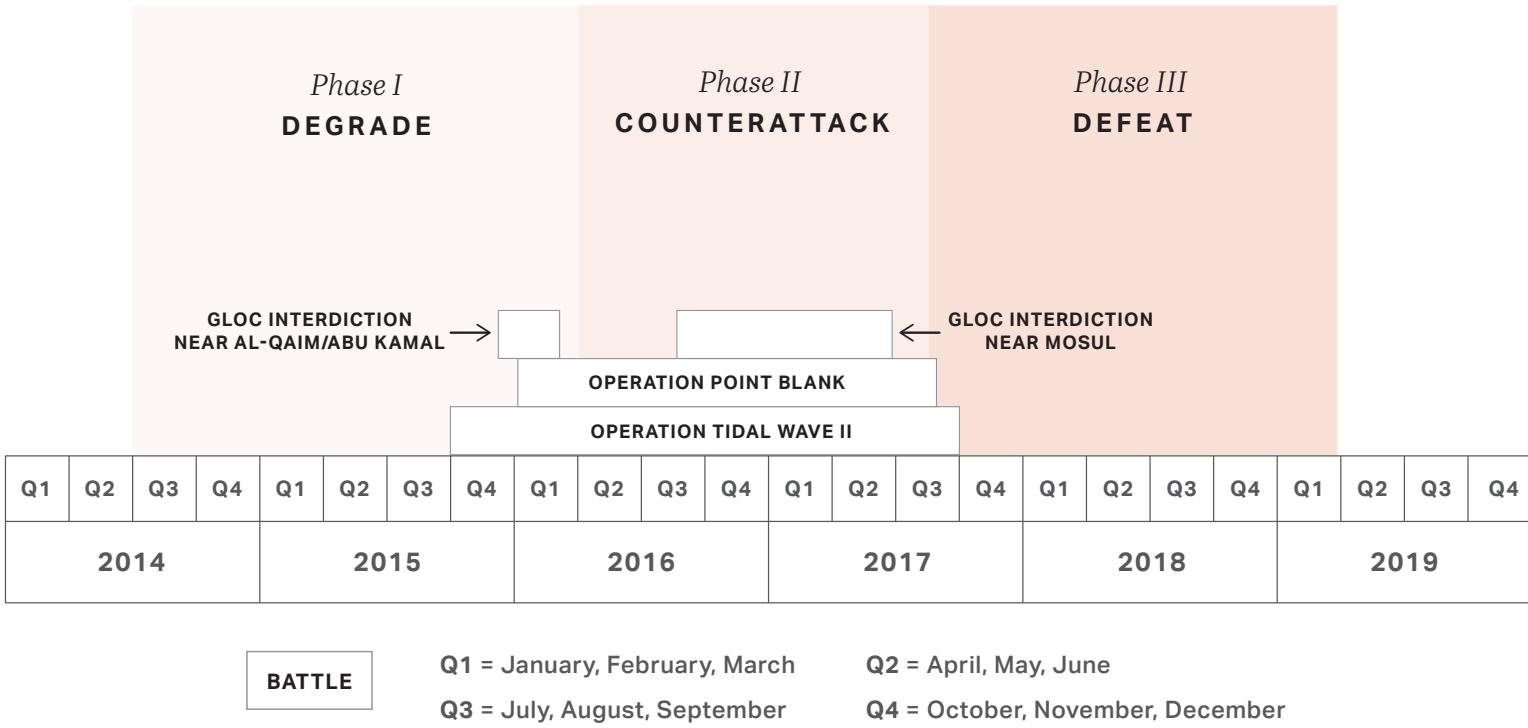
The deep fight—attacks on strategic targets intended to directly degrade ISIS capabilities—and close fights unfolded separately in the early stages of the campaign against ISIS. The close fight focused on stopping ISIS’s atrocities, repelling its offensives, and protecting Baghdad, while the deep fight often amounted to relatively spo-

¹ For more on the history of ISIS, see Howard J. Shatz and Erin-Elizabeth Johnson, *The Islamic State We Knew: Insights Before the Resurgence and Their Implications*, Santa Monica, Calif.: RAND Corporation, RR-1267-OSD, 2015.

² RAND interview with Army officer, March 31, 2020; RAND interview with USAF officer, January 8, 2020.

³ RAND interview with USAF official, December 2, 2019; RAND interview with Gen Charles Q. Brown, February 20, 2020.

Figure 5.1
Timeline of Deep Fight Operations



SOURCE: Timeline constructed from various sources cited in this chapter.

radic air strikes against strategic targets as they were identified and vetted. That is not to say that the deep fight did not consist of carefully crafted operations that leveraged intelligence and network analysis. Rather, the preponderance of deliberate strikes in the first year were not linked to broader operations or strategic aims. The deep- and close-fight efforts occurred in parallel and did little to reinforce one another, nor did they enable the Iraqis and Syrians to seize the initiative. As LTG Sean MacFarland, former CJTF-OIR Commander, noted, “we were only mowing the grass, not getting at the enemy center of gravity.”⁴ Therefore, CJTF-OIR needed to develop a comprehensive campaign plan that integrated and sequenced the close and deep fights to apply pressure from multiple directions against ISIS’s critical nodes to hasten its defeat.⁵

The deep fight that emerged in OIR rested on three key ISIS target sets: leadership, resources, and logistics. The logic behind targeting ISIS leaders was to remove particularly charismatic or effective members of the organization to degrade ISIS’s capability and destabilize its C2, in line with the post–September U.S. counterterrorism strategy that sought to capture or kill militant leaders.⁶ This task was largely carried out by the SOJTF in OIR,⁷ employing both raids and RPA air strikes.⁸ The operations against ISIS’s resource base largely focused on strikes on cash reserves and revenue-generating activities, especially the production and distribution of oil. These strikes were intended to reduce ISIS’s ability to pay its fighters, conduct operations globally, and

⁴ RAND interview with LTG (ret.) Sean MacFarland, March 31, 2020.

⁵ RAND interview with LTG (ret.) Sean MacFarland, March 31, 2020; RAND interview with Gen Charles Q. Brown, February 20, 2020.

⁶ For more on the debate over the effect of leadership decapitation on terrorist organizations, see Robert A. Pape, *Bombing to Win: Air Power and Coercion in War*, Ithaca, N.Y.: Cornell University Press, 1996; Robert A. Pape, “The Strategic Logic of Suicide Terrorism,” *American Political Science Review*, Vol. 97, No. 3, August 2003; Jenna Jordan, “When Heads Roll: Assessing the Effectiveness of Leadership Decapitation,” *Security Studies*, Vol. 18, No. 4, December 2009; Jenna Jordan, “Attacking the Leader, Missing the Mark,” *International Security*, Vol. 38, No. 4, Spring 2014; Jenna Jordan, *Leadership Decapitation: Strategic Targeting of Terrorist Organizations*, Stanford, Calif.: Stanford University Press, 2019; Daniel Byman, “Do Targeted Killings Work?” *Foreign Affairs*, Vol. 85, No. 2, April 2006; Daniel Byman, *A High Price: The Triumphs and Failures of Israeli Counterterrorism*, New York: Oxford University Press, 2011; Patrick B. Johnston, “Does Decapitation Work?” *International Security*, Vol. 36, No. 4, Spring 2012.

Airmen have long thought that attacks on enemy leadership should be a focus of air campaigns. In particular, John Warden identified enemy leadership as the most important center of gravity. See John Warden, *The Air Campaign: Planning for Combat*, Washington, D.C.: National Defense University Press, 1988; Stephen T. Hosmer, *Operations Against Enemy Leaders*, Santa Monica, Calif.: RAND Corporation, MR-1385-AF, 2001.

⁷ See, for example, the death of ISIS Emir Abu Bakr al-Baghdadi by suicide during a SOF raid in October 2019. White House, “Statement from the President on the Death of Abu Bakr al-Baghdadi,” October 27, 2019; Jim Garamone, “Central Command Chief Gives Details on Baghdadi Raid,” U.S. Department of Defense, October 30, 2019.

⁸ See, for example, “US Says It Killed Key Islamic State Moneyman,” Associated Press, June 23, 2017; Terri Moon Cronk, “OIR Spokesman: Top ISIL Operative Killed in Coalition Airstrike in Syria,” U.S. Department of Defense, November 16, 2016.

govern within its territory.⁹ Lastly, interdicting ISIS's logistics and disrupting its ability to move goods, weapons, and fighters in the AOR was deemed essential to preventing the resupply of its frontline forces and undermining its ability to fight. The case studies in this chapter focus on deliberate strikes targeting ISIS resources and logistics networks. We do not address the targeting of ISIS leadership because of constraints on the availability of unclassified information surrounding these strikes.¹⁰

Case Study Selection

Our analysis of the use of deliberate air strikes in the deep fight focuses on two broad categories of targets: ISIS resources and logistics. Table 5.1 displays our case studies, the phase of OIR that they occurred in, and the target. These four deliberate-strike operations are emblematic of the deep fight that developed in OIR. Although they varied in targets, geography of strikes, and timing within the campaign, they possess a number of commonalities in strategic aims and, to a lesser extent, operational approaches. Ultimately, these operations sought to cripple ISIS's strategic and operational centers of gravity to accelerate its demise and support partner efforts to retake territory from the enemy.

We do not organize these cases by phases of OIR, as many of these operations stretched across phases. Rather, the cases are organized by the strategic targets of the operations: ISIS resources and logistics. For the first category, we profile two cases—

Table 5.1
Deep-Fight Case Studies

Case Study	Phase of OIR	Targets
Operation Tidal Wave II	Phases I–III (October 2015–October 2017)	ISIS resources (oil)
Operation Point Blank	Phases I–II (January 2016–September 2017)	ISIS resources (cash)
GLOC interdiction near Abu Kamal and Al-Qaim	Phase I (October 2015–February 2016)	ISIS logistics (GLOCs)
GLOC interdiction near Mosul	Phase II (September 2016–July 2017)	ISIS logistics (GLOCs)

⁹ Charles Q. Brown Jr., “Department of Defense Press Briefing by Lt. Gen. Brown via Teleconference from al-Udeid Air Base, Qatar,” transcript, U.S. Department of Defense, February 18, 2016.

¹⁰ Greg Miller, “U.S. Launches Secret Drone Campaign to Hunt Islamic State Leaders in Syria,” *Washington Post*, September 1, 2015.

Operation Tidal Wave II and Operation Point Blank.¹¹ In the former, airpower was employed against ISIS's oil production and distribution network, mainly near Mosul and Deir ez-Zur, from October 2015 to October 2017.¹² In the latter, airpower was employed to destroy ISIS stockpiles of cash, primarily around Mosul and Raqqa, between January 2016 and September 2017 to directly create a cash crunch.¹³ The theory of victory behind these two operations was that starving ISIS of resources would reduce its capacity to operate, thereby undermining its organizational and military strength.

The second category of operations profiled are those that sought to disrupt ISIS logistics routes—often referred to as GLOCs—to halt flows of weapons and fighters to the front lines, isolating and weakening ISIS forces occupying Iraqi cities. These operations were intended to support the close fight to liberate cities, albeit indirectly. The first interdiction operation focused on disrupting the flow of goods, resources, and personnel between Iraq and Syria near the Al-Qaim and Abu Kamal border crossings in the period from October 2015 to February 2016. The second interdiction operation tried to disrupt ISIS's ability to resupply its fighters in Mosul during the prolonged battle to liberate the city, from September 2016 to July 2017.

Evolution in Coalition Targeting Processes

The deliberate-targeting process is a fundamental component of USAF and joint doctrine. However, deliberate strikes on ISIS strategic targets were largely absent at the outset of the campaign because of the lack of vetted targets, the need to collect intelligence, and the necessary reinvigoration of the deliberate-targeting process—all required to develop a deep fight in OIR. This necessitated not only collecting and analyzing intelligence to identify particular targets to strike but also identifying which targets, if struck, would help erode ISIS's overall strength. Therefore, the coalition needed to understand ISIS's network to identify critical nodes and the militant's center of gravity.

Three important shifts occurred that affected the effort to improve the deliberate-targeting process for OIR. First, the CFACC requested that intelligence agencies, other

¹¹ Operation Tidal Wave was a U.S. Army Air Forces bombing campaign against oil refineries in Romania during World War II to deprive Germany of access to fuel. Jay A. Stout, *Fortress Ploesti: The Campaign to Destroy Hitler's Oil Supply*, Havertown, Pa.: Casemate Publishers, 2003.

¹² Refer to the comments by John Allen, then—special presidential envoy for the Global Coalition to Counter ISIL, and Ash Carter, then—Secretary of Defense: John Allen, "Allen: Degrading and Defeating ISIL," *Defense News*, December 29, 2014; Ash Carter, statement during "U.S. Strategy for Syria and Iraq and Its Implications for the Region," hearing before the U.S. House Committee on Armed Services, December 1, 2015.

¹³ Steven Warren, "Department of Defense Press Briefing by Colonel Warren via Teleconference from Baghdad, Iraq," transcript, U.S. Department of Defense, May 13, 2016.

services, and other entities within the U.S. government share more information about ISIS.¹⁴ This interagency effort helped illuminate ISIS's structure and how it functioned which, in turn, provided the CFACC with a better understanding of which target sets to strike. Second, efforts to develop specific targets within these pillars of ISIS strength were hampered by a lack of available ISR assets, which were largely tied up supporting the close fight. This improved slightly when the CFACC obtained both contractor-owned, contractor-operated and government-owned, contractor-operated RPAs to help develop and execute targets for the deep fight.¹⁵ The third shift was leadership changes, both within CJTF-OIR and AFCENT, as discussed in Chapter Two, that fostered the development of the deep fight.¹⁶

An additional important development that shaped OIR strategic attack and air interdiction efforts was the introduction of *deliberate-dynamic* strikes. This term was used to describe two types of strikes that emerged in OIR. Many officials we interviewed used the term *deliberate-dynamic* to describe strikes developed through the CAOC-run deliberate-targeting process but that did not have a set date or time. In joint doctrine, these are referred to as *deliberate on-call* strikes.¹⁷ Others used *deliberate-dynamic* to describe preplanned strikes that were generated in a few days by a CJTF-OIR- or CJFLCC-run target-development process to support operations in the close fight. This second process emerged from a general frustration with the lengthy deliberate-strike process, which was perceived as unable to develop targets on an operationally relevant timeline because the speed of partner operations and ISIS adaptation outstripped the four- to six-week CAOC-run deliberate targeting process.¹⁸ Thus, the CJFLCC Commander instituted this process to support the close fight in a way that was more responsive to changing conditions.

Starving ISIS's Resource Base: Operation Tidal Wave II, October 2015–October 2017

Background of Operation Tidal Wave II

During its territorial expansion between June 2014 and September 2014, ISIS captured key oil fields and refineries in northeastern Syria and northern Iraq that were

¹⁴ RAND interview with USAF official, December 2, 2019; RAND interview with LTG (ret.) Sean MacFarland, March 31, 2020; RAND interview with Maj Gen (ret.) Scott Zobrist, December 3, 2019.

¹⁵ These contractor assets were MQ-1 Predators and MQ-9 Reapers, which could perform ISR but could not carry or fire weapons. RAND interview with Maj Gen (ret.) Scott Zobrist, December 3, 2019.

¹⁶ RAND interview with LTG (ret.) Sean MacFarland, March 31, 2020.

¹⁷ Joint Publication 3-60, *Joint Targeting*, Washington, D.C.: Joint Chiefs of Staff, January 31, 2013.

¹⁸ RAND interview with Brig Gen Matthew Isler, December 6, 2019.

concentrated near Deir ez-Zur,¹⁹ including Syria's two largest old fields, al-Omar and al-Tanak,²⁰ and near Mosul and Tikrit, including oil fields in Ajil, Himym, and Qayyarah.²¹ By March 2016, ISIS's territorial conquest meant that 42 oil-production sites in Syria and Iraq were estimated to be under its control.²² Although it is difficult to precisely determine the extent of ISIS's oil operations, one estimate was that ISIS produced approximately 45,000 to 80,000 barrels of oil per day and earned \$1 million to \$3 million a day from oil sales at the height of its operations.²³

Oil, however, was only one of ISIS's many sources of revenue. Under Secretary of the Treasury for Terrorist Financing and Intelligence David Cohen called ISIS "probably the best-funded terrorist organization we have confronted."²⁴ The organization used its resources to pay fighters, purchase weapons, and fund military operations, both in Iraq and Syria and abroad. A cash surplus also underpinned ISIS's ability to govern, by providing funding for administrative expenses, the repair of roads and infrastructure, and other state-like functions required to bind citizens in the territory it controlled to its so-called caliphate.

ISIS's economic model centered on self-sufficiency and the control of territory, which enabled it to establish diverse income streams, including criminal activity, extortion, taxation, oil and natural gas sales, and smuggling.²⁵ According to Rukmini Cal-

¹⁹ Colin P. Clarke, Kimberly Jackson, Patrick B. Johnston, Eric Robinson, and Howard J. Shatz, *Financial Futures of the Islamic State of Iraq and the Levant: Findings from a RAND Corporation Workshop*, Santa Monica, Calif.: RAND Corporation, CF-361, 2017, p. 8.

²⁰ Michael R. Gordon and Eric Schmitt, "U.S. Steps Up Its Attacks on ISIS Controlled Oil Fields in Syria," *New York Times*, November 12, 2015; Quy-Toan Do, Jacob N. Shapiro, Christopher D. Elvidge, Mohamed Abdel-Jelil, Daniel P. Ahn, Kimberly Baugh, Jamie Hansen-Lewis, and Mikhail Zhizhin, *How Much Oil Is the Islamic State Group Producing*, Washington, D.C.: World Bank, October 2017, pp. 31–32.

²¹ Erika Solomon and Guy Chazan, "ISIS Inc: How Oil Fuels the Jihadi Terrorists," *Financial Times*, October 14, 2015; Omar Al-Nidawi, "How ISIL Changed the Oil Map of Iraq," Al Jazeera, December 1, 2017.

²² Quy-Toan Do, Jacob N. Shapiro, Christopher D. Elvidge, Mohamed Abdel-Jelil, Daniel P. Ahn, Kimberly Baugh, Jamie Hansen-Lewis, and Mikhail Zhizhin, *How Much Oil Is the Islamic State Group Producing*, Washington, D.C.: World Bank, October 2017, p. 4.

²³ Steven Warren, "Department of Defense Press Briefing by Col. Warren," transcript, Combined Joint Task Force—Operation Inherent Resolve, January 6, 2016; Quy-Toan Do, Jacob N. Shapiro, Christopher D. Elvidge, Mohamed Abdel-Jelil, Daniel P. Ahn, Kimberly Baugh, Jamie Hansen-Lewis, and Mikhail Zhizhin, *How Much Oil Is the Islamic State Group Producing*, Washington, D.C.: World Bank, October 2017; Matthew Reed, "Taking Stock of ISIS Oil: Part 1," *The Fuse*, October 23, 2015; David Cohen, "Remarks of Under Secretary for Terrorism and Financial Intelligence David S. Cohen at the Carnegie Endowment for International Peace, 'Attacking ISIL's Financial Foundation,'" U.S. Department of the Treasury, October 23, 2014; Karen Leigh, "ISIS Makes up to \$3 Million a Day Selling Oil, Say Analysts," ABC News, August 2, 2014.

²⁴ Patrick B. Johnston, Mona Alami, Colin P. Clarke, and Howard J. Shatz, *Return and Expand? The Finances and Prospects of the Islamic State After the Caliphate*, Santa Monica, Calif.: RAND Corporation, RR-3046, 2019, p. 31.

²⁵ Jean-Charles Brisard and Damien Martinez, *ISIS Financing: 2015*, Paris: Center for the Analysis of Terrorism, May 2016, p. 5. See also Patrick B. Johnston, Mona Alami, Colin P. Clarke, and Howard J. Shatz, *Return and*

limachi's analysis of ISIS records, "the militants monetized every inch of territory they conquered, taxing every bushel of wheat, every liter of sheep's milk, and every watermelon sold at markets they controlled."²⁶ In 2014, the *New York Times* estimated that ISIS gained 49 percent of its revenue from extortion and taxation in Iraq, 40 percent from stolen Iraqi banks, 8 percent from oil, and 2 percent from kidnapping ransoms.²⁷ In 2014, ISIS's offensive into Iraq yielded a significant windfall and left it with a cash surplus, but a large portion of these assets (e.g., cash confiscated from banks) was not renewable.²⁸

Yet "tax revenue the Islamic state earned far outstripped income from oil sales," and CJTF-OIR could target much of this income only by rolling back ISIS's territorial holdings.²⁹ For instance, farmers had to pay a harvest tax, truckers paid a highway tax, and all individuals living under ISIS control had to pay zakat, which is traditionally an Islamic act of charity. Such taxation was made possible by ISIS's territorial control. By one estimate, taxes generated six times as much revenue for ISIS than its oil business.³⁰

Additionally, according to one estimate, by September 2014 ISIS had assets valued at between \$1.3 billion and \$2 billion, because of returns from its different enterprises and its seizure of assets in Iraqi banks.³¹ In general, however, ISIS tended to invest its resources in human capital, such as paying the salaries of its fighters, and tried to avoid investing in fixed infrastructure because of its vulnerability. A notable exception to this approach was ISIS's oil business.³²

Because the majority of ISIS's revenue was internally derived, the U.S. government's traditional counterterrorism model of targeting foreign donors and banks to halt the international movement of funds would not have much effect. Instead, CJTF-OIR needed to take direct military action to degrade ISIS's finances.³³ ISIS's oil business was a source of income that could be degraded independently of liberating ter-

²⁶ Rukmini Callimachi, "The ISIS Files," *New York Times*, April 4, 2018.

²⁷ Sarah Almukhtar, "ISIS Finances Are Strong," *New York Times*, May 19, 2015.

²⁸ Patrick B. Johnston, Mona Alami, Colin P. Clarke, and Howard J. Shatz, *Return and Expand? The Finances and Prospects of the Islamic State After the Caliphate*, Santa Monica, Calif.: RAND Corporation, RR-3046, 2019, p. 40.

²⁹ Rukmini Callimachi, "The ISIS Files," *New York Times*, April 4, 2018.

³⁰ Rukmini Callimachi, "The ISIS Files," *New York Times*, April 4, 2018.

³¹ Matthew Levitt, "Terrorist Financing and the Islamic State," testimony before the U.S. House of Representatives Committee on Financial Services, November 13, 2014.

³² Sarah Almukhtar, "ISIS Finances Are Strong," *New York Times*, May 19, 2015.

³³ Adam Szubin, "Remarks of Acting Under Secretary Adam Szubin on Countering the Financing of Terrorism at the Paul H. Nitze School of Advanced International Studies," U.S. Department of the Treasury, October 10, 2016.

ritory by airpower, unlike many other ISIS financial sources. ISIS oil revenue was derived mainly from marked-up local sales to the millions of people living under ISIS rule.³⁴ ISIS tanker trucks also smuggled oil, selling it to markets outside its territory, and ISIS fighters also relied on the fuel that the organization produced.³⁵

To pressure ISIS finances, CJTF-OIR began to strike oil-related targets in September 2014. However, these initial strikes were not systematic or persistent, nor part of a broader strategy to pressure and dismantle ISIS. Rather, these were strikes on easily identified, usually fixed targets, since efforts to reinvigorate and refine the deliberate-targeting process were ongoing.³⁶ In response to these initial piecemeal strikes, ISIS successfully repaired the parts of its oil network that were damaged and altered its distribution routes to evade targeting.³⁷ As Secretary of Defense Ash Carter noted, “We were striking parts of the energy infrastructure which were largely small scale, [such as] ISIS-operated refining facilities. That proved to not be very effective.”³⁸

The coalition needed a new, more consistent military effort to degrade ISIS’s oil revenue but lacked sufficient intelligence on ISIS’s oil operations.³⁹ In the spring of 2015, a U.S. SOF raid in Syria provided a huge trove of detailed information about ISIS’s oil operations, giving the coalition the ability to identify the critical nodes that, if targeted, would have the greatest impact on degrading the enemy’s oil enterprise.⁴⁰ In response, Operation Tidal Wave II was launched and would become the most extensive deep-fight effort of OIR.

The Application of Airpower in Operation Tidal Wave II

Operation Tidal Wave II began on October 21, 2015, and represented a significant expansion of air operations against oil assets—and the first systematic deliberate-

³⁴ Luay Al-Khatteeb and Eline Gordts, “How ISIS Uses Oil to Fund Terror,” Brookings Institution, September 27, 2014; Matthew Reed, “Taking Stock of ISIS Oil: Part 2,” *The Fuse*, October 29, 2015; Colin P. Clarke, Kimberly Jackson, Patrick B. Johnston, Eric Robinson, and Howard J. Shatz, *Financial Futures of the Islamic State of Iraq and the Levant: Findings from a RAND Corporation Workshop*, Santa Monica, Calif.: RAND Corporation, CF-361, 2017, p. 8.

³⁵ Luay Al-Khatteeb, “How Iraq’s Black Market in Oil Funds ISIS,” CNN, August 22, 2014.

³⁶ Helene Cooper and Eric Schmitt, “Airstrikes by U.S. and Allies Hit ISIS Targets in Syria,” *New York Times*, September 22, 2014.

³⁷ Christopher Garver, “Department of Defense Press Briefing by Colonel Garver via Teleconference,” transcript, U.S. Department of Defense, June 29, 2016; Luay Al-Khatteeb, “Will U.S. Strikes Halt ISIS’ Oil Riches?” CNN, September 25, 2014.

³⁸ U.S. House of Representatives Committee on Armed Services, “U.S. Strategy for Syria and Iraq and Its Implications for the Region,” hearing, December 1, 2015.

³⁹ U.S. House of Representatives Committee on Armed Services, “U.S. Strategy for Syria and Iraq and Its Implications for the Region,” hearing, December 1, 2015.

⁴⁰ U.S. House of Representatives Committee on Armed Services, “U.S. Strategy for Syria and Iraq and Its Implications for the Region,” hearing, December 1, 2015.

targeting operation in OIR. The operation consisted of deliberate strikes on high-impact targets in all elements of ISIS's oil supply chain, from production to refining to transportation and distribution. Instead of putting ISIS's oil production capability out of action for mere days as previous strikes had, the intent of Operation Tidal Wave II was to systematically destroy ISIS's ability to generate revenue by knocking out specific installations for six months to a year, with the end goal of fundamentally eroding a key pillar of its strength: its finances.⁴¹ It appears that the coalition might have initially overestimated the amount of revenue that ISIS derived from oil and natural gas, but natural resources were a revenue target set that CJTF-OIR could prosecute unlike other parts of ISIS's economy, such as agriculture.

Operation Tidal Wave II had three stages. The first stage consisted of developing targets for this operation, leveraging intelligence from the SOF raid, a federated network of intelligence agencies, and air operations center (AOC) analyses. The second stage, roughly October 21, 2015, to August 7, 2016, encompassed the operation's initial large-scale strikes, expanding the volume and variety of targets from the previous effort in 2014. This phase focused largely on gas-oil separation plants and oil tanker trucks, which represented a shift, as trucks were not a part of initial strikes in 2014 because of legal concerns but were a critical part of ISIS oil distribution network.⁴²

On November 16, 2015, coalition air strikes engaged ISIS tanker trucks for the first time, destroying 116 trucks in Deir ez-Zur.⁴³ In compliance with the LOAC, two coalition F-15E fighters dropped leaflets prior to the attack to warn drivers to leave the area, while four A-10 attack aircraft and two AC-130 gunships from Incirlik Air Base serviced the targets.⁴⁴ Less than a week later, on November 22, the coalition conducted a second strike on ISIS oil trucks near Al-Hasakah and Deir ez-Zur, using four A-10s

⁴¹ Michael R. Gordon and Eric Schmitt, "U.S. Steps Up Its Attacks on ISIS-Controlled Oil Fields in Syria," *New York Times*, November 12, 2015.

⁴² John Allen, David Asher, Sean MacFarland, and Nancy Youssef, "Economic Defeat of the Islamic State: Behind the Scenes of Operation Tidal Wave II," panel, Washington, D.C., Brookings Institution and Foundation for Defense of Democracies, May 10, 2019. Prior to Operation Tidal Wave II, tanker trucks were specifically excluded from targeting because of concerns regarding the LOAC's principle of distinction, which is discussed later in this chapter. See Jeffrey Miller and Ian Corey, "Follow the Money: Targeting Enemy War-Sustaining Activities," *Joint Force Quarterly*, Vol. 87, No. 4, October 2017.

⁴³ Michael R. Gordon, "U.S. Warplanes Strike ISIS Oil Trucks in Syria," *New York Times*, November 16, 2015; Steven Warren, "Military Operations in Iraq and Syria," C-SPAN video, November 18, 2015.

⁴⁴ Luis Martinez, "US Warplanes Destroy 116 ISIS Fuel Trucks in Syria," ABC News, November 16, 2015; Richard Sisk, "US A-10 Attack Planes Hit ISIS Oil Convoy to Crimp Terror Funding," Military.com, November 16, 2015; Michael R. Gordon, "U.S. Warplanes Strike ISIS Oil Trucks in Syria," *New York Times*, November 16, 2015; DoD, "Coalition airstrikes destroy #ISIL fuel trucks near Abu Kamal, Syria, to degrade ISIS oil revenue," Facebook post, November 18, 2015.

and two AC-130s to launch 24 precision-guided munitions and cannon fire to destroy 283 oil tanker trucks.⁴⁵

The coalition also began targeting gas-oil separation plants during the second stage, with the majority of these targets hit in the first six months.⁴⁶ On December 19, 2015, the coalition struck five gas-oil separation plants near Raqqa, the largest deliberate strike since the start of Operation Tidal Wave II. Twenty coalition fighters, bombers, and RPAs from three contributing nations dropped over 140 munitions.⁴⁷ Following this, on February 2, 2016, a coalition air strike destroyed the Omar gas-oil separation plant near Deir ez-Zur.⁴⁸ Finally, in June 2016, the coalition struck ISIS's self-proclaimed Ministry of Oil headquarters in Mosul, reducing the ability of ISIS to manage its illicit operations.⁴⁹ By the end of the second stage, coalition officials estimated that Operation Tidal Wave II had cut ISIS's oil revenue by about half, from \$30 million per month to \$15 million per month. One metric often cited by U.S. government and coalition officials was reports that ISIS was reducing the salaries of its fighters by as much as 50 percent as a result of diminished oil revenues.⁵⁰ ISIS did reportedly reduce its expenditures, especially salaries and benefits, as a result CJTF-OIR pressure. Whether this stemmed only from the reduction in its oil income or was also a result of its loss of territory is unclear. In all likelihood, it was both factors together that strained ISIS's finances.

The third and final stage of Operation Tidal Wave II took place roughly from August 7, 2016, to October 21, 2017, and began with a large strike on 83 tanker trucks near the Abu Kamal border crossing in Syria.⁵¹ Strikes against ISIS oil assets, including tanker trucks, oil wells, and oil stills, rapidly increased at the outset of the third stage, rising from just tens to hundreds of strikes and targets engaged each month. Most

⁴⁵ Steven Warren and Jeff Davis, "Department of Defense Press Briefing by Colonel Warren via Teleconference from Baghdad, Iraq," transcript, U.S. Department of Defense, November 24, 2015; Jim Miklaszewski, "U.S. Destroys 280 ISIS Oil Trucks in the City of Deir ez-Zor," NBC News, November 23, 2015.

⁴⁶ RAND CJTF-OIR strike release data set. Matthew Reed, "Tidal Wave II: Understanding the Pentagon's New Strategy to Cripple ISIS Oil," *The Fuse*, November 23, 2015.

⁴⁷ Steven Warren and J. B. Brindle, "Department of Defense Press Briefing by Col. Warren via Teleconference from Baghdad, Iraq," transcript, U.S. Department of Defense, December 22, 2015.

⁴⁸ Steven Warren, "Department of Defense Press Briefing by Col. Warren via Teleconference from Baghdad, Iraq," transcript, U.S. Department of Defense, February 10, 2016.

⁴⁹ Christopher Garver, "Department of Defense Press Briefing by Colonel Garver via Teleconference," transcript, U.S. Department of Defense, June 29, 2016.

⁵⁰ Christopher Garver, "Department of Defense Press Briefing by Col. Garver via Teleconference from Baghdad, Iraq," transcript, U.S. Department of Defense, July 6, 2016; Steven Warren, "Military Operations in Iraq and Syria," C-SPAN video, February 17, 2016.

⁵¹ There is technically no coalition-provided end date on Operation Tidal Wave II, but the number of strikes declined sharply in October 2017, according to the RAND CJTF-OIR strike release data set. Jim Michaels, "ISIL Oil Trucks, Worth \$11 Million, Destroyed in Massive Airstrike," *USA Today*, August 9, 2016.

of these new strikes targeted ISIS's oil distribution network—specifically, oil tanker trucks. On December 8, 2016, coalition A-10 attack aircraft destroyed a fleet of 168 ISIS oil tanker trucks near Palmyra, Syria, the largest strike of its kind, which cost ISIS more than \$2 million.⁵² During the third phase, some of the most notable successes came from attacks that targeted individual oil wells.⁵³ As part of this effort, the coalition began attacking ISIS's underground oil infrastructure (e.g., well casings), making it harder, more costly, and time-consuming for ISIS to repair the damage or extract oil through makeshift techniques.⁵⁴ The coalition attacked more than 900 oil wells during the third stage, a tenfold increase from the second stage.

In the third stage, the coalition began engaging another new target, the thousands of civilian-run oil stills in eastern Syria that refined most of the crude oil that ISIS extracted, and destroyed 700 of these facilities.⁵⁵ These targets were not struck earlier for two reasons. First, these stills sprang up along the roads near Syrian oil fields only after coalition attacks rendered most of the oil refineries under ISIS control inoperable. Second, the stills were civilian run, although these civilians paid taxes to ISIS to operate the stills, giving the coalition pause in targeting them—like the oil tanker trucks—until an option that minimized civilian casualties could be implemented.⁵⁶ According to CFACC Lt Gen Jeffrey Harrigian, by May 2017, Operation Tidal Wave II “resulted in ISIS’s lowest revenue income and inflow at any point since 2014.”⁵⁷ The group’s oil revenue dwindled to less than \$4 million a month from a peak of \$50 million, according to the coalition.⁵⁸ By the end of the operation, coalition air strikes, coupled with efforts to reduce smuggling near the Turkish border, had deprived ISIS of approximately 90 percent of its oil revenues.⁵⁹

⁵² CJTF-OIR, “Coalition Airstrike Destroys 168 Da’esh Oil Tanker Trucks in Central Syria,” Hanscom Air Force Base video, December 9, 2016; Joby Warrick, “Inside the Economic War Against the Islamic State,” *Washington Post*, December 31, 2016.

⁵³ Joby Warrick, “Inside the Economic War Against the Islamic State,” *Washington Post*, December 31, 2016.

⁵⁴ Joby Warrick, “Inside the Economic War Against the Islamic State,” *Washington Post*, December 31, 2016.

⁵⁵ Matthew Reed, “Trump vs. ISIS Oil,” *The Fuse*, July 12, 2017.

⁵⁶ Matthew Reed, “Trump vs. ISIS Oil,” *The Fuse*, July 12, 2017.

⁵⁷ Jeffrey Harrigian, “Department of Defense Press Briefing by General Harrigian via Teleconference,” transcript, U.S. Department of Defense, May 24, 2017.

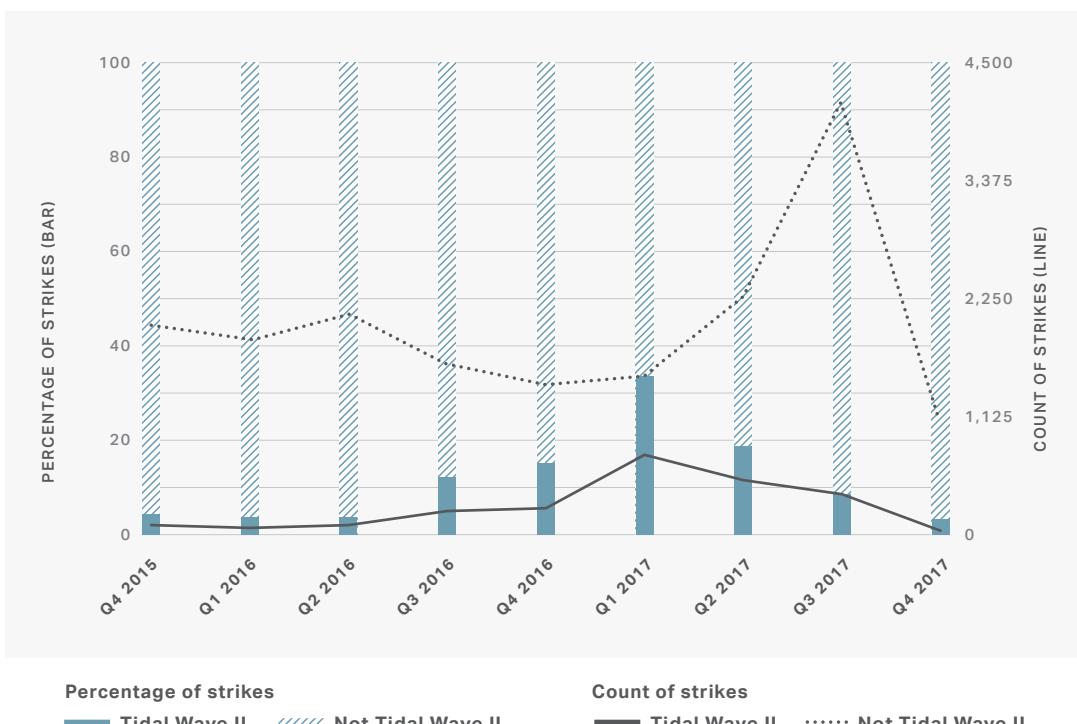
⁵⁸ Glenn A. Fine, Steve A. Linick, and Ann Calvaresi Barr, *Operation Inherent Resolve: Lead Inspector General Report to the United States Congress, July 1, 2017–September 31, 2017*, Washington, D.C.: U.S. Department of Defense, November 3, 2017, p. 24.

⁵⁹ Glenn A. Fine, Steve A. Linick, and Ann Calvaresi Barr, *Operation Inherent Resolve: Lead Inspector General Report to the United States Congress, July 1, 2017–September 31, 2017*, Washington, D.C.: U.S. Department of Defense, November 3, 2017, p. 24; Dion Nissenbaum and Ghassan Adnan, “Oil Smuggling Allegations Dominate Turkey-Russia Rift,” *Wall Street Journal*, December 4, 2015.

Over the course of Operation Tidal Wave II, the coalition conducted approximately 4,000 strikes against ISIS oil targets in Iraq and Syria.⁶⁰ The first phase was relatively limited, about 6 percent of the coalition's overall strikes in early 2016, because the targeting enterprise was still learning about ISIS's network and developing targets (see Figure 5.2). Between August and December 2016, strikes on ISIS oil targets in Syria rose to around 20 percent of the total coalition air strikes, particularly around the oil-heavy areas of Deir ez-Zur, Abu Kamal, and Raqqa. The operation peaked in early 2017, as coalition aircraft prosecuted more than 700 oil strikes and then tapered off until they ended in October 2017.

Figure 5.3 shows the number of Tidal Wave II air strikes by location and makes it clear that most of these attacks took place in Syria, with Deir ez-Zur as a particular focus.⁶¹

Figure 5.2
Level of Effort for Operation Tidal Wave II

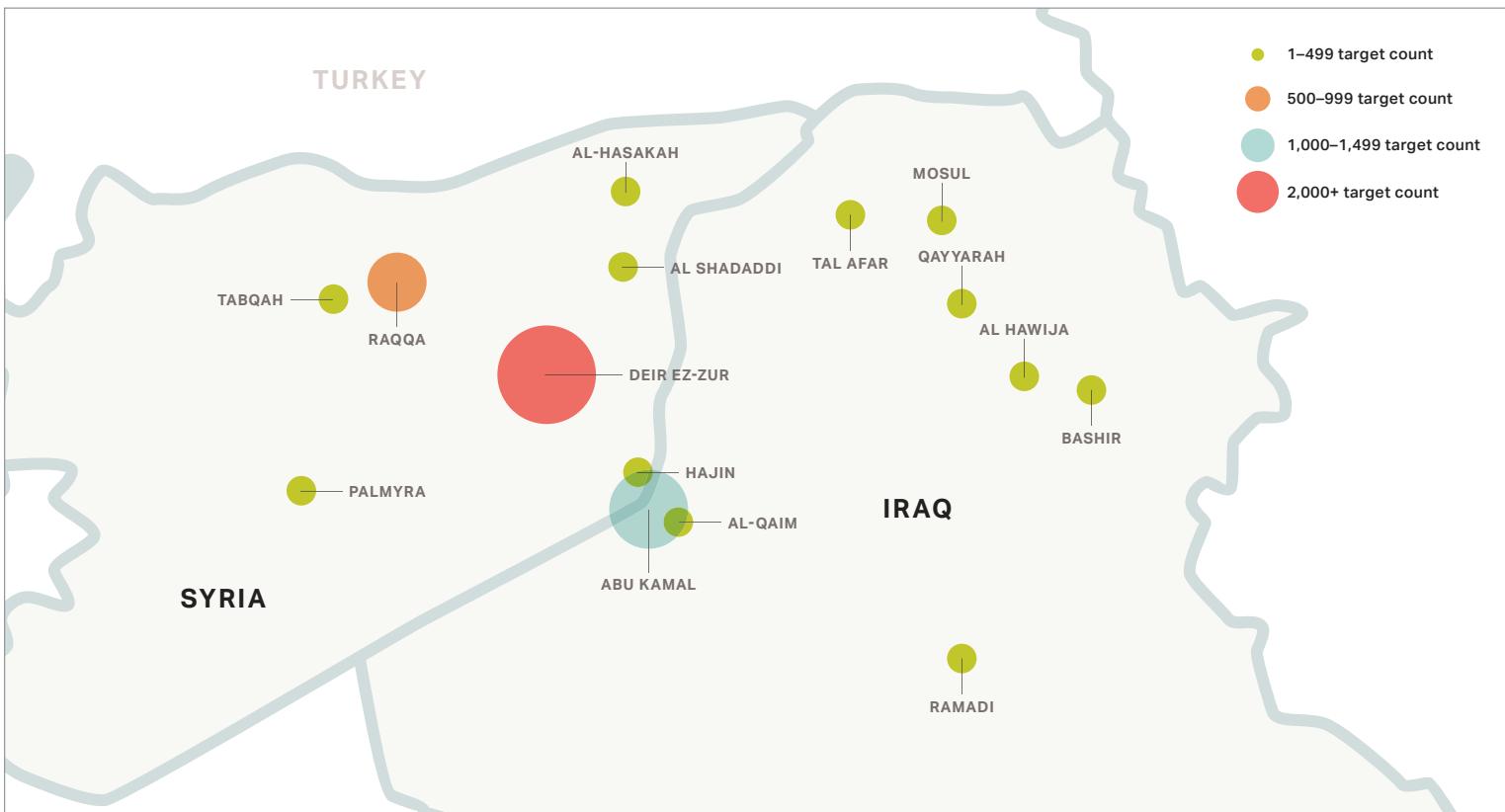


SOURCE: RAND CJTF-OIR strike release data set.

⁶⁰ The information presented here and in the following paragraphs is based on analysis of the RAND CJTF-OIR strike release data set.

⁶¹ Steven Warren, "Military Operations in Iraq and Syria," C-SPAN video, November 18, 2015.

Figure 5.3
Operation Tidal Wave II Strikes by City

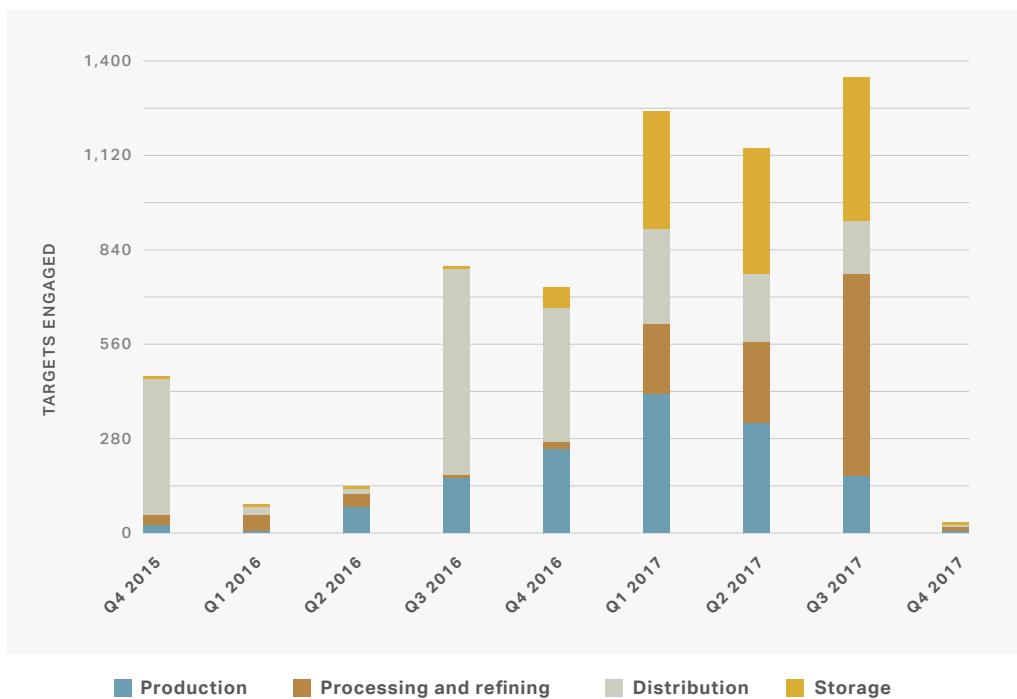


SOURCE: RAND CJTF-OIR strike release data set.

The types of oil targets engaged changed over time, as seen in Figure 5.4. We categorize ISIS oil assets into three bins: production (wellheads, pumps and pump stations, drilling rigs, and other equipment associated with production), processing and refining (gas-oil separation plants, stills, and mobile refineries), and distribution and storage (oil tanker trucks, storage tanks and facilities, collection points, manifolds, and pipelines).

Between November 2015 and August 2016, the coalition undertook ten to 50 Tidal Wave II strikes a month and engaged production, processing, and refining sites 40 percent of the time. Thereafter, strikes increased as the coalition shifted its focus to distribution targets, especially tanker trucks, which accounted for approximately 70 percent of targets engaged between August and December 2016.⁶² Moreover, the overall number of strikes associated with this operation increased sevenfold between July and September, and this pace remained constant for the rest of 2016.

Figure 5.4
Targets Engaged in Operation Tidal Wave II



SOURCE: RAND CJTF-OIR strike release data set.

⁶² Only 1 percent of targets during this period were processing and refining sites, which included a modular oil refinery and some processing equipment.

Operation Tidal Wave II continued to intensify in 2017, with the number of targets engaged jumping from just over 700 in the prior three months to 1,250 targets. Notably, the coalition struck or destroyed more than 200 processing and refining targets—more than a tenfold increase from the last three months of 2016. Distribution and storage targets struck jumped in the first half of 2017, with the number of storage targets, such as oil tanks and barrels, increasing almost sevenfold from the end of 2016. This shift in targets reflected a change in ISIS toward more-mobile and -distributed oil operations. Between March and September, the number of processing and refining targets continued to increase until surpassing all other targets, at 40 percent of the total targets engaged. Targets within this category similarly shifted from refineries—the main target of the coalition in 2016—to oil stills, reflecting the degradation of ISIS's oil production capabilities.

By the middle of 2017, coalition air strikes left ISIS with a severely diminished capability to produce, refine, transport, and store oil on a large scale. What oil stores and small refining capability ISIS had left, the coalition found and destroyed. From July to September 2017, more than 1,300 targets were struck, damaged, or destroyed—the most targets engaged during the entire operation. The coalition serviced its final oil targets in October 2017, concluding the operation. In total, the coalition engaged 2,095 distribution targets, 1,242 storage targets, 1,187 processing and refining sites and equipment, and 1,421 production targets (see Figure 5.5).

Coalition partners participated in many of the strikes against oil. In the early stages of OIR, preplanned deliberate strikes against fixed targets provided an opportunity to involve less advanced coalition air forces, which were not as proficient at engaging mobile on-call targets. Therefore, a number of Arab partners (including Bahrain, Jordan, Morocco, Saudi Arabia, and the United Arab Emirates) participated in early strike operations against ISIS oil refineries in Syria.⁶³ By the time Operation Tidal Wave II began in October 2015, however, many of these Arab partners were less active in OIR.⁶⁴

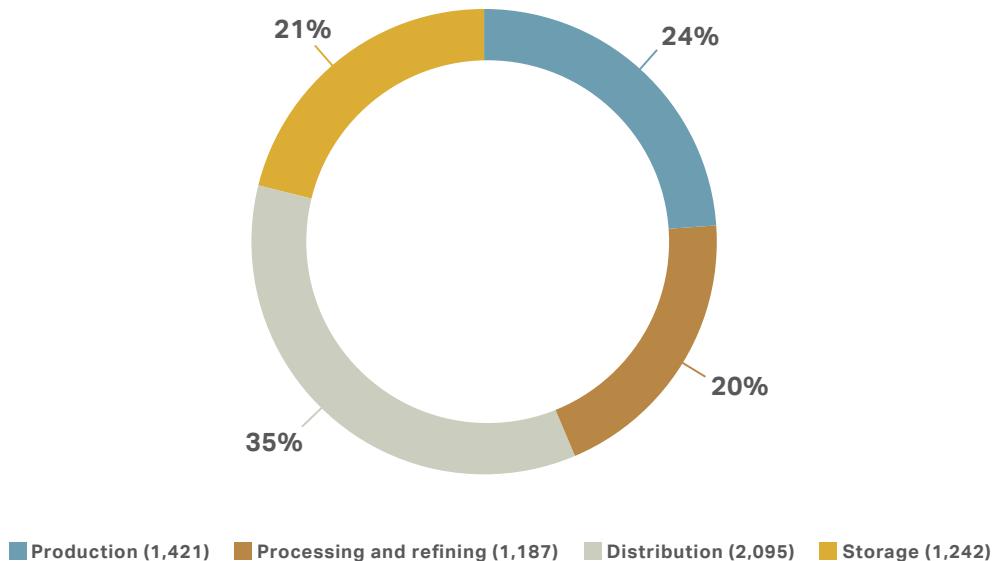
France and the United Kingdom also were key participants in a number of high-profile missions against the Omar oil field and around Raqqa.⁶⁵ The French used

⁶³ Amy McCullough, "Targeting ISIS," *Air Force Magazine*, October 30, 2014; Patricia Dias, Tobias Feakin, Ken Gleiman, Peter Jennings, Daniel Nichola, Simone Roworth, Benjamin Schreer, and Mark Thompson, *Strike from the Air: The First 100 Days of the Campaign Against ISIL*, Canberra: Australian Strategic Policy Institute, December 2014, p. 30; "Moroccan F-16 Carry Out Airstrikes Against ISIS," *Morocco World News*, December 10, 2014; Deborah Amos, "U.S.-Led Coalition Airstrikes Hit ISIS's Oil Refineries," NPR, September 25, 2014.

⁶⁴ The United Arab Emirates and Saudi Arabia reduced their air contributions to the fight against ISIS after they launched an air war in Yemen in March 2015.

⁶⁵ Michael R. Gordon and Eric Schmitt, "U.S. Steps Up Its Attacks on ISIS Controlled Oil Fields in Syria," *New York Times*, November 12, 2015; UK Ministry of Defence, "RAF Air Strikes in Iraq and Syria: December 2015," webpage, updated September 5, 2018; "French Jets Strike ISIS Oil Sites in Syria," Agence France-Presse, January 1, 2016.

Figure 5.5
Breakdown of Targets Engaged in Operation Tidal Wave II



SOURCE: RAND CJTF-OIR strike release data set.

Mirage 2000s to bomb ISIS oil installations during Operation Tidal Wave II, while the United Kingdom used Typhoon FGR4s and Tornado GR4s to engage targets and MQ-9 Reaper RPAs to conduct intelligence and strikes.⁶⁶ Others that took part in strikes against ISIS oil assets were Australian F/A-18As, Canadian CF-18s, and Belgian, Danish, and Dutch F-16s.⁶⁷ Many of these partner strikes took place in late 2015 because of the unwillingness of some coalition partners to accept a greater risk of civilian casualties, which increased over time as the operation increasingly focused on tanker trucks and small oil stills.⁶⁸

For its part, the United States employed a variety of aircraft in Operation Tidal Wave II. Although information about specific types of airframes and munitions is not widely available, it appears that A-10 attack aircraft and AC-130 gunships were com-

⁶⁶ Paul Hutcheon, “RAF Fighters Preparing to Target Daesh Leadership,” *The Herald*, December 5, 2015; UK Ministry of Defence, “RAF Air Strikes in Iraq and Syria: August 2016,” webpage, updated September 5, 2018; “French Jets Strike ISIS Oil Installations in Syria,” *Arab Weekly*, January 1, 2016; UK Ministry of Defence, “RAF Air Strikes in Iraq and Syria: January 2015,” webpage, updated September 5, 2018.

⁶⁷ Jose Pagliery, “U.S. Takes Aim at the ISIS Oil Business,” CNN, December 11, 2015; “ISIS Mission: Canadian CF-18s Drop Laser-Guided Bombs over Iraq,” CBC News, November 2, 2014; “Flow of ISIL Oil Revenue Slowing, Report Says,” Yahoo Finance Canada, November 17, 2015; Rouba Al-Fattal, Glenn Davidson, Peggy Mason, Kyle Matthews, Saeed Rahnema, and Stéphanie Von Hlatky, “Canada’s Syria Dilemma: What to Do in the Fight Against ISIS,” Open Canada, December 11, 2015.

⁶⁸ We thank Raphael Cohen for this point.

monly used to target oil trucks and other distribution targets. F-15E and F-16C fighters and B-1B bombers also struck oil targets and dropped leaflets during the operation.⁶⁹

The coalition carefully chose munitions to ensure that it destroyed oil infrastructure while limiting collateral damage. USAF officials noted that the use of GBU-38/B JDAMs outfitted with low collateral-damage warheads produced only limited effects against oil infrastructure.⁷⁰ Therefore, the USAF transitioned to other munitions, balancing the need for warheads with greater penetration with the desire to ensure low collateral damage. U.S., British, and Canadian aircraft employed GBU-12 LGBs, while the United Kingdom also used Paveway IV LGBs, Brimstone missiles, and Hellfire missiles.⁷¹ It is also worth noting that the coalition chose to outfit A-10 attack aircraft with PGU-14s—a 30 mm depleted-uranium armor-piercing cannon shell that DoD had previously said it would not use in OIR—for two Operation Tidal Wave II strikes. Coalition planners determined that PGU-14s would be the most likely to render oil trucks inoperable during strikes in Syria in November 2015.⁷² Throughout OIR, coalition officials noted that deliberate strikes (as opposed to dynamic strikes) were accompanied by more optically guided ordnance because there was more time and rigor involved in matching targets to munitions.⁷³ For example, strikes against wellheads featured munitions that were fused for slightly delayed detonation to affect the entire underground structure, preventing ISIS from simply fitting a new pipe to the well after the strike.”⁷⁴

⁶⁹ Luis Martinez, “US Warplanes Destroy 116 ISIS Fuel Trucks in Syria,” ABC News, November 16, 2015; CENTCOM, “24 Sept F 15 Strike Mayadin Modular Refinery,” YouTube video, September 25, 2014; “UAE: Renewed Airstrikes Hit ISIS Oil Refineries,” *Arutz Sheva*, February 16, 2015; Jim Michaels, “ISIL Oil Trucks, Worth \$11 Million, Destroyed in Massive Airstrike,” *USA Today*, August 9, 2016; Lara Seligman, “Bombing ISIS: US Official Shares Lessons from 6 Months of Airstrikes,” *Defense News*, May 2, 2016.

⁷⁰ Joseph Trevithick, “A-10 Warthogs Drop Bunker Buster Bombs in Combat for the First Time,” *The Drive*, August 18, 2017; Joseph Trevithick, “USAF Fought ISIS with the Wrong Bombs and Tactics for Months,” *The Drive*, May 31, 2017.

⁷¹ UK Ministry of Defence, “RAF Air Strikes in Iraq and Syria: December 2015,” webpage, updated September 5, 2018. “A Running List of the British Air Strikes Against Isis in Syria,” *The Independent*, December 3, 2015; UK Ministry of Defence, “RAF Air Strikes in Iraq and Syria: November 2015,” webpage, updated September 5, 2018; “ISIS Mission: Canadian CF-18s Drop Laser-Guided Bombs over Iraq,” CBC News, November 2, 2014.

⁷² It remains unclear why PGU-14 was determined to be the best weapon for these attacks, given that the oil tanker trucks were unarmored. This suggests that the use of the munitions was to set the oil alight to ensure that it could not be salvaged. Thomas Gibbons-Neff, “The Pentagon Said It Wouldn’t Use Depleted Uranium Rounds Against ISIS: Months Later, It Did—Thousands of Times,” *Washington Post*, February 16, 2017.

⁷³ RAND interview with LTG (ret.) Sean MacFarland, March 31, 2020.

⁷⁴ AFHRA interview with Maj Michael R. Dumas, August 8, 2018; RAND interviews with USAF officials and coalition officials, March 2020.

Reinvigorating the Deliberate-Targeting Process for Operation Tidal Wave II

Initially, the CJTF-OIR Commander did not establish clear priorities for the deep fight but was willing to engage strategic targets as they became available. Yet, in 2014, CJTF-OIR lacked the intelligence needed to identify the key elements of ISIS oil operations or distinguish the energy infrastructure exploited by ISIS from the civilian oil assets being used by the population at large.⁷⁵ This, coupled with a shortage of pre-planned targets at the outset of the campaign, resulted in few strategic-strike operations. As now-Gen Charles Q. Brown noted, “The art we had of building target sets and doing deep studies on adversaries, in some cases was a lost art.”⁷⁶ Therefore, there was a need “to set a durable framework for target development” while conducting additional target systems analysis to understand ISIS operations. Thus, CJTF-OIR needed to rebuild the joint targeting enterprise to be able to conduct sustained strategic and interdiction strikes in the deep fight.

On May 16, 2015, a U.S. SOF raid on ISIS oil minister Abu Sayyaf captured key documents explaining in detail the organization’s oil operations, including how it recruited civilians to take part in its activities.⁷⁷ Armed with this information, CJTF-OIR began to analyze how it could strike ISIS oil assets to have a lasting effect on the system.⁷⁸ This was supplemented by a joint coalition and U.S. Department of State analysis of oil infrastructure in Iraq and Syria, which identified “the critical nodes that if targeted would have the greatest impact against the revenue stream of ISIS,” as Chairman of the Joint Chiefs of Staff Gen Joseph Dunford explained.⁷⁹

Generating deliberate targets required identifying and then vetting these targets with pattern-of-life analysis to ensure that these were valid enemy targets and to minimize civilian causalities, which meant that ISR assets were needed for deep-fight target development. However, at that time, most ISR assets were allocated to support the close fight, which was CJTF-OIR’s “main effort,” as determined by the commander.⁸⁰ Dynamic-targeting and force-protection requests usually obtained a large share of the ISR assets because these missions had clear objectives and were important to subordinate commanders. Because of these competing requirements and the overall emphasis

⁷⁵ Paraphrased from Ash Carter, statement during “U.S. Strategy for Syria and Iraq and Its Implications for the Region,” hearing before the U.S. House Committee on Armed Services, December 1, 2015.

⁷⁶ Michael R. Gordon and Eric Schmitt, “U.S. Steps Up Its Attacks on ISIS-Controlled Oil Fields in Syria,” *New York Times*, November 12, 2015.

⁷⁷ Matthew Reed, “Blowing Up the Islamic State’s Oil Company,” *Foreign Policy*, October 26, 2016.

⁷⁸ Steven Warren, “Department of Defense Press Briefing by Col. Warren via DVIDS from Baghdad, Iraq,” transcript, U.S. Department of Defense, November 13, 2015.

⁷⁹ U.S. House of Representatives Committee on Armed Services, “U.S. Strategy for Syria and Iraq and Its Implications for the Region,” hearing, December 1, 2015.

⁸⁰ This pool also included assets from other services, although many retained some of their organic assets. RAND interview with USAF official, December 2, 2019; Edward O. Ziembinski, “CJTF-OIR: Future Operations Synchronization Board (FOSB),” Center for Army Lessons Learned, December 2015, pp. 2, 4.

on the close fight in OIR's strategy, it was initially difficult to justify diverting ISR away from the close fight for underdeveloped targets that had not been identified as a priority in the deep fight.⁸¹

The air component argued that exclusively focusing on the close fight enabled ISIS to freely operate in its rear areas, which meant that when ground operations began, they were unnecessarily prolonged and bloody.⁸² Moreover, when ground offensives were not occurring, CJTF-OIR was missing opportunities to develop deliberate targets and to directly weaken ISIS with deep strikes. According to this view, exclusively prioritizing ISR for on-call support to ground troops when there were few ground operations was wasteful.

Given OIR's strategic emphasis on destroying the physical caliphate, it was difficult to rationalize taking ISR out of the close fight to try to find strategic targets in rear areas.⁸³ The integrated campaign plan promulgated by CJTF-OIR Commander LTG MacFarland, which included Iraqi and Syrian partner ground schemes of maneuver and deep-strike operations and designated the main and supporting efforts across time, helped free up ISR assets to develop deliberate targets for the deep fight. In this respect, the CFACC's push for ISR assets benefited from the integrated campaign plan and a CJTF-OIR Commander who wanted to reapportion assets in favor of the deep fight. According to MacFarland, "I had to divert resources from [the close] fight in order to go after these [deep fight] targets. . . . And of course, any time you try to move a [unmanned aerial vehicle] line someplace, there's concern by subordinate commanders."⁸⁴ Additional decisions—such as creating named deep-fight operations, like Tidal Wave II—also helped the CFACC obtain needed resources.⁸⁵

For Operation Tidal Wave II, the CAOC's Strategy Division established standard operating procedures for strikes, reflecting best practices. The ISR Division was deeply involved in developing the targets for this operation, because ISR assets, such as RPAs, were pivotal to target identification, development, and validation.⁸⁶ ISIS network targets were nominated for strikes and then vetted and ultimately validated at the Target Vetting Board, which included CENTCOM and the CJTF-OIR stakeholders.⁸⁷ This board would examine the intelligence about each oil target to ensure that it was valid,

⁸¹ Email correspondence with LTG (ret.) Sean MacFarland, June 24, 2020.

⁸² Email correspondence with Maj Gen Scott Zobrist, June 24, 2020.

⁸³ RAND interview with LTG (ret.) Sean MacFarland, March 31, 2020.

⁸⁴ John Allen, David Asher, Sean MacFarland, and Nancy Youssef, "Economic Defeat of the Islamic State: Behind the Scenes of Operation Tidal Wave II," panel, Washington, D.C., Brookings Institution and Foundation for Defense of Democracies, May 10, 2019.

⁸⁵ RAND interview with LTG (ret.) Sean MacFarland, March 31, 2020; RAND interview with USAF official, December 2, 2019; RAND interview with Gen Charles Q. Brown, February 20, 2020.

⁸⁶ RAND interview with USAF official, December 2, 2019.

⁸⁷ RAND interview with USAF official, March 4, 2020.

determining compatibility with the commander's intent, the law of war, and the ROE. This process occurred repeatedly, so that the ISR Division was identifying new targets for strikes—or in some cases, older targets for restrike—while targets were being validated at the Target Vetting Board.⁸⁸ Targets that were approved or validated by the Target Vetting Board would then get added to either the joint target list or the restricted target list when the board approved the target as valid, but it placed restrictions on attacking the target, ranging from how it should be engaged to prohibiting engagement altogether.⁸⁹ In Operation Tidal Wave II, oil trucks were often initially on the restricted target list, as they had specific engagement requirements to be compliant with the LOAC and ROE.

Once the targets for the operation were approved, they were moved to the JIPTL, developed by the ISR Division in conjunction with the Combat Plans Division, which organized validated targets in order of priority.⁹⁰ For Tidal Wave II and similar operations, sequencing the targets—both on the JIPTL and for eventual execution on the ATO—was critical to hitting the correct locations at the right time to take down key nodes of ISIS's oil enterprise. The Combat Plans Division's targeting effects and combined effects teams would consider both kinetic and nonkinetic means to engage the targets on the JIPTL, examining the weaponeering options—the process of determining which type of munition and method of delivery would achieve the desired effect. Each engagement option identified through weaponeering is accompanied by a collateral damage estimation, an analysis of the potential effects of the strike on civilian and civilian objects.⁹¹ As previously noted, weaponeering was critical to Operation Tidal Wave II's ability to degrade targets so that they could not be easily repaired, ensuring that the effects of the strikes were enduring.⁹² Additionally, for these strikes to be legally compliant, air strikes on oil trucks required leaflet drops to ensure that the civilian drivers of the trucks had left the area.⁹³ Other leaflets were dropped to civilian populations as part of psychological operations in Operation Tidal Wave II, discour-

⁸⁸ RAND interview with USAF official, December 2, 2019; RAND interview with Gen Charles Q. Brown, February 20, 2020.

⁸⁹ Joint Publication 3-60, *Joint Targeting*, Washington, D.C.: Joint Chiefs of Staff, January 31, 2013.

⁹⁰ Joint Publication 3-60, *Joint Targeting*, Washington, D.C.: Joint Chiefs of Staff, January 31, 2013.

⁹¹ Joint Publication 3-60, *Joint Targeting*, Washington, D.C.: Joint Chiefs of Staff, January 31, 2013.

⁹² Steven Warren, "Department of Defense Press Briefing by Col. Warren via Teleconference from Baghdad, Iraq," transcript, U.S. Department of Defense, February 10, 2016.

⁹³ Steven Warren and Jeff Davis, "Department of Defense Press Briefing by Colonel Warren via Teleconference from Baghdad, Iraq," transcript, U.S. Department of Defense, November 24, 2015; Christopher Garver, "Department of Defense Press Briefing by Col. Garver via Teleconference from Baghdad, Iraq," transcript, U.S. Department of Defense, June 8, 2016; AFHRA interview with Lt Col Aaron Redfern, August 28, 2018.

aging them from purchasing ISIS oil.⁹⁴ Following this, the targets would be moved to the Combat Operations Division, which would execute the deliberate strikes on ISIS oil targets as part of the ATO. Because these were deliberate strikes, there were future plans for strikes that would take place in 72 to 96 hours.⁹⁵

ISIS's oil network adapted in response to coalition strikes, moving its oil storage within the two-week deliberate targeting time frame or shifting to use civilian-run stills to refine crude oil. These changes made it difficult to do pure deliberate targeting. This required the coalition to employ deliberate on-call targeting—that is, preplanned targets that were dynamically executed at the time of the commander's choosing—because many oil targets could be engaged only at a specific time, such as when a vehicle arrived at a location or when a civilian driver was not present in the vehicle.⁹⁶ Operation Tidal Wave II strikes were largely conducted as deliberate on-call strikes through the Combat Operations Division's dynamic targeting cell.

Coalition pilots noted that Tidal Wave II strikes were often executed on the back of CAS missions, meaning that aircraft assigned to CAS would deliver ordnance unused in their CAS mission against deliberate on-call targets before returning to base.⁹⁷ However, rather than pilots connecting with a JTAC located in one of the strike cells, as they would for dynamic targeting, the CAOC directed the strikes.⁹⁸ As Lt Gen Brown noted,

I know there's a target that we can go strike, then I want [to] match up that target. And that's why we call it a kind of deliver on call. So, we have targets that can be serviced or struck. And now we have an aircraft that has weapons on its way home and have the gas to [do] it, we'll go in and strike it. Versus them coming home and not just coming back another day to strike it, if the opportunity presents itself. So, it's really just taking advantage of opportunities is the way in which we strike.⁹⁹

However, while this was an efficient way of delivering munitions and supporting both the close and the deep fights simultaneously, it often meant that the ordnance dropped

⁹⁴ Lead Inspector General for Overseas Contingency Operations, Operation Inherent Resolve, Quarterly Report to the United States Congress July 1, 2017–September 31, 2017, p. 24.

⁹⁵ Curtis E. LeMay Center for Doctrine Development and Education, Air University, *Targeting*, Annex 3-60, Maxwell Air Force Base, Ala., March 15, 2019, p. 31.

⁹⁶ RAND interview with USAF official, January 29, 2020; Joint Publication 3-60, *Joint Targeting*, Washington, D.C.: Joint Chiefs of Staff, January 31, 2013.

⁹⁷ AFHRA interview with Maj Michael R. Dumas, August 8, 2018.

⁹⁸ RAND interview with U.S. Navy official, February 3, 2020.

⁹⁹ Charles Q. Brown Jr., "Department of Defense Press Briefing by Lt. Gen. Brown via Teleconference from Southwest Asia," transcript, U.S. Department of Defense, May 27, 2016.

on Operation Tidal Wave II targets might not have been first-choice weaponeering had it been a preplanned deliberate strike.¹⁰⁰

Finally, the CAOC—specifically, the Strategy Division—was also responsible for assessing the efficacy of strikes. One of the unique elements of Operation Tidal Wave II was its emphasis on restrikes, which intended to keep facilities offline and equipment in disrepair. Therefore, the CFACC developed a process to analyze the strike damage and monitor ISIS activity in the surrounding area—largely using ISR—to see whether ISIS was trying to repair equipment or move oil assets elsewhere, to determine whether a restrike was needed or if more ISR was required to track ISIS oil activities, because the organization made its operations mobile in response to the strikes.

Challenges in Operation Tidal Wave II

Operation Tidal Wave II was ultimately a success, destroying most of ISIS's oil enterprise and thus reducing its funding. By 2018, ISIS was no longer able to produce and smuggle large amounts of oil.¹⁰¹ Turkey's efforts to police and control its border with Syria also reduced the ability of ISIS to sell its oil there and contributed to pressure on ISIS's oil enterprise.¹⁰² Yet the militants adjusted to the loss of income from natural resources, which was not as significant of a financial stream as many seemed to believe. On the one hand, as was widely reported, ISIS reduced its expenditures by cutting public services and wages, but at the same time it also increased taxation, extortion, and criminal activity to compensate for many of the losses.¹⁰³ Oil was a less important source of revenue for ISIS than taxation and extortion. Nevertheless, depriving ISIS of this source of income made the organization more reliant on taxation, forced ISIS militants to resort to more-draconian policies for extracting resources, and reduced the organization's ability to pay its fighters. As a result, ISIS experienced a personnel shortage as it scaled back its recruitment of foreign fighters and some number of existing fighters deserted because of the pay cuts.¹⁰⁴ As attrition mounted once Iraqis and Syrians went on the offensive, this became more of a strain. In short, the reduction in oil revenue contributed to internal challenges and tensions within ISIS but alone

¹⁰⁰ RAND interview with Gen Charles Q. Brown, February 20, 2020.

¹⁰¹ Mathew Reed, "ISIS Is Out of the Oil Business," *The Fuse*, March 27, 2018.

¹⁰² Patrick B. Johnston, Mona Alami, Colin P. Clarke, and Howard J. Shatz, *Return and Expand? The Finances and Prospects of the Islamic State After the Caliphate*, Santa Monica, Calif.: RAND Corporation, RR-3046, 2019, p. 51.

¹⁰³ Jean-Charles Brisard and Damien Martinez, *ISIS Financing: 2015*, Paris: Center for the Analysis of Terrorism, May 2016, pp. 5, 24–25.

¹⁰⁴ Jean-Charles Brisard and Damien Martinez, *ISIS Financing: 2015*, Paris: Center for the Analysis of Terrorism, May 2016, p. 30; Aymenn al-Tamimi, "Archive of Islamic State Administrative Documents (Cont.)," Aymen-njawad.org, January 11, 2016.

was unlikely to have lead it to collapse.¹⁰⁵ Yet Tidal Wave II was not without its challenges—many of which were overcome during the course of the operation, while others reflected more-enduring issues with the allocation of ISR assets and in the targeting process.

The first challenge was the legality of targeting oil distribution networks. Although oil fields, production facilities, and associated equipment and storage were all viable targets from the outset of the operation, distribution networks—namely, oil tanker trucks—were not clearly valid military targets. These tankers raised three concerns regarding the LOAC's principle of distinction: The trucks themselves were civilian objects, the drivers of the trucks were civilians, and the oil in the tanks became a civilian object that people relied on once purchased from ISIS.¹⁰⁶ As Chairman of the Joint Chiefs of Staff Dunford noted, “We assessed that the majority of the truck drivers were, in fact, just people trying to make a living in the region.”¹⁰⁷ However, under the LOAC, if a belligerent uses a civilian object for military purposes, the object loses its protected status and becomes a valid military target. CJTF-OIR analysis showed that trucks formed the basis of ISIS’s oil distribution network, which was funding its military operations. Thus, once trucks that carried ISIS oil or were credibly deemed to be loaded with oil whose nature, use, and purpose made it a contribution to military action, they became valid military targets.¹⁰⁸ Therefore, the coalition went to great lengths to identify and target only those trucks that could reasonably be associated with an ISIS-controlled oil facility.¹⁰⁹

Because oil trucks were driven by civilians, who had protected status under the LOAC, the coalition needed to develop a way to engage the trucks when they were driverless.¹¹⁰ According to Gen Paul Selva, former Vice Chairman of the Joint Chiefs of Staff, coalition forces “used a set of tactics, techniques, and procedures that warned drivers in advance so they could flee their trucks. . . . [W]e are looking for more opportunities to do exactly the same thing so we don’t alienate the civilian population, those that are not ISIS adherents.”¹¹¹ These prestrike warnings included leaflet drops, which

¹⁰⁵ Aymenn al-Tamimi, “Archive of Islamic State Administrative Documents (Cont.),” Aymennjawad.org, January 11, 2016.

¹⁰⁶ Jeffrey Miller and Ian Corey, “Follow the Money: Targeting Enemy War-Sustaining Activities,” *Joint Force Quarterly*, Vol. 87, No. 4, October 2017, p. 33.

¹⁰⁷ U.S. Strategy for Syria and Iraq and Its Implications for the Region,” hearing before the House Committee on Armed Services, December 1, 2015.

¹⁰⁸ RAND interview with USAF official, December 2, 2019.

¹⁰⁹ Jeffrey Miller and Ian Corey, “Follow the Money: Targeting Enemy War-Sustaining Activities,” *Joint Force Quarterly*, Vol. 87, No. 4, October 2017, p. 34.

¹¹⁰ RAND interview with USAF official, December 2, 2019.

¹¹¹ U.S. Senate Committee on Armed Services, “The U.S. Strategy to Counter the Islamic State of Iraq and the Levant and U.S. Policy Toward Iraq and Syria,” hearing, December 9, 2015.

often indicated the time and location of strikes, to assist the drivers in their escape and low aircraft passes to encourage the drivers to abandon their trucks.¹¹² After warnings were issued, CENTCOM's collateral-damage mitigation criteria required a few hours of pattern-of-life analysis using FMV to ensure that the drivers had fled to a safe distance before strikes could be approved.¹¹³ The coalition also struck tanker trucks when drivers were not present—for example, at night—but this still required a several-hours-long transient scan to confirm that civilians were not at risk.¹¹⁴ It is worth noting that similar challenges also existed for targeting oil stills, which were civilian run. However, as these were fixed targets, they could more easily be observed for long periods and engaged when no civilians were present.¹¹⁵

The second challenge was obtaining the ISR assets, primarily RPAs, needed to develop targets, authorize strikes, and assess their effects. As LTG Sean MacFarland explained, the Army-heavy CJTF-OIR staff often was disinclined to pull “ISR away for targets that weren’t well developed,” especially when MacFarland “couldn’t point to a bad guy like in the close fight.”¹¹⁶ Operation Tidal Wave II was a long deep-fight operation with multiple target sets and thus required many ISR assets over an extended period to develop targets. Developing targets for a hybrid enemy with relatively few clearly marked fixed assets was challenging and time-consuming in and of itself. As an A-10 pilot who flew missions in Operation Tidal Wave II explained, “I had pretty specific deliberate targets during Tidal Wave II, when we were trying to target [ISIS’s] revenue, oil revenue, funding streams. But when you talk about the dynamic nature of how their network mutated, it made it difficult to do pure deliberate targeting because they weren’t a true state network with a robust command and control nodal network. . . . It was a tough mission.”¹¹⁷ This process was further complicated by CENTCOM’s stringent collateral-damage mitigation measures, which required extensive pattern-of-life analysis in the form of a specific number of hours of uninterrupted FMV to limit civilian casualties. Finally, ISR was needed to assess the effects of the strikes and determine whether restrikes were required.

¹¹² Jeffrey Miller and Ian Corey, “Follow the Money: Targeting Enemy War-Sustaining Activities,” *Joint Force Quarterly*, Vol. 87, No. 4, October 2017, p. 34; “Here Are the Leaflets the United States Dropped on the Islamic State,” *War Is Boring*, January 22, 2016; Steven Warren and Jeff Davis, “Department of Defense Press Briefing by Colonel Warren via Teleconference from Baghdad, Iraq,” transcript, U.S. Department of Defense, November 24, 2015.

¹¹³ AFHRA interview with Lt Col Aaron Redfern, August 28, 2018; RAND interview with USAF official, December 2, 2019.

¹¹⁴ RAND interview with USAF official, December 2, 2019; RAND interview with coalition officials, March 3, 2020.

¹¹⁵ Matthew Reed, “Trump vs. ISIS Oil,” *The Fuse*, July 12, 2017.

¹¹⁶ RAND interview with LTG (ret.) Sean MacFarland, March 31, 2020.

¹¹⁷ RAND interview with USAF official, January 29, 2020.

This contributed to the third challenge, which was an enduring issue throughout the deep strikes profiled in this chapter: a general frustration by many in CJTF-OIR over the lengthy deliberate-targeting process. One senior CJTF-OIR official argued that the “CJTF-OIR targeting process was too long to be effective.” Consequently, “It became irrelevant. ISIS knew it took more than two weeks, so every two weeks they moved their stuff.”¹¹⁸ This largely centered on the long interval between target development and engagement and the number of assets required to develop targets for deliberate-strike operations. A key holdup in this process was the high evidentiary standards and layers of approval required for deliberate strikes, which were greater than those for dynamic strikes. As Lt Gen Harrigian noted, the deliberate-targeting process “can take from days to weeks to develop, depending on the target and the time needed to observe daily patterns of life and behavior.”¹¹⁹ Delays also provided time for ISIS, noted to be an adaptive adversary, to change its oil enterprise by, for example, making its operations more mobile by consistently switching its oil storage locations or turning oil tanker trucks into mobile storage. These measures increased the survivability of ISIS’s oil business, as the larger number of distributed mobile targets were more challenging for airpower to strike, but it also hurt the efficiency of ISIS oil production and sales.

Relatedly, the fourth challenge was the difficulty in measuring the effects of the strikes, as there were no clear measures of effectiveness to assess the impact of Operation Tidal Wave II on ISIS. Although it was possible to quantify the tactical-level impact of a strike (for example, 50 tanker trucks destroyed, or five oil-gas separation plants disabled), battle damage assessments required routine surveillance to determine whether restrikes were needed. This requirement complicated poststrike effectiveness measures and increased the demands on already overtaxed ISR assets. As OIR Spokesperson COL Christopher Garver noted, “it was difficult” to determine “what kind of damage we did” to a target and then even more challenging to assess “what kind of economic impact that has.”¹²⁰

Moreover, ISIS adapted to strikes over the course of the campaign, further compounding the challenge in assessing Operation Tidal Wave II strikes over time. As Acting Under Secretary of the Treasury for Terrorism and Financial Intelligence Adam Szubin noted,

¹¹⁸ RAND interview with Brig Gen Matthew Isler, December 6, 2019. Two weeks was the pattern observed in Mosul. In other places, ISIS’s movement timeline varied, but most of ISIS’s movements were inside coalition deliberate-targeting operations timelines, which effectively negated the effectiveness of those operations. In Mosul, it took the deliberate-targeting process 34 days to get approval.

¹¹⁹ Jeffrey Harrigian, “Department of Defense Press Briefing by General Harrigian via Teleconference,” transcript, U.S. Department of Defense, May 24, 2017.

¹²⁰ Christopher Garver, “Department of Defense Press Briefing by Col. Garver via Teleconference from Baghdad, Iraq,” transcript, U.S. Department of Defense, June 8, 2016.

We have insights on certain things like how many oil wells we've taken out and we have estimates of what proportion of the production those oil wells accounted for, but this is not a static picture. Of course, ISIS is then turning to other oil wells. They've proven very adaptive. So it has proven very difficult to quantify, let's say, monthly figures.¹²¹

Beyond tracking tactical-level statistics, measuring the strategic effects of these strikes was difficult—in other words, the impact they had on ISIS's overall strength. The coalition pointed to different indicators over the course of the operation to try to capture the strategic impact—for example, decreases in revenue generated from oil, cuts to ISIS fighter salaries, increases in production and distribution costs, or increases in taxes meant to recoup money generated from oil. However, these measures of effectiveness were not clearly defined, nor were they systematically tracked over the course of Operation Tidal Wave II. Moreover, CJTF-OIR increased pressure on ISIS in the close fight and the deep fight simultaneously, which increased the challenge of isolating the effects of one operation versus another. As more ISIS records have become available, however, it has become clear ISIS was not as dependent on oil as many believed but that taxation and extortion generated six times as much income as ISIS's extraction and sale of natural resources.¹²²

Operation Tidal Wave II Case Conclusion

As the first major deep fight in OIR, Operation Tidal Wave II demonstrated the ability of strategic strikes to directly erode ISIS strength, albeit perhaps less than was initially reported. Operation Tidal Wave II represented a notable shift in how airpower was employed in OIR.¹²³ As CJTF-OIR Deputy Commander Maj Gen Peter Gersten asserted, “Operation Tidal Wave II was one of our most synchronized, coordinated strikes in the war to date. It was the initiation of the entire intelligence community coming together, multi-agency, multi-coordination, highly sophisticated targeting procedures [to eliminate ISIS's ability] to finance and make money for the war.”¹²⁴ But this operation was not without its challenges, most of which—such as attaining ISR assets against the backdrop of a more pressing close fight and measuring how strikes on ISIS were actively degrading its oil business—were enduring issues across most of the deep-fight cases profiled in this chapter.

¹²¹ Paul Cruickshank and Nicole Magney, “A View from the CT Foxhole: Adam Szubin, Acting Under Secretary for Terrorism and Financial Intelligence, U.S. Department of the Treasury,” *CTC Sentinel*, Vol. 9, No. 8, August 2016.

¹²² Rukmini Callimachi, “The ISIS Files,” *New York Times*, April 4, 2018.

¹²³ RAND interview with Brig Gen Brook J. Leonard, January 23, 2020.

¹²⁴ Peter Gersten, “Department of Defense Press Briefing by Maj. Gen. Gersten via Teleconference from Baghdad, Iraq,” transcript, U.S. Department of Defense, April 26, 2016.

Finding, Fixing, and Finishing ISIS Finances: Operation Point Blank, January 2016–September 2017

Background of Operation Point Blank

By early 2016, ISIS faced mounting financial challenges. A string of territorial losses and air strikes against its oil enterprise, combined with a decline in international oil prices and difficulties maintaining production infrastructure, led to an appreciable decline in revenue.¹²⁵ Just as important, the decrease in revenue weakened ISIS's ability to govern and tarnished its international appeal, which was derived in part from the group's ability to administer the self-proclaimed caliphate. However, ISIS had amassed a considerable cash surplus during 2014 and 2015, including the estimated \$500 million in cash it stole from Iraqi state-owned banks in 2014 alone.¹²⁶ According to one estimate, by 2015, ISIS controlled 80 banks in Iraq and 35 in Syria, which provided ISIS with considerable cash reserves.¹²⁷

Because international sanctions limited the organization's access to the international financial system, ISIS's cash holdings were an important source of strength. ISIS could transfer money using the *hawala* system, which is an informal system of exchanging currency.¹²⁸ Nevertheless, as Under Secretary Cohen stated in a congressional testimony, "Operating entirely in cash is both cumbersome and risky—cash is bulky, vulnerable to theft, and requires complicated logistics to transport."¹²⁹ CJTF-OIR aimed to exploit this weakness to increase the financial pressure on ISIS, beginning in 2016 with another deep-strike operation.

Between January 2016 and September 2017, the coalition undertook a targeted operation to identify and destroy ISIS's existing cash stockpiles, named Operation Point Blank. Although smaller than Operation Tidal Wave II, Operation Point Blank represented a parallel effort to destroy key elements of ISIS's financial operations, weakening its ability to govern, attract adherents, and recruit, equip, and retain fighters. The successful operation demonstrated the CFACC and CJTF-OIR's ability to

¹²⁵ ISIS's revenue dropped from between \$970 million and \$1.9 billion in 2014 to a maximum of \$870 million in 2016. Jérôme Cousseran and Agnès Levallois, *The Financing of the “Islamic State” in Iraq and Syria (ISIS)*, Brussels: Directorate-General for External Policies, European Parliament, September 2017, p. 9.

¹²⁶ Jérôme Cousseran and Agnès Levallois, *The Financing of the “Islamic State” in Iraq and Syria (ISIS)*, Brussels: Directorate-General for External Policies, European Parliament, September 2017, p. 9; Matthew Rosenberg, Nicholas Kulish, and Steven Lee Myers, "Predatory Islamic State Wrings Money from Those It Rules," *New York Times* November 29, 2015.

¹²⁷ Jean-Charles Brisard and Damien Martinez, *ISIS Financing: 2015*, Paris: Center for the Analysis of Terrorism, May 2016, p. 23.

¹²⁸ Jean-Charles Brisard and Damien Martinez, *ISIS Financing: 2015*, Paris: Center for the Analysis of Terrorism, May 2016, pp. 23–24.

¹²⁹ U.S. Department of Treasury, "Testimony of Under Secretary Cohen before the House Financial Services Committee on ‘The Islamic State and Terrorist Financing,’" press release, November 13, 2014.

coordinate with the interagency and to prosecute a deep fight. By eroding ISIS's financial strength, the air strikes conducted as a part of Operation Point Blank produced notable effects, although it is difficult to precisely estimate the amount attributed to this particular operation.

The Application of Airpower in Operation Point Blank

Operation Point Blank began in January 2016, roughly three months after the first strike in Operation Tidal Wave II. From the beginning, it was intended to be a complementary effort, to hollow out ISIS's existing cash reserves, while Tidal Wave II disrupted ISIS's cash flows. OIR spokesperson COL Steven Warren summarized the theory undergirding the operation: "A combination of taking away [ISIS's] ability to earn money by striking oil and taking away the money that they have on hand by striking the Daesh cash really puts the squeeze on them. . . . We believe that continuing this pressure . . . is going to, over time, really begin to eat away at their ability to continue their operations."¹³⁰

Over the course of Operation Point Blank, including the months leading up to its official start date, coalition aircraft struck or destroyed a total of 36 ISIS financial targets over a span of nearly two years.¹³¹ Two-thirds of the targets were engaged in the operation's first year, with the greatest number of targets hit in February (five), April (three), and May (four) 2016. As seen in Figure 5.6, Mosul was the focus of operations through September, where 15 financial targets were destroyed since the operation commenced in January. Although initially concentrated in Iraq, the operation expanded into Syria in May 2016 and continued through the summer. After a brief lull, operations resumed in December 2016, with periodic strikes focused on Syria continuing through the summer of 2017. Operation Point Blank ended in August 2017, with the most intense period of strikes during its 21-month duration, striking five financial targets across Abu Kamal, Hawija, and Deir ez-Zur between July 26 and August 3.¹³²

With just 36 targets struck over nearly two years, Operation Point Blank represented a smaller and more focused effort than the concurrent Tidal Wave II operation, in which roughly 2,400 strikes engaged approximately 5,400 oil and gas targets between October 2015 and October 2017. The narrow focus of the campaign and the discrete number of strikes can be attributed to the relatively small pool of potential targets and the operation's reliance on available intelligence, which was also derived from the Abu Sayyaf raid. The level of effort for Operation Point Blank never exceeded

¹³⁰ Steven Warren, "Department of Defense Press Briefing by Col. Warren via Teleconference from Baghdad, Iraq," transcript, U.S. Department of Defense, January 20, 2016.

¹³¹ According to the RAND CJTF-OIR strike release data set, the coalition struck three financial targets before the first strikes in January 2016. The total number of financial targets listed is drawn from the strike releases and may differ from DoD statements regarding the operation because of data access or availability.

¹³² Analysis of the RAND CJTF-OIR strike release data set.

1 percent of CJTF-OIR strikes in any month. The majority of targets were located in Mosul, reflecting its financial importance (see Figure 5.6).

The effort to target ISIS cash stockpiles benefited from the improvements made to the deliberate-targeting process and the intelligence gained during the course Operation Tidal Wave II. “The Tidal Wave strikes led us to [ISIS’s] bank sources, their bank sources have led us to their distribution sources, and their distribution sources have led us to their foreign fighters,” Maj Gen Gersten explained.¹³³ By early 2016, AFCENT had acquired a few organic ISR aircraft and acquired additional targeting specialists in the CAOC. The intelligence collected from the air-breathing ISR assets was fused with information gathered from the federated ISR system that the CAOC built to support target development for OIR, then assessed through a detailed network analysis. COL Warren, the chief spokesperson for OIR in Baghdad, observed, “We do have a much better sense now for what this enemy looks like, how this enemy operates and how they’re structured.”¹³⁴

Target development required close coordination with interagency counterfinancing efforts with support from the U.S. Departments of Treasury and State, which managed the broader counterfinancing line of effort against ISIS. Treasury worked in conjunction with Iraqi authorities to identify exchange houses, cash auctions, storage and distribution facilities, and other financial nodes within ISIS-held territory.¹³⁵ Meanwhile, intelligence analysts tracked ISIS’s financial operations through a combination of satellite and aerial imagery, electronic intercepts, and HUMINT, identifying distribution, collection, and storage nodes. A newly developed digital database minimized inefficiencies that emerged as a result of overlapping roles, responsibilities, and activities within the interagency and improved synchronization with U.S. intelligence agencies. “The problem before was that everyone was running hard, but not necessarily in the same direction,” Lt Col Jeff Sgarlata, the deputy chief of the CAOC’s ISR Division, explained to a reporter. “We’re now operating more efficiently and more effectively.”¹³⁶

CJTF-OIR engaged three groups of financial targets: storage facilities (e.g., banks), distribution sites (e.g., cash collection points, distribution centers, and financial exchanges), and financial buildings (e.g., finance headquarters and offices). Together, coalition strikes across the three categories disrupted ISIS’s ability to extract or raise

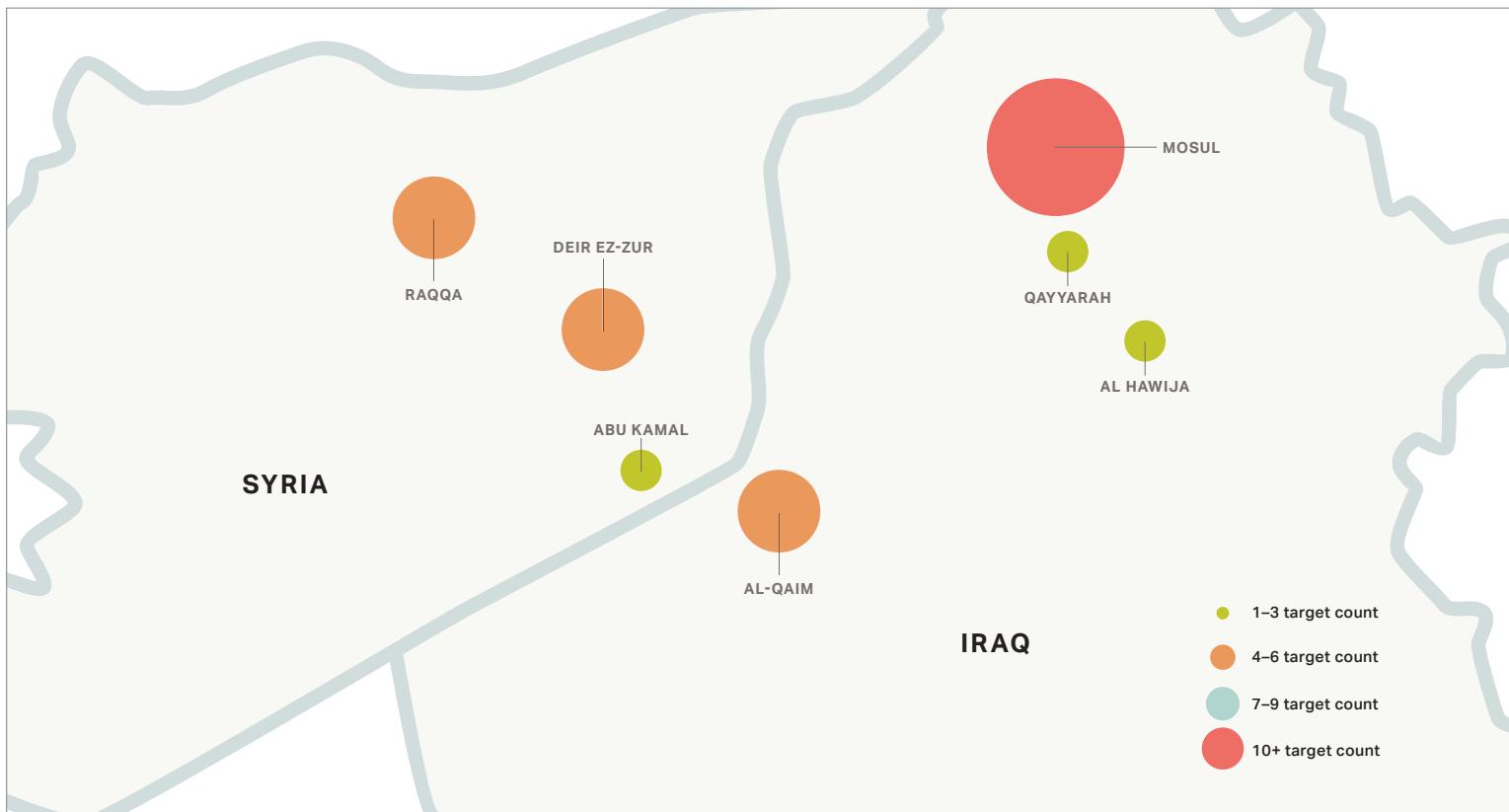
¹³³ Peter Gersten, “Department of Defense Press Briefing by Maj. Gen. Gersten via Teleconference from Baghdad, Iraq,” transcript, U.S. Department of Defense, April 26, 2016.

¹³⁴ Quoted in Eric Schmitt, “U.S. Says Its Strikes Are Hitting More Significant ISIS Targets,” *New York Times*, May 25, 2016.

¹³⁵ Paul Cruickshank and Nicole Magney, “A View from the CT Foxhole: Adam Szubin, Acting Under Secretary for Terrorism and Financial Intelligence, U.S. Department of the Treasury,” *CTC Sentinel*, Vol. 9, No. 8, August 2016.

¹³⁶ Eric Schmitt, “U.S. Says Its Strikes Are Hitting More Significant ISIS Targets,” *New York Times*, May 25, 2016.

Figure 5.6
Operation Point Blank Strikes by City



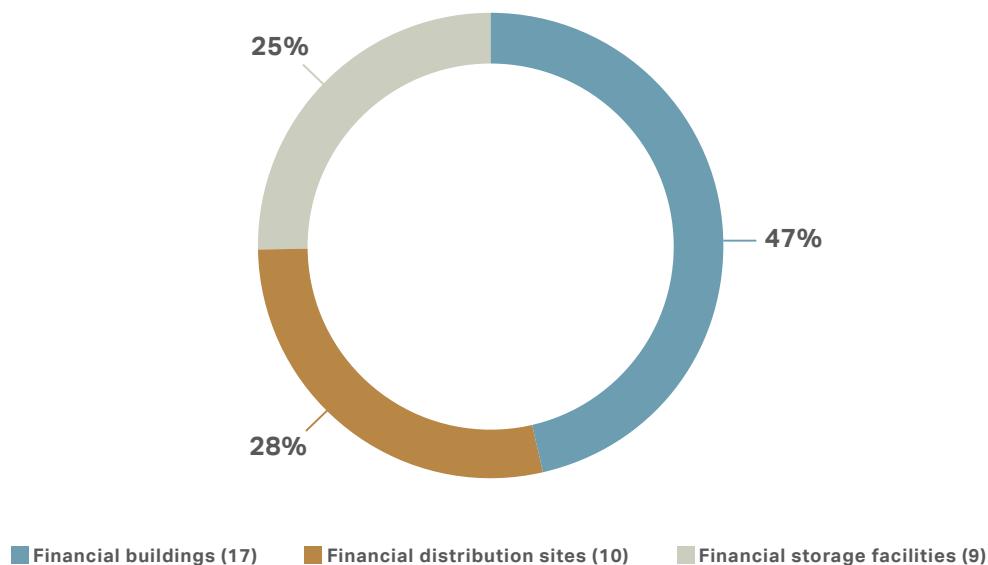
SOURCE: RAND CJTF-OIR strike release data set.

wealth, store and transport cash reserves, use revenue to pay fighter and bureaucratic salaries or finance operations, and maintain the mirage of a functioning administrative apparatus (see Figure 5.7).

In some cases, these were restrikes on previous targets, as ISIS would seek to mitigate the impact of the strikes. In the words of one USAF officer, “We would hit the money, you’d see FMV of it going up in the air, and ISIS would bring bucket loaders to try to scoop it back up.”¹³⁷ This practice led the coalition to shift its tactics to incinerate cash to render it unusable. ISIS also adapted by distributing and moving its surviving cash storage to make it more difficult to target. Warren explained, “[W]e got a little ahead of ourselves and we announced, ‘Hey, we hit all this cash,’ and sure enough, all the cash moved. . . . We could have just kind of said, you know, we struck a building and left it at that. . . . [ISIS] may well have thought, ‘Lucky shot, they got our cash.’”¹³⁸

Although the coalition refrained from releasing information about the types of aircraft used in Operation Point Blank, it appears that many or all of the strikes were launched by manned platforms. These included aircraft piloted by the U.S. Navy (F/A-18C or F/A-18E/F fighters) and USAF, including reportedly B-1B bombers and

Figure 5.7
Types of Targets Struck in Operation Point Blank



¹³⁷ RAND interview with USAF official, December 2, 2019.

¹³⁸ Steven Warren, “Department of Defense Press Briefing by Colonel Warren via Teleconference from Baghdad, Iraq,” transcript, U.S. Department of Defense, March 11, 2016.

F-15E fighters.¹³⁹ These strike platforms were supported by ISR assets, including RPAs, required to monitor the target area, both before and after strikes.¹⁴⁰

A combination of “exquisite” intelligence, including information derived from the documents obtained during the raid on Abu Sayyaf, and “phenomenal” weaponeering aided the coalition’s efforts to destroy often well-fortified stockpiles while protecting surrounding buildings.¹⁴¹ Describing a January 2016 strike that destroyed an ISIS bank in Mosul, one person interviewed noted that the CAOC team—specifically, the targeting effects team—was able to tailor the munitions and calibrate a precise angle and velocity of delivery in response to information about “how many stories [were] in the bank, where individuals were on what floor, where the money was stored, what the structure of the bank was, the materials that comprised the bank.”¹⁴² Tasked with destroying a large cache of currency concealed in the basement of a nine-story building, the weaponeers designed a plan to drop three GBU-39 Small Diameter Bombs with fuses set for different delays to “open up the roof” with successive detonations on different floors to kill the ISIS personnel working there. This was the consecutive miracles technique: The bombs were dropped nearly simultaneously into the same spot, and then a pair of 2,000-pound JDAMs penetrated the basement vault and incinerated the stockpile, later estimated to hold 75 percent of the cash available for fighter salaries, without damaging a mosque in the building’s vicinity.¹⁴³ As one interviewee quipped, “it wasn’t a pickup basketball game.”¹⁴⁴

CJTF-OIR placed great emphasis on reducing collateral damage in Operation Point Blank strikes, although they were not always successful.¹⁴⁵ In a separate strike executed on April 5, 2016, in Mosul, U.S. aircraft employed a controversial tactic known as roof knocking, most commonly used by the Israeli Air Force, to warn civil-

¹³⁹ Steven Warren, “Department of Defense Press Briefing by Col. Warren via Teleconference from Baghdad, Iraq,” transcript, U.S. Department of Defense, January 20, 2016; AFHRA interview with Brig Gen Daniel J. Orcutt, September 25, 2019.

¹⁴⁰ Steven Warren, “Department of Defense Press Briefing by Col. Warren via Teleconference from Baghdad, Iraq,” transcript, U.S. Department of Defense, January 20, 2016.

¹⁴¹ AFHRA interview with Brig Gen Daniel J. Orcutt, September 25, 2019.

¹⁴² AFHRA interview with Brig Gen Daniel J. Orcutt, September 25, 2019.

¹⁴³ AFHRA interview with Brig Gen Daniel J. Orcutt, September 25, 2019; AFHRA interview with Col Johnny Barnes II, July 24, 2019; CENTCOM, “Jan. 11: Coalition Airstrike Destroys Daesh Finance Distribution Center Near Mosul,” video, January 11, 2016; Steven Warren, “Department of Defense Press Briefing by Col. Warren via Teleconference from Baghdad, Iraq,” transcript, U.S. Department of Defense, January 20, 2016; Barbara Starr, “First on CNN: U.S. Bombs ‘Millions’ in ISIS Currency Holdings,” CNN, January 13, 2016.

¹⁴⁴ AFHRA interview with Brig Gen Daniel J. Orcutt, September 25, 2019.

¹⁴⁵ Steven Warren, “Department of Defense Press Briefing by Col. Warren via Teleconference from Baghdad, Iraq,” transcript, U.S. Department of Defense, January 20, 2016.

ians away from a building identified as a cash storage and distribution site.¹⁴⁶ After an RPA-executed pattern-of-life study showed that a woman and her children resided in the building and had remained there even after a leaflet drop warning them of an impending strike, a U.S. aircraft airbursted a Hellfire missile above the structure to “ensure that she and her children were out of the building” before the operation continued, Maj Gen Peter Gersten, CJTF-OIR deputy commander for operations and intelligence, explained during a briefing to reporters. Airmen confirmed that the civilians had evacuated the building before dropping precision munitions on what U.S. officials described as the “exact location” of a room storing an estimated \$150 million.¹⁴⁷ This first U.S. use of the tactic was “a test to see if [the tactic] worked” to mitigate the risk of noncombatant casualties, Warren said. “It didn’t,” he added, noting that the woman reentered the building shortly before the second blast.¹⁴⁸

Challenges in Operation Point Blank

Many of the challenges that emerged in Operation Point Blank resembled those that occurred in Operation Tidal Wave II. As in Operation Tidal Wave II, ISIS worked to reduce the vulnerability of its key assets. As the coalition spokesperson noted, “[W]e are going to see [ISIS] react to our strikes, whether it’s storing their cash in smaller amounts in multiple locations or whether it’s moving it more often.”¹⁴⁹ Reportedly, ISIS eventually stopped relying on installations to store its cash and instead buried its money in a network of hidden locations.¹⁵⁰ Although this measure disguised the location of ISIS’s cash, it also must have made it significantly more difficult to conduct business. Change in ISIS’s behavior meant that much of the previously obtained intelligence about its financial operations was no longer accurate, and additional time was therefore required to collect intelligence to develop and validate deliberate targets. But before some target packages could be approved, ISIS had altered its operations once again.¹⁵¹ This may account for the limited number of targets associated with this operation.

¹⁴⁶ Adam Taylor, “Israel’s Controversial ‘Roof Knocking’ Tactic Appears in Iraq: And This Time, It’s the U.S. Doing It,” *Washington Post*, April 27, 2016.

¹⁴⁷ Peter Gersten, “Department of Defense Press Briefing by Maj. Gen. Gersten via Teleconference from Baghdad, Iraq,” transcript, U.S. Department of Defense, April 26, 2016.

¹⁴⁸ Adam Taylor, “Israel’s Controversial ‘Roof Knocking’ Tactic Appears in Iraq: And This Time, It’s the U.S. Doing It,” *Washington Post*, April 27, 2016.

¹⁴⁹ Steven Warren, “Department of Defense Press Briefing by Col. Warren via Teleconference from Baghdad, Iraq,” transcript, U.S. Department of Defense, January 20, 2016.

¹⁵⁰ Patrick B. Johnston, Mona Alami, Colin P. Clarke, and Howard J. Shatz, *Return and Expand? The Finances and Prospects of the Islamic State After the Caliphate*, Santa Monica, Calif.: RAND Corporation, RR-3046, 2019, pp. 58–59.

¹⁵¹ RAND interview with Brig Gen Matthew Isler, December 6, 2019.

ISR requirements were particularly demanding for Operation Point Blank because of the coalition's focus on minimizing civilian casualties and, in some of the earlier strikes, the need to assess whether a restrike was necessary. However, the CFACC struggled to obtain RPAs for strategic operations, aside from the component's organic government-owned, contractor-operated systems that it obtained in late 2016.¹⁵² The competing demands for ISR were particularly high during this operation because of the partner ground offensive, in addition to Operation Tidal Wave II and other deep-fight operations.

As in Operation Tidal Wave II, measuring the effectiveness of strikes against ISIS cash stockpiles remained an unresolved challenge. "It's proven to be a pretty hard intelligence question to be able to measure ISIL's overall accounting. Of course, they go to great lengths to keep that hidden," said then-Acting Under Secretary for Terrorism and Financial Intelligence Adam Szubin, noting that most estimates of the organization's currency reserves were either "a snapshot in time [or] it's a more impressionistic data point about what's happening in Mosul or Raqqa," which does not "present us with the ability to compare how they are doing year on year."¹⁵³ Without "the denominator in the equation," as one commander put it, the coalition used observed changes in ISIS expenditures, taxation rates, fees, and other extortion as measures of a strike's effectiveness.¹⁵⁴ Reports that the organization had halved fighters' salaries and suspended payments to the families of suicide bombers in late January 2016, for instance, were cited as evidence that the January 11 Mosul bank strike had achieved its objective of weakening ISIS's ability to "sell itself as a quasi-governing authority, while fighting a multi-front war."¹⁵⁵ Although unable to attribute the effects to specific strikes, the coalition also interpreted desertion rates, fighter morale, and efforts to sell vehicles and other equipment as surrogate indicators that Operation Point Blank had weakened ISIS's financial strength and degraded its ability to fight.¹⁵⁶ There is not yet sufficient evidence of ISIS operations to attribute these factors specifically to Operation Point

¹⁵² RAND interview with Maj Gen (ret.) Scott Zobrist, December 3, 2019.

¹⁵³ Paul Cruickshank and Nicole Magney, "A View from the CT Foxhole: Adam Szubin, Acting Under Secretary for Terrorism and Financial Intelligence, U.S. Department of the Treasury," *CTC Sentinel*, Vol. 9, No. 8, August 2016.

¹⁵⁴ Peter Gersten, "Department of Defense Press Briefing by Maj. Gen. Gersten via Teleconference from Baghdad, Iraq," transcript, U.S. Department of Defense, April 26, 2016; Paul Cruickshank and Nicole Magney, "A View from the CT Foxhole: Adam Szubin, Acting Under Secretary for Terrorism and Financial Intelligence, U.S. Department of the Treasury," *CTC Sentinel*, Vol. 9, No. 8, August 2016.

¹⁵⁵ Paul Cruickshank and Nicole Magney, "A View from the CT Foxhole: Adam Szubin, Acting Under Secretary for Terrorism and Financial Intelligence, U.S. Department of the Treasury," *CTC Sentinel*, Vol. 9, No. 8, August 2016; Jose Pagliery, "ISIS Cuts Its Fighters' Salaries by 50%," CNN, January 19, 2016.

¹⁵⁶ AFHRA interview with Col Johnny L. Barnes, July 24, 2019; AFHRA interview with Brig Gen Daniel J. Orcutt, September 25, 2019; Peter Gersten, "Department of Defense Press Briefing by Maj. Gen. Gersten via Teleconference from Baghdad, Iraq," transcript, U.S. Department of Defense, April 26, 2016; Conor Gaffey, "Up to \$800 Million of ISIS Cash Has Been Destroyed: U.S. Official," *Newsweek*, April 27, 2014.

Blank, instead of Operation Tidal Wave II or the loss of territory. What we do know is that ISIS derived the bulk of its income from controlling territory and taxing people, and that it continued to do so and to have enough cash to continue to resist the Syrian and Iraqi offensives, although a “confluence of factors contributed to the decline in Islamic State revenues starting in late 2015.”¹⁵⁷

Operation Point Blank Case Conclusion

In Operation Point Blank, airpower directly weakened ISIS’s ability to conduct business and move money, which in turn hurt its military and terrorist operations. An exact accounting of the currency destroyed by coalition air strikes is not publicly available, but statements by coalition and U.S. government officials indicate that the strikes removed more than \$500 million from ISIS coffers by August 2016.¹⁵⁸ LTG Stephen Townsend estimated the damage to the organization’s cash reserves, combined with the destruction of its oil infrastructure and concurrent territorial losses, had created a liquidity crisis for ISIS, which hampered the group’s ability to govern and contributed to an overall decline in the number and morale of available fighters.¹⁵⁹ However, as there are no officially published desertion rates, whether the air strikes in Operation Point Blank achieved this effect is unclear. Indeed, these quantitative estimates of the monetary losses conceal the operation’s intangible strategic effect. As Special Envoy Brett McGurk testified before the Senate Committee on Foreign Relations, the air strikes “created a virtuous cycle: terrorist fighters are not paid, their supplies run low, they have less will to fight, and they are more easily defeated,” but, once again, these assertions are difficult to prove.¹⁶⁰

The use of airpower to target cash stockpiles presented CJTF-OIR with an opportunity to prosecute a focused deep fight that had an outsized impact in part because the campaign was coordinated with interagency actors. Yet the operation was not without its own challenges. The time-sensitivity of the targets, combined with ISIS’s gen-

¹⁵⁷ Patrick B. Johnston, Mona Alami, Colin P. Clarke, and Howard J. Shatz, *Return and Expand? The Finances and Prospects of the Islamic State After the Caliphate*, Santa Monica, Calif.: RAND Corporation, RR-3046, 2019, p. 55.

¹⁵⁸ Sean MacFarland, “Department of Defense Press Briefing by Lieutenant General Sean MacFarland, Commander, Combined Joint Task Force-Operation Inherent Resolve via Teleconference from Baghdad, Iraq,” transcript, U.S. Department of Defense, August 10, 2016. This estimate was in line with a previous public estimate, which described the lost cash “to the tune of hundreds of millions of dollars.” Steven Warren, “Department of Defense Press Briefing by Col. Warren via Teleconference from Baghdad, Iraq,” transcript, U.S. Department of Defense, May 18, 2016.

¹⁵⁹ Stephen Townsend, “Department of Defense Press Briefing by Lt. Gen. Townsend via Teleconference from Baghdad, Iraq,” transcript, U.S. Department of Defense, December 14, 2016.

¹⁶⁰ Brett McGurk, “Global Efforts to Defeat ISIS,” testimony before the Senate Foreign Relations Committee, June 28, 2016. For similar assessments by Gen Dunford and Secretary Carter, see their remarks during U.S. Senate Committee on Armed Services, “Counter ISIL (Islamic State of Iraq and the Levant) Operations and Middle East Strategy,” hearing, April 28, 2016.

eral mobility and adaptability, stressed the deliberate-strike approval process. The allocation of assets—in particular, the high demand for ISR—remained a persistent source of friction. Despite success in disrupting ISIS’s financial operations, coalition officials recognized that the surest way to destroy the organization’s wealth was still to roll back its territorial gains.¹⁶¹ The air strikes had produced shortfalls and forced ISIS to adjust its operations, but the group continued to generate substantial income through taxation and extortion of the people under its control, widely asserted to be its top source of revenue, at approximately \$400 million–\$800 million in 2015.¹⁶²

Stopping ISIS Resupply: Interdicting Logistics and Supporting Networks Between Syria and Iraq, October 2015–February 2016

Background of the Abu Kamal–Al-Qaim Interdiction Operation

By the summer of 2014, the Syrian city of Abu Kamal and the Iraqi city of Al-Qaim had fallen to ISIS, giving the militant organization control of a strategic border crossing and the ability to transit fighters, weapons, and other material between Iraq and Syria.¹⁶³ Even before ISIS, the area had functioned as a “transnational portal through which men and money [could] flow relatively freely in either direction.”¹⁶⁴ ISIS also exploited cross-border tribal connections, particularly along the historical smuggling routes that existed between Al-Qaim and Abu Kamal.¹⁶⁵ As part of its efforts to reimagine the geography of territory under its control, ISIS integrated the two districts on either side of the border into a single entity (the so-called Euphrates state) within its caliphate and settled foreign fighters and their families in this area.¹⁶⁶ Under ISIS’s control, this area was essential for its operations, logistics, recruitment, and training and was vital to ISIS smuggling activities.¹⁶⁷ With this border crossing, ISIS controlled cross-border trade in weapons, fuel, people, cars, and other goods.

¹⁶¹ Matthew Rosenberg, Nicholas Kulish, and Steven Lee Myers, “Predatory Islamic State Wrings Money from Those It Rules,” *New York Times*, November 29, 2015.

¹⁶² Stefan Heißner, Peter R. Neumann, John Holland-McCowan, and Rajan Basra, *Caliphate in Decline: An Estimation of the Islamic State’s Financial Fortunes*, London: International Centre for the Study of Radicalisation and Political Violence, 2017, p. 7.

¹⁶³ Harith Hasan and Kheder Khaddour, “The Transformation of the Iraqi-Syrian Border: From a National to a Regional Frontier,” Carnegie Endowment for International Peace, March 31, 2020.

¹⁶⁴ Michael Weiss and Hassan Hassan, *ISIS: Inside the Army of Terror*, New York: Regan Arts, 2015, p. 105.

¹⁶⁵ Ben Connable, Natasha Lander, and Kimberly Jackson, *Beating the Islamic State: Selecting a New Strategy for Iraq and Syria*, Santa Monica, Calif.: RAND Corporation, RR-1562-OSD, 2017, p. 16.

¹⁶⁶ Harith Hasan and Kheder Khaddour, “The Transformation of the Iraqi-Syrian Border: From a National to a Regional Frontier,” Carnegie Endowment for International Peace, March 31, 2020.

¹⁶⁷ Waleed al-Rawi and Sterling Jensen, “Understanding the Wilaya AlForat: Heart of Daesh’s Homeland,” *Small Wars Journal*, April 5, 2016.

The GLOCs between Al-Qaim and Abu Kamal were important to both ISIS's military operations and to the governance of its caliphate. Degrading its ability to transit the border, therefore, would reduce ISIS's ability to resupply its personnel on both sides of the border and reduce its narrative of a united caliphate. As a result, the coalition launched an operation in late 2015 to interdict ISIS GLOCs and logistics sites around Abu Kamal and Al-Qaim to reduce ISIS's ability to ferry weapons, goods, and personnel from Syria to Iraq.

The Application of Airpower in the Abu Kamal–Al-Qaim Interdiction Operation

The interdiction operation around Abu Kamal and Al-Qaim began in October 2015 and ended in February 2016. It was concurrent with the ground fights planned around the early 2016 time frame in the MERV and was intended to aid these fights by degrading ISIS's ability to launch attacks in the MERV. Lt Gen Brown explained the theory behind developing deep-fight interdiction operations that were directly linked to supporting the ground fight: “[S]trike in areas that are away from the close fight so that those fighters can't get to that next fight . . . as opposed to striking them when they're in contact.”¹⁶⁸ The air component argued that ISIS's ability to freely move people, weapons, and goods between Syria and Iraq made it resilient, enabling the organization to reconstitute in areas that were not a focus of coalition operations.

Both the planning and the execution of this effort fell under the CFACC in support of CJTF-OIR. According to Brown, the objective of this operation “was to restrict Daesh movement throughout the Euphrates River Valley,”¹⁶⁹ thereby disrupting ISIS logistics, operational movements, and force generation, which in turn would weaken ISIS's ability to fight in the MERV. Moreover, these routes—in particular, around Abu Kamal and Al-Qaim—supported ISIS fighters in Ramadi. In part, the impetus for this operation emerged from a desire to demonstrate the value of the deep fight, which at the time was underdeveloped, by linking deliberate strikes in the deep to the close fight, which received the preponderance of effort and attention in CJTF-OIR.

This target-development process began in October 2015 but was stymied at first because of a lack of ISR assets required to successfully develop targets. Around that time, the deputy CFACC, Maj Gen Scott Zobrist, led an AFCENT effort to obtain several additional ISR assets in the form of government-owned, contractor-operated and contractor-owned, contractor-operated RPAs, with the intent of aiding the target development for this operation in particular.¹⁷⁰ These additional RPAs were used

¹⁶⁸ Charles Q. Brown Jr., “Department of Defense Press Briefing by Lt. Gen. Brown via Teleconference from Southwest Asia,” transcript, U.S. Department of Defense, May 27, 2016.

¹⁶⁹ Sean Kimmons, “General: Airpower Key to ISIL Fight; Strikes to Continue,” U.S. Air Force, February 18, 2016.

¹⁷⁰ RAND interview with Maj Gen (ret.) Scott Zobrist, December 3, 2019; RAND interview with USAF official, December 2, 2019.

solely for CFACC target development and enabled the CAOC to build out this operation. From November 2015 to January 2016, the CAOC—leaning heavily on the ISR Division—developed 14 targets, which were then validated by CJTF-OIR, the TEA at the time.¹⁷¹ Target development took three months, in part because of the challenges in obtaining sufficient ISR for target development and bottlenecks in the target-validation process.

On February 15, 2016, after three months of intelligence preparation, a mix of USAF, RAF, and other coalition aircraft delivered 15 strikes against 14 logistics and facilities targets used by an ISIS facilitation network near Al-Qaim and Abu Kamal (see Figure 5.8). In these strikes, coalition aircraft reportedly employed 80 precision-guided munitions against these targets.¹⁷² Two British Tornado fighters dropped four Paveway IV laser-guided bombs, while a RAF MQ-9 Reaper provided ISR support for the strike.¹⁷³ Information about the U.S. aircraft and munitions involved are not publicly available, although the coalition released a video of the strike.¹⁷⁴ Prior to the attack on Abu Kamal, the coalition dropped leaflets warning the local population of an impending strike in a bid to reduce civilian casualties.¹⁷⁵ However, despite efforts to reduce collateral damage, one of the coalition air strikes killed three civilians at a staging area near Al-Qaim.¹⁷⁶

Taken together, the 15 strikes against locations near Abu Kamal and Al-Qaim represented the sixth-highest number of OIR strikes in one day on any city in 2016.¹⁷⁷ The strikes successfully hit their aimpoints, servicing 14 targets within a logistics facilitation network: four weapon storage facilities and caches, four headquarters (including a media headquarters), two internet cafés, and two IED and logistics facilities, as well as two sanctuary targets—an ISIS barracks and a staging area.¹⁷⁸ The precise locations of the targets are not available, but they likely stretched along the road connecting the two cities, as well as along the Euphrates and inside the cities themselves.

¹⁷¹ RAND interview with USAF official, December 2, 2019.

¹⁷² Sean Kimmons, “General: Airpower Key to ISIL Fight; Strikes to Continue,” U.S. Air Force, February 18, 2016.

¹⁷³ UK Ministry of Defence, “RAF Air Strikes in Iraq and Syria: February 2016,” webpage, updated September 5, 2018.

¹⁷⁴ CJTF-OIR, “Feb. 15: Coalition Airstrike Destroys Daesh Weapons Storage Near Abu Kamal,” video, Defense Visual Information Distribution Service, February 15, 2016.

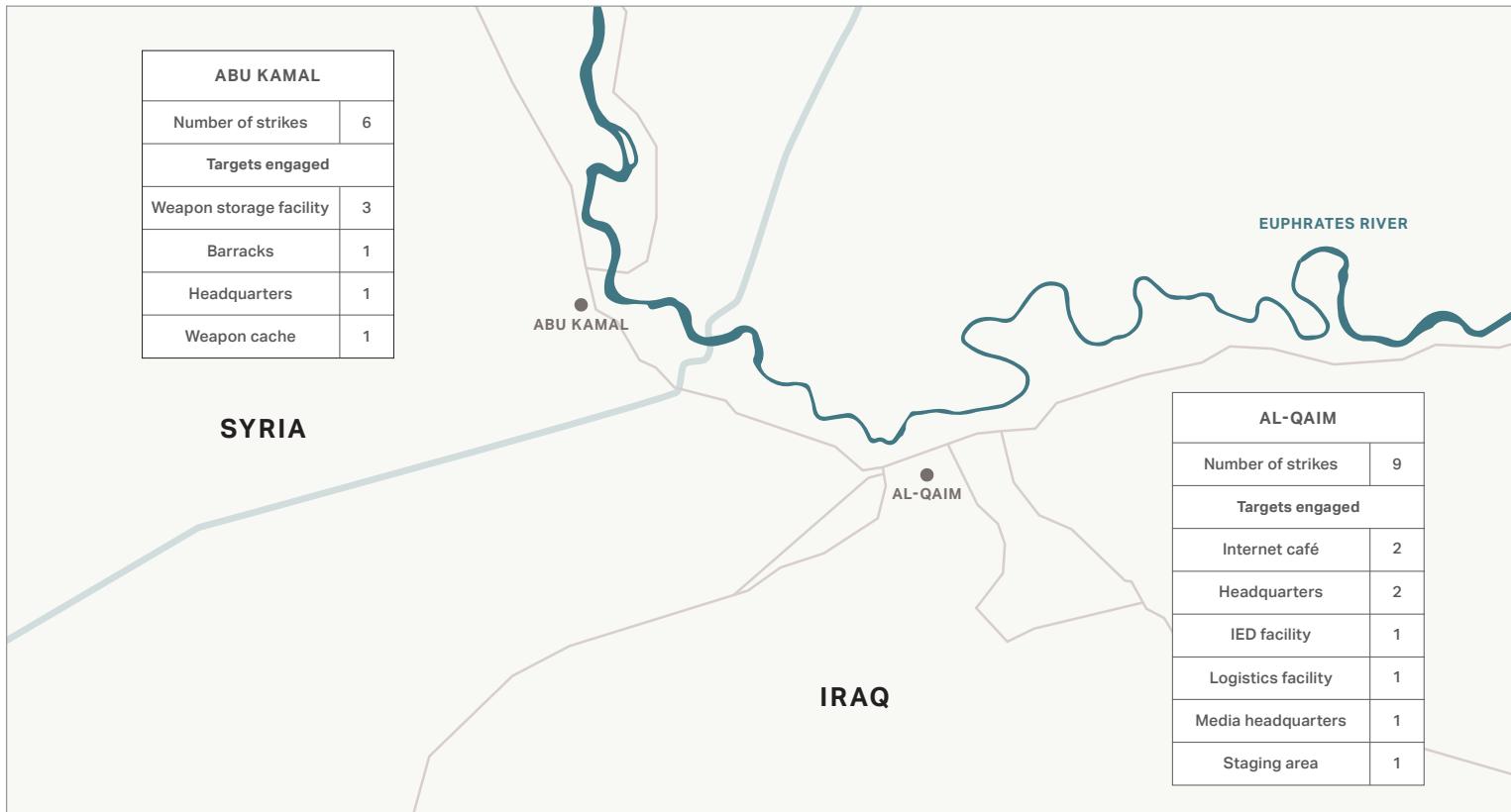
¹⁷⁵ Khuloud Saba, “Flyers dropped this morning in Abu Kamal #Syria from military airplanes,” Twitter post, February 16, 2016. The flyer read, “The attack is coming. Leave the area immediately in order to guarantee your safety. Distance yourselves from ISIS members to avoid the bombs that will drop soon” (RAND translation).

¹⁷⁶ CENTCOM, “July 28: U.S. Central Command Releases Iraq and Syria Civilian Casualty Assessments,” press release, July 28, 2016.

¹⁷⁷ RAND CJTF-OIR strike release data set.

¹⁷⁸ CFTF-OIR, “Military Strikes Continue Against ISIL Terrorists in Syria and Iraq,” February 16, 2016.

Figure 5.8
Abu Kamal–Al-Qaim Interdiction Operation, February 15, 2016



SOURCE: RAND CJTF-OIR strike release data set.

Challenges of the Abu Kamal–Al-Qaim Interdiction Operation

This operation, which lasted for several months but involved only a single set of 14 air strikes, differed greatly from the larger and more sustained strategic air strike operations profiled earlier in this chapter. Yet many of the challenges proved to be the same.

The ability to obtain the requisite ISR to successfully develop deliberate targets remained an issue. Many ISR assets were tied up supporting the close fight because of ongoing ground operations occurring at the same time, such as retaking the Q-West airfield, which was critical for the Mosul offensive and was a higher priority.¹⁷⁹ This resulted in a greater weight of effort being assigned to the ground efforts at the Future Operations Synchronization Board, which meant that the CFACC was unable to advocate effectively for more ISR for this operation.¹⁸⁰ Nevertheless, the air component believed that more ISR was being allocated to the close fight than was needed during periods in which Iraqi forces were not operating. Moreover, because this operation had been nominated by the air component, it lacked the CJTF-OIR buy-in that the strategic attack operations enjoyed, which meant that there were few proponents in CJTF-OIR advocating for this operation in the ISR apportionment process. Eventually, the air component identified a workaround in the form of government-owned, contractor-operated and contractor-owned, contractor-operated RPAs paid for with USAF funding, but this required expending additional resources.¹⁸¹

However, the additional RPAs were still not sufficient for efficient target development, which required surveillance of a wide area of operations. The thin spread of ISR assets meant that the targeting process proceeded at a glacial pace. According to a USAF officer, as part of this operation, “we developed 15 targets from November 2015 through January 2016,” but then engaged “them all in one day.”¹⁸² This slow pace of target development was compounded by bottlenecks in the target-validation process, stemming from slowdowns with both the intelligence community and CJTF-OIR, as the target-validation authority at the time. As one USAF official remarked, “The IC [intelligence community] was too slow for a CT [counterterrorism] fight.”¹⁸³

In addition, the long-term effects of this operation seemed negligible. The USAF officer explained that the February 2016 strike, “scared ISIS. They briefly withdrew from the city [Al-Qaim and Abu Kamal], but returned 48–72 hours later after no

¹⁷⁹ RAND interview with USAF official, December 2, 2019.

¹⁸⁰ Edward O. Ziembinski, “CJTF-OIR: Future Operations Synchronization Board (FOSB),” Center for Army Lessons Learned, December 2015, pp. 2, 4.

¹⁸¹ See, for example, Under Secretary of Defense (Comptroller), “Reprogramming Action—Internal: Intelligence, Surveillance, and Reconnaissance (ISR) Request,” April 18, 2016.

¹⁸² RAND interview with USAF official, December 2, 2019.

¹⁸³ RAND interview with USAF and coalition officials, March 4, 2020.

follow-on. This led the CJTF J2 and J3 to question: ‘Is the juice worth the squeeze?’¹⁸⁴ As a one-off event with no follow-up, it appeared as though this operation did not have the intended effect of halting ISIS’s cross-border operations or forcing it to adapt to secondary, less transitable GLOCs. It is not clear that even a more sustained interdiction effort would have been beneficial, given the number of ISR assets required to surveil the relatively large area in question and because ISIS’s relatively small logistics operations made each individual target less valuable.

The Abu Kamal–Al-Qaim Interdiction Operation Case Conclusion

The Abu Kamal–Al-Qaim interdiction operation aimed to reduce ISIS’s ability to resupply its personnel on both sides of the Iraq–Syria border. However, the operation was fraught with challenges, including the unavailability of critical ISR assets, an overall deprioritization of this operation by CJTF-OIR in favor of the close fight, and a failure to have a lasting impact on ISIS behavior and cross-border movement. It is unclear whether even without a number of these challenges—for example, if the operation was allocated a sufficient number of ISR platforms—that this operation would have had a demonstrable effect on ISIS’s operations, which were small and agile. Furthermore, the aims of this operation were perhaps flawed, as it is unlikely that ISIS would have stopped its cross-border smuggling even if its preferred GLOCs were disrupted because it had alternate avenues that it could use for movement.

Disrupting ISIS Freedom of Maneuver: Interdiction of GLOCs Near Mosul, September 2016–June 2017

Background of the Mosul GLOC Interdiction Operation

Mosul became ISIS’s Iraqi capital after the group seized control of the city in June 2014. ISIS viewed Mosul, Iraq’s largest Sunni city, as an important element of its vision to create a global caliphate. Mirroring the approach it took in developing Raqqa as its Syrian capital, ISIS built an extensive system of governance in Mosul and exerted uncontested control over the city until coalition operations to liberate the city began in October 2016.¹⁸⁵ During that time, ISIS had nearly two and a half years to fortify Mosul, building an elaborate set of defensive works, including an extensive VBIED

¹⁸⁴ RAND interview with USAF official, December 2, 2019. J2 is the intelligence shop and J3 is for operations at CJTF-OIR.

¹⁸⁵ Eric Robinson, Daniel Egel, Patrick B. Johnston, Sean Mann, Alexander D. Rothenberg, and David Stebbins, *When the Islamic State Comes to Town: The Economic Impact of Islamic State Governance in Iraq and Syria*, Santa Monica, Calif.: RAND Corporation, RR-1970-RC, 2017, p. 74.

production network, throughout city that would complicate the Iraqi advance and neutralize many of the coalition's warfighting advantages.¹⁸⁶

In February 2015, CENTCOM announced plans for military operations to retake Mosul by March or April.¹⁸⁷ This forecast and subsequent timetables proved to be optimistic, and the Mosul operation was pushed back several times throughout 2015 and 2016, as building partner capacity efforts with Iraqi and Kurdish forces progressed slowly.¹⁸⁸ Moreover, shaping operations around the city were required to set favorable conditions for the assault, and these too required time to have effect.

The coalition identified that ISIS's freedom of movement to and from Mosul and the surrounding areas was key to its steady supply of fighters, weapons, and materiel. To support retaking Mosul, then, the coalition needed to disrupt ISIS's GLOCs and supply routes in advance of the larger battle. Coalition air strikes would target GLOCs from Ba'aj to Mosul, arcing up toward Tal Afar, to shape the conditions for the eventual liberation of the city (see Figure 5.9). Ultimately, the coalition developed this deep-fight operation to reduce the ability of ISIS to rotate forces, resupply, and use VBIEDs against Iraqi ground forces during what would become the nine-month battle for Mosul.

The Application of Airpower in the Mosul GLOC Interdiction Operation

The purpose of this operation was to identify and disrupt ISIS's secondary GLOCs to Mosul and disrupt ISIS's military resupply in northern Iraq to support the close fight in Mosul. CJTF-OIR officials also believed that disabling the GLOCs around Mosul would impede the eventual retreat of ISIS fighters when the liberation of the city finally occurred.

As noted, plans to take Mosul in spring 2015, according to then-Secretary of Defense Ash Carter, were "entirely unrealistic," based on an "imaginary timetable" and "imaginary force."¹⁸⁹ The shifting dates of the Mosul operation also affected the timelines for shaping operations near the city, including the GLOC interdiction effort. Planning for this effort initially began in late 2015 but was delayed several times until September 2016, when the Iraqis indicated that it would begin efforts to liberate the city. Although the battle to liberate Mosul officially began in October 2016, this inter-

¹⁸⁶ David R. Kogon, "The Coalition Military Campaign to Defeat the Islamic States in Iraq and Syria 21 Aug 2016–05 Sep 2017," Combined Joint Task Force—Operation Inherent Resolve, 2017; Aden Magee, "Lessons to Be Learned: The Employment of Suicide Vehicle Borne Improvised Explosive Devices [sic] in the Islamic State's Defense of Mosul," *Small Wars Journal*, January 12, 2018.

¹⁸⁷ CENTCOM, "Department of Defense Background Briefing via Teleconference by an Official from U.S. Central Command," transcript, U.S. Department of Defense, February 19, 2015.

¹⁸⁸ Stephen Kalin, "Iraq Readies for Offensive to Rid Mosul of ISIS," *Time*, September 9, 2016.

¹⁸⁹ Ash Carter, "A Lasting Defeat: The Campaign to Destroy ISIS," Belfer Center for Science and International Affairs, Harvard Kennedy School, October 2017, pp. 13–14.

Figure 5.9
Map of Mosul GLOC Interdiction Operation



SOURCE: RAND CJTF-OIR strike release data set.

dition operation began in advance to help shape conditions on the ground, with the aim of assisting the Iraqi and Kurdish ground forces' advance.

The air component planned and executed this interdiction operation in support of CJTF-OIR, in that this operation was intended to facilitate the close fight, specifically the battle for Mosul. ISR collection was needed to develop deliberate targets primarily around Ba'aj and Balaj. In September 2016, Lt Gen Harrigian noted, "We are saturating the battle space with ISR particularly in the area of Mosul[,] . . . getting real-time visibility and awareness to the right people."¹⁹⁰

The second phase consisted of the operation's initial strikes, deliberate targeting of GLOC infrastructure in and around Ba'aj and Balaj, and approaching Tal Afar, to prevent ISIS from resupplying its forces in Mosul. In December 2016, coalition strikes ramped up against supply routes, key terrain, and excavating equipment.¹⁹¹ According to the OIR spokesperson Col John Dorrian, "These strikes have been conducted to reduce the ability of ISIL to rotate forces, resupply, and use vehicle-borne improved explosive devices against the Iraqi security forces."¹⁹²

The third phase of the operation sought to expand the targets that had been developed for the interdiction operation. Planners for this operation assumed that once they had degraded the primary GLOCs, ISIS would create and use secondary GLOCs that spanned from the Syrian border to Mosul. Therefore, the CFACC required ISR to identify these GLOCs and develop new targets related to these routes to degrade them. Once these had been identified and validated, the coalition conducted deliberate strikes to degrade the secondary GLOCs.¹⁹³ Additionally, ISR was needed to assist with identification of ISIS personnel and vehicles that had been validated as targets in the earlier phases of the operation, in order for the CFACC to conduct deliberate on-call strikes against them.

Between September 2016 and June 2017, the coalition delivered approximately 180 strikes in support of the Mosul GLOC interdiction effort (see Figure 5.10), which was a relatively small effort that made up no more than 5 percent of coalition strikes in any month. From September through December, the coalition averaged 14 strikes and 23 targets engaged per month, mainly striking weapons and VBIED facilities, as well as logistics sites, including headquarters, tunnels, and staging areas (see Figure 5.11). From January through May 2017, the coalition increased its effort to an average of 25 strikes a month, resulting in more than double the number of targets engaged. Weap-

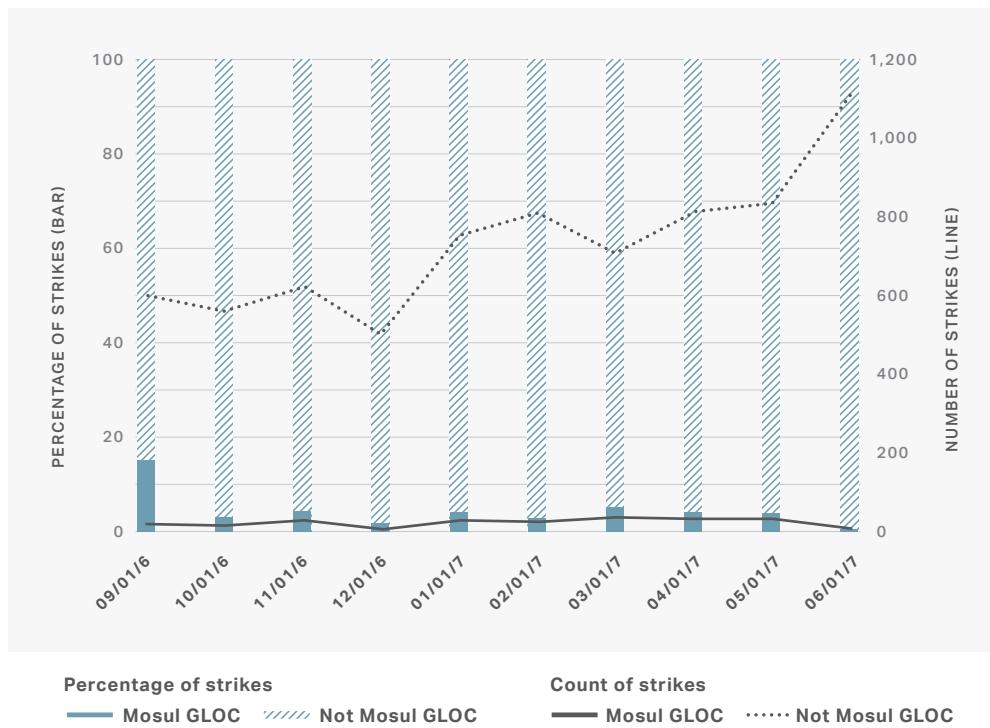
¹⁹⁰ Jeffrey Harrigian, "Department of Defense Press Briefing by Lt. Gen. Harrigian via Teleconference from Al Udeid Air Base, Qatar," transcript, U.S. Department of Defense, September 13, 2016.

¹⁹¹ John Dorrian, "Department of Defense Press Briefing by Col. Dorrian via Teleconference from Baghdad, Iraq," transcript, U.S. Department of Defense, December 8, 2016.

¹⁹² John Dorrian, "Department of Defense Press Briefing by Col. Dorrian via Teleconference from Baghdad, Iraq," transcript, U.S. Department of Defense, December 8, 2016.

¹⁹³ RAND interview with USAF official, December 2, 2019.

Figure 5.10
Level of Effort of the Mosul Interdiction Operation



SOURCE: RAND CJTF-OIR strike release data set.

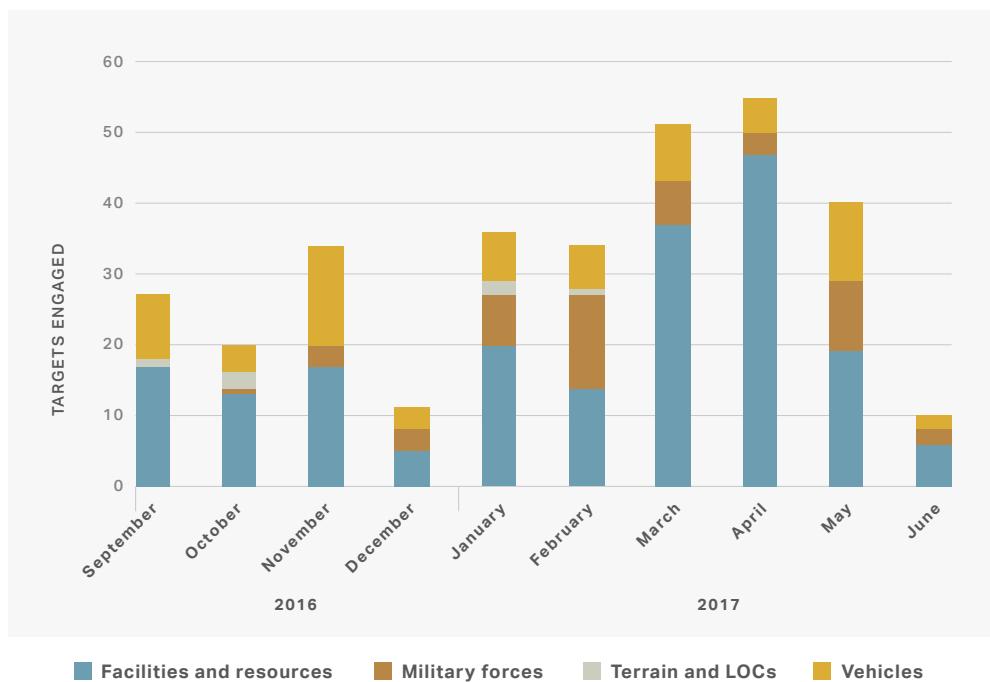
ons and IED facilities, staging areas, headquarters, and logistics sites continued receiving the majority of strikes, but the number of military forces—specifically, tactical vehicles or “technicals” that supported logistics networks—increased from two to 30 engaged between 2016 and 2017. By June, the coalition had either struck, damaged, or destroyed more than 300 targets that supported ISIS GLOCs to the west of Mosul.¹⁹⁴

Although information on the airframes and munitions used in the Mosul GLOC interdiction operation is not widely available, it appears that UK Typhoons, Australian F/A-18A fighters, and U.S. Army AH-64 Apaches were among the aircraft used in coalition operations that targeted ISIS VBIEDs and VBIED facilities in and around Mosul.¹⁹⁵

¹⁹⁴ Analysis of the RAND CJTF-OIR strike release data set.

¹⁹⁵ UK Ministry of Defence, “RAF Typhoon Destroys a Daesh Truck-Bomb, Near Mosul,” YouTube video, October 19, 2016; Tim Lester, “Australian Fighter Jets Bomb Islamic State Targets in Battle for Mosul,” Yahoo News Australia, March 4, 2017; Peter Cook, “Department of Defense Press Briefing by Pentagon Press Secretary Peter Cook in the Pentagon Briefing Room,” transcript, U.S. Department of Defense, November 7, 2016.

Figure 5.11
Types of Targets Struck in the Mosul Interdiction Operation



SOURCE: RAND CJTF-OIR strike release data set.

During the second and third phases of this operation, Iraqi ground force partners were hit with a series of devastating attacks by ISIS VBIEDs, which were being produced on an industrial scale inside Mosul.¹⁹⁶ A U.S. Army commander noted, “ISIL’s primary weapon system was that vehicle-borne IED. And they used it actually with—with pretty good effectiveness. One out of every two VBIED attacks resulted in some type of . . . casualty, whether it was vehicles, equipment, or personnel.”¹⁹⁷ Around December 2016, it became nearly impossible for the Iraqi partners to move the front lines forward, as casualty rates within Iraqi partner forces were so high that American commanders leading the operation were worried that the rates were unsustainable.¹⁹⁸ According to Martin, the CJFLCC Commander, 80 percent of the VBIED attacks in Mosul killed Iraqi forces or damaged their equipment, while CJTF-OIR was able

¹⁹⁶ Aden Magee, “Lessons to Be Learned: The Employment of Suicide Vehicle Borne Improvised Explosive Devises [sic] in the Islamic State’s Defense of Mosul,” *Small Wars Journal*, January 12, 2018.

¹⁹⁷ Brett Sylvia, “Department of Defense Press Briefing by Col. Sylvia via Teleconference from Baghdad, Iraq,” transcript, U.S. Department of Defense, January 11, 2017.

¹⁹⁸ Tim Arango, Eric Schmitt, and Rukmini Callimachi, “Hungry, Thirsty and Bloodied in Battle to Retake Mosul from ISIS,” *New York Times*, December 18, 2016.

to interdict only 20 percent of these attacks. The ongoing interdiction effort, which sought to reduce ISIS's ability to fortify the front lines and resupply its forces, was not having a "measurable outcome" on ISIS's operations.¹⁹⁹ This included ISIS's ability to use VBIEDs to great effect, as Iraqi forces were demoralized to the extent that the FLOT would not advance, and risked stalling the close fight.

As a result, a parallel effort emerged to stop VBIEDs within the city. To mitigate the damage caused by VBIEDs and to buy CJFLCC time to gather intelligence on the ISIS VBIED network in Mosul, Martin began to request air strikes to crater the roads nightly for several weeks "to create obstacles and impede ISIS's ability to move VBIEDs forward."²⁰⁰ This effort, led by the CJFLCC Commander, became a focus of CJTF-OIR operations in Mosul. It emerged not only because of the devastating physical and psychological effects of ISIS's VBIED operations but also because the CJFLCC Commander concluded that the deliberate-targeting process "just won't work" in an urban fight, such as Mosul, because the timelines of the deliberate-targeting process was unable to rapidly shift the dynamics on the front lines.²⁰¹

In this separate effort, the CJFLCC Commander realized that the command possessed the necessary assets to conduct its own targeting process that could be more responsive to developments on the battlefield and information from Iraqi partners. Therefore, the ground component leveraged all its collection assets, including air breathing ISR, HUMINT, and signals intelligence, to conduct a target systems analysis that identified two critical nodes in the VBIED network—the engineers who built the VBIEDs and the homemade explosives.²⁰² Armed with this new intelligence, CJTF-OIR began a "middle fight" effort within Operation Eagle Strike. As a part of this effort, the CJFLCC Commander reallocated some of his organic ISR assets, such as MQ-1C RPAs, from CAS to develop "middle" targets.²⁰³ The process for developing middle targets mirrored the steps in the deliberate-targeting process but was expedited so that targets could be generated on a faster timeline, closer to 24 to 48 hours, compared with the four to six weeks required for deliberate-target development. The

¹⁹⁹ RAND interview with GEN Joseph Martin, June 16, 2020.

²⁰⁰ RAND interview with GEN Joseph Martin, June 16, 2020; RAND interview with Gen Jeffrey Harrigian, June 5, 2020. See also Mosul Study Group, *What the Battle for Mosul Teaches the Force*, Washington, D.C.: U.S. Army, September 2017, p. 36; Mike Giglio, "This Is How Ground Troops in Mosul Are Calling US Airstrikes on ISIS," *BuzzFeed News*, November 19, 2016; Brett Sylvia, "Department of Defense Press Briefing by Col. Sylvia via Teleconference from Baghdad, Iraq," transcript, U.S. Department of Defense, January 11, 2017.

²⁰¹ RAND interview with GEN Joseph Martin, June 16, 2020; RAND interview with Gen Jeffrey Harrigian, June 5, 2020. See also Mosul Study Group, *What the Battle for Mosul Teaches the Force*, Washington, D.C.: U.S. Army, September 2017, p. 36; Mike Giglio, "This Is How Ground Troops in Mosul Are Calling US Airstrikes on ISIS," *BuzzFeed News*, November 19, 2016; Brett Sylvia, "Department of Defense Press Briefing by Col. Sylvia via Teleconference from Baghdad, Iraq," transcript, U.S. Department of Defense, January 11, 2017.

²⁰² RAND interview with U.S. Army official, June 16, 2020.

²⁰³ RAND interview with Brig Gen Matthew Isler, December 6, 2019.

effort had its own approval process and board, which sought to degrade ISIS's critical capabilities, including VBIED production in CJFLCC's area of operation.²⁰⁴ According to one coalition official, "it was a deliberate targeting operation led by the land component, run by an Army O-6, through a fusion cell. The commander approved the targets and we conducted the strikes overnight. The cell produced three to five targets daily."²⁰⁵ Attacks on these targets were then executed by coalition air force assets under the rubric of *deliberate-dynamic* strikes. Although this was a non doctrinal approach, the CFACC, Lt Gen Harrigian, concluded that it was "exactly what [the coalition] needed" to generate "enough momentum" to keep the Iraqis moving, and that this process "worked" in Mosul.²⁰⁶

The CJFLCC-run deliberate-dynamic counter-VBIED operation also benefited from the delegation of TEA to lower levels and the ability of U.S. advisers to accompany Iraqi forces to the front lines, which was possible after CJTF-OIR Commander LTG Stephen Townsend issued Tactical Directive 1. Although Tactical Directive 1 "empowered" U.S. forces supporting the Iraqis in Mosul, the vast majority of the air strikes were still approved via the strike cells because they had access to more intelligence than battlefield advisers, more capacity and expertise on their staffs, and were colocated with Iraqi and Kurdish TEAs who could approve strikes, which in turn enabled the strike cells to deliver air strikes faster than frontline advisers could.²⁰⁷

Figure 5.12 shows the number of air strikes (both those deliberately planned in the CAOC and CJFLCC's deliberate-dynamic strikes) against VBIED factories, facilities, and staging areas. There was an appreciable increase in the number of strikes against these ISIS targets between December 2016 and February 2017, as CJFLCC tried to support continued Iraqi force movements in Mosul and build momentum.²⁰⁸ These air strikes peaked in April 2017, when 18 VBIED targets were engaged in Mosul. As a result of these efforts, CJFLCC reversed the initial ratio of successful-to-failed ISIS VBIED attacks, as only 20 percent of ISIS's attacks caused damage.²⁰⁹ Reducing the VBIED threat and demonstrating that CJTF-OIR was responsive to the Iraqis increased the willingness of the Iraqi forces to move forward, which in turn began a virtuous cycle that stimulated ISIS to come out of its hiding spots and enabled CJFLCC to identify new targets and use ground- and air-based fires to attrite them.

²⁰⁴ RAND email exchange with Brig Gen Matthew Isler, June 30, 2020.

²⁰⁵ Email exchange with Brig Gen Matthew Isler, June 30, 2020

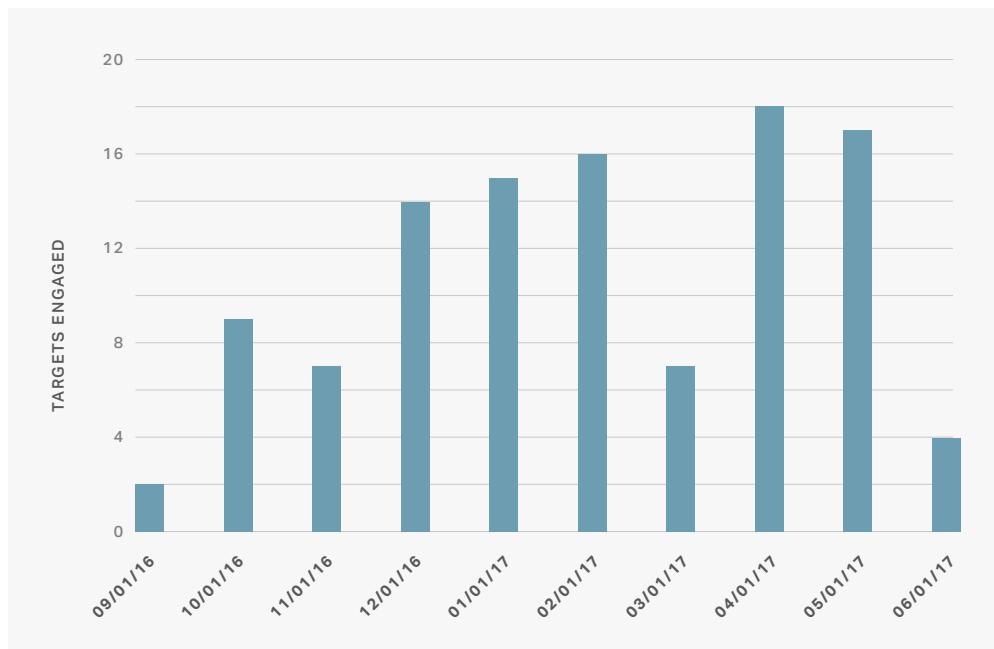
²⁰⁶ RAND interview with Gen Jeffrey Harrigian, June, 5, 2020.

²⁰⁷ RAND interview with U.S. Army officer, June 16, 2020. Tactical Directive 1 did enable frontline commanders to more readily employ tactical indirect counterbattery fires in Mosul. And frontline U.S. advisers did at times authorize air strikes, but in general they found that strike cells were faster at identifying and approving targets.

²⁰⁸ RAND interview with GEN Joseph Martin, June 16, 2020.

²⁰⁹ RAND interview with GEN Joseph Martin, June 16, 2020.

Figure 5.12
VBIED Targets Engaged in the Mosul Interdiction Operation, December 2016–June 2017



SOURCE: RAND CJTF-OIR strike release data set.

Although we have detailed the effort to target ISIS VBIEDs inside Mosul in this chapter, we stress that this was a separate operation that occurred in parallel to the effort to degrade ISIS GLOCs in and around the city. Although the two were not explicitly linked, the GLOC interdiction effort should have had an appreciable effect on reducing the VBIED threat given ISIS's continued supply needs. Because it did not, the VBIED threat remained and led CJFLCC to innovate, developing a nondoctrinal approach to overcome some of the shortcomings of the deliberate-strike process. Moreover, while we have detailed the “middle fight” effort in this chapter, we do not assert that it is actually indicative of or a part of the deep fight. Rather, it is an in-between area that emerged close to, but not, where troops were in contact, and it was hoped that airpower could be employed in this middle area to disrupt ISIS's operations in the close fight.

Challenges of the Mosul GLOC Interdiction Operation

The Mosul GLOC interdiction operation was not without challenges, ranging from airspace coordination, to ISR availability, to the targeting process, to political considerations. Airspace coordination, especially between surface and air fires, was the pri-

mary factor that limited the speed and volume of joint fires in the Mosul operation.²¹⁰ These coordination challenges were directly tied to airspace management. Although CJTF-OIR controlled all the airspace, the commander delegated airspace control to the ground and air components, which affected the amount of coordination required to conduct air strikes. Lt Gen Harrigian characterized the airspace as a “patchwork of irregular shapes.” But during the operations to liberate Mosul, this became a particular point of tension between the air and ground components. As one coalition official noted, “In the case of OIR, the ground commander owns the FSCL, so the CFACC [came] up with plans to support at that line.”²¹¹ This dynamic complicated the execution of the GLOC interdiction operation, as the location of the FLOT affected the FSCL. The CJFLCC Commander determined the location of the FLOT and the FSCL, but there were frequent changes because of the fast pace of the battle and the often-unpredictable movement of Iraqi forces, which in turn complicated target development for the CFACC.

As the Mosul Study Group noted, in an urban fight, “deep and shaping operations may equate to just a few city blocks from the front lines.”²¹² In many respects, despite the CFACC’s planning, the component’s ability to execute strikes in specific geography as planned was determined by the CJFLCC Commander. As one coalition official lamented, “the CFACC has few or no assets to do anything in his AOR, and it kept shrinking as the front line moved forward.”²¹³ This was further exacerbated by the creation of the middle fight to better reduce the VBIED threat, which further shrank the CFACC’s area of operation.

Additionally, the operation required ISR to develop targets against infrastructure, supply routes, and VBEID factories, but the available ISR—specifically, the RPAs—was tied up in the close fight in Mosul and in support of the SDF while closing in on Raqqa. Part of the challenge was that CJTF-OIR wanted to “cover down on every [Iraqi] formation that they had as they moved” so that CJTF-OIR “had the confidence to execute their scheme of maneuver.”²¹⁴ As one coalition official noted,

Right after the Mosul operation started, CJTF-OIR moved all CJTF-OIR-controlled ISR to Raqqa during a critical moment, because they thought Mosul was going to fall quickly and the SDF were ready to take Raqqa. However, it took the ISF nine months to get through Mosul. By taking ISR, they took away our ability

²¹⁰ RAND email correspondence with Brig Gen Matthew Isler, July 22, 2020.

²¹¹ RAND interview with coalition officials, March 2, 2020.

²¹² Mosul Study Group, *What the Battle for Mosul Teaches the Force*, Washington, D.C.: U.S. Army, September 2017.

²¹³ RAND interview with UK official, January 23, 2020.

²¹⁴ RAND interview with Gen Jeffrey Harrigian, June 5, 2020.

to find targets beyond immediate protection of ground forces. This led to early culmination of ISF after Mosul break-in.²¹⁵

The air component's lack of ISR assets meant that it was short of the required assets to develop targets, identify secondary GLOCs, and conduct personal identification of ISIS fighters and vehicles traveling to Mosul. Additionally, the large geographical area of the operation—from Ba'aj to Mosul and through Tal Afar—created a requirement for even more ISR assets to provide continuous coverage over such a wide area of operations and to be prepared to deliver deliberate on-call and dynamic strikes on primary and secondary GLOCs. As one coalition official summed up, “finding the ‘movers,’ who never used the same routes, in that size of territory was very difficult.”²¹⁶

A third challenge was the targeting process for the operation more broadly. Similar to other deep fight cases, the deliberate targeting process timelines were too long for the rapidly shifting environment. As the Mosul Study Group noted, “For deliberate targeting, whether in support of deep shaping operations or a planned strike in support of the close fight, processing and approval took time. This was due to stringent requirements of target development, understanding patterns of life, and positive identification, balanced with considerations of collateral damage and civilian causalities.”²¹⁷ Deliberate planning timelines could not keep up with ISIS, which altered its operations roughly every two weeks, or the Iraqi forces whose often did not decide on their plans until the last minute. This meant that by the time the four- to six-week deliberate target development and validation process was complete, the approved target packages were often irrelevant.²¹⁸ An example of this was a large deliberately planned strike on an ISIS VBIED factory near Hawija in 2016. A large strike package hit 44 desired mean points of impact, but there were no secondary explosions observed. It was later determined that ISIS had already moved its operations and that the air strike destroyed an empty chicken farm.²¹⁹

Fourth, political considerations—in particular, the desire not to be seen supporting the PMF—also hampered this operation.²²⁰ The PMF’s Shia militias were operating in support of the government of Iraq with the aim of liberating the city of Tal Afar

²¹⁵ RAND interview with Brig Gen Matthew Isler, December 6, 2019.

²¹⁶ RAND interview with USAF official, December 2, 2019.

²¹⁷ Mosul Study Group, *What the Battle for Mosul Teaches the Force*, Washington, D.C.: U.S. Army, September 2017.

²¹⁸ RAND interview with Brig Gen Matthew Isler, December 6, 2019.

²¹⁹ RAND email exchange with Brig Gen Matthew Isler, June 30, 2020.

²²⁰ Michael Knights and Matthew Schweitzer, “Shiite Militias Are Crashing the Mosul Offensive,” *Foreign Policy*, November 18, 2016.

and reaching the outskirts of Mosul.²²¹ Although the coalition purposefully withheld CAS from the PMF, the GLOC interdiction strikes were proximate to where the Shia militias were operating, prompting concern that these strikes could be interpreted as support to the PMF and limiting the area near Tal Afar where aircraft could strike to interdict parts of ISIS IED networks.

Furthermore, the development of a middle fight to reduce the ISIS VBIED threat presented several challenges for the CFACC. First, in essence, the land component was executing its own “deep fight,” further degrading the CFACC’s area of control and undermining the air component’s efforts to place greater emphasis on strategic targets, which were increasingly seen as ineffective. As one coalition official noted, “the CTS went into Mosul and got lit up with VBEIDs[;] . . . 10 VBIEDs hit the ISF every day. This shocked the ISF and they culminated. We did not target ISIS VBIED operations right until CJFLCC stood up its fusion cell.”²²² The GLOC operation was described by an intelligence official as “whack-a-mole without a full targeting system that understands multiple nodes,” stressing the need for network development, as this interdiction operation sought to degrade not only GLOCs but also an IED facilitation network. The same official questioned how the CFACC measured the success of the operation, “I asked, what were the MOEs [measures of effectiveness] for the op [operation]? It wasn’t clear.”²²³ Second, the terms being used to describe different targeting processes were confused, making it difficult to even understand the overall “apportionment between deliberate and dynamic targeting.”²²⁴ For these reasons and more, it is unclear that this operation had any tangible strategic or tactical effect, as it seemingly failed to impede ISIS’s ability to support its forces in Mosul.

Mosul GLOC Interdiction Operation Case Conclusion

The GLOC interdiction operation was conducted in support of the close fight in Mosul. It was intended to demonstrate how the integration of the deep fight could support the close one in the liberation of Mosul. However, the operation was beset by challenges. Deliberate strikes could not be produced quickly enough and in sufficient quantities to restrict ISIS freedom of maneuver in and around Mosul and to limit ISIS’s ability to use VBIEDs. The impact of VBIED attacks was so acute that CJFLCC developed its own deliberate-dynamic middle fight to reduce its success rate and enable

²²¹ Tim Lister, “The Mosul Campaign: From Here to Horizon,” *CTC Sentinel*, December 2016. However, in an effort to reassure the city’s predominantly Sunni population, PMF units were not permitted by the government of Iraq to enter Mosul during the main battle. Michael Knights and Matthew Schweitzer, “Shiite Militias Are Crashing the Mosul Offensive,” *Foreign Policy*, November 18, 2016; “Iraqi PM Abadi: Shiite Militia Won’t Join Battle for Mosul,” Rudaw, July 4, 2015.

²²² RAND interview with Brig Gen Matthew Isler, December 6, 2019.

²²³ RAND interview with USAF official, March 4, 2020.

²²⁴ RAND interview with USAF official, January 29, 2020.

Iraqi partners to maneuver without suffering unacceptable casualties. Airpower, therefore, was needed to counter this ISIS tactic, but this meant preplanned targets that were rapidly generated by CJFLCC instead of the CFACC-run deliberate-targeting process. As a result, the interdiction operation seemingly failed to have any strategic or tactical effect, as it did not impede ISIS's ability to support its forces in Mosul. In contrast, airpower delivered timely fires to support CJFLCC's deliberate-dynamic targeting process, which effectively countered ISIS's VBIED attacks and enabled Iraqi forces to liberate Mosul.

The Deep Fight: Conclusions

The chapter concludes with a brief summary of overarching findings across the case studies and themes raised by interviewees on the deep fight.

Narrowly Scoped Operations with Clear Strategic Targets Were More Effective

A review of the four case studies examined in this chapter reveals patterns in how airpower was employed in the deep fight. These cases explored operations to degrade ISIS strength through attacking strategic and operational targets—specifically, resources and logistics networks. However, the case studies highlight important differences in how airpower was employed against these two distinct sets of targets. Operations that targeted resources seemingly exhibited greater strategic impact—as well as greater tactical success—than the operations that sought to interdict ISIS GLOCs. This is, in part, due to the relative clarity of these targets, as opposed to the interdiction operations, which sought to target not only terrain and GLOCs but also military facilities (such as VBIED factories), storage sites, and vehicles.

The operations to degrade ISIS's financial strength—Operation Tidal Wave II and Operation Point Blank—were more narrowly scoped and focused on a more discrete set of targets than the interdiction operations and thus easier to execute. Moreover, the targets of these strategic operations tended to have greater intrinsic value than the interdiction operations, which meant that they had a higher return for the same amount of resources invested. Moreover, they were not tied to directly supporting the ground fight, as the two interdiction operations were intended to support Ramadi and the liberation of Mosul, respectively. In many ways, this clear delineation between the deep fight and the close fight helped avoid conflict over airspace control, because these strategic operations were removed geographically or temporally from the ground operations.²²⁵ However, as effective as these two operations were, it is unlikely that they could have been scaled further, in part because of the availability of targets and their reliance on exquisite intelligence. Moreover, if the operations had been expanded, they

²²⁵ For more on airspace C2, see Appendix B.

might have been seen as less successful, as doing so would have required additional resources, while the returns would have declined, as efforts would have needed to shift to smaller, less lucrative targets, such as smugglers.

Shortage of ISR Assets Affected the Development of the Deep Fight

Another theme that clearly comes through the case studies in this chapter was the competition between the close and deep fights over limited ISR platforms—in particular, RPAs (also discussed in Chapter Four). Airmen interviewed for this study generally agreed that insufficient RPAs were apportioned to the deep fight and that this hindered deep-strike operations against ISIS.²²⁶ This was in part because CJTF-OIR prioritized the close fight, but it was also because of an inability to forecast requirements and a willingness to reallocate ISR assets when ground operations were paused. Now-Gen Brown noted, “It’s hard to forecast. I don’t think we have the tools, particularly because of the way the fight was designed. I wouldn’t call it a wag, but it was an educated guess. As you go back and look at it, how do you understand what is the right amount if you’re doing armed overwatch versus deliberate strike?”²²⁷

Across the four cases, there were difficulties associated with identifying, tracking, and engaging mobile targets within the time frame of the deliberate-targeting cycle. The targets for the two interdiction cases were largely mobile, and the strategic cases became mobile as ISIS modified its bulk cash and oil operations to improve their survivability. As Lt Gen Harrigian explained, the requirement to “consistently stare at and maintain custody of targets” necessitated tracking mobile targets for hours and days and across great distances, which was not always possible because there were too few RPAs.²²⁸ Given that the close fight deprived ISIS of its territory, which was its main source of income, as well as source of legitimacy, prioritizing the close fight over the deep one made sense. Yet that does not mean that ground commanders truly required all the ISR assets that they were given or that ISR could not have been more dynamically and efficiently allocated across the close and deep fights to achieve better outcomes. Because we do not have the data to adjudicate between these claims, this question will need to be answered by future analysis.

The Deliberate Strike Process Is in Need of Reinvigoration

It was widely acknowledged among airmen, CJTF-OIR officials, and coalition partners that, at the outset of OIR, there was not a systematic deliberate-targeting cam-

²²⁶ RAND interview with Maj Gen (ret.) Scott Zobrist, December 3, 2019; RAND interview with USAF official, December 2, 2019.

²²⁷ RAND interview with Gen Charles Q. Brown, February 20, 2020.

²²⁸ Christian Clausen, “Next Level of RPA Operations, USAFCENT Commander Recognizes Airmen,” Creech Air Force Base, Nev., January 10, 2018.

paign.²²⁹ This was in part attributed to the lack of targeteers and intelligence professionals within USAF who were familiar with building target packages.²³⁰ As a USAF officer noted, “We worked on rebuilding the deliberate targeting enterprise of the U.S. government, which had atrophied after 9/11. It meant getting the IC [intelligence community] switched back to help produce more target sets.”²³¹

Another frequent observation that emerged from our interviews was a general frustration with the length of time that the deliberate-strike process took—as it was being rebuilt and even later in the campaign.²³² As one airman at CJTF-OIR noted, “The OIR targeting process was very long and tedious—too long to be effective. It became irrelevant.”²³³ Another USAF general officer noted that the bottlenecks in the target-validation process arrested the timeline, explaining, “I was briefing deliberate targets to CENTCOM, but you can’t do that and operate at the speed of war.”²³⁴ As was seen most clearly in the two interdiction operations, the target packages for these operations were not always developed in an operationally relevant timeline, as many targets were gone before they had been validated. This was due to a “lack of capacity both in people and tools or resources to develop targets,” as well as a “pretty robust requirement for what it took to validate a target” in terms of the hours of uninterrupted FMV.²³⁵

Issues within the deliberate strike process led to a reliance on deliberate on-call strikes, enabling a faster response to emerging targets. However, several airmen pointed out that, while these on-call deliberate strikes were highly responsive, they often were not informed by network analysis of ISIS operations and might have been much less effective than they could have been. An A-10 pilot explained, “We would see an emerging target set worth of additional development and then you hear it was already struck—it may have manifested itself into something with a better payoff, but you can’t know.”²³⁶ Moreover, on-call strikes did not always achieve the desired effect, as there was a mismatch between weapons available and target requirements, resulting in the use of a less optimal weapon. LTG MacFarland noted, “C. Q. Brown was one of my best advocates in shifting the fight from close to deep. He was saying, ‘Look,

²²⁹ RAND interview with Brig Gen Matthew Isler, December 6, 2019; interview with LTG (ret.) James L. Terry, March 27, 2020; RAND interview with LTG (ret.) Sean MacFarland, March 31, 2020; RAND interview with Gen Jeffrey Harrigian, December 17, 2019.

²³⁰ RAND interview with Gen Jeffrey Harrigian, December 17, 2019; RAND interview with Maj Gen (ret.) Bruce Miller, January 8, 2020; RAND interview with Lt Gen Scott Kindsvater, February 13, 2020.

²³¹ RAND interview with Lt Gen Scott Kindsvater, February 13, 2020.

²³² AFHRA interview with Lt Col Christopher J. Wheaton, September 17, 2019.

²³³ RAND interview with Maj Gen (ret.) Scott Zobrist, December 6, 2019.

²³⁴ RAND interview with Lt Gen Scott Kindsvater, February 13, 2020.

²³⁵ RAND interview with Gen Jeffrey Harrigian, June 5, 2020.

²³⁶ RAND interview with USAF official, January 29, 2020.

on a deliberate strike, I'm going to drop ordnance. On a dynamic strike, I might just fly without the optimal ordnance. I'm going to be more effective if I can do deliberate strikes, which makes the most sense.”²³⁷ Airmen noted that precision-guided munitions used on deliberate-dynamic strike runs were often applied to the wrong target sets and dudded in the process.²³⁸

Such issues also led to the development of an abbreviated version of the deliberate-targeting process, as demonstrated in Mosul. Although this is a non doctrinal use of airpower, it proved to be effective where traditional deliberate strikes had failed to produce results.

Interdiction Operations Did Not Have the Intended Effect on the CJTF-OIR Campaign

At the outset of OIR, there was lack of understanding at CJTF-OIR headquarters about how the deep fight could be developed to support both the overall strategy and the close-fight efforts that dominated the campaign. Therefore, the close and deep fights operated in parallel, rather than in tandem, to achieve a strategic aim. Brown, for example, sought to make air strikes “more proactive than reactive . . . to put more pressure in multiple locations because we had the capacity but weren’t being used appropriately.”²³⁹ Similarly, MacFarland understood the importance of deep strikes against ISIS to support the close fight by “get[ting] at the enemy center of gravity” and eliminating “what allows the enemy to reconstitute himself.”²⁴⁰ The idea was that, together, the deep fight would “turn off the hose” at the source while the close fight “mopped up whatever water trickled out the end of the hose.”²⁴¹ By identifying strategic targets, the hope was that “every bomb now has a greater impact.”²⁴² Nevertheless, it is worth noting that strategic operations against ISIS’s oil and money were important but not the overriding factor that led to the destruction of the caliphate.²⁴³ Ultimately, it was airpower when paired with partner ground forces that liberated all the territory that had once been under ISIS control. Strategic attacks helped hasten that process, but it is unlikely that they alone could have created that outcome.

In contrast, the interdiction operations, which were directly intended to shape the close fight, did not have the intended tactical, operational, or strategic effects on

²³⁷ RAND interview with LTG (ret.) Sean MacFarland, March 31, 2020.

²³⁸ RAND interview with USAF official, January 29, 2020.

²³⁹ RAND interview with Gen Charles Q. Brown, February 20, 2020.

²⁴⁰ RAND interview with LTG (ret.) Sean MacFarland, March 31, 2020.

²⁴¹ RAND interview with Maj Gen (ret.) Scott Zobrist, December, 3, 2019.

²⁴² Eric Schmitt, “U.S. Says Its Strikes Are Hitting More Significant ISIS Targets,” *New York Times*, May 25, 2016.

²⁴³ RAND interview with LTG (ret.) Sean MacFarland, March 31, 2020.

ISIS. The joint targeting enterprise struggled to develop deliberate interdiction targets in a timely manner in part because of the large geographic areas that needed to be monitored to identify and vet such targets. Nonetheless, it was not clear that this was a lucrative target for airpower or that air forces could appreciably disrupt ISIS's distributed logistics operations. Moreover, as was discovered during the Mosul operation, ISIS prepositioned large amounts of equipment, materiel, and personnel—including its VBIED production facilities—within the large cities it controlled to insulate them from efforts to cut them off and deprive them of needed resources. Given this, the interdiction operations did not have a tangible impact on ISIS, nor on the outcomes of the close fights in these areas.

Conclusion

The case studies and interviews demonstrate that the strategic application of airpower in the deep fight could play an important, although not decisive, role. However, the defeat-ISIS strategy had identified ISIS's territory as its center of gravity, thereby determining that the close fight would be prioritized. Nevertheless, the case studies illustrate examples of how deliberate targeting can be used effectively, which, in OIR, was largely for strategic attacks, as well as ineffectively, as seen in the interdiction missions. In many ways, ISIS was a particularly difficult adversary to target through deliberate strikes. Yet many of the challenges that were encountered in OIR, such as the competition over ISR assets, the disagreements about battlespace geometry, the long time between target development and engagement, and the need to fuse ISR assets from across DoD, yield lessons that are important to consider for any future deliberately planned air operations.

Enabling the Fight: Defensive Counterair and Air Mobility Operations

This chapter addresses elements of air operations against ISIS that did not fall under the close- or deep-fight rubrics but rather enabled those operations to occur. These critical enabling missions consist of DCA, airlift, and aerial refueling operations. In addition to discussing these elements of airpower across the campaign, this chapter examines the specific cases of U.S. and coalition DCA against Russian, Syrian, and Iranian air assets in Syria in July 2017; humanitarian relief airdrops to Yazidi refugees on Mount Sinjar, which nominally started the intervention against ISIS in August 2014; and aerial refueling in support of coalition forces during the battle to liberate Mosul from ISIS's control beginning in October 2016 (see Figure 6.1).

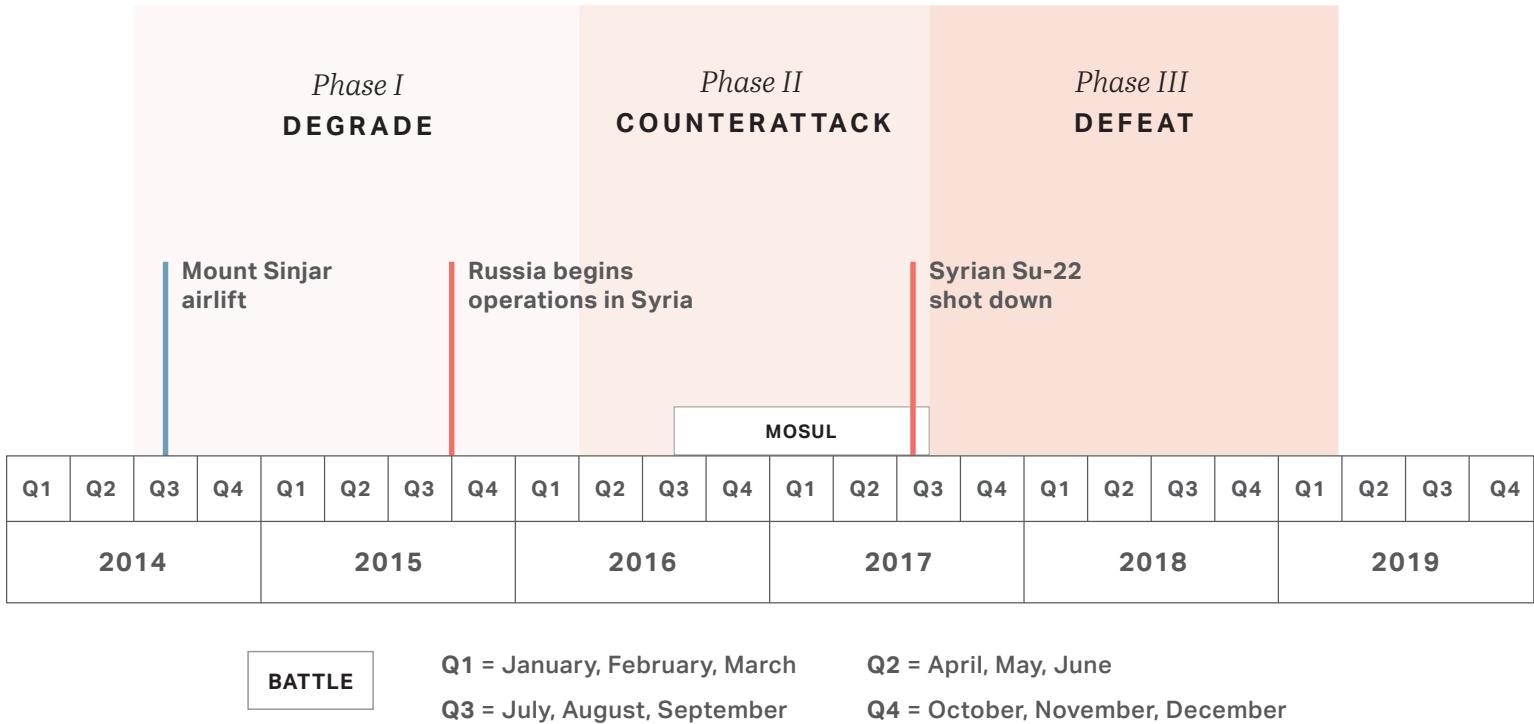
Analytic Approach

Our analysis focuses on two categories of operations. First, we look at DCA missions flown by U.S. and other coalition forces to counter Russian, Syrian, and Iranian airpower in Syria. DCA is defined as “direct (active and passive) defensive actions taken to destroy, nullify, or reduce the effectiveness of hostile air . . . threats against friendly forces and assets” and includes flying missions, such as CAP.¹ For this category, we first analyze how the coalition met the emerging DCA requirement, which increased greatly following the entrance of the Russian Air Force into Syria in October 2015, and how this requirement evolved during the operation. Although the coalition interactions with the Russian Air Force and the air-to-air incidents that occurred in Syria received a healthy amount of attention, the extent of the DCA mission in OIR tends to be an underappreciated aspect of the campaign.² We seek to analyze the contours

¹ Joint Publication 3-01, *Countering Air and Missile Threats*, Washington, D.C.: Joint Chiefs of Staff, April 21, 2017, p. x; Curtis E. LeMay Center for Doctrine Development and Education, Air University, *Counterair Operations*, Annex 3-01, Maxwell Air Force Base, Ala., September 6, 2019, p. 36.

² For example, DCA sorties are not tallied separately in the monthly AFCENT airpower summaries. They would solely be accounted for in the statistics noting the total number of sorties flown.

Figure 6.1
Timeline of DCA and Air Mobility Operations



of this mission and its impact on OIR, before profiling the U.S. downing of a Syrian Su-22 Fitter in June 2017 near Raqqa to illustrate how DCA was performed.

The second category of operations we focus on is air mobility—specifically, airlift and aerial refueling. Joint doctrine defines air mobility as “the rapid movement of personnel, materiel, and forces to and from, or within, a theater by air.”³ Within that, airlift is defined as operations that “transport and deliver forces and materiel through the air in support of strategic, operational, and/or tactical objectives”⁴ and is a key enabler of global air mobility operations. In OIR, airlift was used to transport equipment, supplies, and personnel in support of operations in Syria and Iraq,⁵ as well as to air-drop supplies to coalition ground force partners⁶ and humanitarian aid to civilians.⁷ Such operations were undertaken by a number of coalition members, including the United States, United Kingdom,⁸ Australia,⁹ the Netherlands,¹⁰ and Qatar.¹¹ Like DCA, we examine requirements of this mission in OIR, noting where it evolved. Although most airlift operations in OIR consisted of transporting equipment, people, and supplies within the area of operations, we have chosen to profile the air-dropping of aid to Yazidi refugees on Mount Sinjar. This humanitarian airlift merits attention not only because it was the first use of airpower against ISIS but also because it demonstrated the ability of several nations to rapidly respond to an evolving situation and form an early nucleus of the coalition.

We profile aerial refueling as another key mission of air mobility.¹² Aerial refueling serves as a force multiplier in global operations by reducing reliance on en route airfields and FOBs and increasing “the range, payload, loiter time, and flexibility” of aircraft.¹³ In OIR, aerial refueling was essential—there were no forward bases close

³ Joint Publication 3-17, *Air Mobility Operations*, Washington, D.C.: Joint Chiefs of Staff, February 5, 2019, p. vii.

⁴ Joint Publication 3-17, *Air Mobility Operations*, Washington, D.C.: Joint Chiefs of Staff, February 5, 2019, p. xiv.

⁵ Cynthia A. Innocent, “8th Expeditionary Air Mobility Squadron Expedites the Fight,” Air Mobility Command, December 26, 2016; CENTCOM, “816th EAS Moves Cargo Through Syria,” October 27, 2017.

⁶ Jonathan Hehnly, “386th AEW Deliver Critical Supplies to Frontlines,” Air Mobility Command, June 21, 2017.

⁷ Jennifer Hlad, “Breaking the Siege on Sinjar,” *Air Force Magazine*, September 28, 2015.

⁸ CJTF-OIR, “United Kingdom,” March 10, 2016.

⁹ Australian Department of Defence, “ADF Delivers Fifth Shipment to Iraq,” September 26, 2014.

¹⁰ William Banton, “Dutch C-130’s Supply Coalition Fight,” U.S. Department of Defense, October 10, 2017.

¹¹ AFCENT, “Qatari Emiri Air Force Re-Commits Airlift to Fight Against ISIS,” Facebook post, July 11, 2017.

¹² Joint Publication 3-17, *Air Mobility Operations*, Washington, D.C.: Joint Chiefs of Staff, February 5, 2019, p. GL-7.

¹³ Joint Publication 3-17, *Air Mobility Operations*, Washington, D.C.: Joint Chiefs of Staff, February 5, 2019, p. xv.

enough to most of the battlefields for fighters to provide effective CAS without tanker support. The USAF and allied air forces aerial refueling supported aircraft from the U.S. Navy, the USMC, and virtually every member of the coalition as they conducted a variety of missions over Iraq and Syria. Coalition partners that contributed tanker aircraft to the OIR air refueling effort, in addition to those of the United States included Australia,¹⁴ Canada,¹⁵ Italy,¹⁶ Singapore,¹⁷ and the United Kingdom.¹⁸ We examine aerial refueling requirements throughout the course of the campaign and specifically profile aerial refueling in support of close- and deep-fight operations intended to aid in the liberation of Mosul. This lengthy operation, detailed in both Chapters Four and Five, required extensive aerial refueling support to achieve the number of strike and reconnaissance sorties deemed necessary in the long fight to rid the city of ISIS. This aerial refueling operation merits attention because such efforts enabled the close and deep fights and were essential to the ability of airpower to achieve strategic-level objectives in support of the coalition.

DCA

ISIS did not possess an air capability beyond small UASs that it used for tactical reconnaissance and attacks.¹⁹ However, there was still a substantial DCA requirement for OIR, particularly after Russia intervened to support the Bashar al-Assad regime in Syria's civil war in September 2015. The arrival of advanced Russian combat aircraft and SAMs created a potential threat to coalition aircraft. Such capabilities enabled the Syrian Army and Air Force to successfully go on the offensive against their opponents, increasing the chances for deliberate or accidental encounters between Syrian regime forces and those of the anti-ISIS coalition. This was reinforced by the air-to-air shootdown of a Russian Su-24 operating near the Syrian-Turkish border by a Turkish

¹⁴ Australian Department of Defence, "Global Operations, Iraq," undated.

¹⁵ Royal Canadian Air Force, "CC-150 Polaris Returns to Canada After Participating in Operation Impact," January 28, 2019.

¹⁶ Italian Ministry of Defence, "Kuwait: 3000 ore di volo per i KC-767 rischierati presso la Task Force Air," press release, January 10, 2017.

¹⁷ Alexander W. Riedel, "Powering Partnerships: Singapore Tankers Boost Coalition Forces, Bring Fuel to Fight," Air Combat Command, September 7, 2017.

¹⁸ CJTF-OIR, "United Kingdom," March 10, 2016.

¹⁹ Although we use the term *RPA* to refer to coalition Predators, Reapers, and Global Hawks, we have opted to use *UAS* when referring to the unmanned platforms used by ISIS and other adversaries, such as Iran, in recognition of their less advanced capabilities. Gideon Grudo, "ISIS UAS Capabilities Choked, Posing Little Threat in 2018," *Air Force Magazine*, January 26, 2018.

F-16 fighter in November 2015, which highlighted the risks of such encounters.²⁰ But within Syrian territory and airspace, for most of the war, three state actors—the Syrian regime, Russia, and, to a more limited extent, Iran²¹—possessed air capabilities that the coalition viewed as necessary to deter or defend against.

Mitigating this threat involved two elements. The first was developing deconfliction arrangements with the Russians. In October 2015, Washington and Moscow agreed to a memorandum of understanding regarding safety-of-flight rules for manned and unmanned aircraft in Syria.²² These arrangements were subsequently suspended and then reestablished twice, once following the April 2017 U.S. cruise missile attack against a Syrian air base in retaliation for the regime's use of chemical weapons and again after a U.S. fighter shot down a Syrian airplane that was attacking coalition partner forces in June 2017.²³ As part of this arrangement, the coalition and the Russians agreed to a de facto deconfliction line at the Euphrates River, although this delineation was not always clear, as discussed later. Another key part was the creation of a telephone hotline between the CAOC and the Russian AOC in Syria and a similar connection between the CJTF-OIR headquarters and its Russian counterpart, which became increasingly active communications channels as coalition military operations in Syria expanded.²⁴ The second element was conducting DCA operations to deter potential adversaries from attacking coalition or partner forces or, if necessary, to defend against any such attack.

The coalition provided DCA through two primary means. The first was to employ multirole fighters that could prosecute air-to-ground strikes (CAS, interdiction, and deep strikes) and defend themselves if attacked, while also being available for DCA if required. Coalition F-16 Fighting Falcons; F-15E Strike Eagles; F/A-18 Hornets and Super Hornets; and F-22 Raptors, Typhoons, and Rafales were all able to operate in this capacity and carried medium- and short-range air-to-air missiles in addition to their air-to-ground ordnance as a matter of course when flying counterland missions. The second element was to use fighter aircraft that were particularly well suited to DCA, such as F-22 Raptors, F/A-18E/F Super Hornets, and F-15E Strike Eagles, as escorts for more heavily laden fighters or attack aircraft, typically flying

²⁰ Cydney Weiner and Andrea Mitchell, "U.S. Confirms That Downed Russian Plane Entered Turkish Airspace," NBC News, November 30, 2015.

²¹ Albin Szakola, "Iran Admits Conducting Drone Strikes in Syria," *Business Insider*, September 26, 2016.

²² Lisa Ferdinando, "U.S., Russia Sign Memorandum on Air Safety in Syria," U.S. Department of Defense, October 20, 2015.

²³ "US, Russian Generals Revive Agreement on Syrian Airspace," VoA News, May 6, 2017; Hossam Abouzahr and Tarek Radwan, "Syria's Buffer Zone Along the Euphrates," Atlantic Council, August 29, 2017.

²⁴ Andrew S. Weiss and Nicole Ng, "Collision Avoidance: The Lessons of U.S. and Russian Operations in Syria," Carnegie Endowment for International Peace, March 20, 2019; Phil Stewart, "As Syria War Tightens, U.S. and Russia Military Hotlines Humming," Reuters, August 23, 2017; RAND interview with former U.S. government official, January 8, 2020.

CAPs above aircraft conducting deliberate-strike missions or orbiting in CAS stacks.²⁵ However, even in this role, the F-22 Raptors or other escorts also carried some air-to-ground munitions to attack ground targets as needed.²⁶

Aircraft tasked with DCA also augmented the C2 capabilities provided by E-3 Sentry and E-7 Wedgetail AEW&C aircraft to coordinate coalition air activity and deconflict with Russian and Syrian aircraft.²⁷ Lt Gen Jeffrey Harrigian, the AFCENT Commander and CFACC from July 2016 through August 2018 and an F-22 Raptor pilot himself, noted at the time that “the F-22’s ability to fuse information, understand where our friendly forces are, what the Syrian air force or the Russian air force are executing, and then provide that information to the joint force—it’s frankly been unmatched.”²⁸

The coalition required DCA capabilities in two main geographic areas (see Figure 6.2). The first was the stretch of Syrian territory east of the Euphrates, where eventually the coalition combated ISIS with little separation from pro-regime ground forces and airpower that operated on the opposing side of the river and were fighting under al-Assad’s guidance to reclaim “every inch” of Syrian territory.²⁹ The second was an exclusion zone, or “bubble,” around the al-Tanf garrison in southeastern Syria, which coalition forces retook from ISIS and subsequently held to disrupt the primary GLOC between Iraq and Syria.³⁰ Al-Tanf garrison also housed a small U.S. SOF presence, although U.S. SOF operated with local partners in both areas: with the SDF east of the Euphrates and with Maghawir al-Thawra around al-Tanf garrison.³¹

The nature of the threat in the two areas was broadly similar, albeit with some important differences. In both regions, the coalition was concerned that the Syrian

²⁵ John Tirpak and Brian Everstine, “Syria Strike Story Shifting; AFCENT Says F-22s Flew Strike Cap, Basic JASSMs Used,” *Air Force Magazine*, April 19, 2018; “The F-22’s Undetected, Indispensable Role over Syria,” *Air Force Magazine*, May 24, 2017.

²⁶ Jeffrey Harrigian, “Department of Defense Press Briefing by General Harrigian via Teleconference,” transcript, U.S. Department of Defense, May 24, 2017.

²⁷ Oriana Pawlyk, “The F-22 in Syria: Deconflicting, Not Dog-Fighting,” Military.com, June 27, 2017.

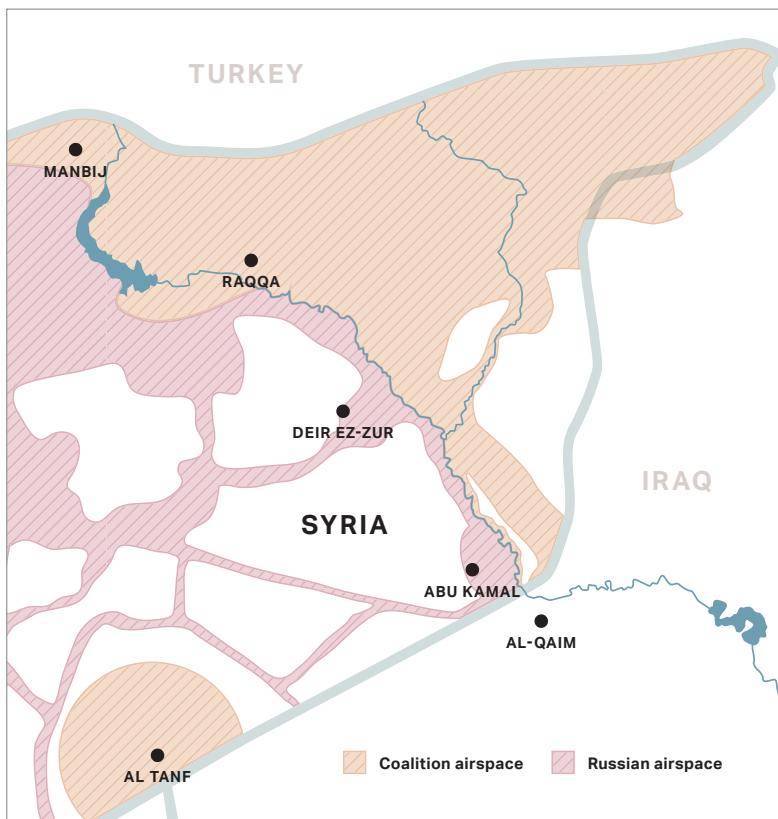
²⁸ Jeffrey Harrigian, “Department of Defense Press Briefing by General Harrigian via Teleconference,” transcript, U.S. Department of Defense, May 24, 2017.

²⁹ David E. Sanger and Rick Gladstone, “Defiant Bashar al-Assad Vows to Retake ‘Every Inch’ of Syria,” *New York Times*, June 7, 2016.

³⁰ David Botti, “First Came ISIS, Then Iran: How the Mission at a U.S. Base in Syria Kept Growing,” *New York Times*, February 4, 2019.

³¹ Former Deputy Assistant Secretary of Defense Michael Mulroy’s commented: “It is also important to highlight the work of our other D-ISIS [defeat-ISIS] partners in Syria known as the Mughawir al-Thawra, or MaT. The MaT, a force composed of Arab tribal members, continues to conduct daily counter-ISIS patrols in the 55-kilometer deconfliction zone around At Tanf Garrison. The MaT provides security and stability within the zone to support the D-ISIS coalition campaign.” These remarks were made during a Middle East Institute private roundtable on June 27, 2019.

Figure 6.2
Complex and Contested Syrian Airspace



SOURCE: Institute for the Study of War, "Situation in Euphrates River Valley: March 8, 2019," 2019.

regime's or its allies' aircraft would be used to strike ground force partners (the SDF or Maghawir al-Thawra) or coalition personnel accompanying them. Indeed, Syrian aircraft and Iranian-made UASs did attempt to strike coalition partners, with U.S. SOF in proximity, on several occasions.³² AWACS controllers had to employ the international emergency frequency ("guard calls") to ward off approaching Syrian or Russian aircraft on multiple occasions, while U.S. fighters executed "headbutts," flying across the course of an opposing aircraft and dispensing flares as a warning to alter course.³³

³² Michael R. Gordon, "U.S. Says It Shot Down Drone That Attacked Fighters in Syria," *New York Times*, June 8, 2017.

³³ See the November 17, 2017, encounter between U.S. F-22s and Russian Su-24s described in Eric Schmitt, "In Syria's Skies, Close Calls with Russian Warplanes," *New York Times*, December 8, 2017; Joseph Trevithick, "Russian Su-25 Almost Hits US F-22 During Intercept over Syria, but Is There More Going On?" *The Drive*,

In three instances, U.S. pilots shot down manned Syrian and unmanned Iranian-made aircraft—an Su-22 Fitter and two Shahed 129 UASs, all of which were likely flown or controlled by Syrian regime forces—to protect partners on the ground. After these incidents, CJTF-OIR reiterated that the air-to-air shootdowns were conducted solely to defend coalition and partner forces, in keeping with the coalition’s ROE, noting: “The Coalition does not seek to fight Syrian regime, Russian, or pro-regime forces partnered with them, but will not hesitate to defend Coalition or partner forces from any threat.”³⁴

In addition to the risk that pro-regime aircraft would target coalition partners’ ground forces, a more remote scenario that still prompted concern was that these same adversaries might seek to shoot down coalition aircraft. However, there is no publicly disclosed incident in which these states attempted to shoot down coalition jets over Syria using either fighters or SAMs. Thus, the primary threat was the adversaries using air strikes against coalition personnel or partners operating on the ground.

Although the overall threat was similar in eastern Syria and the al-Tanf garrison exclusion zone, an important difference between the two areas was the scope of territory in eastern Syria compared with the much smaller 55-kilometer exclusion zone around al-Tanf garrison. Because the garrison is close to the Mediterranean—roughly 160 nautical miles (300 kilometers) from the coast—naval assets flying off a carrier in the Eastern Mediterranean were well placed to provide air cover over the exclusion zone, overflying Israel and Jordan to reach it.³⁵ The second important difference was that Iranian UASs and Iranian-backed militia forces were a heightened threat around al-Tanf garrison, violating the perimeter of the exclusion zone on more than one occasion.³⁶ Iranian-affiliated forces did operate in the vicinity of the deconfliction line at the Euphrates River, but the primary concern in this area remained Syrian regime strikes on partner or coalition forces or, in a worst-case scenario, an escalation with Russian aircraft operating nearby. The risk of an air-to-air incident with the Syrian regime was heightened by Syrian Air Force pilots operating out of the base at Deir ez-Zur, just across the Euphrates deconfliction line, using the river as a navigation aid.³⁷ In the latter stages of the campaign, the coalition often observed Syrian aircraft

December 14, 2017; Logan Nye, “Here’s How Fighter Jets Can ‘Headbutt’ Other Planes to Send Them a Message,” *Business Insider*, September 22, 2018.

³⁴ CENTCOM, “Coalition Shoots Down Armed UAV in Syria,” press release, June 20, 2017.

³⁵ It is worth noting that there was not consistent carrier presence in the Mediterranean throughout the course of OIR. See Appendix B for details of CSG locations. See also Adam Evenhaim, “Syria: The World’s Most Contested Airspace,” *Ynetnews*, November 24, 2015.

³⁶ Hannah Ryan, “Timeline of Escalation in Syria: U.S. vs. Iran, Russia, Syria and ‘Pro-Regime’ Forces Post January 20, 2017,” Just Security, June 22, 2017; David Botti, “First Came ISIS, Then Iran: How the Mission at a U.S. Base in Syria Kept Growing,” *New York Times*, February 4, 2019.

³⁷ All Source Analysis, “Attack on Dayr az Zawr Airbase,” November 27, 2017.

flying near the river with unknown intent, requiring DCA to ward off these aircraft, lest they approach U.S. personnel and partners too closely.³⁸

Another important characteristic of the DCA mission over Syria was that it required tactical adaptation to deal with gray areas in the deconfliction agreement. Press accounts often reduce the deconfliction line to the Euphrates River, and it is true that was the main dividing line. That said, the United States had carve-outs west of the river (e.g., near Tabqah Dam), just as Russia negotiated carve-outs east of the river (e.g., around Deir ez-Zur).³⁹ As clarified by then-Secretary of Defense Jim Mattis, “[The deconfliction line is] not going to look that neat. You know, it’ll be based on where does the river bend here . . . [and] which side of the river is a town on there . . . this sort of thing. So, it may look a little more squiggly.”⁴⁰ This created ambiguity that heightened the risk of inadvertent escalation. It also incentivized both the coalition and Russia to avoid ceding airspace unilaterally that could set a precedent for further erosion of the deconfliction line. Thus, coalition pilots were operating under guidance to avoid escalation while continuing to assert control of airspace allocated to the coalition.⁴¹ Similarly, the coalition sought to establish precedents favoring its operational requirements, such as the ability to transit Syrian airspace between al-Tanf garrison and eastern Syria, for which there were contested interpretations of what was allowed in the deconfliction agreement.⁴²

Evolution of the Air Threat

When coalition air forces began striking ISIS in eastern Syria in 2014, U.S. commanders believed that they were effectively operating with Damascus’s acquiescence.⁴³ There was no direct channel of communication between U.S. and Syrian forces, but the disposition of the Syrian IADSs, which were often in passive mode, was interpreted by U.S. commanders as signaling regime acceptance of coalition strikes against ISIS within Syria’s eastern territory.⁴⁴ The threat environment intensified when Russia

³⁸ RAND interview with coalition officials, March 2, 2020.

³⁹ Jim Mattis, “Media Availability with Secretary Mattis En Route to Europe,” transcript, U.S. Department of Defense, June 27, 2017; Robert Hamilton, *Russian and American De-Confliction Efforts in Syria: What’s the End-game in the Civil War?* Philadelphia: Foreign Policy Research Institute, April 2018.

⁴⁰ Jim Mattis, “Media Availability with Secretary Mattis En Route to Europe,” transcript, U.S. Department of Defense, June 27, 2017.

⁴¹ RAND interview with Gen Jeffrey Harrigan, December 17, 2019.

⁴² RAND interview with Gen Jeffrey Harrigan, December 17, 2019.

⁴³ U.S. commanders did not believe that they had Syria acquiescence for strikes in western Syria (i.e., the vicinity of Aleppo), where Syrian air defense radars, including those of SA-17 SAMs, were turned on. RAND interview with LTG (ret.) Sean MacFarland, March 31, 2020.

⁴⁴ RAND interview with Maj Gen (ret.) Scott Zobrist, December, 3, 2019. See also DoD spokesperson’s RADM John Kirby’s account: “[I]n our air missions there and in the north and to the east [of Syria], we have not been threatened by Syrian air defense systems, that their posture has remained what I would call passive.” John Kirby,

increased the scope of its involvement in the conflict in 2015, deploying modern fighters and long-range SAMs, although the coalition was able to manage this change in part through the deconfliction mechanism that was established to avoid unintended escalation between the powers.⁴⁵

There were times when U.S. commanders interpreted Russian maneuvering in the air as aggressive and times when coalition commanders were skeptical that Russia was using the deconfliction channel to convey all the information the coalition believed was required of it.⁴⁶ Some coalition airmen noted that Russian air engagements were typically “professional” and could be managed.⁴⁷ An outside analysis cited the success of the deconfliction channel in preventing major air-to-air incidents but noted that Russia employed risky maneuvers “tied to narrow goals, such as forcing U.S. counterparts to hold a conversation on one of the deconfliction hotlines, schedule a face-to-face meeting, or adjust a deconfliction agreement in Russia’s favor.”⁴⁸ USAF leaders clarified that while generally interactions with the Russians were professional, the coalition did have to cope with aggressive Russian maneuvering that occasionally occurred and were not necessarily triggered by geopolitical events or in response to ground force maneuvers. Therefore, the frequency of hotline calls “ebb[ed] and flow[ed] based on the situation in the battlespace.”⁴⁹

The risk of air-to-air engagements was also elevated by specific events. For example, when the United States accidentally hit Syrian regime forces in a September 2016 strike in Deir ez-Zur, there were fears among the coalition that the regime or those allied with it might intentionally seek to target coalition aircraft.⁵⁰ Similarly, when the United States destroyed an advancing column of Syrian forces and Russian mercenaries in 2018, the coalition operated under a heightened threat perception in anticipation of possible retaliation. The climate was perhaps most tense in 2017, when all three of the coalition’s air-to-air shootdowns occurred (see Table 6.1). In two of those incidents,

⁴⁵ “Department of Defense Press Briefing by Rear Admiral Kirby in the Pentagon Briefing Room,” transcript, October 8, 2014.

⁴⁶ Andrew Weiss and Nicole Ng, “Collision Avoidance: The Lessons of U.S. and Russian Operations in Syria,” Carnegie Endowment for International Peace, March 20, 2019.

⁴⁷ RAND interview with Gen Jeffrey Harrigian, December 17, 2019.

⁴⁸ RAND interview with USAF officer Lt Gen David S. Nahom, December 19, 2019. See also Michael Tremel’s remarks during 61st Tailhook Convention, “Year of the Supercarrier,” Reno, Nev., September 7–10, 2017.

⁴⁹ Andrew Weiss and Nicole Ng, “Collision Avoidance: The Lessons of U.S. and Russian Operations in Syria,” Carnegie Endowment for International Peace, March 20, 2019.

⁵⁰ Jeffrey Harrigian, “Department of Defense Press Briefing by General Harrigian via Teleconference,” transcript, U.S. Department of Defense, May 24, 2017. On patterns of Russian behavior, see Eric Schmitt, “In Syria’s Skies, Close Calls with Russian Warplanes,” *New York Times*, December 8, 2017; Joseph Trevithick, “Russian Su-25 Almost Hits US F-22 During Intercept over Syria, but Is There More Going On?” *The Drive*, December 14, 2017.

⁵¹ RAND interview with Brig Gen Richard Coe, April 22, 2020.

Table 6.1
U.S. Shootdowns of Iranian and Syrian Aircraft in OIR

Date	Opposing Aircraft	U.S. Aircraft
June 8, 2017	Iranian-made Shahed 129 UAS	USAF F-15E Strike Eagle
June 18, 2017	Syrian Air Force Su-22 Fitter	U.S. Navy F/A-18E Super Hornet
June 20, 2017	Iranian-made Shahed 129 UAS	USAF F-15E Strike Eagle

USAF F-15E Strike Eagles shot down Iranian-armed UASs that targeted U.S. partners in al-Tanf garrison. In a third incident, which is presented below as a case study, a U.S. Navy F/A-18E Super Hornet shot down a Syrian Su-22 Fitter that released ordnance against partner forces in eastern Syria.

Syrian Su-22 Fitter Shootdown, June 18, 2017

When a U.S. Navy F/A-18E Super Hornet shot down a Syrian Su-22M4 Fitter attack aircraft near Raqqa in June 2017, it was the first air-to-air kill of a manned aircraft by a U.S. pilot since Operation Allied Force in 1999.

Background

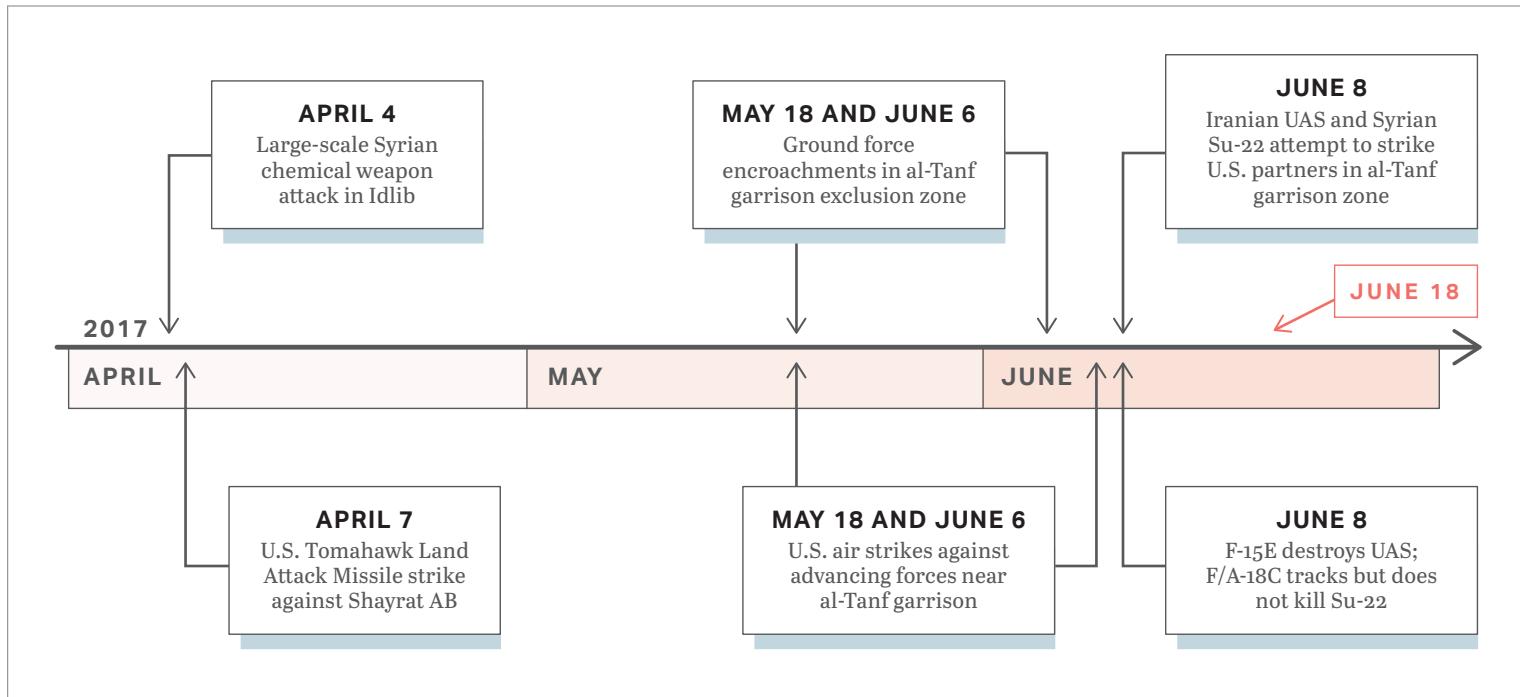
The months preceding the downing of the Syrian Su-22 Fitter was arguably the tensest period for the DCA mission during OIR. The overall strategic context was that the coalition, on the one hand, and the Syrian regime—backed by Russia and Iran—on the other, were racing to liberate the same stretch of territory in the MERV (i.e., Abu Kamal, Mayadin, and Deir ez-Zur).⁵¹ In addition, the Syrian regime launched a major chemical weapon attack in Idlib governorate, located in northwest Syria, in April 2017. This led to a U.S. retaliatory strike on April 7 in the form of a barrage of Tomahawk Land-Attack Missiles (TLAMs) against al-Shayrat airfield in western Syria, believed to be the point of origin of the chemical weapon attack.⁵² Tensions between the United States and the pro-regime alliance in Syria continued to escalate in a series of encounters before the downing of the Su-22 Fitter (see Figure 6.3). Although that incident would occur in eastern Syria, the bulk of the escalation cycle actually occurred around al-Tanf garrison, located in southwest Syria, where pro-regime forces appeared intent on advancing inside the 55-kilometer exclusion zone. These events included provocations by Syrian regime, Russian, Iranian, and Iranian-backed forces.

Following the response to the chemical weapon attack, the first incident that ratcheted up tensions between the coalition and pro-regime forces was movement by

⁵¹ Robert Hamilton, *Russian and American De-Confliction Efforts in Syria: What's the Endgame in the Civil War?* Philadelphia: Foreign Policy Research Institute, April 2018.

⁵² Mark Katkov, Jessica Taylor, and Tom Bowman, “Trump Orders Syria Airstrikes After ‘Assad Choked Out the Lives’ of Civilians,” NPR, April 6, 2017.

Figure 6.3
Escalation Prior to June 18 Su-22 Shootdown



SOURCE: Hannah Ryan, "Timeline of Escalation in Syria: U.S. vs. Iran, Russia, Syria and 'Pro-Regime' Forces Post January 20, 2017," Just Security, June 22, 2017.

Iranian-backed militias to transit the exclusion zone around al-Tanf garrison in May 2017. Coalition air strikes were called in on May 18 to repulse a convoy of Iranian-supported fighters that had advanced halfway into the exclusion zone and fired on the local Syrian partners (Maghawir al-Thawra) that U.S. forces were training at the site.⁵³ Although the United States responded decisively with air strikes, the tone of the accompanying messaging from DoD was to deescalate the situation by offering Russia an off-ramp. Specifically, defense officials took pains to note that they believed the Iranian action had occurred in spite of Russia's opposition to it. For example, Secretary Mattis stated, "We believe [the Iranian-backed militias] moved into that zone against the advice of the Russians. Or . . . apparently against the advice of the Russians. I can't confirm that either, but it looks like the Russians tried to dissuade them."⁵⁴

After smaller skirmishes in late May, another incursion by pro-regime forces into the exclusion zone on June 6, 2017, elicited a new round of air strikes. In a similar outcome to the May 18 incursion, coalition strikes destroyed militia vehicles and compelled the fighters to withdraw to their launching area, a regime checkpoint just outside the exclusion zone.⁵⁵ Two days later, the confrontation took on an aerial dimension when an Iranian Shahed 129 UAS fired a missile at a vehicle in the vicinity of al-Tanf garrison. An attempt to deal with the UAS through electronic attack from another aircraft initially appeared to drive it off, but the CAOC cleared an F-15E Strike Eagle on CAP over the area to shoot the UAS down if it returned.⁵⁶ A half-hour later, the UAS approached again. "When we saw the drone turn back towards friendly forces, we weren't waiting around for anybody's permission. We destroyed it," the U.S. pilot recounted.⁵⁷

Later the same day, a Syrian Su-22 Fitter penetrated the airspace over the exclusion zone. Two U.S. Navy F/A-18C Hornets tracked the Syrian jet, but after it dropped its bombs and turned away, it was allowed to exit the area, as it no longer appeared to pose a threat.⁵⁸

In retrospect, the limited U.S. response to the Syrian regime's Su-22 Fitter attack on June 8 was a critical point in this chain of events. Gen David Goldfein, chief of staff of the USAF, and Harrigian, the CFACC, seized on it to reiterate the ROE to

⁵³ Phil Stewart and Suleiman Al-Khalidi, "U.S. Strikes Syria Militia Threatening U.S.-Backed Forces," Reuters, May 18, 2017.

⁵⁴ Jim Mattis, Joseph F. Dunford, and Brett McGurk, "Department of Defense Press Briefing by Secretary Mattis, General Dunford and Special Envoy McGurk on the Campaign to Defeat ISIS in the Pentagon Press Briefing Room," transcript, U.S. Department of Defense, May 19, 2017.

⁵⁵ Paul McCleary, "U.S. Bombs Iranian Militia in Syria, as Fight for Raqqa Begins," *Foreign Policy*, June 6, 2017.

⁵⁶ "How U.S. F-15E Drone Shoot-Down Changed Air Game in Syria," *Aviation Week Network*, September 18, 2017.

⁵⁷ Phil Stewart, "In Syrian Skies, U.S. Pilots Learn How Fast Air War Can Morph," Reuters, August 28, 2017.

⁵⁸ RAND interview with Gen Jeffrey Harrigian, December 17, 2019.

U.S. airmen “eyeball-to-eyeball” and to make it clear that he trusted them to make the right decision.⁵⁹ After discussing the incident with Goldfein, Harrigian met with airmen supporting OIR from across services, including U.S. Navy pilots operating from USS *George H.W. Bush* stationed in the Eastern Mediterranean, to clarify self-defense ROE related to hostile intent and hostile acts against coalition and partner forces.⁶⁰ As recounted by a member of the U.S. Navy F/A-18 Hornet team that shot down an Su-22 Fitter two weeks later, they received “very clear commander’s guidance . . . the clearest that we’ve seen.”⁶¹ As described by another U.S. Navy pilot who was also on the receiving end of the interaction with Harrigian, the message was: “I have your back; I’ve given you authority to fight.”⁶² The CFACC’s guidance was not to seek escalation; rather, if opposing aircraft triggered ROE through hostile intent or act, then the airmen had the authority and responsibility to defend coalition and partner forces, including by shooting down the hostile aircraft.

The June 18 Shootdown

When the four-ship flight of F/A-18C Hornets and F/A-18E Super Hornets launched from USS *George H.W. Bush* on the morning of June 18, 2017, it was to prosecute a CAS mission.⁶³ The support was for the SDF, operating around Jadin, Syria, a town located in the Euphrates valley between Tabqah Dam and Raqqa. The SDF’s ground maneuver was part of shaping operations in preparation for an assault on ISIS in Raqqa that would culminate in its liberation roughly four months later. Additionally, Jadin was sensitive territory, as it sits west of the Euphrates in one of the deconfliction carve-outs referenced earlier. It was also a region in which the SDF was operating with little separation from Syrian regime forces.

The pilots, who were four months into their deployment, flew east from their launch point near Crete, passed south of Cyprus, and then took the “northern route” to the location where they were to provide CAS, flying from the Mediterranean coast through Turkish airspace and then into eastern Syria.⁶⁴ When they arrived at the area designated for the CAS mission, they were already prepared for the potential of an air-to-air engagement because of their experience in theater, prebriefs, and the en route

⁵⁹ RAND email correspondence with Gen Jeffrey Harrigian, July 13, 2020.

⁶⁰ RAND interview with Gen Jeffrey Harrigian December 17, 2019.

⁶¹ LCDR Jeff Krueger, remarks at the 61st Tailhook Convention, “Year of the Supercarrier,” Reno, Nev., September 7–10, 2017.

⁶² RAND interview with U.S. Navy officer, February 3, 2020.

⁶³ The definitive account of this event was the first-person account given by the four pilots directly involved in the incident at the 2017 Tailhook Symposium. Unless otherwise footnoted, this section is based on that account and simply notes the speaker and the time in the video in which he cites information appearing in this narrative. For the video, see 61st Tailhook Convention, “Year of the Supercarrier,” Reno, Nev., September 7–10, 2017.

⁶⁴ Michael Tremel, remarks at the 61st Tailhook Convention, “Year of the Supercarrier,” Reno, Nev., September 7–10, 2017, minute 9:00.

updates they received by radio from the JTAC for the mission. Reflecting on the event, LCDR Jeff Krueger noted, “A few escalation events started occurring in the AOR that required the air wing to take on more of a DCA—or air-to-air—mindset.”⁶⁵

Even before the Syrian Su-22 Fitter arrived on scene, there was reason for the Navy pilots to consider potential air-to-air contingencies. First, Syrian regime ground forces were operating in proximity to the SDF, so just as coalition aircraft were overhead to provide support to their local partners, it was possible Syrian aircraft would be doing the same in support of pro-regime forces. In addition, a Russian Su-35 Flanker fighter aircraft arrived overhead and began circling the CAS stack.⁶⁶ The Russian jet was monitored by one of the F/A-18E Super Hornet pilots, who was having issues with his Forward Looking Infrared (FLIR) sensor, which was critical for air-to-ground targeting. To make use of the Super Hornet’s other capabilities, the pilot switched to air-to-air master mode, tracking the Russian fighter, while the remaining three F/A-18 Hornets focused on the air-to-ground mission.⁶⁷ It is worth highlighting that the sensor malfunction was just one of several issues encountered on the mission, but the pilots continued to adapt to meet the mission objectives.

As the F/A-18E Super Hornet in air-to-air mode extended out from the CAS stack to monitor the Russian fighter, it detected another aircraft approaching from the south. The E-3 Sentry AWACS aircraft monitoring the area determined that the new aircraft was a Syrian Su-22 Fitter.⁶⁸ At that point, the Super Hornet pilot descended from his altitude in the CAS stack of 20,000–24,000 feet to visually identify the Syrian jet.⁶⁹ Once the identification was made, his wingman took over as the primary interlocutor with the JTAC on the ground, who helped the pilots determine the Su-22 Fitter’s proximity to the FLOT and thus the risk it posed to the partner forces on the ground.

To warn off the Syrian aircraft, an AWACS controller transmitted international emergency “guard calls” while, in concert, the Navy pilot tracking the Su-22 Fitter executed three “headbutts,” dispensing flares in front of the Syrian jet. Ignoring these warnings, the Fitter dove toward the coalition partners below and released its munitions, which crossed the threshold of hostile act to which airmen were empowered to respond immediately, given their ROE and the guidance that Lt Gen Harrigian had

⁶⁵ Jeff Krueger, remarks at the 61st Tailhook Convention, “Year of the Supercarrier,” Reno, Nev., September 7–10, 2017, minute 5:45.

⁶⁶ William Vieter, remarks at the 61st Tailhook Convention, “Year of the Supercarrier,” Reno, Nev., September 7–10, 2017, minute 11:00; “Eight Minutes over Syria,” *Naval Aviation News*, March 21, 2018.

⁶⁷ Michael Tremel, remarks at the 61st Tailhook Convention, “Year of the Supercarrier,” Reno, Nev., September 7–10, 2017, minute 12:50.

⁶⁸ “Eight Minutes over Syria,” *Naval Aviation News*, March 21, 2018.

⁶⁹ Michael Tremel, remarks at the 61st Tailhook Convention, “Year of the Supercarrier,” Reno, Nev., September 7–10, 2017, minute 14:00.

underscored in the days prior to the incident.⁷⁰ This commander's guidance was also captured in the special instructions provided with the ATO.⁷¹ Accordingly, the F/A-18E Super Hornet pilot immediately engaged the Su-22 Fitter with one of the two AIM-9X Sidewinder infrared-homing air-to-air missiles that his aircraft was carrying. The AIM-9 failed to strike its target, so the pilot fired his one AIM-120 AMRAAM active radar-homing missile.

The AMRAAM struck the Su-22 Fitter, and the Syrian pilot ejected. Of immediate concern to the four F/A-18 Hornets was that, in the course of the interaction, they had descended to altitudes that put them within the weapon engagement zones of Syrian air defense systems.⁷² Given the risk, compounded by the possibility that shooting down the Syrian jet might have increased the regime's willingness to employ those air defenses, the pilots quickly exited Syrian airspace. After an aerial refueling, the two F/A-18C Hornets, which had not used any of their munitions, were retasked to Mosul, where they conducted CAS against ISIS forces there, while the two F/A-18E Super Hornets jettisoned their bombs and returned to their carrier.⁷³

DCA Conclusion

Compared with other potential contingencies involving near-peer or regional adversaries, OIR initially faced a very permissive threat environment in the air. The primary adversary, ISIS, possessed no air capabilities beyond small UASs and fielded only rudimentary ground-based air defense capabilities. The air environment became more challenging in 2015, when Russia escalated its involvement in the conflict, but that development was made manageable by the deconfliction agreement, as well as Russia and the broader pro-Syrian regime alliance being generally focused on different territory and airspace than from coalition. The al-Assad regime fought to stabilize its position in western Syria, while ISIS operated well to the east. The air environment became genuinely contested, albeit still within the bounds of a very limited conflict, from 2017 onward, when coalition and pro-regime forces were attempting to liberate the same stretch of territory from ISIS control in eastern Syria, and the disposition of pro-regime forces became more aggressive around the al-Tanf garrison exclusion zone. From that point on, DCA became a critical requirement for the coalition to be able to deliver counterland airpower while protecting coalition and partner forces from adversaries' air attacks.

⁷⁰ Jeff Krueger, remarks at the 61st Tailhook Convention, "Year of the Supercarrier," Reno, Nev., September 7–10, 2017, minute 24:00.

⁷¹ RAND interview with Gen Jeffrey Harrigian, December 17, 2019.

⁷² Michael Tremel, remarks at the 61st Tailhook Convention, "Year of the Supercarrier," Reno, Nev., September 7–10, 2017, minute 22:00.

⁷³ Michael Tremel, remarks at the 61st Tailhook Convention, "Year of the Supercarrier," Reno, Nev., September 7–10, 2017, minute 22:30.

The air-to-air engagements of June 2017 would prove to be the last in OIR, as of the time of this writing. Following the shootdown of a second Shahed 129 UAS by another F-15E Strike Eagle on June 20,⁷⁴ aerial tensions deescalated. However, the DCA task continued to protect coalition forces operating in Syria. The success of the DCA mission in OIR is indicated not by the three air-to-air kills that did occur but by the fact that coalition and partner forces were able to conduct their operations against ISIS without suffering losses from hostile airpower and without the situation in the air escalating into a larger conflict with the Syrian regime or Russia.

Air Mobility Operations

In comparison to the sometimes-novel applications of counterland, ISR, and DCA airpower in the war against ISIS, air mobility operations—airlift and aerial refueling—in OIR were relatively familiar and generally worked as intended. However, this should not be taken to mean that it was a simple matter to achieve this level of effectiveness.

Evolution of Air Mobility in OIR

Overall demands for airlift and aerial refueling in OIR were driven in large part by the tempo and location of air and ground operations in the conflict—and therefore were affected by changes in the location of the front lines or the arrival of the Russians in Syria (see Table 6.2). Thus, while the overall scale of air mobility operations across the course of the conflict was fairly stable, modifications to air and ground operations required similar changes in the air mobility operations that supported them. Basing patterns for air mobility forces did not greatly shift during the conflict, aside from the notable opening of Incirlik Air Base to tanker and airlift flights supporting OIR starting in 2015; major air bases in Qatar and the United Arab Emirates remained the centers of gravity for OIR air mobility operations throughout the conflict. However, where airlifters needed to fly and where tankers could orbit changed as the fighting moved north and west, away from the heart of Iraq, as operations in Syria expanded and thus required additional airlift support,⁷⁵ and as the threat rings of Russian missiles and airpower made large parts of Syrian airspace inhospitable to slow, vulnerable aircraft.

Some changes affected the air mobility force in particular. In addition to the arrival of the Russians, 2015 also brought a new demand on the air refueling force with the start of the Saudi-led bombing campaign in Yemen, which U.S. tankers would

⁷⁴ Michael R. Gordon, “American Warplane Shoots Down Iranian-Made Drone over Syria,” *New York Times*, June 20, 2017.

⁷⁵ RAND interview with coalition personnel, March 2, 2020.

Table 6.2
Coalition Airlift and Tanker Activity in OIR

	Phase I: Degrade	Phase II: Counterattack	Phase III: Defeat	2014–2019 Total
Start date	August 8, 2014	April 1, 2016	August 8, 2017	August 8, 2014
End date	March 31, 2016	August 7, 2017	March 23, 2019	March 23, 2019
Airlift sorties	14,442	10,973	14,555	39,970
Airlift cargo (tons)	111,355	92,973	81,465	285,793
Airlift passengers	68,100	72,624	130,967	271,691
Total				
Supplies air-dropped (tons)	765	528	692	1,984
Tanker sorties	22,725	17,398	16,594	56,717
Fuel offloaded (million lbs)	1,388	1,043	1,125	3,556
Aircraft refuelings	134,321	98,638	98,495	331,454
Average per month (mean)				
Airlift sorties	722	691	721	714
Airlift cargo (tons)	5,568	5,727	4,285	5,103
Airlift passengers	3,405	4,645	6,299	4,852
Supplies air-dropped (tons)	35	35	33	35
Tanker sorties	1,136	1,060	870	1,013
Fuel offloaded (million lbs)	69	66	60	64
Aircraft refuelings	6,716	5,980	5,155	5,919

SOURCE: RAND AFCENT airpower summary data set.

NOTE: Because AFCENT data are released by month without regard to operational phases, the Phase II and III totals and averages above are approximations from including all August 2017 and March 2019 data in Phase III.

support for more than three years.⁷⁶ Furthermore, humanitarian needs and thus the airdrops providing relief changed conspicuously over the course of the campaign. The emergency humanitarian relief flights in the early weeks of the operation, especially at Mount Sinjar and Amiri,⁷⁷ were particular to that period in the conflict, when ISIS forces were still advancing and thus able to cut off large civilian populations. Later in

⁷⁶ This obligation was unpopular with many airmen, who regretted the diversion of tanker resources from OIR and the number of occasions when the Saudis or Emiratis would request more tanker support than they would actually use. AFHRA interview with Col Johnny Barnes II, July 24, 2019; AFHRA interview with Brig Gen Daniel J. Orcutt, September 25, 2019.

⁷⁷ USAF, “AF Conducts Airstrikes Against ISIL, Airdrops Humanitarian Aid Near Amiri,” September 2, 2014.

the war, the demand for airdrops would center on resupply efforts for isolated partner units and coalition SOF.⁷⁸

Airlift in OIR

The vast majority of coalition intratheater airlift activity was essentially routine transportation of equipment, supplies, and personnel—on the order of 20 to 25 airlift sorties on a typical day, a complex effort planned and coordinated by the CAOC’s Air Mobility Division located at Shaw Air Force Base, South Carolina.⁷⁹ It should be noted that a higher level of airlift activity would have been required for deployment and sustainment if OIR had been conducted from austere bases rather than modern facilities in locations where U.S. forces had often been well established and operating for years and where many basic supply requirements were met by the host nations or could be contracted from local sources.⁸⁰

The largest share of the airlift demand was satisfied by the USAF’s C-17 Globemasters and C-130 Hercules operating out of AUAB, which serves as the central air mobility hub for the theater.⁸¹ USAF C-130 Hercules aircraft also operated from other locations in the theater, including Turkey and Kuwait.⁸² Among the other coalition members, Australia, Canada, Denmark, the United Kingdom, and New Zealand contributed C-130H Hercules or C-130J Super Hercules aircraft for substantial parts of the OIR campaign,⁸³ and Qatar supported the airlift effort with its C-130 Hercules and C-17 Globemaster airlift force.⁸⁴ It is also important to note that, at the global level, the roster of aircraft supporting OIR also included USAF intertheater airlift forces, C-17 Globemasters, and C-5B Galaxies based outside the CENTCOM AOR

⁷⁸ Jim Michaels, “U.S. Increasing Airdrops of Supplies to Forces Battling ISIL in Syria,” *USA Today*, January 17, 2017.

⁷⁹ The Air Mobility Division also coordinated AFCENT’s airlift operations with U.S. Transportation Command’s intertheater strategic airlift operations through Air Mobility Command’s Tanker Airlift Control Center, located at Scott Air Force Base, Ill. See AFCENT, “Air Mobility Division (AMD),” July 1, 2017.

⁸⁰ Michael J. Lostumbo, Michael J. McNerney, Eric Peltz, Derek Eaton, David R. Frelinger, Victoria A. Greenfield, John Halliday, Patrick Mills, Bruce R. Nardulli, Stacie L. Pettyjohn, Jerry M. Sollinger, and Stephen M. Worman, *Overseas Basing of U.S. Military Forces: An Assessment of Relative Costs and Strategic Benefits*, Santa Monica, Calif.: RAND Corporation, RR-201-OSD, 2013, pp. 58–62; Anthony H. Cordesman, *The Gulf Military Balance*, Vol. 1: *The Conventional and Asymmetric Dimensions*, Washington, D.C.: Center for Strategic and International Studies, January 2014, pp. 36–41.

⁸¹ Ted Nichols, “Al Udeid-Based C-17s Link AFRICOM, CENTCOM,” 446th Airlift Wing, September 5, 2018.

⁸² Stephen Hudson, “Air National Guard Supports Airlift Operations at Ali Al Salem,” U.S. Central Command, July 10, 2019.

⁸³ Andrew Hetherington, “New Anzac Alliance in the MER,” Royal Australian Air Force, undated.

⁸⁴ “Qatar Emiri Air Force Marks Milestone in Fight Against ISIS,” *Qatar Tribune*, November 23, 2017.

and providing long-haul strategic airlift under the direction of U.S. Transportation Command.

Compared with these efforts, air-dropping humanitarian relief supplies to beleaguered civilians or materiel to coalition or partner forces constituted only a small part of the overall OIR airlift effort. But these are worth noting, because they are a critical way that airpower supported ground operations. Airdrops can directly help their recipients, providing them with vital supplies needed to survive, move, and fight, and in doing so they can provide a boost to morale and ground force motivation. To illustrate one application of airlift in OIR, we examine the most famous airlift operation of the campaign: the humanitarian airdrop of aid to Yazidi refugees at Mount Sinjar in the first days of the operation.

Preventing Humanitarian Disaster: The Mount Sinjar Airlift, August 2014

The U.S. military intervention against ISIS began with an airlift operation, the August 2014 delivery of humanitarian relief supplies to Yazidi refugees besieged on Mount Sinjar. Although it was a brief effort within the long campaign that would become OIR, its effects on its recipients were profound, and it was the catalyst for the formation of what would become the global coalition against ISIS.

Background

The ISIS assault on Sinjar began at dawn on August 3, 2014. Situated approximately 50 kilometers from the Syrian border, the town and its surroundings were home to an estimated 400,000 ethnic Yazidis, an ethno-religious community designated by ISIS as a “pagan minority” and sentenced to murder, rape, enslavement, and pillage.⁸⁵ Over the next several days, an estimated 9,900 Yazidis—roughly 2.5 percent of the population at the time—were killed or kidnapped, as thousands fled north to the relative safety of Mount Sinjar. There, they endured temperatures over 122 degrees Fahrenheit with little access to food, water, or medical supplies.⁸⁶ Determined to prevent what he described as a “potential act of genocide,” President Barack Obama authorized a USAF-led relief mission on August 7, as well as targeted air strikes to break the siege and protect trapped civilians. “When we face a situation like we do on that mountain—with innocent people facing the prospect of violence on a horrific scale, when we have a mandate to help—in this case, a request from the Iraqi government—and when we have the unique capabilities to help avert a massacre,” he said, “I believe the United States of America cannot turn a blind eye.”⁸⁷

⁸⁵ United Nations Office of the High Commissioner for Human Rights, “They Came to Destroy”: ISIS Crimes Against the Yazidis, Geneva, June 15, 2016, p. 29.

⁸⁶ Valeria Cetorelli, Isaac Sasson, Nazar Shabila, and Gilbert Burnham, “ISIS’ Yazidi Genocide: Demographic Evidence of the Killings and Kidnapping,” *Foreign Affairs*, June 8, 2017.

⁸⁷ Barack Obama, “Statement by the President,” speech delivered at the White House State Dining Room, Washington, D.C., August 7, 2014.

Although contingency planning for a U.S. role in combating ISIS began as early as June 2014, the preparation and execution of the Sinjar airdrop operation were completed within nine days, with periodic air strikes to degrade nearby ISIS positions continuing through the fall.⁸⁸ The first major air operation of the anti-ISIS campaign, the airlift lessened the threat to the trapped Yazidi community and demonstrated the U.S. military's capacity to quickly deliver humanitarian assistance to civilians in an austere and nonpermissive environment. By rallying Australia, the United Kingdom, and other foreign partners, the humanitarian operation also contributed to the U.S. effort to forge an international coalition against ISIS.

The August 2014 Airlift

On August 5, 2014, the Theater Direct Delivery Cell of the Air Mobility Division at the 609th Air Operations Center at AUAB was notified of a potential relief airdrop after the government of Iraq requested U.S. assistance delivering humanitarian aid.⁸⁹ In the best of conditions, “the logistics of these things are hard,” one interviewee noted. “The supplies have to come in, they have to be built, you’ve got to put parachutes on them, and that’s . . . an entire orchestration.”⁹⁰ The urgency of the request, however, magnified the challenge. Over the next 36 hours, planners from the 437th Airlift Wing, then deployed to AUAB in Qatar as part of the 816th Expeditionary Airlift Squadron, established a CAOC mission-planning cell. Simultaneously, the 618th Air Operations Center (Tanker Airlift Control Center) at Scott Air Force Base prepared C-17 Globemaster-specific missions.⁹¹ To meet the compressed timeline, loadmasters from the 816th and 15th Airlift Squadrons coordinated with U.S. Army riggers from the 11th Quartermaster Company, 264th Combat Sustainment Support Battalion, 82nd Sustainment Brigade, to load an average of 100 pallets per day in one-time-use container delivery systems, which are designed to allow items to be accessed quickly on delivery.⁹² For the remainder of the operation, the quartermasters would maintain a round-the-clock loading schedule.⁹³

⁸⁸ RAND interview with USAF officer Maj Gen (ret.) Bruce Miller, January 8, 2020; RAND interview with U.S. Army officer LTG (ret.) James L. Terry, March 27, 2020; Jennifer Hlad, “Breaking the Siege on Sinjar,” *Air Force Magazine*, September 28, 2015.

⁸⁹ Chuck Hagel, John Kerry, Julie Bishop, and David Johnston, “Joint Press Conference by Secretary Hagel, Secretary Kerry, Foreign Minister Bishop, and Minister of Defense Johnston at AUSMIN in Sydney, Australia,” transcript, U.S. Department of Defense, August 12, 2014.

⁹⁰ AFHRA interview with Maj Shane M. Praiswater, August 14, 2019.

⁹¹ Jennifer Hlad, “Breaking the Siege on Sinjar,” *Air Force Magazine*, September 28, 2015.

⁹² Shawn Nickel, “Joint Team Supports Humanitarian Air Drop in Northern Iraq,” press release, U.S. Air Forces Central Public Affairs, August 8, 2014.

⁹³ Kristin Davis, “From Start to Finish, Airdrop to Displaced Iraqis Was Like No Other,” *Air Force Times*, November 4, 2014; Marc V. Schanz, “Al Udeid Serves as Critical Hub for Humanitarian Airdrops,” *Air Force Magazine*, August 18, 2014.

A dearth of intelligence on ISIS positions around Mount Sinjar, the fluidity of the situation, uncertainty over the duration of the mission, and the lack of U.S. ground forces on Mount Sinjar to provide coordinates and clear drops complicated the mission. Although land corridors (in which aid is transported and distributed by ground convoys) or air bridges (in which goods are transported by air to airports, airfields, or improvised landing strips for distribution by ground personnel) are more-reliable and cost-effective means of distributing humanitarian aid,⁹⁴ the proximity of ISIS forces and the lack of sufficient ground security dictated the need to deliver aid by parachute. The approach entailed a higher risk of wastage (whether from damage on contact or diversion from the intended beneficiaries) and introduced the danger that desperate civilians might crowd drop zones or attempt to recover supplies from unsafe terrain.⁹⁵ Although the USAF uses the Joint Precision Airdrop System (JPADS), a GPS device, to mitigate some of these risks and guide cargo to its target, it is unclear whether these were used in the operation, given the U.S. military's past condition that ground troops recover the device. In either event, aircrews recognized that the imperfect conditions would require frequent adjustments as better information about the situation on the ground became available. "We knew we were going to be dropping again until we got orders to stop," Maj Mike Damron, Air Mobility Division tactics chief, later explained. "We just didn't know exactly where on the mountain we were going to drop. That changed almost every night."⁹⁶

On the evening of August 7, one USAF C-17 Globemaster III and two C-130H Hercules aircraft, flying from AUAB, escorted by two F-16C Fighting Falcons from the 13th Fighter Squadron, air-dropped 72 bundles containing 8,000 Meals, Ready-to-Eat (MREs) and 5,300 gallons of fresh drinking water.⁹⁷ To limit exposure to ground threats, the planes flew at low altitude and limited time over the drop zones to under 15 minutes, Pentagon officials later confirmed.⁹⁸ The daily missions expanded on August 10 to include an additional C-130 Hercules; on August 12 and 13, a second

⁹⁴ Michael Eisenstadt, "The Aerial Delivery of Humanitarian Aid in Syria: Options and Constraints," Washington Institute for Near East Policy, May 27, 2016.

⁹⁵ Michael Eisenstadt, "The Aerial Delivery of Humanitarian Aid in Syria: Options and Constraints," Washington Institute for Near East Policy, May 27, 2016.

⁹⁶ Jennifer Hlad, "Breaking the Siege on Sinjar," *Air Force Magazine*, September 28, 2015.

⁹⁷ AFHRA interview with Maj Shane M. Praiswater, August 14, 2019; Benjamin W. Stratton, "Misawa Pilots Save Iraqi Civilians, Earn 2014 Mackay Trophy," U.S. Indo-Pacific Command, December 15, 2015; Eric M. White, "Reservists Air Drop Life-Sustaining Cargo in Iraq" Air Force Reserve Command, August 26, 2014. Initial reporting erroneously stated that the escorts were Navy U.S. F/A-18s. For a correction, see DoD, "Background Information on the Humanitarian Assistance Operation Near Sinjar, Iraq," fact sheet, undated.

⁹⁸ As an additional precaution, President Obama delayed announcing his decision to authorize humanitarian air-drops until the operation was under way and all U.S. planes had cleared the area. Helene Cooper, Mark Landler, and Alissa J. Rubin, "Obama Allows Limited Airstrikes on ISIS," *New York Times*, August 7, 2014.

C-17 Globemaster contributed to the operation as well.⁹⁹ With the assistance of Yazidis living in the United States, U.S. intelligence developed a high-resolution digital map identifying vulnerable structures, such as water and cell towers, houses, sheds, and garages, which improved the accuracy of the airdrops.¹⁰⁰ By August 14, nine C-17 Globemaster and 16 C-130 Hercules missions dropped 596 bundles, totaling 689,280 pounds of humanitarian aid, including 35,397 gallons of water and 114,216 halal MREs.¹⁰¹

Within days of the operation's start, UK and Australian aircrews mobilized to support the U.S.-led airlift. On August 9, hours after the UK government announced a plan to dispatch humanitarian advisers to assess needs in northern Iraq, two British Hercules transports, flying from RAF Akrotiri, conducted their first airdrop on Mount Sinjar.¹⁰² Seven subsequent airdrops followed on August 11 and 12.¹⁰³ Four RAF Chinook transport helicopters were deployed to Cyprus soon after in anticipation of an aerial evacuation mission, as well as four Tornado jets tasked with "a specialist surveillance role to give us a more complete picture of the situation in the crisis area," British Defense Secretary Michael Fallon explained in a statement confirming their deployment.¹⁰⁴ An Australian C-130J Super Hercules flying from Al Minhad Air Base in the United Arab Emirates delivered 1,500 boxes of high-energy biscuits and 340 boxes of bottled water on August 13—the country's first humanitarian airdrop since the 1999 Timor-Leste crisis.¹⁰⁵

⁹⁹ DoD, "Humanitarian Airdrops, Strikes Against ISIL Continue in Iraq," August 10, 2014.

¹⁰⁰ Jenna Kajeski, "The Daring Plan to Save a Religious Minority from ISIS," *New Yorker*, February 19, 2018.

¹⁰¹ Jennifer Hlad, "Breaking the Siege on Sinjar," *Air Force Magazine*, September 28, 2015. Combined with simultaneous operations in the vicinity of Amiri, Iraq, more than 815,000 pounds of humanitarian aid, composed of 121,000 meals and 45,500 gallons of water, were dropped within the span of a week. Kristin Davis, "From Start to Finish, Airdrop to Displaced Iraqis Was Like No Other," *Air Force Times*, November 4, 2014.

¹⁰² UK Department for International Development, "Aircraft Carrying UK Aid on Their Way to Help Iraqis," press release, August 9, 2014.

¹⁰³ Between August 9 and 14, RAF dropped 9,420 reusable water purification containers carrying 12,760 gallons (48,300 liters) of water, 1,296 shelter kits, and 1,824 solar-powered lanterns. "UK Planes to Drop Emergency Aid to Iraqi Refugees," BBC, August 9, 2014; UK Ministry of Defence, "New UK Aid Supplies Delivered to Iraq," press release, August 14, 2014.

¹⁰⁴ UK Ministry of Defence, "Tornados Ready to Support Humanitarian Operations," press release, August 12, 2014; Dan Lamothe, "British Military Sending Tornado Fighter Jets for Iraq Air Campaign," *Washington Post*, August 12, 2014. British Special Air Service units deployed to northern Iraq at the time might have contributed to the airlift effort, but their role has not been publicly confirmed. Associated Press and Reuters, "Britain Deploys SAS to Iraq, France Sending Weapons to Kurds," *Christian Science Monitor*, August 14, 2014.

¹⁰⁵ Agence France-Presse, "Australia Makes Its First Airdrop to Stranded Yazidis in Iraq," *Straits Times*, August 14, 2014; "RAAF Herc Undertakes Second Iraq Air Drop," *Australian Air Aviation*, September 1, 2014; Martin Chulov, Julian Borger, Richard Norton-Taylor, and Dan Roberts, "US Troops Land on Iraq's Mt Sinjar to Plan for Yazidi Evacuation," *The Guardian*, August 13, 2014.

To halt the advance of ISIS forces and lessen the threat to those escaping the mountain, USAF and U.S. Navy aircraft, including B-1B Lancers, F-15E Strike Eagles, F/A-18E/F Super Hornets, and MQ-1 Predators, executed air strikes against ISIS positions near the mountain. Between August 9 and 13, five armored personnel carriers, an armed truck, and a mortar position firing on Kurdish forces defending evacuating Yazidi civilians were among the targets struck.¹⁰⁶ Although the U.S. military has not confirmed the extent of their role, a small team of U.S. SOF and British Special Air Service forces directed some of these strikes.¹⁰⁷ Additionally, Yazidi activists in communication with trapped family members likely also provided data to help target U.S. air strikes against ISIS fighters in the area.¹⁰⁸ Combined with concurrent efforts since August 7 to provide CAS to Kurdish forces defending Erbil, the strikes allowed Kurdish forces to regain their footing, fortify defensive positions, and redirect fighters to defend Yazidis attempting to flee the mountain.¹⁰⁹ Nonetheless, the delivery of water, food, and other critical supplies remained the priority. “We are, right now, gripped by the immediacy of the crisis, and our focus . . . is to provide immediate relief to those that are suffering,” LTG William Mayville Jr., director of operations for the Joint Staff, stated in a press briefing. “We need to continue to sustain the humanitarian assistance, and we need to be able to protect that effort.”¹¹⁰

In Washington, the Obama administration reviewed options for a broader evacuation effort for the Yazidis still trapped on Mount Sinjar. The prospect of conducting an aerial evacuation was dismissed on the grounds that the mission would require coordination by U.S. troops on the ground in Sinjar and at a nearby airfield. Reports that ISIS fighters had fired on Iraqi and Kurdish helicopter crews, which airlifted a small number of refugees, underscored the potential danger of exposing U.S. forces.¹¹¹

¹⁰⁶ Michael D. Shear and Tim Arango, “Iraq Airstrikes May Continue for Months, Obama Says,” *New York Times*, August 9, 2014; “10 Days in Iraq: Aid Drops, Air-Strikes and 200,000 New Refugees,” BBC, August 19, 2014; DoD, “Humanitarian Airdrops, Strikes Against ISIL Continue in Iraq,” August 10, 2014; Claudette Roulo, “Humanitarian Assistance Continues in Iraq,” U.S. Department of Defense, August 11, 2014; DoD, “U.S. Provides Aid to Yezidis, Strikes ISIL Mortar Position,” August 13, 2014; Joe Pappalardo, “Year One: Inside the Air War Against ISIS,” *Popular Mechanics*, September 21, 2015.

¹⁰⁷ RAND interview with LTG (ret.) James L. Terry, March 27, 2020; Martin Chulov, Julian Borger, Richard Norton-Taylor, and Dan Roberts, “US Troops Land on Iraq’s Mt Sinjar to Plan for Yazidi Evacuation,” *The Guardian*, August 13, 2014.

¹⁰⁸ Jenna Krajeski, “The Daring Plan to Save a Religious Minority from ISIS,” *New Yorker*, February 19, 2018.

¹⁰⁹ William Mayville, “Department of Defense Press Briefing by Lt. Gen. Mayville in the Pentagon Briefing Room,” transcript, U.S. Department of Defense, August 11, 2014; “10 Days in Iraq: Aid Drops, Air-Strikes and 200,000 New Refugees,” BBC, August 19, 2014.

¹¹⁰ William Mayville, “Department of Defense Press Briefing by Lt. Gen. Mayville in the Pentagon Briefing Room,” transcript, U.S. Department of Defense, August 11, 2014.

¹¹¹ Dan Lamothe, “Could Marines Evacuate Iraqi Civilians from Iraq’s Mount Sinjar?” *Washington Post*, August 13, 2014; Helene Cooper and Michael D. Shear, “Militants’ Siege on Mountain in Iraq Is Over, Pentagon Says,” *New York Times*, August 14, 2014.

A more direct ground route, along a southern path toward Baghdad, required traversing areas controlled by ISIS, introducing the risk that fighters might hide among the refugees and expose fleeing Yazidis, U.S. partners, and any accompanying American troops to attack.¹¹² An alternative western route through Syria, favored by those who had already escaped the mountain, would require U.S. aircraft to fly into Syrian airspace to support the evacuation, putting U.S. aircraft at risk of being attacked by the Syrian IADS.¹¹³ (See Figure 6.4 for an illustration of these routes.) The Obama administration sought to avoid “involving U.S. troops re-entering a combat role in Iraq,” clarified Ben Rhodes, the deputy national security adviser. “It involves frankly a very difficult logistical challenge of moving folks who are in danger on that mountain into a safer position.”¹¹⁴

The airlift’s success, however, resolved the matter for the administration. On the morning of August 13, a V-22 Osprey delivered a USMC advance team to Mount Sinjar, followed soon after by 20 Army Special Forces, transported from Erbil by UH-60 Black Hawks.¹¹⁵ “Got up on the mountain and no one was there!” one interviewee recalled.¹¹⁶ A more circumspect Pentagon statement released at the time reported that U.S. forces found “far fewer Yazidis on Mount Sinjar than previously feared” and determined that the U.S. effort had allowed thousands of Yazidis to escape the mountain over the previous few days. The remaining Yazidis were deemed to be “in better condition than previously believed.”¹¹⁷ In a statement, the Pentagon press secretary, RADM John Kirby, confirmed that U.S. air strikes had allowed Kurdish Peshmerga forces to escort thousands of trapped Yazidis off the mountain. “Based on this assessment the interagency has determined that an evacuation mission is far less likely,” Kirby stated.¹¹⁸

¹¹² Helene Cooper and Michael D. Shear, “Militants’ Siege on Mountain in Iraq Is Over, Pentagon Says,” *New York Times*, August 14, 2014.

¹¹³ Helene Cooper and Michael D. Shear, “Militants’ Siege on Mountain in Iraq Is Over, Pentagon Says,” *New York Times*, August 14, 2014. For an assessment of Syrian air defenses before the Russian intervention, see Karl P. Mueller, Jeffrey Martini, and Thomas Hamilton, *Airpower Options for Syria: Assessing Objectives and Missions for Aerial Intervention*, Santa Monica, Calif.: RAND Corporation, RR-446-CMEPP, 2013.

¹¹⁴ Robert Burns and Julie Pace, “Obama Considering Military Options for Rescuing Iraqi Refugees,” Associated Press, August 13, 2014.

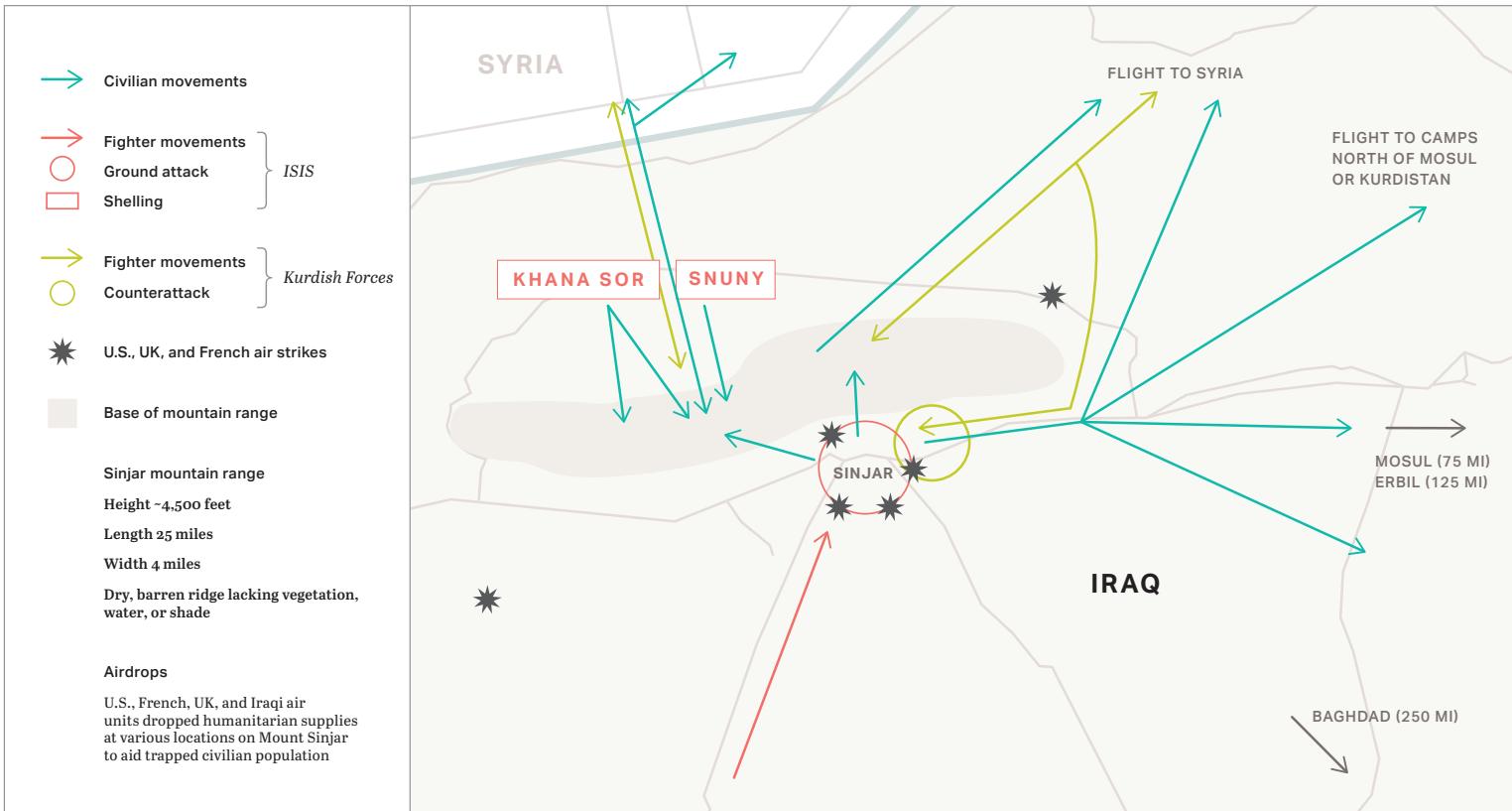
¹¹⁵ The V-22 Osprey belonged to the 22nd Marine Expeditionary Unit, deployed to the area as part of the Bataan Amphibious Ready Group. Martin Chulov, Julian Borger, Richard Norton-Taylor, and Dan Roberts “US Troops Land on Iraq’s Mt Sinjar to Plan for Yazidi Evacuation,” *The Guardian*, August 13, 2014; “Official: Green Berets Fly to Sinjar in Iraq,” *Military Times*, August 13, 2014.

¹¹⁶ RAND interview with LTG (ret.) James L. Terry, March 27, 2020.

¹¹⁷ “President said we’re going to break the siege of this mountain, and we broke that siege,” tweeted then-Assistant Secretary of State Brett McGurk. Quoted in Karen DeYoung and Craig Whitlock, “Rescue Mission for Yazidis on Iraq’s Mount Sinjar Appears Unnecessary, Pentagon Says,” *Washington Post*, August 13, 2014.

¹¹⁸ John Kirby, “Department of Defense Press Briefing by Rear Adm. Kirby in the Pentagon Briefing Room,” transcript, U.S. Department of Defense, August 14, 2014.

Figure 6.4
Map of Mount Sinjar Operation



In televised remarks the next evening, Obama announced the end of the siege and the imminent cessation of U.S. humanitarian airdrops and evacuation operations. “Our military was able to successfully strike ISIL targets around the mountains, which improved conditions for civilians to evacuate the mountain safely,” he said, affirming that air strikes to protect U.S. personnel and facilities in Iraq would continue indefinitely. “The situation on the mountain has greatly improved, and Americans should be very proud of our efforts.”¹¹⁹

Mount Sinjar Airlift Conclusion

The Mount Sinjar operation demonstrated how air crews operating without ground elements and strong intelligence could successfully complete a complex airdrop mission amid an evolving crisis. Despite a dearth of information, less-than-perfect delivery mechanisms, little time to prepare, and difficult terrain, U.S. and allied airmen delivered critical relief to trapped civilians, removed the immediate threat to the Yazidi community, and enabled the flight of several thousand at-risk refugees.¹²⁰ The successful operation provided U.S. planners with a test case for later partnered humanitarian airdrops, such as the August 30, 2014, operation to relieve entrapped Shia Turkmen in Amirli, Iraq.¹²¹ U.S. and coalition monitoring of the refugee camps around or on Mount Sinjar, including the use of a U-2 Dragon Lady operated by the 9th Intelligence Squadron based at Al Dhafra Air Base, continued to avert a recurrence of ISIS targeting the Yazidis, and USAF C-130 Hercules and C-17 Globemasters continued to airdrop food, water, and other critical supplies over the fall.¹²² By breaking the siege on Mount Sinjar, the U.S. airlift eased the pressure on Kurdish forces and the ISF. Backed by U.S. air support, Kurdish forces later recaptured a stretch of territory linking Erbil to Mount Sinjar during a two-day offensive in early December.¹²³

The airdrop’s strategic consequences were profound. By defusing the humanitarian crisis quickly, the airlift allowed the Obama administration to avoid selecting an evacuation option that might have exposed U.S. forces to greater risk and accelerated the start of combat operations. Moreover, the urgent plight of the Yazidis catalyzed the international community’s mobilization and establishment of the political foundation for constructing the Global Coalition to Defeat ISIS over the next few months. Intended as an interim solution to an urgent humanitarian crisis, the Sinjar operation

¹¹⁹ Terri Moon Cronk, “Obama Praises Success of Humanitarian Operations in Iraq,” U.S. Department of Defense, August 14, 2014.

¹²⁰ To date, the demand for humanitarian assistance in Sinjar remains high. See Food Security Cluster, *Sinjar Assessment FSC Partners Report*, Rome, August 2017.

¹²¹ DoD, “U.S., Partner-Nations Conduct Humanitarian Airdrop in Iraq,” August 30, 2014.

¹²² “Going to the Mountain Top,” *Air Force Magazine*, February 2015, p. 29.

¹²³ LTG James L. Terry told reporters that the offensive was backed by 53 air strikes from coalition forces that destroyed ISIS storage units, bulldozers, guard towers, vehicles, and three bridges. Tim Arango, “Backed by U.S. Airstrikes, Kurds Reverse an ISIS Gain,” *New York Times*, December 18, 2014.

gave key allies who were not yet ready to bomb ISIS both a reason and an opportunity to join the intervention and demonstrated that a light-footprint, air-centric approach could make a difference and thus reinforced the administration's nascent Iraq-first, multinational strategy.

International support for air operations in Iraq expanded in the wake of the successful operation. "Our allies' first goal was Mount Sinjar," one interviewee recalled.¹²⁴ Following the suspension of humanitarian airdrops on August 14, RAF reassigned its Tornados to conduct ISR for anti-ISIS ground forces operating elsewhere in the country. The United Kingdom also deployed RC-135W Airseeker, Reaper, Sentinel, and Sentry ISR aircraft to conduct surveillance missions over Iraq and Syria.¹²⁵ Over the next month, Belgium, Canada, Denmark, France, and the Netherlands announced plans to join the United States, the United Kingdom, and Australia in the air campaign in Iraq, while Saudi Arabia and the United Arab Emirates pledged to contribute to air operations against ISIS targets in Syria.¹²⁶

Air Refueling in OIR

Air refuelers enabled the air war against ISIS, giving fighter and attack aircraft the ability to fly farther, stay airborne longer, conduct more strikes, and provide more CAS and ISR capability. Then-Deputy Combined Forces Air Component Commander Maj Gen David Nahom noted in 2017 that "[t]here is no way you could do it without the gas. . . . We just don't have the basing up close. It's just incredible to watch the tanker mission."¹²⁷ Brig Gen John Williams, director of mobility forces at CAOC, also observed: "When you look at being expeditionary, there's really nobody else who does this business the way we do it, if you don't have refueling support, you just can't do the offensive operations. . . . If you don't have that, you aren't supporting the troops in contact."¹²⁸

¹²⁴ RAND interview with Maj Gen (ret.) Bruce Miller, January 8, 2020.

¹²⁵ Claire Mills, *ISIS/Daesh: The Military Response in Iraq and Syria*, London: House of Commons Library, Briefing Paper No. 06995, March 8, 2017, pp. 8–9.

¹²⁶ Justin Worland, "3 More Countries Join the Coalition Against ISIS," *Time*, September 26, 2014; Helene Cooper, "Obama Enlists 9 Allies to Help in the Battle Against ISIS," *New York Times*, September 5, 2014; Government of the Netherlands, "Netherlands to Make Military Contribution to Fight Against ISIS," press release, September 24, 2014; "Belgium to Send Six F-16 Jets to Battle ISIS Militants in Iraq," NBC News, September 24, 2014; "MP's Support UK Air Strikes Against ISIS in Iraq," BBC, September 26, 2014; Aleksandra Sagan and Kady O'Malley, "ISIS Mission: MP's Approve Canada's Air Combat Role," CBC, October 7, 2014; Kathleen J. McInnis, *Coalition Contributions to Countering the Islamic State*, Washington, D.C.: Congressional Research Service, August 24, 2016.

¹²⁷ Howard Altman, "MacDill Tanker Crews Refuel Military Aircraft in Fight Against ISIS," *Tampa Bay Times*, July 20, 2017.

¹²⁸ Brian Everstine, "Refuelers in the Desert," *Air Force Magazine*, August 29, 2017.

The scale of the aerial refueling effort relative to the campaign as a whole was considerable. Air operations in OIR were characterized by long sorties because of the range from main operating bases to key battlefields and requirements for strike aircraft to loiter in CAS stacks or on CAP until they were called on to attack targets. Thus, it was typical for counterland sorties to involve refueling from a tanker at least once on the way to the target and again on the return flight to base—and often during the aircraft's time on station as well.¹²⁹ During most of OIR, approximately one-quarter of all OIR sorties were tankers—averaging more than 34 per day, typically—and these conducted an average of roughly six refuelings per sortie (see Table 6.3). Moreover, AFCENT tankers and their crews were simultaneously supporting U.S. and allied operations over Afghanistan, which typically amounted to roughly another 5,000 sorties per year,¹³⁰ as well as other theater requirements in the CENTCOM AOR. Finally, from mid-2015 until November 2018, tankers and crews also provided aerial refueling to Saudi and Emirati aircraft during the Saudi-led air war in Yemen.¹³¹

This was a modest rate of daily tanker sortie generation, compared with Operation Desert Storm or Operation Iraqi Freedom, in which the first month of each war saw U.S. tankers average several hundred sorties per day.¹³² However, in each of those conflicts, major combat operations ended after just six weeks, in contrast to OIR's

Table 6.3
OIR Aerial Refueling Summary, 2015–2019

Year	Total Sorties (Strike, ISR, Airlift, Tanker)	Number of Tanker Sorties	Percentage of Tanker Sorties	Number of Aircraft Refuelings	Average Tanker Sorties per Day	Average Refuelings per Tanker Sortie
2015	55,417	14,737	27	84,381	40.4	5.7
2016	54,915	13,064	24	80,912	35.8	6.2
2017	56,386	13,243	23	70,536	36.3	5.3
2018	40,985	8,697	21	52,061	23.8	6.0
2019	41,502	7,049	17	44,994	19.3	6.4

SOURCE: RAND AFCENT airpower summary data set.

¹²⁹ RAND interview with USAF officer, January 29, 2020.

¹³⁰ RAND AFCENT airpower summary data set.

¹³¹ Phil Stewart, "U.S. Halting Refueling of Saudi-Led Coalition Aircraft in Yemen's War," Reuters, November 9, 2018.

¹³² During Operation Iraqi Freedom, "1801 total aircraft flew 41,404 sorties in a 720-hour period between 19 March and 18 April 2003," and, among those, "tankers flew 9064 sorties and refueled over 29,000 receivers," an average of 302 tanker sorties per day (Alexander Wathen, "The Miracle of Operation Iraqi Freedom Airspace Management," *Air and Space Power Chronicles*, October 2005). During Operation Desert Storm, "the coalition tanker fleet transferred over 700 million pounds of fuel during roughly 50,000 refuelings to about 2,000 aircraft

more than four and a half years of sustained operations. A more parallel comparison case would be Operation Enduring Freedom. During the first four months of the air war in Afghanistan (from October 2001 to February 2002), USAF tankers flew approximately 5,500 sorties, an average of 46 per day, amounting to 44 percent of total USAF sorties during that period.¹³³

USAF tankers attached to AFCENT conducted the majority of aerial refueling in OIR.¹³⁴ More than 30 KC-135 Stratotankers were based at AUAB, composing rotating contingents from multiple tanker squadrons home based in the United States or other theaters and attached to the 379th Air Expeditionary Wing (AEW).¹³⁵ Starting in 2015, additional KC-135 Stratotankers supported OIR from Incirlik Air Base. The 380th AEW, based at Al Dhafra Air Base, included a dozen larger KC-10 Extenders,¹³⁶ whose ability to conduct both flying-boom refueling, used by USAF aircraft, and hose-and-drogue refueling, compatible with U.S. Navy and European aircraft, in the same mission was particularly useful in a coalition operation, such as OIR, and in which U.S. Navy and USMC aircraft participated.¹³⁷ In addition to the USAF tankers and USMC KC-130J Hercules tankers, seven other coalition members also deployed one or more tankers to OIR. Australia and the United Kingdom deployed A330 Multi Role Tanker Transports (MRTTs), Canada and Germany provided A310 MRTTs, France and Singapore sent KC-135 Stratotankers, and Italy committed a KC-767.¹³⁸

Although demand for refueling in OIR was intense, it never outstripped supply, albeit at the cost of sustaining tanker operations at an intensity that placed heavy demands on aircraft and crews.¹³⁹ When operational demands in OIR or Afghani-

over the 43 days of combat" (U.S. General Accounting Office, *Operation Desert Storm: An Assessment of Aerial Refueling Operational Efficiency*, Washington, D.C., November 1993). According to USAF statistics at the time, "KC-135 and KC-10 tankers flew almost 14,000 combat sorties while transferring about 725 million pounds of fuel to roughly 60,000 receiver aircraft[.] . . . about 240 Air Force tanker missions involving the refueling of more than 1,000 aircraft each day." See U.S. General Accounting Office, *Operation Desert Storm: An Assessment of Aerial Refueling Operational Efficiency*, Washington, D.C., November 1993.

¹³³ Rebecca Grant, *The Afghan Air War*, Arlington, Va.: Air Force Association, September 2002, pp. 24–25.

¹³⁴ Michael Battles, "Air Force Team Fuels Aerial Defeat-ISIS Fight," U.S. Department of Defense, October 7, 2017.

¹³⁵ Brian Everstine, "Refuelers in the Desert," *Air Force Magazine*, August 29, 2017. We also referred to Google Earth Pro historical imagery.

¹³⁶ Marjorie Bowlden and Preston Webb, "Wisconsin Air Guard Members Play Supporting Role in Mosul Victory," Wisconsin Department of Military Affairs, August 4, 2017.

¹³⁷ John A. Tirpak, "Risky Business," *Air Force Magazine*, December 1, 2009.

¹³⁸ Brian Everstine, "Refuelers in the Desert," *Air Force Magazine*, August 29, 2017; Simon Newton, "On the Ground with 'the Fuelies': How the RAF's Aircraft Are Kept Flying," Forces.net, June 24, 2019; Alexander W. Riedel, "Powering Partnerships: Singapore Tankers Boost Coalition Forces, Bring Fuel to Fight," Air Combat Command, September 7, 2017.

¹³⁹ Adam J. Herbert, "Stretch Mobility," *Air Force Magazine*, April 27, 2017.

stan made it necessary, CENTCOM could call on additional tanker resources from the United States. As one general officer who served in the CJTF-OIR headquarters later noted, tankers' wide responsibilities in theater made them high-demand assets, but when competing for allocation of these platforms, "the biggest, highest priority customer" is favored, and during this time CENTCOM represented both of the two highest U.S. priorities.¹⁴⁰ Air refueling was central to every operation and battle in OIR because of the partner forces' heavy reliance on air support to enable both defensive and offensive operations. As an example, we next turn our attention to the role of air refueling in the battle to liberate Mosul.

Tanking for the Joint Fight: Aerial Refueling to Support the Liberation of Mosul, October 2016–July 2017

As discussed at length earlier in this report, the fight for Mosul, Iraq's second largest city and one of the two centers of ISIS's institutional power, was a pivotal battle to defeat ISIS. The Battle of Mosul itself lasted for approximately nine months, from October 2016 to July 2017, and it followed a prolonged period of shaping operations against ISIS targets in and around the city. Both the preparatory actions and the battle for the city itself were supported by the continuous employment of aerial refueling operations.

Background

U.S. and coalition basing options in the Middle East necessitated the widespread use of tanker aircraft to support fighter and attack aircraft engaged in counterland operations, as well as deep strikes on ISIS strategic targets. This was especially true in the battle for Mosul, where the density of targets and the high intensity of urban combat in what both sides saw as a decisive contest required a large number of aircraft on station to provide responsive CAS for Iraqi and Kurdish partner forces, and to conduct interdiction attacks to deny ISIS reinforcements and freedom of movement. Altogether, this added up to a substantial demand for tankers.

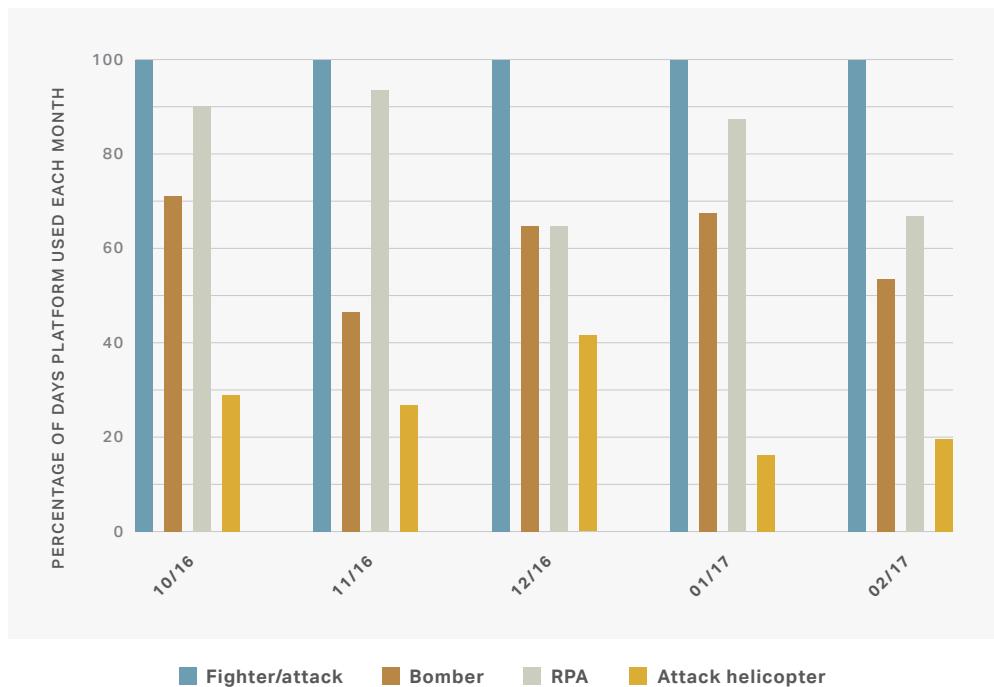
Since the coalition's air strikes were mostly fighter or attack aircraft, and they were utilized almost every day of the Mosul battle, aerial refueling was needed to enable the bulk of the coalition's airpower to just reach the fight. See Figure 6.5 for a snapshot of aircraft usage in Iraq from October 2016 to February 2017.¹⁴¹

Compounding this was the fact that Mosul was one of the most-distant locations from bases in the Persian Gulf of any major battle in Iraq (see Table 6.4). Even the closest major coalition base, Incirlik, is some 375 nautical miles away. Moreover, gener-

¹⁴⁰ RAND interview with Maj Gen (ret.) Bruce Miller, January 8, 2020.

¹⁴¹ Given changes in CJTF-OIR's reporting of strikes, we do not have aircraft usage data for the entirety of the Mosul operation. Nevertheless, these data demonstrate some of the operational requirements for various aircraft types in Iraq during a part of the Mosul operation, thus providing the reader with a greater understanding of why aerial refueling was so vital to the effort.

Figure 6.5
Aircraft Usage in Iraq by Type, October 2016–February 2017



SOURCE: RAND CJTF-OIR strike release data set.

Table 6.4
Ranges from OIR Coalition Fighter/Tac Recce Bases to Mosul

Base	Users	Approx. Range to Mosul (nm)
Incirlik AB, Turkey	United States, Denmark, Germany	370
Ahmad al-Jaber AB, Kuwait	United States, Italy, Poland	500
RAF Akrotiri, Cyprus	United Kingdom	510
AUAB, Qatar	United States	790
Al Dhafra AB and Al Minhad AB, UAE	United States, Australia, France	930

ally, these were not preplanned deliberate strikes in which, once an aircraft reached its assigned coordinates, it dropped its weapons and went home. Instead, the vast majority of the sorties over Mosul were CAS missions in which the aircraft needed to loiter for an hour or more waiting for a JTAC to call for air strikes. With tanker support, fighters could fly long missions of seven or eight hours, or even longer, limited less by fuel than by the physical and cognitive endurance of the pilot and the number of munitions carried. As one USAF general officer interviewed for this study quipped, “Those pilots [flying from Al Dhafra Air Base and AUAB] got good at using their piddle packs.”¹⁴²

Aerial Refueling During the Liberation of Mosul

As discussed earlier in this report, Iraqi and Kurdish forces depended on coalition air-and ground-based fires to enable them to uproot a dug-in enemy while not suffering unsustainable losses. ISIS had leveraged the time it took for the coalition to develop ground forces able to retake the city by heavily fortifying the complex urban landscape of Mosul. To provide the overwatch for the Iraqi and Kurdish forces during the slow, grinding attack on Mosul, coalition aircraft needed a lot of fuel. On average, 35 to 40 tanker sorties per day were needed to fill the tanker tracks that supported OIR (see Figure 6.6). The operational tempo for the tanker force was particularly high during the final months of the operation, when the old city of western Mosul was being cleared in the face of strong resistance, which coincided with the beginning of the Battle of Raqqa.

Tanker operations were the responsibility of the CAOC Combat Plans Division’s Air Refueling Combat Team, which planned, tasked, and executed air refueling operations in OIR and throughout the CENTCOM AOR.¹⁴³ As the Mosul fight proceeded, these coordination and planning cells within the CAOC were aided by a tool kit developed by the Defense Innovation Unit Experimental (DIUX). DIUX created an automated tanker planning tool that helped planners pair aircraft with tankers to refuel them.¹⁴⁴ In some cases, the tool helped cut the amount of planning time for refueling operations in half. Air Force Capt Benjamin Mendel remarked, “We commonly refer to it as the ‘easy button,’ which can go ahead and really create the plan in a matter of seconds.”¹⁴⁵

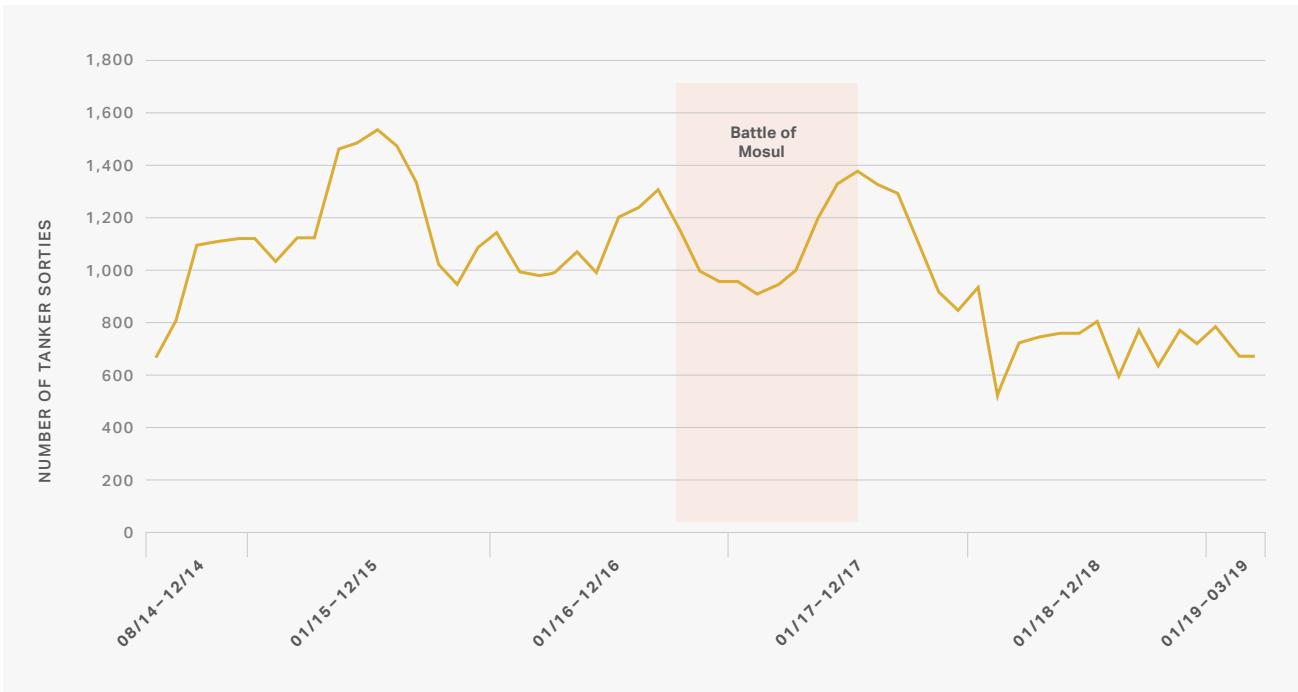
¹⁴² RAND interview with Maj Gen (ret.) Scott Zobrist, December 6, 2019. On recent innovation in in-flight urine collection technology for fighter pilots, see Mike Mount, “How Do Pilots Spell Relief: AMXD,” CNN, May 16, 2008.

¹⁴³ See AFCENT, “Combat Plans Division (CPD),” July 1, 2017.

¹⁴⁴ Richard Whittle, “New DIUX Software Saves Air Force Millions of Pounds of Airborne Tanker Gas a Month,” *Breaking Defense*, September 19, 2017.

¹⁴⁵ Dan Lamothe, “The Pentagon Has Tried to Get Silicon Valley on Its Side for Years: Now It’s Part of the Air War Against ISIS,” *Washington Post*, July 19, 2017. On the further development of this effort to improve the efficiency and connectivity of CAOC systems, see Jim Perkins and James Long, “Software Wins Modern Wars: What the Air Force Learned from Doing the Kessel Run,” Modern War Institute, January 17, 2020.

Figure 6.6
OIR Air Refueling Sorties by Month



SOURCE: RAND AFCENT airpower summary data set.

NOTE: Data interpolated for July–September 2017 and April–May 2018 to compensate for missing values in monthly reporting.

Because the coalition was operating in permissive airspace over Iraq, there was little risk to long overwatch missions to support partner ground forces as long as the aircraft had sufficient fuel and weapons. Tanker aircraft would fly along designated tanker tracks, where other aircraft would be vectored to link up and to refuel. Tanker aircraft often waited at higher altitudes for improved fuel efficiency and descended when receiver aircraft approached at assigned times in need of gas.¹⁴⁶ As one USAF A-10 Warthog pilot observed, CAS missions involved “a lot of hold and nontraditional ISR time, followed by brief ten to 15 minutes of pure terror for engagement that ate a lot of gas.”¹⁴⁷ To provide the persistent coverage that was required for dynamic CAS missions, tanking was needed for flying circles in the sky in a holding pattern and after servicing targets on the ground.

Until the Russians began military operations in Syria, the coalition was able to operate vulnerable large-body aircraft across the area of operations. At one point, the coalition had up to five or six tanker tracks in northern Syria, northern Iraq, or southern Turkey.¹⁴⁸ When Russia began military operations in Syria, it increased the risk to aerial refueling operations, limited their operating areas, and complicated their planning. Brig Gen Daniel Orcutt recalled that when “Russian ships shot cruise missiles from the Caspian Sea” into Syria at “medium altitude,” they passed “through the air refueling tracks.”¹⁴⁹ Fortunately, the coalition tanker aircraft were able to avoid the missiles.

Interoperability was one of the keys to the success of aerial refueling operations. For USAF operations, in-flight refueling is almost taken for granted, but it remains a complicated operation, with two aircraft flying in close proximity to each other and coordinating their movements to hold their positions while dealing with disturbances, such as turbulence. Tanking other nations’ aircraft is even more complicated because the pilots do not practice together as often, but in OIR multinational tanking was integral to air operations, given the variety of aircraft involved and because it freed up USAF tanking assets to take on other theater-wide responsibilities. At least six partner air forces contributed to the OIR air refueling effort during the battle for Mosul. For example, on October 24, 2016, the U.S. and Australian Air Forces conducted their first-ever formation flight with a USAF KC-10 Extender and a Royal Australian Air Force KC-30A. In this operation alone, the two coalition aircraft provided 600,000 pounds of fuel to other aircraft fighting in Mosul.¹⁵⁰ In late 2016, the Royal Australian Air Force’s United Arab Emirates-based KC-30 averaged slightly more than 30 sorties

¹⁴⁶ John Tirpak, “Risky Business,” *Air Force Magazine*, December 1, 2009.

¹⁴⁷ RAND interview with USAF officer, January 29, 2020.

¹⁴⁸ AFHRA interview with Lt Col Gary B. Symon, September 16, 2019.

¹⁴⁹ AFHRA interview with Brig Gen (ret.) Daniel Orcutt, September 25, 2019.

¹⁵⁰ Dario Leone, “RAAF and USAF Tankers Complete First Ever Formation Flight to Support Combat Aircraft Involved in Mosul Offensive, *Aviation Geek Club*, November 7, 2016.

ties per month, with an average duration of eight hours.¹⁵¹ The Singapore Air Force contributed a KC-135R Stratotanker to the coalition's aerial refueling capability, typically refueling four to six aircraft per sortie, during the final months of the fighting in western Mosul.¹⁵²

Mosul Aerial Refueling Conclusion

Coalition aerial refueling operations provided continuous support to aircraft engaged in the air war against ISIS and enabled operations to continue unimpeded. Although the tanker force is often forgotten about by nature of its behind-the-scenes operations, its slogan "No Kick Ass Without Tanker Gas" rang true in the fight against ISIS. As Col Paul Birch, 380th Expeditionary Operations Group commander and F-15E Strike Eagle pilot, noted, "Nothing—and I mean literally nothing—is possible in terms of fighter aviation in CENTCOM unless we get help from our brothers and sisters in the tanker world. . . . Fighters and tankers are a very close-knit team taking the fight to Da'esh."¹⁵³

Conclusion

Discussions of the use of airpower in OIR naturally tend to center on air strikes against ISIS—targets struck, numbers of munitions used, and effects on the progress of the war on the ground. However, as this chapter has illustrated, the ability of the coalition air forces to conduct these strikes to degrade and defeat ISIS cannot realistically be separated from the missions that had to be accomplished to enable them. DCA, airlift (including airdrop missions), and air refueling underpinned OIR, providing the uninterrupted protection and sustainment that the campaign required.

¹⁵¹ Australian Department of Defence, "Air Task Group (ATG)—2016 Statistics," webpage, undated.

¹⁵² Alexander W. Riedel, "Powering Partnership: Singapore Tankers Boost Coalition Forces," Air Mobility Command, September 5, 2017; Zakir Hussain, "Singapore to Extend SAF Contribution to Counter-ISIS Coalition, Says PM Lee Hsien Loong at Meeting with President Trump," *Straits Times*, October 24, 2017.

¹⁵³ Tyler Woodward, "Interoperability Accelerates Fight Against Daesh," Ramstein Air Base, November 2, 2016.

Airpower Against the Islamic State: Lessons and Recommendations for Future Air Wars

On March 23, 2019, the SDF wrested control of the last remaining territory under ISIS rule in the MERV in Syria, marking the end of ISIS's physical caliphate.¹ This represented the operational defeat of ISIS and ushered in a new phase of OIR, focused on stabilization.² By March 2019, the coalition had flown more than 88,000 strike sorties; almost 49,000 ISR sorties; airlifted more than 285,000 tons of equipment, personnel, and supplies; and refueled more than 331,000 aircraft. It had launched 32,678 strikes, affecting approximately 81,000 targets, and dropped more than 117,000 weapons over the course of a campaign that liberated nearly 110,000 square kilometers of territory and 7.7 million people in Iraq and Syria from ISIS control.³ Later in 2019, in a further blow to the militant organization, a U.S. raid resulted in the death of ISIS's founder and leader Abu Bakr al-Baghdadi.

The scope and length of the air operations against ISIS—still ongoing at the time of this writing, with the goal of eliminating ISIS remnants and continuing to train, advise, and assist local partners—are impressive. The United States has become all too familiar with prolonged counterinsurgency and counterterrorist operations over the past two decades, but OIR has not fully been appreciated, in part because there has not been a large commitment of U.S. ground forces, nor a large number of American casualties.

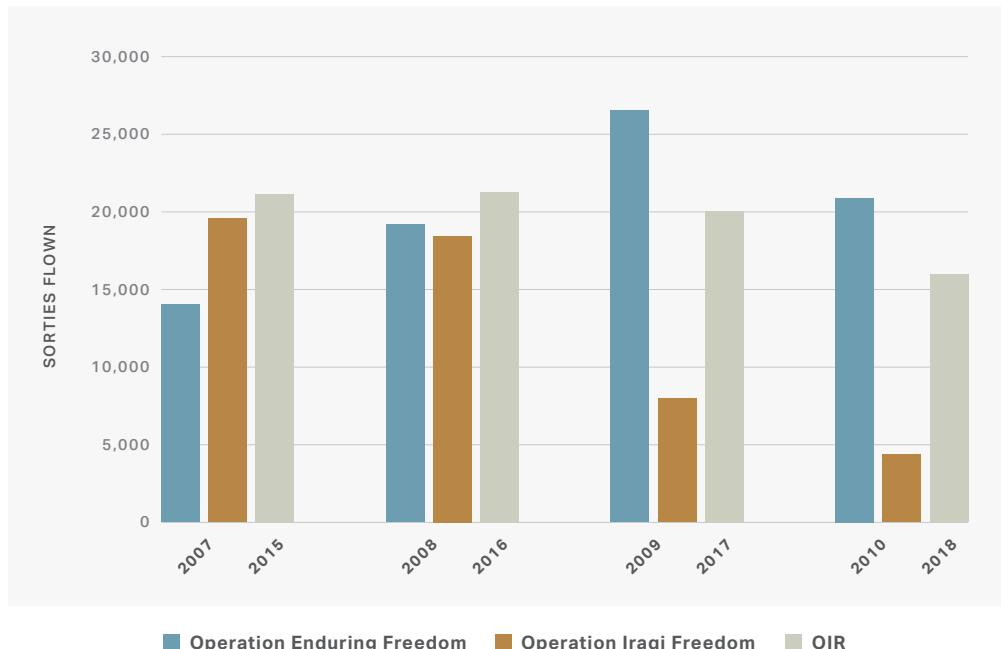
It is easy, therefore, to underestimate the size and duration of the air war and to dismiss it as similar to the counterinsurgency operations that occurred in Iraq after the 2003 invasion until 2011 and are still ongoing in Afghanistan. Figures 7.1 and 7.2 illustrate some of the differences among Operation Enduring Freedom, Operation Iraqi Freedom, and OIR to help prove that point. Figure 7.1 depicts the number of

¹ CJTF-OIR, "Statement from Maj Gen Christopher Ghika on the End of Daesh-Held Territory," U.S. Central Command, March 25, 2019.

² CJTF-OIR, "CJTF Campaign Design," webpage, undated.

³ RAND CJTF-OIR strike release data set and RAND AFCENT airpower summary data set; CENTCOM, "CJTF-OIR Strike Summary, March 10–23, 2019," March 26, 2019.

Figure 7.1
Counterland Sorties Flown in Operations Enduring Freedom and Iraqi Freedom, 2007–2010, and OIR, 2015–2018



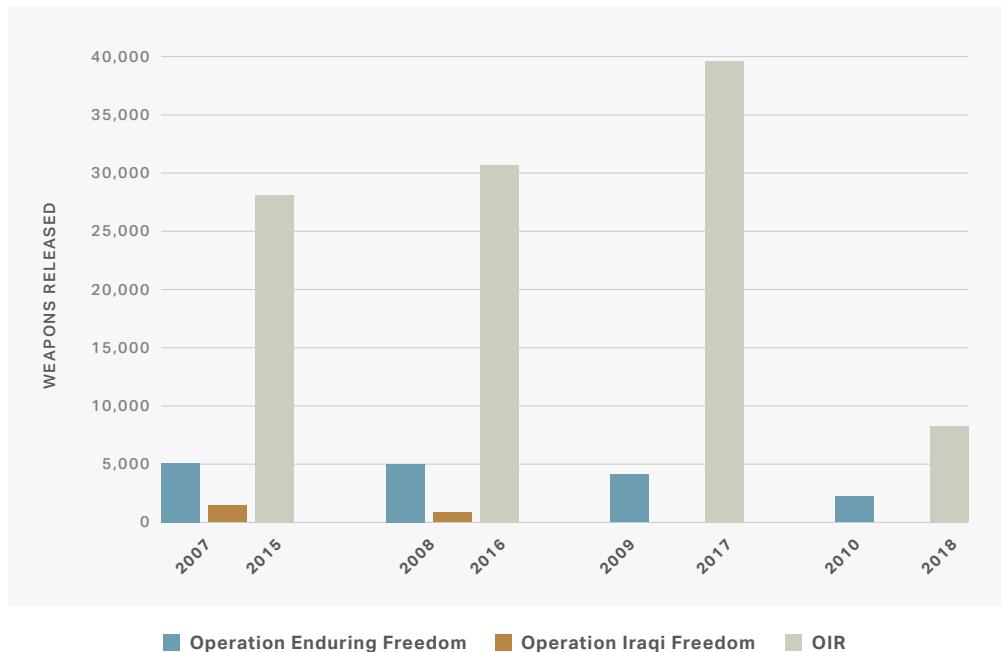
SOURCES: Data for Operations Enduring Freedom and Iraqi Freedom are from Anthony H. Cordesman and Marrisa Allison, *The U.S. Air War in Iraq, Afghanistan, and Pakistan*, Washington, D.C.: Center for Strategic and International Studies, October 14, 2010. Data for OIR are from the RAND AFCENT airpower summary data set.

counterland sorties flown in Operation Enduring Freedom (Afghanistan) and Operation Iraqi Freedom (Iraq) between 2007 and 2010, as well as the number of counterland sorties between 2015 and 2018 in OIR (Iraq and Syria). The numbers of air-to-ground sorties across the three operations appear quite similar. However, for Operation Iraqi Freedom, air-to-ground sorties tapered off in 2009–2010 as the insurgency in Iraq dissipated. In contrast, in Afghanistan, there were between 13,962 and 26,474 sorties annually—on average, 20,000 sorties a year between 2007 and 2010.⁴ Similarly, in OIR, there were as few as 16,056 sorties, in 2018, and as many as 21,161 sorties, in 2015—on average, 19,500 sorties a year.

But the biggest discrepancy among the three—and what sets OIR apart from the two counterinsurgency operations—is the number of weapons released (see Figure 7.2).

⁴ Operation Enduring Freedom and Operation Iraqi Freedom data are drawn from Anthony H. Cordesman and Marrisa Allison, *The U.S. Air War in Iraq, Afghanistan, and Pakistan*, Washington, D.C.: Center for Strategic and International Studies, October 14, 2010.

Figure 7.2
Weapons Released in Operations Enduring Freedom and Iraqi Freedom, 2007–2010, and OIR, 2015–2018

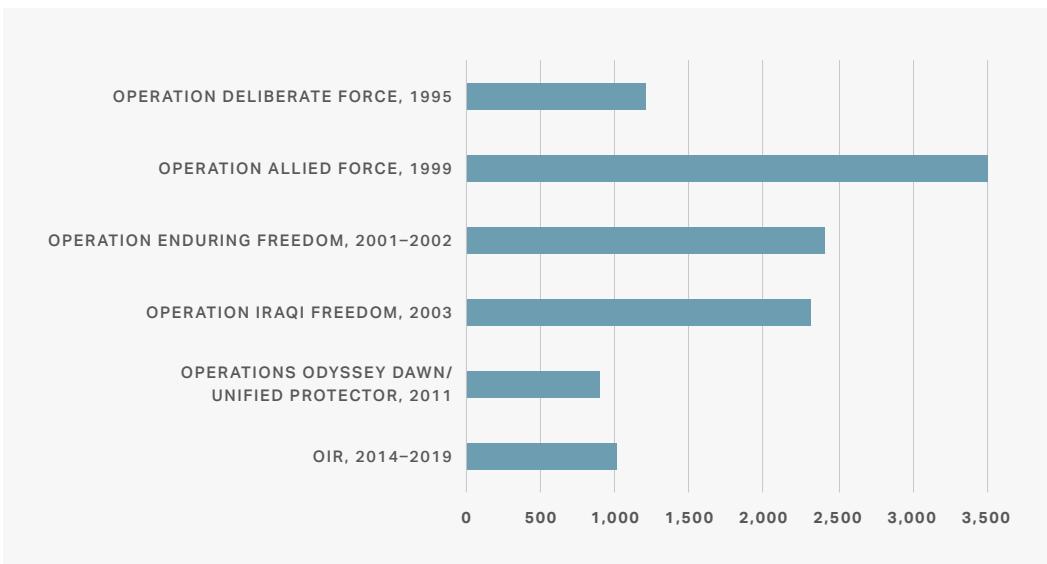


SOURCES: Data for Operations Enduring Freedom and Iraqi Freedom are from Anthony H. Cordesman and Marrissa Allison, *The U.S. Air War in Iraq, Afghanistan, and Pakistan*, Washington, D.C.: Center for Strategic and International Studies, October 14, 2010. Data for OIR are from the RAND AFCENT airpower summary data set.

In Afghanistan, aircraft engaged as few as 2,365 targets in 2010 and as many as 5,198 in 2007. On average, 4,200 weapons a year were dropped in Afghanistan. In Iraq, even at the height of counterinsurgency operations in 2007, fewer than 2,000 weapons were dropped. In stark contrast, in OIR, coalition aircraft dropped as few as 8,335 weapons in 2018 and as many as 39,584 weapons in 2017. On average, the coalition annually released 26,645 weapons. Comparing these statistics reveals that OIR involved more-intense combat operations than the counterinsurgency operations. Moreover, since much ink has been spilled criticizing the initially limited and gradual application of airpower, it is easy to overlook the fact that, at points, OIR was a fairly intense air war, with an average of 1,592 counterland sorties flown and 2,071 weapons released a month.

Yet OIR was less intense than the initial stages of other, more-conventional fights, as seen in Figure 7.3, which depicts the average number of combat sorties per week in recent U.S. air operations. In the initial phase of major combat operations of Operation Iraqi Freedom and Operation Enduring Freedom, aircraft flew on average more than

Figure 7.3
Average Combat Sorties per Week in Recent U.S. Air Operations



SOURCES: Data from Karl P. Mueller, ed., *Precision and Purpose: Airpower in the Libyan Civil War*, Santa Monica, Calif.: RAND Corporation, RR-676-AF, 2015; T. Michael Moseley, *Operation IRAQI FREEDOM—by the Numbers*, Shaw Air Force Base, S.C.: U.S. Air Forces Central, April 30, 2003; and RAND AFCENT airpower summary data set.

double the number of sorties a week than in OIR. Deliberate Force (Bosnia and Herzegovina) and Odyssey Dawn/Unified Protector (Libya) are more commensurate with OIR in terms of the number of combat sorties per week, while Allied Force (Kosovo) had the most, with an average of 3,500 combat sorties a week during the 11-week operation. None of these operations, however, holds a candle to Operation Desert Storm, the 1991 invasion of Iraq, which we do not include in this chart because it is such an outlier, where U.S. combat aircraft flew an average of 19,800 sorties a week.⁵

Operation Deliberate Force by far had the fewest weapon releases, with only 1,026 bombs dropped over the course of the three-week operation, while Operations Odyssey Dawn and Unified Protector had only 7,642 weapons released over 30 weeks. Operations Allied Force, Enduring Freedom, and Iraqi Freedom (the initial phase of major combat operations only in Afghanistan and Iraq) were relatively similar, with between 22,434 and 29,199 weapons released in operations that lasted four to 11 weeks. Operation Iraqi Freedom was the most intense, with 29,199 weapons dropped

⁵ Karl P. Mueller, ed., *Precision and Purpose: Airpower in the Libyan Civil War*, Santa Monica, Calif.: RAND Corporation, RR-676-AF, 2015, p. 4.

in only a month.⁶ In contrast, in OIR there was an average of 2,071 weapon releases a month. At its peak intensity, only 5,075 bombs were dropped in one month. This is less intense than some of the shorter, larger operations in Kosovo, Afghanistan, and Iraq in 2003. For instance, in one day, the USAF dropped more than 1,400 munitions in Kosovo.⁷ However, because of the duration of OIR, which spanned more than four years, it ranks highest in terms of the overall size of the operations. These statistics are summarized in Table 7.1.

Beyond basic statistics about its intensity, OIR stands out because the air component executed several strategic targeting campaigns against a hybrid adversary. Efforts to conduct some—albeit limited—deliberate targeting stand in stark contrast to the years that U.S. aircraft flew only on-call overwatch flights in Afghanistan and previously in Iraq. Moreover, operations in Syria were in a “complex and contested” air-

Table 7.1
Coalition Airpower in Major U.S.-Led Military Interventions, 1990–2020

Operation	Location	Duration (weeks)	Total Sorties	Average Sorties/Week	Weapons Released
Desert Storm, 1991	Iraq and Kuwait	6	118,700	19,800	227,000
Deliberate Force, 1995	Bosnia	3	3,500	1,200	1,026
Allied Force, 1999	Serbia	11	38,000	3,500	28,018
Enduring Freedom, 2001–2002	Afghanistan	10	23,900	2,400	22,434
Odyssey Dawn/Unified Protector, 2011	Libya	30	26,300	900	7,642
Inherent Resolve, 2014–2019	Iraq and Syria	242	234,000	1,000	115,983

SOURCES: Data compiled from the RAND AFCENT airpower summary data set and from Thomas A. Keaney and Eliot A. Cohen, *Revolution in Warfare? Air Power in the Persian Gulf*, Annapolis, Md.: Naval Institute Press, 1995; Robert C. Owen, ed., *Deliberate Force: A Case Study in Effective Air Campaigning*, Maxwell Air Force Base, Ala.: Air University Press, 2000; Benjamin S. Lambeth, *NATO's Air War for Kosovo: A Strategic and Operational Assessment*, Santa Monica, Calif.: RAND Corporation, MR-1365-AF, 2001; T. Michael Moseley, *Operation IRAQI FREEDOM—by the Numbers*, Shaw Air Force Base, S.C.: U.S. Air Forces Central, April 30, 2003; Benjamin S. Lambeth, *Air Power Against Terror: America's Conduct of Operation Enduring Freedom*, Santa Monica, Calif.: RAND Corporation, MG-166-1-CENTAF, 2006; Karl P. Mueller, ed., *Precision and Purpose: Airpower in the Libyan Civil War*, Santa Monica, Calif.: RAND Corporation, RR-676-AF, 2015.

NOTES: Data reflect only sorties flown under CFACC control, not other flights by land or naval forces' organic aviation assets. Operation Iraqi Freedom was not included because only partial data are available.

⁶ T. Michael Moseley, *Operation IRAQI FREEDOM—by the Numbers*, Shaw Air Force Base, S.C.: U.S. Central Command Air Forces, April 30, 2003.

⁷ Benjamin S. Lambeth, *NATO's Air War for Kosovo: A Strategic and Operational Assessment*, Santa Monica, Calif.: RAND Corporation, MR-1365-AF, 2001, pp. 65–66.

space, thanks to the presence of Syrian, Russian, and Iranian aircraft, which was a departure from the permissive environments U.S. aircraft had become accustomed to operating in. DCA operations became increasingly important in Phase II of OIR, and in June 2017 a U.S. aircraft had the first air-to-air kill of a manned aircraft since Operation Allied Force in 1999. Although this was a far cry from a large-scale air war, U.S. pilots had to relearn and exercise these skills in real time on a battlefield with adversary aircraft—including Russian fighters—where there was a real risk of escalation with a near peer.

On the whole, OIR was a success, and airpower was critical to this outcome. CJTF-OIR achieved its strategic objectives of destroying the so-called Islamic State as a territorial entity in Iraq and Syria while minimizing costs for the coalition. CJTF-OIR adhered to a relatively coherent strategy throughout the campaign. But, as noted throughout this report, the operation was not without significant challenges. Given the prolonged operation and unique attributes, OIR offers lessons that planners, strategists, and policymakers should consider when preparing for future air campaigns against near-peer and nonstate actor adversaries and when deciding whether to undertake such operations.

Airpower Findings and Lessons from OIR

From our examination of air operations in OIR, including our analysis of cases from the close and deep fights, we have identified findings and lessons learned. Although no two military operations are entirely alike and ISIS was a unique adversary, these lessons relate to larger issues of strategy and airpower employment that may apply to varying degrees across many potential contingencies. Therefore, we also include recommendations that the USAF and the joint force could implement to improve their ability to fight and win in the next air campaign against another nonstate or pseudo-state actor or a traditional regional or near-peer adversary.

The Defeat-ISIS Strategy Dictated That Airpower Would Play a Critical Role in OIR

The strategy chosen at the outset fundamentally shaped how airpower was employed against ISIS and did not significantly change throughout the duration of the operation. The defeat-ISIS strategy centered on building and supporting local partners' ground forces to lead the fight against ISIS, to limit physical risk to U.S. and coalition forces, and to avoid turning the conflict into a potentially endless commitment for the United States. As a part of this "limited-liability, limited risk" strategy, airpower provided essential intelligence and fire support to Iraqi, Syrian, and Kurdish partners who were central to OIR's success.

In Phase I of the operation, the introduction of coalition airpower largely halted ISIS's offensive that threatened to overrun Baghdad, Erbil, and Kobani. But ISIS

swiftly learned the lessons of Kobani, and the organization became unwilling to mass forces and attack out of fear of coalition air strikes. ISIS's only significant gains thereafter occurred when coalition aircraft could not or would not intervene because of bad weather and political constraints. Although this demonstrated the deterrent impact of coalition air strikes, ISIS's brutality continued as the organization continued to terrorize Iraqi and Syrian citizens under its control and resist partner forces seeking to roll back its territory. Deep-strike operations helped stress ISIS's finances and hasten its demise but were ultimately peripheral to the overall strategy. Because eliminating ISIS's protostate was paramount, territory was the key measure of success in OIR, which in turn meant that the close fight was prioritized over the deep fight. The partner-led strategy relegated the U.S. military and the coalition to a supporting role in the war, but, within that, airpower was the United States' and the coalition's primary contribution to combat operations.

It is also worth noting that the coalition's Iraqi, Syrian, and Kurdish partners needed significant amounts of air support to seize territorial control from ISIS. They could not have defeated ISIS, certainly not in this time frame, without coalition airpower providing intelligence and precise fires. According to one U.S. Army assessment, coalition ground force partners "depend heavily on fires to disperse or attrite enemy forces prior to the seizure of terrain through maneuver," which "required fire missions in such number as to increase the risk of error or collateral damage."⁸ ISIS proved to be an extremely tenacious adversary, with many of its forces willing to fight to the death in an effort to make the Iraqi and Syrian offensives as costly and demoralizing as possible in the hope that their adversaries would give up. Past experience suggests that, without coalition air support, ISIS's strategy might have worked. Iraqi forces had fled in the face of ISIS attacks in 2014 and often refused to move without visible evidence of reassurance in the form of coalition aircraft overhead at various points in the campaign. Even more than the relatively well-armed Iraqis, lighter Syrian partner forces needed coalition firepower to extract ISIS from its defensive positions in towns and cities. Furthermore, partner confidence—or lack thereof—oftentimes required overwatch sorties and air strikes with little tactical or operational value to motivate them to undertake necessary operations. Because of the unusual circumstances of not having forward-deployed JTACs, the United States innovated, using the strike cells to dynamically integrate airpower with partner ground operations.

But how and where airpower was employed was also affected by the supported ground force partners—not only by their tactical skill but also by their strategic interests. Just like the adage "the enemy gets a vote," so too do partner forces. For example, Iraqi or Kurdish officials had to approve all air strikes in their territory, which thus affected the time that it took for air strikes to be authorized and how airpower was

⁸ ARCENT, "The 'By, With, and Through' Approach: An Army Service Component Command Perspective," white paper, Shaw Air Force Base, S.C., September 7, 2017, p. 7.

employed. Moreover, the coalition often found itself beholden to its ground force partners, who were not ready to move or attack or preferred to maneuver in a different direction based on their parochial interests and preferences. Partner planning processes often differed significantly from those of the United States and at times proved to be incompatible with U.S. procedures, limiting the United States' ability to effectively employ airpower. Additionally, the ISF's cooperation with problematic third parties, such as the Shia PMF, at times constrained the use of coalition airpower, as seen in the battle for Tikrit and in the Mosul GLOC interdiction operation. As OIR progressed, so did the skills of many of the ground partners. This led to them becoming more tactically integrated into the process of calling for air support using tablets to provide coordinates for air strikes on ISIS positions. Taken together, while the United States ostensibly led OIR, the employment of airpower in the operation was fundamentally in support of the ground campaign and shaped by ground force partner capabilities and interests.

Lesson learned: Political considerations, such as the chosen strategy or allied and partner preferences, will at times require airpower to be employed suboptimally compared with how the USAF plans and prepares to operate.

If Aggressive Air Operations Had Been Undertaken Sooner, Airpower Might Have Accelerated the Defeat of ISIS—but Only Slightly

One of the most significant debates surrounding OIR is whether the war could have been won more quickly if airpower had been employed more aggressively from the outset. There is evidence that the initial extremely stringent rules of engagement and the centralization of TEA inhibited the employment of airpower. These controls created bottlenecks in the target-validation process and reduced the number of ISIS targets that could be engaged by aircraft. As these constraints were relaxed, battlefield outcomes improved and strikes against ISIS's finances became more effective. Moreover, concerns that partner and coalition member support would dwindle proved to be unfounded.⁹

If an air war had been prosecuted more forcefully and freely from day one, the coalition would have been able to attrite more ISIS forces who were operating in the open. However, some of the other problems that hindered early operations probably would have still prevented a quick victory. It is doubtful that airpower alone could have dislodged ISIS from the cities and towns that it occupied or that it could have immediately and effectively dismantled ISIS's oil business and its cash reserves. Developing a federated intelligence enterprise and improving the process to build and vet deliberate target packages—of which there were few, if any, at the outset of the conflict—took

⁹ It is worth noting that the coalition took great pains to limit civilian casualties and collateral damage throughout the campaign for moral, legal, and political reasons, even after relaxing the ROE, although these efforts were not always successful.

time. Although these reforms could have been implemented sooner, effective strategic-targeting operations, such as Tidal Wave II or Point Blank, could not have been undertaken until these improvements had been made and in the absence of exquisite intelligence produced by SOF raids.

Moreover, to defeat ISIS, the coalition had to deprive it of the territory and populations it controlled, which were ISIS's primary sources of revenue and strength. This required capable partner ground forces, which were in short supply during the first year. The U.S. experiences in Afghanistan and previously in Iraq demonstrate that building partner capacity is a challenging process that takes time. In OIR, Iraqi and Kurdish forces, especially the hollow U.S.-trained ISF, needed to be equipped and trained and their confidence restored. In Syria, the coalition needed to identify an acceptable partner and then improve its capacity. To a large extent, Iraqi, Kurdish, and Syrian partners' capability and willingness to attack drove the operation's extended timeline.

Conceivably, after reinvigorating the intelligence process, airpower could have put more pressure on ISIS before partners were ready to go on the offensive, weakening the organization and potentially easing the way for future ground campaigns. How much of an effect airpower alone could have had on ISIS is uncertain because of ISIS's protean nature and its ability to adapt. Although ISIS provided state-like functions and at times operated as a conventional army, it was a hybrid force that fluidly shifted between combined arms, guerrilla, and terrorist tactics. Moreover, ISIS proved to be highly adaptive, adjusting its operations in response to coalition air strikes to mitigate its vulnerabilities. As the campaign progressed and its operations became more distributed and clandestine, ISIS presented fewer lucrative targets for airpower, and its forces and operations were made more resilient. In sum, a more aggressive air war might have accelerated ISIS's defeat—but not dramatically. As long as the United States operated within the confines of the defeat-ISIS strategy, which put Iraqi and Syrian partners in the lead and prohibited large numbers of U.S. ground forces, this was going to be a prolonged operation.

Lesson learned: A robust joint intelligence enterprise is a prerequisite for effective air operations, but such enterprises can be difficult to rapidly establish.

Strategic Attacks Hurt ISIS's Finances but Less Than Initially Thought

Deep strikes made a relatively small but notable contribution to OIR. The chosen defeat-ISIS strategy prioritized the close fight over the deep fight, and this was appropriate given that ISIS's main center of gravity was its territory. Moreover, the deep-fight operations had mixed results, with the strategic operations against ISIS's oil enterprise and its cash reserves having notably more success than interdiction operations. Operations Tidal Wave II and Point Blank created new challenges for ISIS and stressed the militants' finances at a key point in the operation, thereby helping turn the tide against ISIS and gaining momentum for coalition and partner forces. But these operations

were not decisive, and their success was in large part because of the exceptional intelligence that the United States had acquired through the raid that killed Abu Sayyaf, which was never replicated.

ISIS's primary source of wealth came from the money it extracted from the people under its control, rather than its oil business or cash stores. Therefore, the effects of strategic attack operations on these targets may be overstated. Moreover, it is not clear that strategic attacks could or should have been expanded further when they required high-demand, low-density assets, such as RPAs, which were needed to support the simultaneous ground offensives against Mosul and Raqqa.

Operations Tidal Wave II and Point Blank were successes, but there were declining numbers of meaningful ISIS targets associated with these operations, which raises questions about whether they could have been scaled further. There were relatively few known currency stashes to begin with, and the coalition quickly hit all these locations in Operation Point Blank. Major oil operations were also serviced and reserviced, leaving few consequential targets left for the coalition to destroy. As both ISIS's banking and oil operations became more distributed, these activities became harder to find, requiring even more scarce ISR to locate and develop these less consequential targets at a point when RPAs were in short supply. Given the other demands and the dwindling number of significant targets, it was sensible for the CJTF-OIR Commander to have prioritized the close over the deep fight.

Lesson learned: To be effective, strategic air operations need to understand the enemy's center of gravity, network, and key sources of strength, but not all an adversary's nodes may be vulnerable to strategic air strikes.

Critical Enablers Were Essential to the Success of OIR

The unsung heroes of OIR were the tanker and RPA communities. Both of these platforms were in high demand and provided vital capabilities that enabled the coalition to execute the defeat-ISIS strategy. The coalition was able to support far-flung operations across the theater, including at times round-the-clock dynamic CAS missions over partner forces and defensive CAPs over Syria, because of its extensive network of bases and the support of its tanker aircraft. OIR benefited from preexisting basing, access, and overflight arrangements in the Middle East. U.S. air bases in the Gulf—notably, AUAB in Qatar, Al Dhafra Air Base in the United Arab Emirates, and Ali Al Salem Air Base in Kuwait—had been built up and already had resident fighter, bomber, ISR, airlift, and aerial refueling aircraft, which enabled the United States to quickly respond to the humanitarian crisis on Mount Sinjar in August 2014 and to undertake air strikes to halt ISIS's advance in Iraq.

Despite the robust air base posture, OIR was a “tanker war” because many of these bases were relatively far from their operating areas, especially for shorter-range fighter and attack aircraft, which typically required several aerial refuelings over the

course of each sortie.¹⁰ This is particularly important because so many of the missions required endurance and loitering over an area waiting to be dynamically tasked to service ISIS targets or to respond to threats in the air in Syria. None of these operations would have been possible without tankers that refueled joint and coalition partner aircraft, including combat, cargo, and reconnaissance aircraft. The 340th Expeditionary Aerial Refueling Squadron at AUAB typically had around 48 KC-135 tankers and supplied nearly two-thirds of CENTCOM's theater-wide tanking demand.¹¹ During OIR, the 609th AOC worked with DoD's DIUx to develop an automated tanker planning tool to expedite the complicated planning process of matching tankers to every recipient in need and to improve the efficiency of operations.

In addition to tankers, RPAs were the platforms in greatest demand in OIR. Despite past research demonstrating a preference of airmen and JTACs for manned assets, the almost limitless desire for RPAs in OIR seemingly bucks this trend.¹² RPAs enabled the “air accompanied” approach that emerged in OIR. Rather than U.S. or coalition JTACs on the ground, operating alongside Iraqi, Syrian, and Kurdish ground partners, JTACs early in OIR instead relied on aerial surveillance—chiefly, FMV provided by RPAs—to overwatch partner forces and call in strikes. By mid-2017, MQ-9 Reapers were able to carry JDAMs (GBU-38s) in addition to Hellfire missiles, providing, in the words of Lt Gen Jeffrey Harrigian, “persistent reconnaissance” and an improved “ability to seamless transition to strike.” In 2017 alone MQ-1s and MQ-9s flew more than 12,000 sorties and delivered 2,900 weapons.¹³

These platforms were required to provide ISR and strike capabilities for the close fight; similarly, they were needed for target development and approval for the deep fight, especially since deliberate strikes required hours of uninterrupted FMV surveillance and custody of targets. Because of this, RPAs were overtired relative to supply with too many missions, ranging from scouting, green-force tracking, positive identification, pattern-of-life analysis, intelligence preparation of the operating environment, target development, on-call CAS, and preplanned deliberate targeting. RPAs’ multiple roles in this campaign meant that there were not enough of these platforms to meet the demands being placed on them, which outpaced supply. Furthermore, multirole

¹⁰ Jeffrey Harrigian, “Crushing ISIS—Airpower Operations in a Complex Battlespace,” remarks to the Air Force Association Air Space and Cyber Conference, National Harbor, Md., September 18, 2017.

¹¹ The size of the aerial refueling squadron is based on RAND’s order of battle in Appendix C. In addition to the approximately 48 KC-135s at AUAB, the USAF maintained about 12 KC-135s at Incirlik Air Base, and approximately ten KC-10s at Al Dhafra Air Base. In total, therefore, there were approximately 70 tankers supporting CENTCOM operations, which is about 15 percent of the total KC-135 and KC-10 fleets. Michael Battles, “Air Force Team Fuels Aerial Defeat-ISIS Fight,” U.S. Department of Defense, October 4, 2017.

¹² Julia Macdonald and Jacquelyn Schneider, “Battlefield Responses to New Technologies: Views from the Ground on Unmanned Aircraft,” *Security Studies*, Vol. 28, No. 2, 2019.

¹³ Quoted in Christian Clausen, “Next Level of RPA Operations, USAFCENT Commander Recognizes Airmen,” Creech Air Force Base, Nev., January 10, 2018.

RPs were allocated separately from strike assets, and at times different components' organic ISR assets were not included in the joint allocation process. Because of these issues, RPs were likely used inefficiently, contributing to shortfalls. We did not have the data to assess the validity of competing ISR requirements, but because the issue was a source of tension between the air and ground components, it merits additional study.

Lesson learned: Inefficient allocation processes for scarce, high-demand assets risk overtaxing platforms and complicating efforts to achieve operational and strategic objectives.

Some Vital Wartime Skills Had Atrophied and Needed to Be Redeveloped

In OIR, the USAF realized that its ability to execute some key warfighting tasks had atrophied during the decades of mainly counterinsurgency operations. In particular, the CFACC discovered that he needed to empower airmen to assertively execute the DCA mission and to reinvigorate the intelligence and deliberate-target development processes. Although Iraq was a permissive operating environment, the airspace over Syria was complicated and at times contested. Because the coalition flew "permissively in a nonpermissive environment" in Syria, it had to take the DCA mission seriously. This mission became more important over time as Russia escalated its involvement in Syria's civil war and brought in aircraft and SAMs and when pro-Syrian regime forces operated in closer proximity to the SDF and the coalition. By 2017, Syrian regime forces and their Russian and Iranian backers were frequently coming into contact in the air and on the ground with the coalition, and when these forces threatened the SDF, there were several air-to-air incidents, including the shootdowns of a Syrian Su-22 Fitter attack aircraft and two Iranian-made Shahed 129 UASs. After years of operations in which almost every weapon release was approved at a high level and scrutinized, at first U.S. pilots were reluctant to hold their ground and act in self-defense against emerging threats. The CFACC at the time, Harrigian, had to empower airmen and remind them that they were not only supported but required to execute this defensive mission.

Similarly, at the outset of the campaign, the CFACC struggled to develop a deep fight while short of targeteers and intelligence professionals with the knowledge of how to build a target set from scratch. To gain sufficient intelligence on ISIS to build targeting packages, the CAOC had to cobble together a federated intelligence enterprise that included agencies across DoD. Even after these improvements, many interviewees for this project, including airmen, viewed the deliberate-targeting process as cumbersome, rigid, and extremely slow. Indeed, our interviews and case studies identified several issues with the dearth of intelligence, bottlenecks with target validation, the stringency of FMV requirements to conduct strikes because of concerns over civilian casualties, and a low NCV, all of which militated against the type of flexibility needed to prosecute an air war against a mobile and adaptive adversary.

Because of the shortcomings of the deliberate-targeting process, members of the coalition identified and implemented workarounds. The first was to conduct many of

the strikes as deliberate on-call or dynamic strikes, especially when they could have been preplanned deliberate strikes. The second was the development of a nondoctrinal “middle fight,” which sought to develop deliberate on-call targets within 48 to 72 hours in CJFLCC’s area of operation. Doctrinally, these strikes would likely have been preplanned deliberate strikes under the CFACC’s area of operation. The development of this method, which was employed successfully, was intended to overcome the long timelines associated between target development and engagement, which were not able to meet the needs of partners, who tended to plan their operations at the last minute.

Lesson learned: Skills and missions that have not been used in recent operations may atrophy, while processes to support these missions may become stagnant, and relearning these skills and adapting such processes can slow down efforts to respond to an adversary.

Battlespace Management Was a Significant Issue for the Joint Fight

Doctrinal inconsistencies, particularly as they relate to targeting and battlespace management, proved to be a persistent source of tension between the air and ground components throughout the duration of OIR. For the first ten months, there was not a deep fight despite there being few partner ground operations. Thereafter, the battlespace was unevenly divided between the close and the deep fight, in part because of the overall emphasis on the ground operations and rolling back ISIS territory. This, in turn, complicated and at times arrested the development of the strategic and interdiction operations, as the shifting FLOT and FSCL further reduced the area under CFACC control. Additionally, the establishment of the strike cells and development of a CJFLCC-managed middle fight provided ground entities with the ability to determine how airpower was applied in ways that are not doctrinally consistent. These changes also produced inefficiencies in the application of airpower, as it required another layer of coordination between the CFACC and the ground entities. Although this was managed in OIR, it is likely to have produced negative lessons learned that should be addressed to prevent such problems from emerging in future wars.

Lesson learned: Doctrinal approaches to battlespace management and air-to-ground integration need to be revisited.

Efforts to Reduce Civilian Casualties and Minimize Collateral Damage Depleted Stockpiles of Precision-Guided Munitions

The coalition’s focus on limiting civilian casualties and collateral damage in OIR was emphasized in the targeting process, as well as the weaponeering of validated strikes. As noted in Chapter Five, weaponeers used advanced technology, such as limited-effect weapons, and tactics, such as delayed fuses or employing multiple weapons consecutively, to minimize damage. A preference for precision-guided munitions was clearly demonstrated in OIR, in part because they reduced the likelihood of civilian casualties. As a result, certain precision-guided munitions were in high demand, resulting in

shortages. And since laser-guided bombs were preferred for moving targets with collateral damage risk, there was high demand for this munition type. Although weaponeering for preplanned deliberate strikes was purposefully developed for the target at hand, this was not the case for on-call deliberate strikes or CAS, resulting in sometimes-inefficient use of munitions, which contributed to shortages.

Lesson learned: Strategic and political considerations require the use of precision-guided munitions, and existing stockpiles are insufficient.

Recommendations

From these findings, we derive a number of recommendations for the joint force and USAF as they go forward.

For the joint force:

- The joint force should revisit its targeting doctrine based on the experience in OIR and determine whether the strike cells should be incorporated into doctrine or whether they should use the JAGIC to integrate airpower with ground partners in the absence of forward JTACs.
- The joint force should look to reinvigorate and reexamine the target-development process to identify bottlenecks and develop ways to make it more efficient and faster. Finding ways to more quickly fuse intelligence from different sources and agencies will help to speed up the process of developing new targets. In addition to updating its database of targets on priority adversaries, the joint force should conduct effective network analysis and more quickly turn that into a feasible set of targets to reduce the time between target development and engagement. As a part of this process, the joint force should consider whether recent practices, such as a certain number of uninterrupted hours of FMV, are a sensible requirement for target development and authorization. In OIR, the coalition benefited from time to refine its targeting processes, but it is likely to lack this luxury in future wars against more-capable adversaries.
- The joint force should develop better allocation processes for high-demand, low-density assets to reduce inefficiencies and increase agility. Such processes should take theater-wide organic capabilities of components into account, as well as the operational demands and strategic objectives of the campaign. Alternative options, or platform substitutes that possess similar capabilities, should be identified and integrated into the joint force's allocation process to reduce the risks of overstretch.

- The joint force should reexamine battlespace management and revise joint doctrine or tactics, techniques, and procedures to improve its ability to quickly and dynamically manage the battlespace between the close and deep fights. Moreover, the joint force should consider whether doctrine should further develop and formalize the “middle fight” concept, as seen in Mosul, to better integrate air and ground power. Battlespace geography is likely to become a larger source of tension as the U.S. Army acquires longer-range ground-based fires, such as the 500-kilometer precision-strike missile. Ignoring this issue risks creating deconfliction problems and slowing down the employment of joint air- and ground-based fires, which would be deeply problematic in a fight against a more capable adversary or in a more contested air environment.

For the USAF:

- The USAF will be expected to limit civilian casualties and collateral damage in future air campaigns, including those against near peers, that may occur in dense urban environments. Therefore, it will need to buy sufficient quantities of different types of precision-guided munitions for different missions and allocate these efficiently across theaters, taking theater-wide responsibilities into account, in addition to current and potentially emerging conflicts. Additionally, the USAF should consider how it can effectively and safely use second- and third-choice munitions by using tactics, techniques, and procedures to produce desired effects and precision. In addition to augmenting its stockpiles of precision-guided munitions, the USAF may want to retain or purchase cheaper dumb bombs to use for missions that do not require precision, particularly those that take place in largely uninhabited areas.
- The USAF should continue to develop more targeteers and intelligence professionals to further supplement the ranks of existing targeting and intelligence officers and airmen.
- Self-defense ROE in air-to-air operations should be stressed to airmen in training and real-world flying events. Leaders should emphasize to airmen that they are empowered and expected to defend the airspace, while avoiding inadvertent escalation. Doing so will better prepare airmen for flying missions in contested airspace against near-peer or more-capable adversaries.

Conclusion

Although the air war was not without challenges, OIR was successful at achieving its strategic aims, first halting ISIS's alarming advance into Iraq and then progressively stripping away its control over territory and people until it ceased to exist as a state-like entity. This operation demonstrated not only the utility of airpower but also its flexibility to operate in ways that departed from traditional doctrinal expectations. Although the war against ISIS was unique, this study found many respects in which the OIR experience can be potentially useful to U.S., allied, and partner planners of future strategies in similar and even dissimilar circumstances.

Timeline of the Air Campaign in Operation Inherent Resolve

Note on Compilation

Every effort has been made to ensure that this timeline of events from 2013 to 2019 is accurate. Entries in Table A.1 were verified against other sources when necessary; however, only the primary source for the item has been cited. Some events, especially the battle for cities, may cover several days. For ease of understanding, a single day, usually the most commonly referenced, was chosen.

Table A.1
Timeline of the Air Campaign in OIR

Date	ISIS	United States	Defeat-ISIS Coalition and Partners	Pro-Syrian Regime Forces	Source
12/30/13	ISIS militants in Iraq clash with security forces, seizing control of parts of Fallujah and Ramadi and setting up checkpoints throughout the area.				Agence France-Presse, "Al-Qaeda-Linked Fighters in Iraq Now Control Parts of Two Cities," <i>Business Insider</i> , January 2, 2014.
1/13/14	ISIS defeats a collection of Syrian opposition groups in Raqqa and seizes the city.				"ISIL Recaptures Raqqa from Syria's Rebels," Al Jazeera, January 14, 2014.
6/10/14	ISIS seizes Mosul as Iraqi ground forces rapidly capitulate. ISIS establishes visible control over a significant amount of territory for the first time.		Iraqi Prime Minister al-Maliki urges Sunni-dominated Fallujah to drive out ISIS militants from the city, announces undetailed plan to arm civilians threatened by ISIS.		Martin Chulov, "ISIS Insurgents Seize Control of Iraqi City of Mosul," <i>The Guardian</i> , June 10, 2014; Institute for the Study of War, "ISIS Sanctuary Map: September 10, 2014," 2014; "Iraqi PM Urges Falluja to Expel Al-Qaida Militants," <i>The Guardian</i> , January 6, 2014.
6/11/14	ISIS seizes Tikrit, killing more than 1,000 Iraqi cadets at Camp Speicher in one of the worst massacres perpetrated by the group. ISIS storms the Turkish consulate in Mosul, holds 49 people hostage for 105 days.				Fazel Hawramy, "ISIS Militants Seize Central Iraqi City of Tikrit," <i>The Guardian</i> , June 11, 2014; Rod Nordland and Alissa J. Rubin, "Massacre Claim Shakes Iraq," <i>New York Times</i> , June 15, 2014; Chris Johnston, "ISIS Militants Release 49 Hostages Taken at Turkish Consulate in Mosul," <i>The Guardian</i> , September 24, 2014.

Table A.1—Continued

Date	ISIS	United States	Defeat-ISIS Coalition and Partners	Pro-Syrian Regime Forces	Source
6/18/14		President Obama meets with senior members of Congress to discuss Iraqi crisis; White House states that it is reviewing "options for increased security assistance."	Government of Iraq requests U.S. air strikes on ISIS positions.		"Iraq Formally Asks US to Launch Air Strikes Against Rebels," BBC, June 18, 2014.
6/24/14		The U.S. military starts an "assessment" mission in Iraq. More than 100 American personnel take stock of the state of the ISF following its collapse in Mosul.			Gordon Lubold, "U.S. Troops Begin Controversial New Mission in Iraq," <i>Foreign Policy</i> , June 24, 2014.
6/30/14	ISIS declares a caliphate in Iraq and Syria, naming ISIS leader Abu Bakr al-Baghdadi as caliph.		Members of the ISF who were attempting to repel ISIS forces from Tikrit retreat.		"ISIS Rebels Declare 'Islamic State' in Iraq and Syria," BBC, June 30, 2014.
7/21/14	ISIS continues attacks in northern and central Iraq, including Baghdad. ISIS's territorial control spreads beyond the Euphrates and Tigris valleys, extending from the Turkish border to the vicinity of Baghdad. ISIS continues to reinforce its control of northern Syria.				Institute for the Study of War, "ISIS Sanctuary Map: September 10, 2014," 2014.
8/3/14	ISIS seizes Mosul Dam and cities of Sinjar and Zumar, leading tens of thousands of Yazidis to flee.				Loveday Morris, "Islamic State Seizes Town of Sinjar, Pushing Out Kurds and Sending Yazidis Fleeing," <i>Washington Post</i> , August 3, 2014.

Table A.1—Continued

Date	ISIS	United States	Defeat-ISIS Coalition and Partners	Pro-Syrian Regime Forces	Source
8/7/14		In response to ISIS encroachment on the Kurdish capital of Erbil and ISIS atrocities against Yazidis in Sinjar, President Obama authorizes airdrops of humanitarian aid to Yazidi refugees and first “targeted air strikes” against ISIS. President Obama reiterates that troops are not returning to Iraq.			Barack Obama, “Statement by the President,” speech delivered at the White House State Dining Room, Washington, D.C., August 7, 2014.
8/11/14		The Obama administration announces that the Central Intelligence Agency will directly arm the Kurdish Peshmerga in Iraq with light weapons and ammunition.	Haider al-Abadi, a Shia technocrat, is nominated as prime minister of Iraq.		Spencer Ackerman, “US to Directly Arm Kurdish Peshmerga Forces in Bid to Thwart ISIS Offensive,” <i>The Guardian</i> , August 11, 2014; “Iraq President Asks Abadi to Succeed PM Nouri Maliki,” BBC, August 11, 2014.
8/24/14	ISIS seizes the Tabqah air base, the last government stronghold in the Raqqa governorate, from Syrian regime forces.				“Syria Conflict: Islamic State Seizes Tabqa Airbase,” BBC, August 24, 2014.
9/5/14			U.S., UK, Australian, Canadian, Danish, French, German, Italian, Polish, and Turkish officials meet at the NATO summit in Wales to assemble a coalition to fight ISIS, building the core foundation of what would become the Global Coalition to Defeat ISIS.		Helene Cooper, “Obama Enlists 9 Allies to Help in the Battle Against ISIS,” <i>New York Times</i> , September 5, 2014.

Table A.1—Continued

Date	ISIS	United States	Defeat-ISIS Coalition and Partners	Pro-Syrian Regime Forces	Source
9/8/14			The Iraqi parliament approves al-Abadi as the next prime minister of Iraq. Al-Abadi's cabinet includes Sunni and Kurdish ministers, demonstrating a visible attempt to unify the country in the face of ISIS.		"Iraqi Parliament Approves New Government Headed by Haider al-Abadi," Reuters, September 8, 2014.
9/10/14		President Obama announces a plan to defeat ISIS that includes arming local forces and expanding strikes in both Iraq and Syria.			Zack Beauchamp, "Obama's 6-Point Plan for Defeating ISIS," Vox, September 10, 2014.
9/14/14			Australia commits up to eight F/A-18F Super Hornets, one E-7A AEW&C aircraft, and a KC-30A air-refueling tanker to the coalition, along with approximately 200 Army SOF soldiers to train Iraqi troops.		"RAAF Headed Back to Iraq," <i>Australian Aviation</i> , September 14, 2014.
9/18/14		U.S. Congress authorizes a program to train and equip Syrian opposition forces, expiring December 11, 2014.			Patricia Zengerle and David Lawder, "U.S. Congress Approves Arming Syrian Rebels, Funding Government," Reuters, September 18, 2014.
9/19/14			French President François Hollande authorizes the first French air strikes against ISIS; two Rafale fighters target an ISIS depot in Mosul, beginning Opération Chammal.		Tamir Eshel, "French Jets Strike ISIS Targets in Mosul, Iraq," <i>Defense Update</i> , September 20, 2014.

Table A.1—Continued

Date	ISIS	United States	Defeat-ISIS Coalition and Partners	Pro-Syrian Regime Forces	Source
9/20/14	ISIS militants advance on Kobani, near the Turkish border in Syria, causing thousands of Syrians to flee to Turkey and creating a humanitarian crisis.				Daren Butler, "About 60,000 Syrian Kurds Flee to Turkey from Islamic State Advance," Reuters, September 20, 2014.
9/22/14			U.S., Bahraini, Jordanian, Qatari, Saudi, and United Arab Emirates aircraft launch air strikes against ISIS in Syria using a mix of fighters, bombers, and Tomahawk missiles, targeting militant positions near Raqqa, among other locations.		Martin Chulov, Spencer Ackerman, and Paul Lewis, "US Confirms 14 Air Strikes Against ISIS in Syria," <i>The Guardian</i> , September 23, 2014.
9/24/14			The Netherlands joins the coalition and makes six F-16s and up to 250 military personnel available for operations. Belgium also joins the coalition, providing six F-16s, a C-130, and up to 120 personnel.		Government of the Netherlands, "Netherlands to Make Military Contribution to Fight Against ISIS," press release, September 24, 2014; "Belgium to Send Six F-16 Jets to Battle ISIS Militants in Iraq," NBC News, September 24, 2014.
9/26/14			The UK initiates Operation Shader following Parliament approval to launch air strikes in Iraq.		"MP's Support UK Air Strikes Against ISIS in Iraq," BBC, September 26, 2014.
9/27/14	U.S. air strikes target ISIS positions near Kobani to relieve pressure from the militants.				"U.S.-Led Planes Strike ISIS Fighters Attacking Syria Town," CBS, September 27, 2014.

Table A.1—Continued

Date	ISIS	United States	Defeat-ISIS Coalition and Partners	Pro-Syrian Regime Forces	Source
9/30/14			The UK launches air strikes against ISIS positions in Rabia, Iraq, as part of Operation Shader.		"Islamic State Crisis: Heavy Fighting on Iraq-Syria Border," BBC, September 30, 2014.
10/7/14			The Canadian Parliament approves military contributions to the coalition for a period of up to six months. Canada sends six CF-18 fighters, two CP-140 surveillance planes, one CC-150 tanker/transport aircraft, and 600 personnel to fight ISIS in Iraq.		Aleksandra Sagan and Kady O'Malley, "ISIS Mission: MP's Approve Canada's Air Combat Role," CBC, October 7, 2014.
10/8/14			An Australian F/A-18F Super Hornet drops two bombs on an ISIS target in Iraq, marking Australia's first air strike against ISIS.		Daniel Hurst and Katharine Murphy, "First Australian Air Strike in Iraq Bombs ISIS Target, Says ADF," <i>The Guardian</i> , October 8, 2014.
10/11/14		U.S. air strikes against ISIS positions near Kobani intensify to slow the ISIS advance and aid the YPG defense.			"Islamic State Crisis: Kurds 'Recapture Key Kobane Hill,'" BBC, October 14, 2014.
10/14/14		President Obama and military representatives from 22 countries meet at Andrews Air Force Base to coordinate an international military response.			Steve Holland and Phil Stewart, "Obama, Foreign Military Chiefs Coordinate Islamic State Plans," Reuters, October 14, 2014.

Table A.1—Continued

Date	ISIS	United States	Defeat-ISIS Coalition and Partners	Pro-Syrian Regime Forces	Source
10/15/14		The Pentagon names U.S.-coordinated operations against ISIS in Iraq and Syria Operation Inherent Resolve.			Philip Ewing, "ISIL Fight: 'Operation Inherent Resolve,'" <i>Politico</i> , October 15, 2014.
10/17/14		CJTF-OIR is formally established at Camp Arifjan in Kuwait. ARCENT commands the task force for roughly the first nine months of the operation.			Operation Inherent Resolve, "Mission," webpage, U.S. Department of Defense, undated.
10/20/14			Danish F-16s launch strikes on ISIS targets in northern Iraq from Kuwait, where Denmark has deployed seven F-16s and 140 personnel. Turkey allows Iraqi Kurdish forces to enter and pass through Turkey to reinforce Syrian Kurdish forces defending Kobani.		"Denmark Drops Its First Bombs on ISIS Targets," <i>The Local</i> , October 20, 2014; "Turkey Enabling Iraqi Kurdish Forces to Cross Borders and Defend Kobane," Al Jazeera, October 20, 2014.
11/2/14			Canada conducts its first air strikes against ISIS positions in Iraq using CF-18 Hornets.		Government of Canada, "Operation IMPACT," webpage, undated.
11/3/14			Singapore sends a KC-135R tanker aircraft to support coalition operations.		"Singapore Will Join Coalition Against Islamic State," Channel NewsAsia, November 3, 2014.

Table A.1—Continued

Date	ISIS	United States	Defeat-ISIS Coalition and Partners	Pro-Syrian Regime Forces	Source
11/8/14		President Obama raises the authorized number of U.S. troops for training the ISF and Peshmerga in Iraq to 3,000.			Spencer Ackerman and Tom McCarthy, "Barack Obama Doubles US Troop Levels for War Against ISIS in Iraq," <i>The Guardian</i> , November 8, 2014.
11/17/14			Italy sends two Predator RPAs and 25 armored vehicles to Jordan and 280 military advisers to Iraq.		Justine Drennan, "Who Has Contributed What in the Coalition Against the Islamic State?" <i>Foreign Policy</i> , November 12, 2014.
12/10/14			Moroccan F-16s conduct air strikes against ISIS positions near Baghdad, marking Morocco's first air strikes in the conflict.		"Moroccan F-16 Carry Out Airstrikes Against ISIS," <i>Morocco World News</i> , December 10, 2014.
12/12/14		The National Defense Authorization Act for FY 2015 authorizes training and equipping the Syrian opposition, the government of Iraq, Kurdish and tribal security forces, and other local security forces in Iraq to fight ISIS through the end of 2016.			Public Law 113-291, National Defense Authorization Act for Fiscal Year 2015; Title XII, Matters Relating to Foreign Nations; Sec. 1209, Authority to Provide Assistance to the Vetted Syrian Opposition, December 19, 2014; Public Law 113-291, National Defense Authorization Act for Fiscal Year 2015; Title XII, Matters Relating to Foreign Nations; Sec. 1236, Authority to Provide Assistance to Counter the Islamic State in Iraq and the Levant, December 19, 2014.

Table A.1—Continued

Date	ISIS	United States	Defeat-ISIS Coalition and Partners	Pro-Syrian Regime Forces	Source
12/24/14	A Jordanian F-16 pilot, Muath al-Kasasbeh, crashes near Raqqa during a mission and is captured by ISIS.		The United Arab Emirates suspends flying air missions against ISIS following the capture of a Jordanian pilot.		"Jordan Pilot Ejected over Syria After 'Technical Failure,'" Yahoo News, December 26, 2014; Helene Cooper, "United Arab Emirates, Key U.S. Ally in ISIS Effort, Disengaged in December," <i>New York Times</i> , February 3, 2015.
1/6/15		The Pentagon investigates "credible" allegations of civilian casualties during U.S. air strikes.			Kristina Wong, "Pentagon Investigating Possible Civilian Casualties in ISIS War," <i>The Hill</i> , January 6, 2015.
1/7/15	Over the next three days, three gunmen who claimed allegiance to al-Qaeda kill 17 and injure 22 at the offices of French magazine <i>Charlie Hebdo</i> and a Jewish grocery store in Paris, among other places.				Lori Hinnant and Elaine Ganley, "French Security Forces Kill Gunmen to End Terror Rampage; 20 Dead in 3 Days of Violence," <i>Star Tribune</i> , January 10, 2015.
1/8/15		France deploys its aircraft carrier <i>Charles de Gaulle</i> for a two-month mission in the Arabian Gulf to join the nine Rafales, six Mirage 2000s, a C-135FR tanker, an E-3F surveillance and control plane, and an Atlantique 2 maritime patrol aircraft already in theater.			Agence France-Presse, "France to Deploy Aircraft Carrier to Gulf in IS Fight: Report," Yahoo News, January 6, 2015.

Table A.1—Continued

Date	ISIS	United States	Defeat-ISIS Coalition and Partners	Pro-Syrian Regime Forces	Source
1/15/15	ISIS makes progress toward Damascus, widening its control of territory beyond the Tigris and Euphrates to the Syrian border with Turkey. ISIS retains control of central and northern Iraqi regions but also begins to expand to the west.				Institute for the Study of War, "ISIS Sanctuary Map: August 2019," webpage, last updated October 12, 2019.
1/20/15	ISIS fighters attack Canadian SOF embedded with the Iraqi military, marking ISIS's first engagement with Western ground forces.				Justin Fishel, "ISIS Has First Gunfight with the West," ABC News, January 20, 2015.
1/31/15			Coalition air strikes and YPG fighters force ISIS withdrawal from the Syrian border town of Kobani.		"ISIS Finally Admits Defeat in Kobani After Air Strikes Force Its Fighters to Retreat," <i>The Guardian</i> , January 31, 2015.
2/3/15	ISIS releases a video in which militants gruesomely burn to death previously captured Jordanian pilot al-Kasasbeh.				Jim Michaels and John Bacon, "Jordan Executes Two in Response to Pilot's Slaying," <i>USA Today</i> , February 3, 2015.
2/4/15			In response to the killing of Jordanian pilot al-Kasasbeh, Jordan begins Operation Martyr Muath, launching air strikes on 56 ISIS targets.		"Jordan: Approximately 7,000 IS Members Killed in Strikes," <i>Times of Israel</i> , February 8, 2015.

Table A.1—Continued

Date	ISIS	United States	Defeat-ISIS Coalition and Partners	Pro-Syrian Regime Forces	Source
2/9/15			The Iraqi defense minister announces the full liberation of Ramadi.		Leith Aboufadel, "Iraqi Army Liberates All of Ramadi," Al-Masdar News, February 9, 2016.
2/10/15			The United Arab Emirates resumes air strikes against ISIS after suspending missions following the capture of a Jordanian pilot.		"UAE Says Its Jets Resume Airstrikes Against Islamic State," Reuters, February 10, 2015.
2/24/15			Coalition air strikes target areas in the Al-Hasakah governorate, where ISIS fighters kidnapped more than 100 Assyrian Christians.		"IS' Abducts Syria Christians, Destroys Iraq Artifacts," Deutsche Welle, February 26, 2015.
4/5/15	ISIS militants seize control of a Palestinian refugee camp with 18,000 people just south of Damascus.				Anne Barnard, "Islamic State Seizes Palestinian Refugee Camp in Syria," <i>New York Times</i> , April 5, 2015.
4/15/15		U.S. SOF kill Abu Sayyaf, the head of gas and oil operations for ISIS.			Eric Schmitt, "Commando Raids on ISIS Yield Vital Data in Shadowy War," <i>New York Times</i> , June 25, 2015.
5/17/15			Despite support from coalition air strikes, Iraqi forces flee as ISIS recaptures Ramadi.		Tim Arango, "Key Iraqi City Falls to ISIS as Last of Security Forces Flee," <i>New York Times</i> , May 17, 2015.
5/20/15	ISIS seizes the ancient Syrian city of Palmyra, a UNESCO World Heritage site.				Anne Barnard and Hwaida Saad, "ISIS Fighters Seize Control of Syrian City of Palmyra, and Ancient Ruins," <i>New York Times</i> , May 20, 2015.

Table A.1—Continued

Date	ISIS	United States	Defeat-ISIS Coalition and Partners	Pro-Syrian Regime Forces	Source
6/16/15			Kurdish YPG and Syrian Arab opposition forces seize the strategic Syrian border town of Tal Abyad near the Turkish border; coalition air strikes kill 40 fleeing ISIS militants.		Ben Hubbard, "ISIS Loses Control of Crucial Syrian Border Town," <i>New York Times</i> , June 16, 2015.
6/19/15	ISIS increasingly threatens territory in and around Baghdad while still launching operations in northern and central Iraq and consolidating control over significant parts of north and central Syria.				Institute for the Study of War, "ISIS Sanctuary Map: August 2019," webpage, last updated October 12, 2019.
6/22/15			Coalition air strikes aid YPG forces in overrunning ISIS militants at a former Syrian government military base near Ayn Isa.		Tom Perry, "Syrian Kurds, on Offensive, Seize Military Base from Islamic State," <i>Reuters</i> , June 22, 2015.
6/30/15	The Pentagon states that the total cost of operations against ISIS has been close to \$3 billion.				Rebecca Shabad, "US Fight Against ISIS Nears \$3 Billion," <i>The Hill</i> , June 30, 2015.
7/24/15			Turkish artillery and F-16s strike ISIS positions in Syria, marking Turkey's first direct confrontation with ISIS.		Ceylan Yegin-su and Helene Cooper, "U.S. Jets to Use Turkish Bases in War on ISIS," <i>New York Times</i> , July 24, 2015.
			Turkey says that it will allow armed U.S. aircraft to use two Turkish air bases (Incirlik and Diyarbakir) in operations against ISIS.		

Table A.1—Continued

Date	ISIS	United States	Defeat-ISIS Coalition and Partners	Pro-Syrian Regime Forces	Source
9/4/15				Russia begins a military buildup at an airfield in Latakia, Syria.	Michael R. Gordon and Eric Schmitt, "Russian Moves in Syria Pose Concerns for U.S.," <i>New York Times</i> , September 4, 2015.
9/22/15		III Armored Corps takes command of CJTF-OIR headquarters.			Donald Sparks, "III Corps Assumes Operation Inherent Resolve Mission," U.S. Central Command, September 22, 2015.
9/30/15				Russian air strikes begin in Syria, marking the beginning of Russia's intervention in support of the al-Assad regime.	Andrew Osborn and Phil Stewart, "Russia Begins Syria Air Strikes in Its Biggest Mideast Intervention in Decades," Reuters, September 30, 2015.
				Russian President Vladimir Putin announces that Russian air strikes against ISIS aim to help shore up support for President al-Assad. U.S. and Syrian opposition forces dispute that ISIS positions are the targets.	
10/9/15	ISIS takes advantage of Russian air strikes on other opposition groups and captures six villages near Aleppo, cutting off a strategic road to the Turkish border.	The United States abandons efforts to train Syrian opposition groups to fight ISIS after spending \$500 million.			Anne Barnard, "ISIS Makes Gains in Syria Territory Bombed by Russia," <i>New York Times</i> , October 9, 2015; Michael D. Shear, Helene Cooper, and Eric Schmitt, "Obama Administration Ends Effort to Train Syrians to Combat ISIS," <i>New York Times</i> , October 9, 2015.

Table A.1—Continued

Date	ISIS	United States	Defeat-ISIS Coalition and Partners	Pro-Syrian Regime Forces	Source
10/15/15			Thirteen Syrian opposition organizations aligned with the coalition announce the establishment of the SDF.		Syrian Democratic Forces, "Declaration of Establishment by Democratic Syria Forces," press release, October 15, 2015.
10/20/15		U.S. and Russian forces establish a deconfliction hotline to avoid conflicts in Syrian airspace.			Lisa Ferdinando, "U.S., Russia Sign Memorandum on Air Safety in Syria," U.S. Department of Defense, October 20, 2015.
10/21/15		Operation Tidal Wave II, targeting key nodes of ISIS's oil network, begins.			Matthew Reed, "Blowing Up the Islamic State's Oil Company," <i>Foreign Policy</i> , October 26, 2016.
10/22/15		The first U.S. servicemember dies fighting ISIS in a joint U.S.-Kurdish raid in northeast Iraq.			Jim Miklaszewski and Courtney Kube, "Master Sgt. Joshua Wheeler, US Commando Killed in ISIS Raid, Ran to Gunfight," NBC News, October 23, 2015.
10/23/15			The ISF and Shia militias liberate Iraq's largest oil refinery near Baiji from ISIS after it first began transiently occupying the refinery in June 2014.		"Iraqi Forces and Militia Seize Most of Baiji Refinery: Officials," Reuters, October 15, 2015; "Iraqi Premier Claims Victory over ISIS in Baiji," Rudaw, October 24, 2015.
11/5/15			France redeploys its aircraft carrier to the Eastern Mediterranean Sea in the fight against ISIS.		Agence France-Presse, "France to Deploy Aircraft Carrier in Anti-IS Fight in Syria, Iraq," <i>Defense News</i> , November 5, 2015.

Table A.1—Continued

Date	ISIS	United States	Defeat-ISIS Coalition and Partners	Pro-Syrian Regime Forces	Source
11/12/15			Peshmerga forces, aided by coalition air strikes, recapture the Iraqi town of Sinjar from ISIS.		Isabel Coles, "Kurdish Forces Seize Iraq's Sinjar Town from Islamic State," Reuters, November 12, 2015.
11/13/15	Terrorists linked to ISIS kill 130 people in a series of attacks throughout Paris. President Hollande calls the attacks an "act of war" and declares a three-month state of emergency.				Cassie Werber, "Paris Has Suffered Europe's Worst Terror Attack in 10 Years: Here's What We Know," Quartz, November 14, 2015; Andrew Griffin, "France State of Emergency Declared for Three Months, Allowing Authorities to Shut Down Websites and Giving Police Sweeping New Powers," <i>The Independent</i> , November 19, 2015.
11/15/15			France launches "massive" air strikes on Raqqa in response to ISIS terror attacks in Paris.		Ben Doherty, "France Launches 'Massive' Airstrike on ISIS Stronghold of Raqqa," <i>The Guardian</i> , November 16, 2015.
11/25/15			The ISF, in coordination with coalition air strikes, begins an assault to retake Ramadi.		Andrew deGrandpre, "Iraqi Troops Gunning for Ramadi Outnumber ISIS 10 to 1," <i>Military Times</i> , November 27, 2015.
12/1/15	Secretary of Defense Ash Carter announces that the United States will expand its SOF in Iraq to fight ISIS in both Iraq and Syria, declaring, "We are at war."				Helene Cooper, "U.S. Special Operations Force in Iraq to Grow, Pentagon Says," <i>New York Times</i> , December 1, 2015.

Table A.1—Continued

Date	ISIS	United States	Defeat-ISIS Coalition and Partners	Pro-Syrian Regime Forces	Source
12/2/15	A couple who declared allegiance to ISIS kill 14 and injure 34 at a government facility in San Bernardino, California.				Michael S. Schmidt and Richard Pérez-Peña, "F.B.I. Treating San Bernardino Attack as Terrorism Case," <i>New York Times</i> , December 4, 2015.
12/4/15			Germany joins the coalition, deploying 1,200 military personnel, six Tornados for ISR, and one A310 tanker/transport to the region.		Alison Smale, "German Parliament Votes to Send Military Assistance to Fight ISIS," <i>New York Times</i> , December 4, 2015.
12/10/15			Coalition air strikes kill ISIS finance minister Abu Saleh and two other senior members of the organization.		"ISIS Finance Minister Abu Salah Killed in American Airstrike," NBC News, December 10, 2015.
12/27/15			Members of the ISF expel ISIS militants from Ramadi and declare victory in the battle.		Ahmed Rasheed and Maher Chmaytelli, "Iraqi Army Declares First Major Victory over Islamic State in Ramadi," <i>Fiscal Times</i> , December 27, 2015.
1/9/16			Coalition air strikes east of Ramadi kill 25 senior ISIS leaders.		Abdelhak Mamoun, "25 ISIS Senior Elements Killed in Aerial Bombardment East of Ramadi," <i>Iraqi News</i> , January 9, 2016.
1/19/16	ISIS confirms that a November U.S. air strike killed well-known propagandist "Jihadi John."				"'Jihadi John' Death: Islamic State Says Mohammed Emwazi Killed," BBC, January 19, 2016.

Table A.1—Continued

Date	ISIS	United States	Defeat-ISIS Coalition and Partners	Pro-Syrian Regime Forces	Source
2/15/16			Canadian Prime Minister Justin Trudeau suspends Canadian air strikes in Iraq and Syria, instead increasing local training forces and humanitarian aid.		"Canada's Air Mission Against ISIS Has Ended, Sajjan Tells Commons Debate," CBC, February 17, 2016.
2/26/16			United Nations Security Council members unanimously adopt a resolution calling for the immediate cessation of all hostilities in Syria, creating a partial ceasefire and an imprimatur for peace talks between the regime and the opposition.		United Nations Security Council, "Security Council Endorses Syria Cessation of Hostilities Accord, Unanimously Adopting Resolution 2268 (2016)," press release, February 26, 2016.
3/18/16		President Obama signs off on a new plan to train Syrian opposition soldiers with a strict mandate to fight ISIS.			Paul McLeary, "The Pentagon Wasted \$500 Million Training Syrian Rebels: It's About to Try Again," <i>Foreign Policy</i> , March 18, 2016.
3/19/2016		A U.S. Marine is killed by ISIS at Fire Base Bell near Makhmur, Iraq.			Andrew Tilghman, "U.S. Marines Report Second Attack on 'Firebase Bell' in Northern Iraq," <i>Military Times</i> , March 21, 2016.
3/22/16	Terrorists from an ISIS cell plant three coordinated bombs that kill 32 and injure 340 at the Brussels airport and metro.				Julia Fioretti, "Brussels Attacks Death Toll Lowered to 32," <i>Huffington Post</i> , March 29, 2016.

Table A.1—Continued

Date	ISIS	United States	Defeat-ISIS Coalition and Partners	Pro-Syrian Regime Forces	Source
3/25/16				Syrian regime forces retake Palmyra from ISIS.	Michael Martinez, Greg Botelho, and Schams Elwazer, "Syrian Troops Retake Palmyra Castle from ISIS, State Media Report," CNN, March 25, 2016.
4/11/16	ISIS recaptures Syrian town of Rai, near the Turkish border.		Irqi forces liberate western Iraqi town of Hit from two years of ISIS rule.		Mustafa Salim and Erin Cunningham, "Iraqi Forces Push Islamic State Out of Key City in Anbar Province," <i>Washington Post</i> , April 11, 2016.
4/13/16		The United States provides 150 vehicles, other heavy equipment, light arms, and ammunition to the Iraqi Kurdish Peshmerga.			Seth Robson, "Kurdish Peshmerga Getting Heavy Weapons for Mosul Push," <i>Stars and Stripes</i> , April 13, 2016.
4/20/16		President Obama authorizes sending an additional 217 troops and Apache attack helicopters to Iraq and \$415 million for the SDF to pay salaries and other "military needs."			Kori Schake, "The Inherent Fallacy of Believing We Can Beat the Islamic State Without U.S. Ground Troops," <i>Foreign Policy</i> , April 20, 2016; Richard Sisk, "B-52 Bombers Carry Out First Airstrikes Against ISIS in Iraq," Military.com, April 20, 2016.
		USAF B-52s carry out their first air strike in Iraq since 1991.			
5/5/16	After months of being pushed back in the area, ISIS militants launch a counterattack and seize the Shaer gas field near Palmyra in eastern Syria.				Suleiman Al-Khalidi, "ISIS Militants Have Seized a Key Gas Field in Eastern Syria," <i>Business Insider</i> , May 5, 2016.

Table A.1—Continued

Date	ISIS	United States	Defeat-ISIS Coalition and Partners	Pro-Syrian Regime Forces	Source
5/19/16			Irqi forces retake the isolated western Iraqi town of Rutbah.		Loveday Morris and Mustafa Salim, "Iraqi Forces Retake Rutbah from ISIS and Eye Fallujah for Next Battle," <i>Washington Post</i> , May 19, 2016.
5/24/16			The SDF and coalition air strikes push back ISIS positions north of Raqqa.		Liz Sly, "U.S.-Backed Offensive in Syria Targets Islamic State's Capital," <i>Washington Post</i> , May 24, 2016.
5/30/16			Irqi forces enter Fallujah under the cover of coalition air strikes.		"Iraqi Forces Advance on IS Group Stronghold of Fallujah," France 24, May 30, 2016.
6/12/16	A gunman who declared allegiance to ISIS during the attack kills 49 people and injures 53 in a nightclub in Orlando, Florida.				Steve Rothaus, "Pulse Orlando Shooting Scene a Popular LGBT Club Where Employees, Patrons 'Like Family,'" <i>Miami Herald</i> , June 12, 2016.
6/26/16			Irqi forces liberate Fallujah after 2.5 years of ISIS rule.		Merrit Kennedy, "Iraqi Forces Claim Victory over ISIS in Fallujah," NPR, June 26, 2016.
6/28/16	Three gunmen linked to ISIS and armed with rifles and explosive vests kill 45 and injure more than 200 at the Istanbul airport.				"Istanbul Airport Attack Toll Rises to 45 as Child Dies," <i>Straits Times</i> , July 2, 2016.
7/1/16	ISIS controls significant portions of northern Syria, including Raqqa, and threatens and controls territory in north and central Iraq, including Mosul.				Institute for the Study of War, "ISIS Sanctuary Map: August 2019," webpage, last updated October 12, 2019.

Table A.1—Continued

Date	ISIS	United States	Defeat-ISIS Coalition and Partners	Pro-Syrian Regime Forces	Source
7/6/16				Violence between Syrian regime forces and opposition forces continues, leading the February 2016 cease-fire to unravel.	"Syrian Army, Rebels Agree to 72-Hour Eid Truce, but Fighting Continues," Reuters, July 6, 2016.
7/9/16			NATO members at the Alliance's Warsaw Summit decide to support the coalition with NATO AWACS surveillance aircraft.		Global Coalition, "NATO's Contribution Towards the Global Coalition Against Daesh," January 31, 2019.
7/10/16			Members of the ISF retake Qayyarah West airfield from ISIS, opening up a key staging base for the eventual counterattack on Mosul.		Bill Roggio, "Iraqi Forces Retake Q-West Airbase South of Mosul," <i>Long War Journal</i> , July 12, 2016.
7/14/16	An ISIS-inspired terrorist drives a truck into a crowd in Nice on Bastille Day, killing 86 and injuring 434.				"Attack on Nice: Who Was Mohamed Lahouaiej-Bouhlel?" BBC, August 19, 2016.
7/15/16	The United States and Russia announce a tentative deal to coordinate air strikes against ISIS and the Nusra Front; the deal also declares a cease-fire between the Syrian regime and the opposition.		Elements of the Turkish military launch a coup and seize control of key locations and communication infrastructure, but forces loyal to the government crush the rebellion.		Gardiner Harris, "U.S. and Russia Agree on Steps to Combat ISIS in Syria," <i>New York Times</i> , July 15, 2016; "Turkey's Coup Attempt: What You Need to Know," BBC, July 17, 2016.

Table A.1—Continued

Date	ISIS	United States	Defeat-ISIS Coalition and Partners	Pro-Syrian Regime Forces	Source
7/16/16			Turkey grounds U.S. air strikes from Incirlik Air Base because of the coup attempt; U.S. aircraft resume flights from Incirlik the following day.		Alan Yuhas, "Turkey Allows US to Resume Syria and Iraq Airstrikes from Incirlik Airbase," <i>The Guardian</i> , July 17, 2016.
7/19/16			An SDF offensive to expel ISIS from the city of Manbij begins; the coalition launches more than 450 air strikes around Manbij during the operation.		"Syrian Rebels Capture Islamic State Headquarters in Manbij: U.S. Military," Reuters, July 19, 2016.
8/12/16			Manbij falls to the SDF as ISIS militants flee.		Suleiman Al-Khalidi and Lisa Barrington, "US-Backed Forces Wrest Control of Syria's Manbij from Islamic State," Reuters, August 12, 2016.
8/21/16	XVIII Airborne Corps assumes command of CJTF-OIR.				Combined Joint Task Force—Operation Inherent Resolve, "Townsend Takes Command of Operation Inherent Resolve," press release, August 21, 2016.
8/24/16			Turkish tanks and Turkish-backed Syrian opposition forces launch Operation Euphrates Shield in northern Syria to drive both Kurdish and ISIS forces away from its border.		Ahmed Deeb, "Operation 'Euphrates Shield' Ends ISIL Rule in Jarablus," Al Jazeera, August 25, 2016.

Table A.1—Continued

Date	ISIS	United States	Defeat-ISIS Coalition and Partners	Pro-Syrian Regime Forces	Source
8/30/16		A U.S. air strike kills Abu Muhammad al-Adnani, ISIS senior leader and director for overseas attacks.			Angus McDowall and Phil Stewart, "Key Islamic State Leader Killed in Apparent U.S. Strike in Syria," Reuters, August 30, 2016.
9/9/16		Secretary of State John Kerry and Russian Foreign Minister Sergey Lavrov finalize an agreement to bolster U.S.-Russian coordination in the targeting of ISIS and the Nusra Front and declare a cease-fire between the Syrian regime and the opposition.			Zack Beauchamp, "Obama's Big Deal to Work with Russia on Syria, Explained," Vox, September 10, 2016.
9/17/16			A coalition air strike hits Syrian regime forces, killing dozens in Deir ez-Zur, marking the first coalition attack on Syrian forces.		Karen DeYoung and Thomas Gibbons-Neff, "U.S. Admits Carrying Out Airstrike That Russia Says Killed 62 Syrian Soldiers," Washington Post, September 17, 2016.
9/28/16				The ISF routs ISIS militants near Kirkuk, depriving ISIS of access to a major oil well.	"Islamic State Loses Control of Last Oil Wells in Iraq: Oil Ministry," Reuters, September 30, 2016.
10/13/16		The U.S.-Russia brokered cease-fire between the Syrian regime and the opposition collapses following a mistaken coalition attack on regime forces and renewed Russian air strikes.			Michael R. Gordon and Andrew E. Kramer, "Tension with Russia Rises as U.S. Halts Syria Negotiations," New York Times, October 13, 2016.

Table A.1—Continued

Date	ISIS	United States	Defeat-ISIS Coalition and Partners	Pro-Syrian Regime Forces	Source
10/15/16			The Turkish-backed Syrian opposition forces seize the symbolic town of Dabiq from ISIS.		Max Blau and Isil Sariyuce, "Syrian Rebels Capture Symbolic ISIS-Held Town," CNN, October 16, 2016.
10/16/16			Iraqi and Kurdish forces launch an offensive to liberate Mosul from ISIS with coalition air and artillery support.	France again deploys the <i>Charles de Gaulle</i> to the Eastern Mediterranean for operations against ISIS.	Babak Dehghanpisheh and Ahmed Rasheed, "Iraq Launches Mosul Offensive to Drive Out Islamic State," Reuters, October 16, 2016; Fred Pleitgen, "On Board the French Nuclear Carrier Battling ISIS," CNN, October 17, 2016.
10/21/16	ISIS unsuccessfully launches a counterattack against the recently lost Iraqi oil city of Kirkuk.				"Security Forces End IS Assault on Iraqi Oil City, State TV Says," Reuters, October 22, 2016.
10/25/16	ISIS attacks and seizes control over half of the remote town of Rutbah from the ISF and Sunni tribal forces.				"Islamic State Takes Control of Half Iraqi Town Near Jordan-Syria Border: Sources," Reuters, October 25, 2016.
11/6/16			The U.S.-backed SDF launches a campaign on the ISIS stronghold of Raqqa.		Eric Schmitt, "U.S.-Backed Militia Opens Drive on ISIS Capital in Syria," <i>New York Times</i> , November 6, 2016.
11/15/16			Iraqi forces liberate one-third of eastern Mosul from ISIS control after a month of fighting.		"Iraq Says Islamic State Dislodged from a Third of Eastern Mosul," Reuters, November 16, 2016.

Table A.1—Continued

Date	ISIS	United States	Defeat-ISIS Coalition and Partners	Pro-Syrian Regime Forces	Source
11/30/16		The National Defense Authorization Act for FY 2017 extends assistance, with some amendments, to the Syrian opposition, the government of Iraq, Kurdish and tribal security forces, and other local security forces in Iraq to fight ISIS through 2018.			Public Law 114-328, National Defense Authorization Act for Fiscal Year 2017; Title XII, Matters Relating to Foreign Nations; Sec. 1221, Modification and Extension of Authority to Provide Assistance to the Vetted Syrian Opposition, November 30, 2016; Public Law 114-328, National Defense Authorization Act for Fiscal Year 2017; Title XII, Matters Relating to Foreign Nations; Sec. 1222, Modification and Extension of Authority to Provide Assistance to Counter the Islamic State of Iraq and the Levant, November 30, 2016.
12/8/16		The Pentagon estimates that 50,000 ISIS militants have been killed since the U.S. intervention began more than two years ago.			"U.S. Estimates 50,000 Islamic State Fighters Killed So Far: U.S. Official," Reuters, December 8, 2016.
12/10/16	ISIS defeats Syrian regime forces and recaptures Palmyra despite heavy Russian air strikes in support of the Syrian forces.				Suleiman Al-Khalidi, "Islamic State Militants Capture Palmyra Despite Heavy Russian Strikes," Reuters, December 10, 2016.
12/21/16		Turkish-backed Syrian opposition forces attack the ISIS-controlled city of al-Bab, killing 138 ISIS fighters.			Tulay Karadeniz and Orhan Coskun, "Battle for Syria's al-Bab Intensifies, 14 Turkish Soldiers Killed: Army," Reuters, December 21, 2016.

Table A.1—Continued

Date	ISIS	United States	Defeat-ISIS Coalition and Partners	Pro-Syrian Regime Forces	Source
12/29/16		A U.S. air strike kills Abu Jandal al-Kuwaiti, a senior ISIS commander, near Raqqa.	Iraqi forces begin the second phase of the attack on Mosul, seizing one-quarter of the city.		"U.S. Coalition Says Senior Islamic State Commander Kuwaiti Killed in Syria," Reuters, December 29, 2016; Isabel Coles and Stephen Kalin, "Iraqi Forces Launch Second Phase of Mosul Offensive Against Islamic State," Reuters, December 29, 2016.
1/1/17	An al-Qaeda-trained gunman who declared allegiance to ISIS kills 39 and wounds 79 in a nightclub in Istanbul.				Rengin Arslan, "Abdulkadir Masharipov: Who Is Istanbul Gun Attack Suspect?" BBC, January 17, 2017.
1/5/17			Irqi forces, led by CTS troops, retake 70 percent of eastern Mosul and reach the Tigris three days later.		Stephen Kalin and Isabel Coles, "Iraqi General Says 70 Percent of East Mosul Retaken from Islamic State," Reuters, January 5, 2017; Stephen Kalin and Ahmed Rasheed, "Iraqi Forces Reach Tigris in Mosul as Suicide Bombs Hit Baghdad," Reuters, January 8, 2017.
1/20/17	Trump is inaugurated as U.S. president and pledges to "eradicate from the face of the earth" Islamic terrorism.		Russia signs a 49-year agreement to enlarge its military presence in Syria, including securing rights to the air base in Latakia.		Peter Baker and Michael D. Shear, "Donald Trump Is Sworn in as President, Capping His Swift Ascent," <i>New York Times</i> , January 20, 2017; Rod Nordland, "Russia Signs Deal for Syria Bases; Turkey Appears to Accept Assad," <i>New York Times</i> , January 20, 2017.

Table A.1—Continued

Date	ISIS	United States	Defeat-ISIS Coalition and Partners	Pro-Syrian Regime Forces	Source
1/23/17			Irqi forces capture all of eastern Mosul from ISIS after 100 days of fighting.		Maher Chmaytelli and Saif Hameed, "Iraqi Forces Claim Recapture of Eastern Mosul After 100 Days of Fighting," Reuters, January 23, 2017.
1/24/17				Iran, Russia, and Turkey agree to enforce a partial cease-fire in Syria between the rebels and the government, although neither the Syrian parties nor the U.S. government approved of the agreement.	Anne Barnard and Hwaida Saad, "Iran, Russia and Turkey Agree to Enforce Syria Cease-Fire, but Don't Explain How," <i>New York Times</i> , January 24, 2017.
2/19/17			Irqi forces launch offensive on ISIS-controlled western Mosul, capturing the Mosul airport four days later.		Maher Chmaytelli and Isabel Coles, "Iraq Launches Offensive on Last Islamic State Stronghold in Mosul," Reuters, February 19, 2017; Isabel Coles and Stephen Kalin, "Iraqi Forces Storm Mosul Airport, Military Base," Reuters, February 23, 2017.
2/24/17			Irqi F-16s hit ISIS targets in Syria for the first time. The United States provides intelligence for Iraqi strikes.		"Iraqi Air Force Hits Islamic State Inside Syria for First Time," Reuters, February 24, 2017.
3/1/17			The last remaining road out of western Mosul is seized by the ISF, trapping militants in the last ISIS stronghold in Iraq.		Stephen Kalin, "Iraqi Army Controls Main Roads out of Mosul, Trapping Islamic State," Reuters, March 1, 2017.

Table A.1—Continued

Date	ISIS	United States	Defeat-ISIS Coalition and Partners	Pro-Syrian Regime Forces	Source
3/6/17			Iraqi forces capture a main government building, a central bank branch, and a museum in western Mosul, limiting ISIS's control to Mosul's Old City.		Isabel Coles and John Davison, "Iraqi Forces Retake Mosul Museum, Close In on IS-Controlled Old Town," Reuters, March 6, 2017.
3/26/17			The U.S.-backed SDF overruns ISIS militants at a military airport near the Euphrates Dam and repels a counterattack a week later.		Angus McDowall and Suleiman Al-Khalidi, "U.S.-Backed Forces Capture Islamic State-Held Airport Near Euphrates Dam," Reuters, March 26, 2017; Suleiman Al-Khalidi, "US-Backed Forces Repel Islamic State Attack Near Syrian Dam," Reuters, April 2, 2017.
3/30/17			Turkey calls off Operation Euphrates Shield in northern Syria after heavy losses and confrontations with U.S.-backed YPG forces.		"Turkey 'Ends' Euphrates Shield Campaign in Syria," BBC, March 30, 2017.
4/1/17			An Iraqi air strike kills ISIS deputy commander Ayad al-Jumaili near the border with Syria.		"Islamic State Second-in-Command Killed in Airstrike, Iraqi Intelligence Says," Reuters, April 1, 2017.
4/4/17			Syrian regime forces launch a chemical attack in Idlib governorate that kills dozens of civilians, prompting condemnation from coalition members.		Anne Barnard and Michael R. Gordon, "Worst Chemical Attack in Years in Syria; U.S. Blames Assad," <i>New York Times</i> , April 4, 2017.

Table A.1—Continued

Date	ISIS	United States	Defeat-ISIS Coalition and Partners	Pro-Syrian Regime Forces	Source
4/6/17		Two U.S. ships launch 59 Tomahawk cruise missiles at the al-Shayrat air base in western Syria in response to the chemical attacks in Idlib; the attack is the first deliberate U.S. attack against Syrian regime forces.			Michael R. Gordon, Helene Cooper, and Michael D. Shear, "Dozens of U.S. Missiles Hit Air Base in Syria," <i>New York Times</i> , April 6, 2017.
4/11/17			The U.S.-backed SDF pushes ISIS fighters back to within a mile of Raqqa.		John Davison, "U.S.-Backed Forces Push Back Islamic State in Raqqa Campaign—Officials," Reuters, April 11, 2017.
5/9/17		The Trump administration approves direct train-and-equip mission with the Syrian Kurdish YPG.			Michael R. Gordon and Eric Schmitt, "Trump to Arm Syrian Kurds, Even as Turkey Strongly Objects," <i>New York Times</i> , May 9, 2017.
5/25/17			NATO officially joins the coalition at a summit in Brussels.		Wilson Center, "NATO to Join Anti-ISIS Coalition," May 25, 2017.
5/31/17			A coalition air strike kills Turki al-Bin'ali, ISIS's Grand Mufti.		"Islamic States Chief Cleric Killed in Syria Air Strike: U.S.-Led Coalition," Reuters, June 20, 2017.
6/8/2017		A USAF F-15E Strike Eagle shoots down an Iranian-made drone near al-Tanf, Syria.			Michael R. Gordon, "U.S. Says It Shot Down Drone That Attacked Fighters in Syria," <i>New York Times</i> , June 8, 2017.

Table A.1—Continued

Date	ISIS	United States	Defeat-ISIS Coalition and Partners	Pro-Syrian Regime Forces	Source
6/16/17				Russia claims to have killed al-Baghdadi in an air strike in May but announces four days later that it cannot confirm his death.	Dmitry Solovyov and Ahmed Rasheed, "Russia's Military Says It May Have Killed IS Leader; West, Iraq Skeptical," Reuters, June 16, 2017; "Russia Has No Confirmation of IS Leader's Death: Interfax," Reuters, June 20, 2017.
6/18/17		A U.S. Navy F/A-18E Super Hornet shoots down a Syrian Su-22 targeting SDF troops over a town south of Tabqah in the Raqqa governorate, the first U.S. air-to-air shootdown of a manned aircraft since 1999.			Michael R. Gordon and Thomas Erdbrink, "U.S. Fighter Jet Shoots Down Syrian Warplane," <i>New York Times</i> , June 18, 2017.
6/20/17		A USAF F-15E shoots down a second Iranian-made drone this month.	Irqi forces completely surround the ISIS-controlled Old City in Mosul. Australia suspends air strikes in Syria following Russian warnings over the U.S. downing of a Syrian jet.	The coalition-backed SDF takes control of the al-Qadisia district of Raqqa.	Julian Borger, "US Shoots Down Second Iran-Made Armed Drone over Syria in 12 Days," <i>The Guardian</i> , June 20, 2017; Maher Chmaytelli, "Iraq's Army Encircles Islamic State in Mosul's Old City: Military," Reuters, June 20, 2017; "Australia Halts Syria Air Strikes After Russia Warning," Al Jazeera, June 20, 2017.

Table A.1—Continued

Date	ISIS	United States	Defeat-ISIS Coalition and Partners	Pro-Syrian Regime Forces	Source
6/25/17					"U.S.-Backed Syrian Groups Take Raqqa District from Islamic State," Reuters, June 25, 2017.
6/29/17			ISF members seize the grounds of the symbolic mosque in Mosul from which al-Baghdadi declared the caliphate three years previously. Iraqi Prime Minister al-Abadi declares the caliphate at an end. During their retreat in Mosul, ISIS forces blow up the mosque where al-Baghdadi declared the caliphate. SDF troops complete the encirclement of Raqqa, ISIS's largest stronghold.		Khaled al-Ramahi and Maher Chmaytelli, "Iraq Declares End of Caliphate After Capture of Mosul Mosque," Reuters, June 29, 2017; Lizzie Dearden, "ISIS' Last Escape Route from Raqqa 'Cut Off' by US-Backed SDF Fighters, Says Syrian Monitoring Group," <i>The Independent</i> , June 29, 2017.
6/30/17			ISIS militants withdraw from their last territory in Aleppo governorate.		"ISIS Withdraws from Last Area of Syria's Aleppo Province: Monitor," <i>Straits Times</i> , June 30, 2017.
7/3/17			SDF troops enter Raqqa's Old City.		"U.S.-Backed Forces Breach Raqqa's Old City in Syria, Coalition Says," Reuters, July 3, 2017.
7/7/17	The United States and Russia, with coordination from Jordan and Israel, agree to a cease-fire in southern Syria.				Aria Bendix, "U.S. and Russia Agree to Cease-Fire in Syria," <i>The Atlantic</i> , July 7, 2017.

Table A.1—Continued

Date	ISIS	United States	Defeat-ISIS Coalition and Partners	Pro-Syrian Regime Forces	Source
7/9/17			The Iraqi prime minister declares victory over ISIS in Mosul, although a few pockets of ISIS fighters continue to resist over the course of the next few days.		"Battle for Mosul: Iraq PM Abadi Formally Declares Victory," BBC, July 10, 2017; "Iraq Strikes Islamic State in Mosul Days After Declaring Victory," Reuters, July 12, 2017.
7/15/17				Heavy Russian air strikes help Syrian regime forces take key oil wells in Raqqa governorate as ISIS militants retreat.	Suleiman Al-Khalidi, "Syrian Army Takes More Oil Fields from Islamic State in Raqqa and Eastern Desert," Reuters, July 15, 2017.
8/6/17				Syrian regime forces seize the last town in Homs governorate held by ISIS, with support from Russian artillery and air strikes.	"Syria Army 'Takes Last IS-Group Held Town in Homs,'" France 24, August 6, 2017.
8/15/17			The Iraqi Air Force bombs the ISIS-held town of Tal Afar, west of Mosul, in preparation for a ground assault.		Maher Chmaytelli, "Iraq Bombing Islamic State-Held Tal Afar Ahead of Assault: Iraqi Military Spokesman," Reuters, August 15, 2017.
8/18/17				Hezbollah and Lebanese forces separately launch cross-border attacks on ISIS positions in Syria.	Tom Perry and Angus McDowall, "Lebanese Army, Hezbollah Announce Offensives Against Islamic State on Syrian Border," Reuters, August 18, 2017.
8/20/17			ISF members begin a siege of Tal Afar and breach the city limits two days later.		Tim Arango, "Iraqi Forces Start Offensive to Retake Tal Afar from ISIS," <i>New York Times</i> , August 20, 2017; "Iraqi Forces Breach Islamic State Stronghold Tal Afar: Statement," Reuters, August 22, 2017.

Table A.1—Continued

Date	ISIS	United States	Defeat-ISIS Coalition and Partners	Pro-Syrian Regime Forces	Source
8/26/17			Iraqi forces capture Tal Afar's city center, isolating small pockets of ISIS militants in the city's periphery, and declare victory five days later.		"Tal Afar's Historic City Centre Recaptured from IS group, Say Iraqi Forces," France 24, August 26, 2017; "IS Conflict: Iraq Declares 'Liberation' of Nineveh Province," BBC, August 31, 2017.
9/5/17		III Armored Corps assumes command of CJTF-OIR.		Syrian regime forces relieve trapped government troops, relieving ISIS's three-year siege of the government-held city of Deir ez-Zur.	U.S. Central Command, "CJTF-OIR Transitions Commanders in the Mission to Destroy ISIS," press release, September 5, 2017; Ellen Francis, "Syrian Army, Allies Break Islamic State Siege in Eastern City," Reuters, September 5, 2017.
9/10/17			The coalition-backed SDF routs ISIS in Raqqa, gaining control of 80 percent of the city; Raqqa falls a week later, though pockets of ISIS militants remain.		"US-Backed Fighters 'Seize 80% of Raqqa from Islamic State,'" <i>The Guardian</i> , September 20, 2017; Saeed Kamali Dehghan, "Raqqa Recaptured from Islamic State by US-Backed Forces," <i>The Guardian</i> , September 27, 2017.
9/21/17			Irqi forces launch an offensive on the ISIS-held city of Hawija.		"Iraq Launches Offensive on Hawija, an Islamic State-Held Region Near Oil City Kirkuk," Reuters, September 21, 2017.
9/25/17			Against U.S. recommendations and despite condemnation from Baghdad, Iraqi Kurds hold a referendum on independence, with the majority voting for independence from Iraq.		"Iraqi Kurds Decisively Back Independence in Referendum," BBC, September 27, 2017.

Table A.1—Continued

Date	ISIS	United States	Defeat-ISIS Coalition and Partners	Pro-Syrian Regime Forces	Source
10/1/17	An ISIS counterattack seizes the town of al-Qaryatayn in Homs governorate from Syrian regime forces.				"Syrian Observatory: Islamic State Captures Town from Government," Reuters, October 1, 2017.
10/5/17			Iraqi forces liberate Hawija.		"Hawija: Iraqi Army Says It Has Recaptured One of Last ISIS Enclaves," <i>The Guardian</i> , October 5, 2017.
10/6/17				The Syrian government claims to have expelled ISIS from central Syria, but ISIS militants seize 12 villages near Hama two days later.	"Syrian Army Ousts IS from Last Central Syria Pocket: Military Source," Reuters, October 6, 2017; "Nusra Front, Islamic State Clash in Syria's Hama Province," Reuters, October 9, 2017.
10/14/17				Syrian regime forces recapture the eastern Syrian city of al-Mayadeen.	Erika Solomon, "Syrian Government Forces Claim Recapture of Mayadeen," <i>Financial Times</i> , October 14, 2017.
10/20/17			The coalition-backed SDF officially declares victory in Raqqa despite the presence of an estimated 100 ISIS fighters.		"U.S.-Backed Forces Declare 'Victory' over ISIS in Raqqa," CBS News, October 20, 2017.
10/23/17			The coalition-backed SDF seizes Syria's largest oil field from ISIS.		Ellen Francis, "U.S.-Backed Militias Seize Key Oil Field in East Syria: SDF," Reuters, October 23, 2017.

Table A.1—Continued

Date	ISIS	United States	Defeat-ISIS Coalition and Partners	Pro-Syrian Regime Forces	Source
10/24/17	Having lost its last major population center, ISIS now only controls desert territory along the Syrian-Iraqi border.				Michal Kranz and Skye Gould, "These Maps Show How Drastically ISIS Territory Has Shrunk Since Its Peak," <i>Business Insider</i> , October 24, 2017.
11/2/17			Irqi forces capture the Akkas gas fields from ISIS, among the last resources under ISIS's control.		"Iraqi Forces Capture Akkas Gas Field from Islamic State," <i>Bahrain Mirror</i> , November 3, 2017.
11/3/17			Irqi forces capture the border crossing in the town of al-Qaim, one of the last ISIS footholds in Iraq.	Syrian regime forces, Russian air strikes, and Iranian-backed groups finally expel ISIS militants from the large eastern city of Deir ez-Zur, returning control of the city to the Syrian regime.	Anne Barnard and Margaret Coker, "ISIS, Squeezed on Two Sides, Loses Syrian City and Border Crossing," <i>New York Times</i> , November 3, 2017.
11/8/17				Syrian regime forces and allies seize Abu Kamal, the last ISIS-held town in Syria.	Laila Bassam and Angus McDowall, "Syrian Army, Allies, Take Last IS Stronghold in Syria: Commander," <i>Reuters</i> , November 8, 2017.
11/9/17				The Syrian government declares victory over ISIS.	Angus McDowall and Sarah Dadouch, "Syria Declares Victory over Islamic State," <i>Reuters</i> , November 9, 2017.

Table A.1—Continued

Date	ISIS	United States	Defeat-ISIS Coalition and Partners	Pro-Syrian Regime Forces	Source
11/11/17		President Trump and President Putin formally meet in Vietnam and call on all parties in the Syrian civil war to participate in the Geneva peace process, although neither side discusses ending or coordinating their military operations.			"Trump and Putin 'Agree to Defeat IS in Syria,'" BBC, November 11, 2017.
11/12/17	ISIS militants recapture Abu Kamal from Syrian regime forces after losing it four days earlier.				Suleiman Al-Khalidi, "Iranian-Backed Militias Routed in Last Syrian Militant Stronghold," Reuters, November 12, 2017.
11/17/17		Iraqi forces retake the border town of Rawa, one of the last ISIS strongholds in the country.			Hamdi Alkhshali, "Iraqi Forces Retake Last ISIS-Held Town," CNN, November 17, 2017.
11/21/17		Although militarily triumphant, Iraq's prime minister says that he is waiting to declare victory over ISIS until it has been routed from the desert.	Iranian President Hassan Rouhani declares the end of ISIS.		Ahmed Rasheed, "Iraq to Declare Final Victory over Islamic State After Desert Campaign," Reuters, November 21, 2017; Babak Dehghanpisheh, "Iran's President Declares End of Islamic State," Reuters, November 21, 2017.
12/9/17		Prime Minister al-Abadi declares victory over ISIS.			Margaret Coker and Falih Hassan, "Iraq Prime Minister Declares Victory over ISIS," New York Times, December 9, 2017.

Table A.1—Continued

Date	ISIS	United States	Defeat-ISIS Coalition and Partners	Pro-Syrian Regime Forces	Source
12/27/17			The coalition estimates that fewer than 1,000 ISIS fighters remain in Syria and Iraq.		"Less Than 1,000 IS Fighters Remain in Iraq and Syria, Coalition Says," Reuters, December 27, 2017.
1/17/18		Secretary of State Rex Tillerson states that U.S. troops will remain in Syria to deter President Assad and Iran from seizing newly liberated territories.			Gardiner Harris, "Tillerson Says U.S. Troops to Stay in Syria Beyond Battle with ISIS," <i>New York Times</i> , January 17, 2018.
1/20/18			Turkish forces launch Operation Olive Branch to push YPG forces aligned with the SDF out of Afrin and Manbij.		"Turkey Targets Kurdish Forces in Afrin: The Short, Medium and Long Story," BBC, January 22, 2018.
2/07/18			Russian mercenaries from the Wagner Group and Syrian regime soldiers attack the SDF and U.S. SOF in Deir ez-Zur. With coalition air strikes, the SDF and U.S. forces repel the attack, probably killing dozens of Russian mercenaries and hundreds of Syrian troops.		Thomas Gibbons-Neff, "How a 4-Hour Battle Between Russian Mercenaries and U.S. Commandos Unfolded in Syria," <i>New York Times</i> , May 24, 2018.
2/24/18			The United Nations Security Council unanimously approves a resolution calling for a 30-day cease-fire in the Damascus suburb of Ghouta.		Megan Specia, "U.N. Security Council Votes in Favor of Syria Cease-Fire After Week of Bloodshed," <i>New York Times</i> , February 24, 2018.

Table A.1—Continued

Date	ISIS	United States	Defeat-ISIS Coalition and Partners	Pro-Syrian Regime Forces	Source
4/19/18			The Iraqi Air Force launches rare strikes on ISIS positions in Syria, killing dozens of militants.		"Iraq Claims Airstrike on Syria Killed 36 ISIS Militants," <i>Haaretz</i> , April 22, 2018.
5/12/18			In a highly fractured vote, Muqtada al-Sadr and a coalition led by the popular mobilization forces win the greatest number of seats in the Iraqi Parliament; the incumbent prime minister, al-Abadi, finishes third.		Jane Arraf, "After Muqtada Al-Sadr's Surprise Win, Iraq's Political Leaders Try to Form Government," <i>NPR</i> , May 26, 2018.
7/25/18	ISIS militants attack and seize a handful of villages in southwest Syria, but Syrian regime forces and loyal militias expel them the same day.				Kareem Shaheen, "Surprise ISIS Attacks Leave More Than 200 Dead in South-West Syria," <i>The Guardian</i> , July 25, 2018.
8/13/18		The National Defense Authorization Act for FY 2019 extends assistance, with some amendments, to the Syrian opposition, the government of Iraq, Kurdish and tribal security forces, and other local security forces in Iraq to fight ISIS through 2019.			Public Law 115-232, National Defense Authorization Act for Fiscal Year 2019; Title XII, Matters Relating to Foreign Nations; Sec. 1231, Extension and Modification of Authority to Provide Assistance to the Vetted Syrian Opposition, August 13, 2018; Public Law 115-232, National Defense Authorization Act for Fiscal Year 2019; Title XII, Matters Relating to Foreign Nations; Sec. 1233, Extension of Authority to Provide Assistance to Counter the Islamic State of Iraq and Syria, August 13, 2018.

Table A.1—Continued

Date	ISIS	United States	Defeat-ISIS Coalition and Partners	Pro-Syrian Regime Forces	Source
9/13/18		XVIII Airborne Corps assumes command of CJTF-OIR headquarters.			U.S. Department of Defense, "Operation Inherent Resolve Transitions Commanders for Defeat-ISIS Mission," press release, September 13, 2018.
10/24/18			Adel Abdul-Mahdi, a Shia former oil and finance minister, is sworn in as the new Iraqi prime minister with support from Shia and Kurdish parties.		Philip Issa, "Iraq's New PM Moving Government Outside Baghdad Green Zone," Associated Press, October 25, 2018.
11/1/18			The U.S.-backed SDF temporarily suspends operations against ISIS because of Turkish attacks in northern Syria; the SDF resumes the fight ten days later.		U.S. Central Command, "U.S. Central Command Statement on Temporary Suspension of SDF Offensive Operations Against ISIS," press release, November 2, 2018; "US-Backed Syrian Fighters Resume Offensive Against IS Group," France 24, November 11, 2018.
12/14/18			The small town of Hajin is captured by the coalition-backed SDF.		"Hajin, One of the Last Towns Held by IS Militants Falls in Syria," <i>Deutsche Welle</i> , December 14, 2018.
12/19/18		President Trump abruptly announces that the United States will withdraw its 2,000 troops from Syria. Secretary of Defense James Mattis resigns in protest the next day.			Julian Borger, "Defense Secretary James Mattis Resigns and Points to Differences with Trump," <i>The Guardian</i> , December 20, 2018.

Table A.1—Continued

Date	ISIS	United States	Defeat-ISIS Coalition and Partners	Pro-Syrian Regime Forces	Source
12/30/18				President al-Assad authorizes Iraqi military attacks against ISIS militants in Syria without waiting for Syrian permission.	"Assad Authorizes Iraq to Attack ISIS in Syria," <i>Haaretz</i> , December 30, 2018.
2/22/19	President Trump announces that the United States will leave 400 troops in Syria.				Roberta Rampton and Idrees Ali, "In Reversal, U.S. to Leave a Total of About 400 Troops in Syria," <i>Reuters</i> , February 22, 2019.
3/23/19			The U.S.-backed SDF seizes the Syrian village of Baghouz, ending ISIS's last claim to any territory. SDF Commander Mazloum Abdi declares "the total destruction of the so-called Islamic State."		Rodi Said, "Islamic State 'Caliphate' Defeated, Yet Threat Persists," <i>Reuters</i> , March 23, 2019.
10/9/19	President Trump allows Turkish military intervention in northern Syria against the U.S.-backed SDF.				Ben Hubbard and Carlotta Gall, "Turkey Launches Offensive Against U.S.-Backed Syrian Militia," <i>New York Times</i> , October 9, 2019.
10/28/19	U.S. SOF corner al-Baghdadi in a tunnel during a raid on his compound near Idlib, Syria; al-Baghdadi kills himself.				"Abu Bakr al-Baghdadi: IS Leader 'Dead After US Raid' in Syria," <i>BBC</i> , October 28, 2019.

Commanding and Controlling Airpower Against the Islamic State

This appendix describes the organization of the coalition campaign and the air war against ISIS.

Command and Control of Early Defeat-ISIS Operations

As Chapter Two described, the military intervention against ISIS that would become OIR began in August 2014. Prior to the establishment of OIR, CENTCOM designated its Army component, ARCENT, as the JFLCC for conducting U.S. operations in Iraq on June 24, 2014, in response to the growing threat posed to Baghdad by ISIS. The JFLCC was co-located with ARCENT at Camp Arifjan, Kuwait, and commanded by the ARCENT Commander, LTG James Terry.¹ The JFLCC's operations initially focused on security cooperation to help Iraq's armed forces deal with the rapidly rising threat of ISIS through a forward headquarters in Baghdad designated as JFLCC-Iraq, under the command of MG Dana Pittard.²

In response to President Obama's August 7 announcement that the United States would begin conducting offensive and defensive operations against ISIS to protect American personnel in Erbil and Yazidi refugees on Mount Sinjar, the JFLCC began directing dynamic air strikes against advancing ISIS forces.³ The JFLCC was redesignated as the CJFLCC on September 17,⁴ reflecting the President's statement one week

¹ Center for Army Lessons Learned, *ARCENT Transition to Combined Joint Task Force—Operation Inherent Resolve: Lessons and Best Practices*, Fort Leavenworth, Kan., March 2016, p. 1.

² Dana Pittard and Wes Bryant, *Hunting the Caliphate: America's War on ISIS and the Dawn of the Strike Cell*, New York: Post Hill Press, 2019, p. 62.

³ Barack Obama, "Statement by the President," speech delivered at the White House State Dining Room, Washington, D.C., August 7, 2014; Liz Sly, Karen DeYoung, and Loveday Morris, "U.S. Expands Airstrikes Against Islamic State Militants in Northern Iraq," *Washington Post*, August 8, 2014.

⁴ In U.S. military parlance, a *joint* entity or operation involves personnel from multiple U.S. armed services, while a *combined* one includes both U.S. and allied or partner armed forces (Joint Publication 1, *Doctrine for the*

earlier that the United States would lead a “broad coalition” to degrade and ultimately destroy ISIS.⁵ On September 19, French fighters would become the first non-U.S. coalition aircraft to conduct air strikes against ISIS.⁶

CJTF-OIR

DoD formally named the operation on October 17, 2014, and established CJTF-OIR to command military operations by the United States and its coalition partners against ISIS in Iraq and Syria.⁷ CJTF-OIR reports to the four-star commander of CENTCOM, headquartered in Tampa, Florida, which commands U.S. forces across an AOR extending from Egypt to Central Asia. ARCENT was assigned as the lead element of the task force, with the ARCENT commander, LTG Terry, dual-hatted as the CJTF-OIR Commander. Table B.1 lists the CENTCOM and CJTF-OIR Commanders between 2013 and 2019.

Figure B.1 shows the command relationships between 2014 and 2015, which was a mix of supported commands and independent commands that informally coordinated with CJTF-OIR.⁸ Both the CJFLCC Commander and the CFACC directly supported the CJTF-OIR Commander. The CJFLCC Commander was a two-star Army division commander, while the CFACC was the three-star AFCENT Commander.

Table B.1
CENTCOM and CJTF-OIR Commanders, 2013–2019

Dates	CENTCOM Commander	CJTF-OIR Commander
2013–2014	GEN Lloyd Austin	—
2014–2015	GEN Lloyd Austin	LTG James Terry
2015–2016	GEN Lloyd Austin	LTG Sean MacFarland
2016–2017	GEN Joseph Votel	LTG Stephen Townsend
2017–2018	GEN Joseph Votel	LTG Paul Funk II
2018–2019	GEN Joseph Votel	LTG Paul LaCamera
2019	GEN Frank McKenzie	LTG Pat White

Armed Forces of the United States, Washington, D.C.: Joint Chiefs of Staff, July 12, 2017, p. II-21).

⁵ CJTF-OIR, “History,” 2017; Barack Obama, “Statement by the President on ISIL,” Washington, D.C.: White House, September 10, 2014.

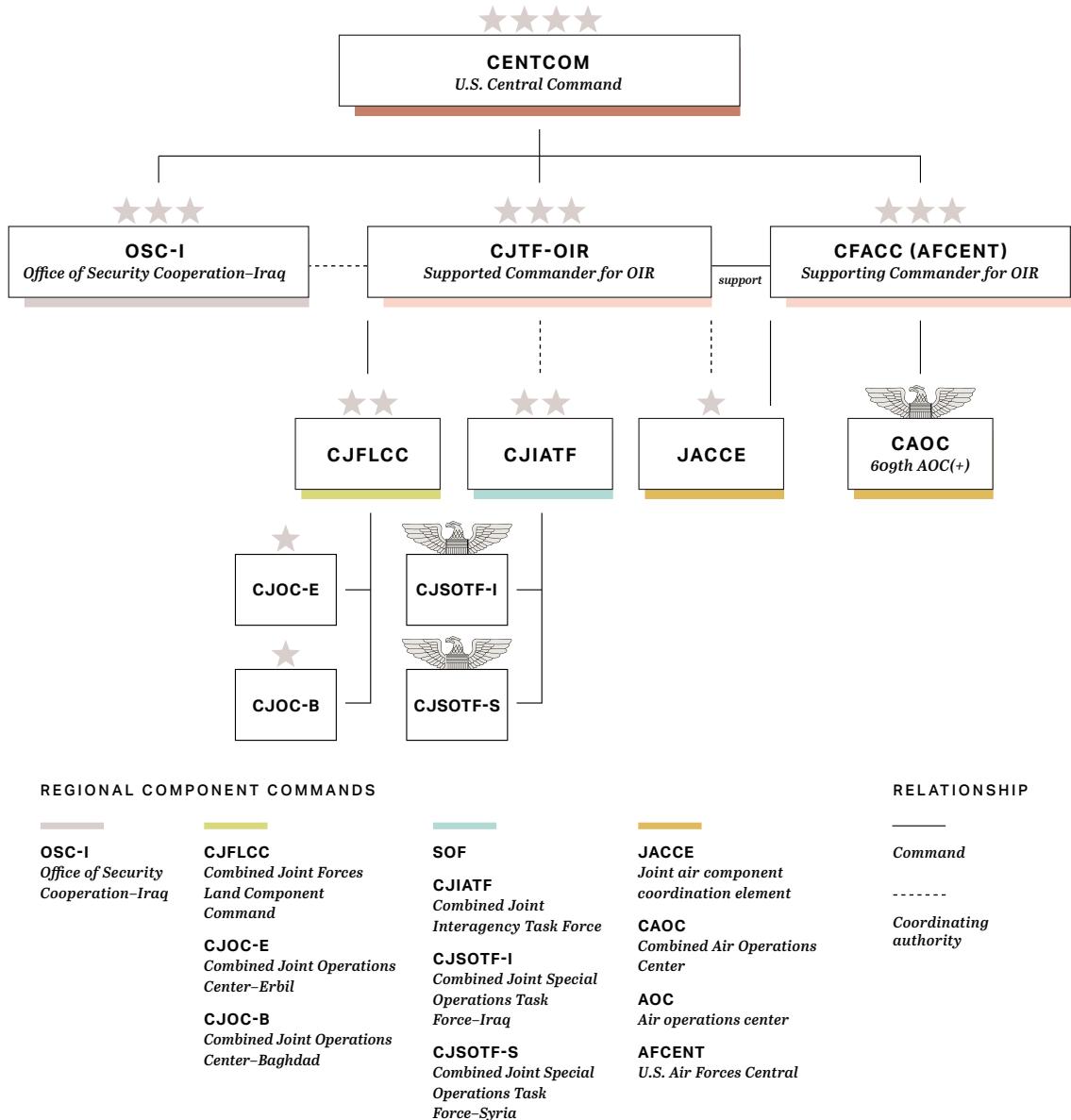
⁶ “France Launches First Airstrikes on IS in Iraq,” BBC, September 19, 2014.

⁷ Several U.S. allies designated their contributions to OIR as operations with their own national designations: Opération Chammal (France), Operation Shader (United Kingdom), Operation Okra (Australia), Operation IMPACT (Canada), and Operation Counter Daesh (Germany).

⁸ We thank COL Francis Park from the Joint History Office for helping us better understand the CJTF-OIR command relationships.

Figure B.1
CJTFOIR Command Relationships, 2014–2015

Joint Task Force
Organizational Chart 2014–2015



The CJFLCC included two CJOCs, located in Baghdad (CJOC-B) and Erbil (CJOC-E), that respectively controlled air strikes in support of Iraqi and Kurdish forces fighting ISIS in Iraq. Commanding from the CAOC at AUAB in Qatar, the CFACC was responsible not only for the coalition air war in Iraq and Syria in support of CJTF-OIR but also for commanding other air operations in CENTCOM's AOR.⁹ These included air operations in Operation Enduring Freedom (later Operation Freedom's Sentinel and Resolute Support Mission) in Afghanistan, the Combined Defense of the Arabian Gulf mission, and support to the Saudi- and United Arab Emirates-led air war in Yemen, which began in March 2015.¹⁰ Thus, the CFACC was organizationally adjacent to CJTF-OIR, as both the CFACC and the CJTF-OIR Commander reported to the CENTCOM Commander. However, within the organizational construct of OIR, the CFACC was the supporting commander.¹¹ Table B.2 lists all the CFACC and deputy CFACCs between 2014 and 2019, within the time frame of this study.

To provide coordination between CJTF-OIR in Kuwait and the CAOC in Qatar, a Joint Air Component Coordination Element is embedded in the CJTF-OIR headquarters. This element is supporting the CFACC but reports to the CJTF-OIR deputy

Table B.2
CENTCOM CFACCs, 2014–2019

Dates	CFACC	Deputy CFACC
2013–2014	Lt Gen John Hesterman III	—
2014–2015	Lt Gen John Hesterman III	Maj Gen Jeffrey Lofgren
2015–2016	Lt Gen Charles Q. Brown Jr.	Maj Gen Scott Zobrist
2016–2017	Lt Gen Jeffrey Harrigan	Maj Gen Jay Silveria
2017–2018	Lt Gen Jeffrey Harrigan	Maj Gen David S. Nahom
2018–2019	Lt Gen Joseph Guastella	Maj Gen Gregory M. Guillot

⁹ In addition to being the CFACC and the AFCENT Commander, this individual wears a third “hat” as the Commander of Air Force Forces assigned to the CENTCOM AOR. In this capacity, this individual exercises administrative and operational control over all USAF units assigned to the theater (Curtis E. LeMay Center for Doctrine Development and Education, Air University, *Command and Control*, Annex 3-30, Maxwell Air Force Base, Ala., January 7, 2020, pp. 7–13, 52–54).

¹⁰ AFCENT, “USAFCENT History,” webpage, undated; White House, “Statement by NSC Spokesperson Bernadette Meehan on the Situation in Yemen,” press release, March 25, 2015.

¹¹ Joint doctrine states that a combined joint task force “normally designates a [subordinate] JFACC [Joint Force Air Component Commander] to establish unity of command and unity of effort for joint air operations” but provides for the option of a theater JFACC who supports but is not subordinate to one or more joint task forces. See Joint Publication 3-30, *Joint Air Operations*, Washington, D.C.: Joint Chiefs of Staff, July 25, 2019, pp. II-2, II-19.

commander for operations and intelligence, an airman, and serves as “the air component commander’s personal and official representative” in the CJTF-OIR headquarters.¹²

The Combined Joint Interagency Task Force and Office of Security Cooperation–Iraq were operating in the area of operations, but were not under the command of CJTF-OIR. The Combined Joint Interagency Task Force was focused on training and equipping Syrian rebels and was led by MG Michael Nagata, who was also the Commander of Special Operations Command Central.¹³ The Combined Joint Interagency Task Force commanded two special operations forces under the umbrella of the Combined Joint Special Operations Task Forces (CJSTOFs)—one in Iraq (CJSOTF-I) and one in Syria (CJSOTF-S). The Office of Security Cooperation–Iraq was tasked with providing equipment and resources to the Iraqi military and in 2014 was led by LTG John Michael Bednarek.¹⁴

In 2015, the command construct for CJTF-OIR was altered, as is shown in Figure B.2. Command of CJTF-OIR subsequently rotated on an annual cycle between the Army’s III Armored Corps and XVIII Airborne Corps in 2016 (see Table B.1), with the corps commander, along with much of the commander’s staff, deploying to Camp Arifjan to lead the task force.¹⁵ The task force commander had two deputies: a deputy commander—strategy and sustainment, held by a UK Army major general, and a deputy commander—operations and intelligence, held by a USAF major general.¹⁶

Additionally, a SOJTF replaced the Combined Joint Interagency Task Force. The SOJTF commanded the two CJSTOFs in Iraq and Syria. Among its activities, the SOJTF oversaw a campaign against ISIS leadership targets employing SOF RPAs and sometimes conventional airpower assets.¹⁷ The ties between CJTF-OIR and the SOJTF were clarified in 2016, but the relationship between the two was not one of direct support.¹⁸ Additionally, the Commander of the Office of Security Cooperation–Iraq became a two-star commander in mid-2015, when MG Paul LaCamera replaced Bednarek.

¹² Curtis E. LeMay Center for Doctrine Development and Education, Air University, *Command and Control*, Annex 3-30, Maxwell Air Force Base, Ala., January 7, 2020, pp. 25–26.

¹³ Sean D. Naylor, “Meet the Shadow Warrior Leading the Fight Against the Islamic State,” *Foreign Policy*, May 1, 2015.

¹⁴ Dana Pittard and Wes Bryant, *Hunting the Caliphate: America’s War on ISIS and the Dawn of the Strike Cell*, New York: Post Hill Press, 2019.

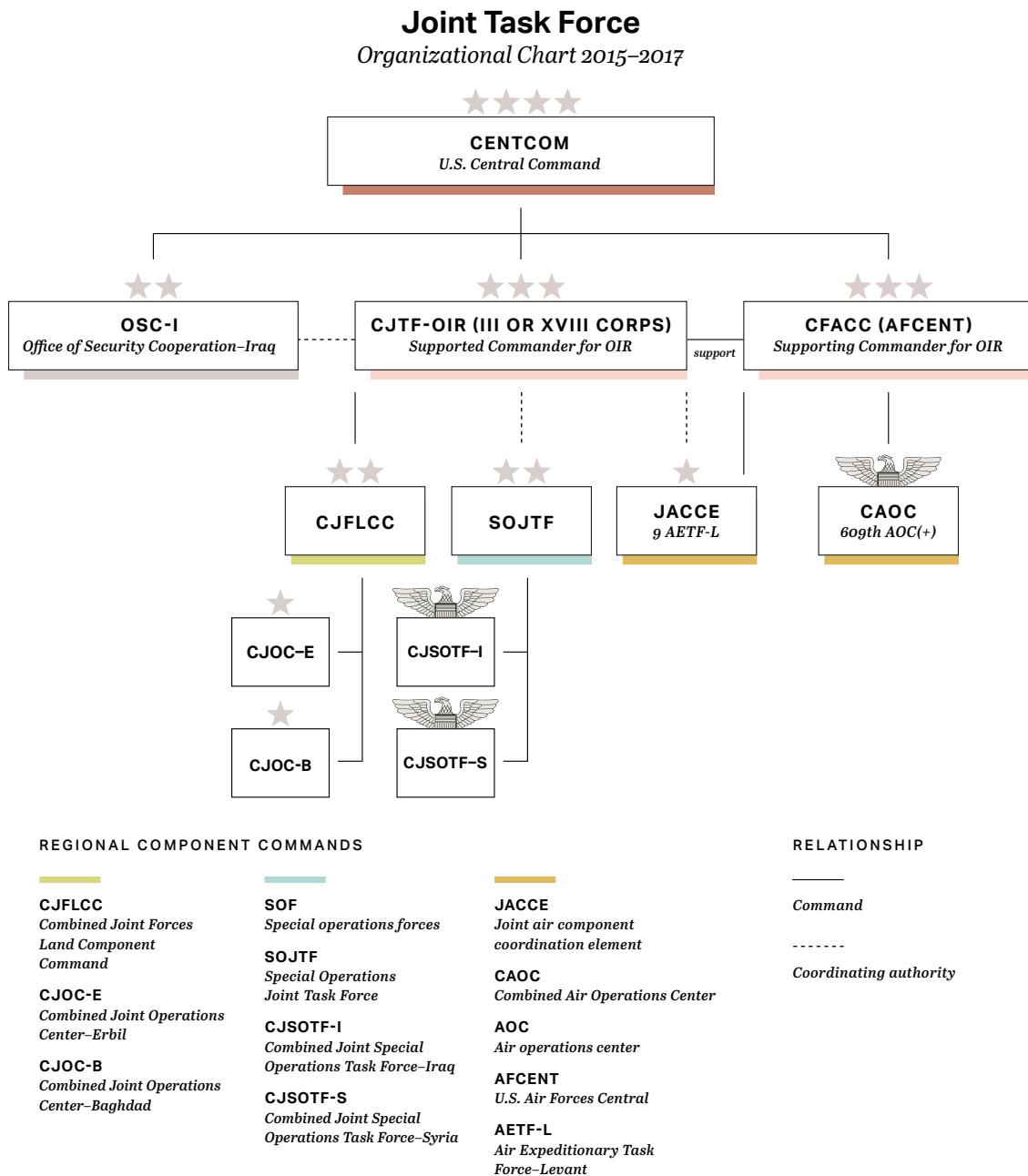
¹⁵ CJTF-OIR, “History,” 2017.

¹⁶ CJTF-OIR, “Biographies,” webpage, undated.

¹⁷ Greg Miller, “U.S. Launches Secret Drone Campaign to Hunt Islamic State Leaders in Syria,” *Washington Post*, September 1, 2015; Linda Robinson, *Assessment of the Politico-Military Campaign to Counter ISIL and Options for Adaptation*, Santa Monica, Calif.: RAND Corporation, RR-1290-OSD, 2016, pp. 44–45.

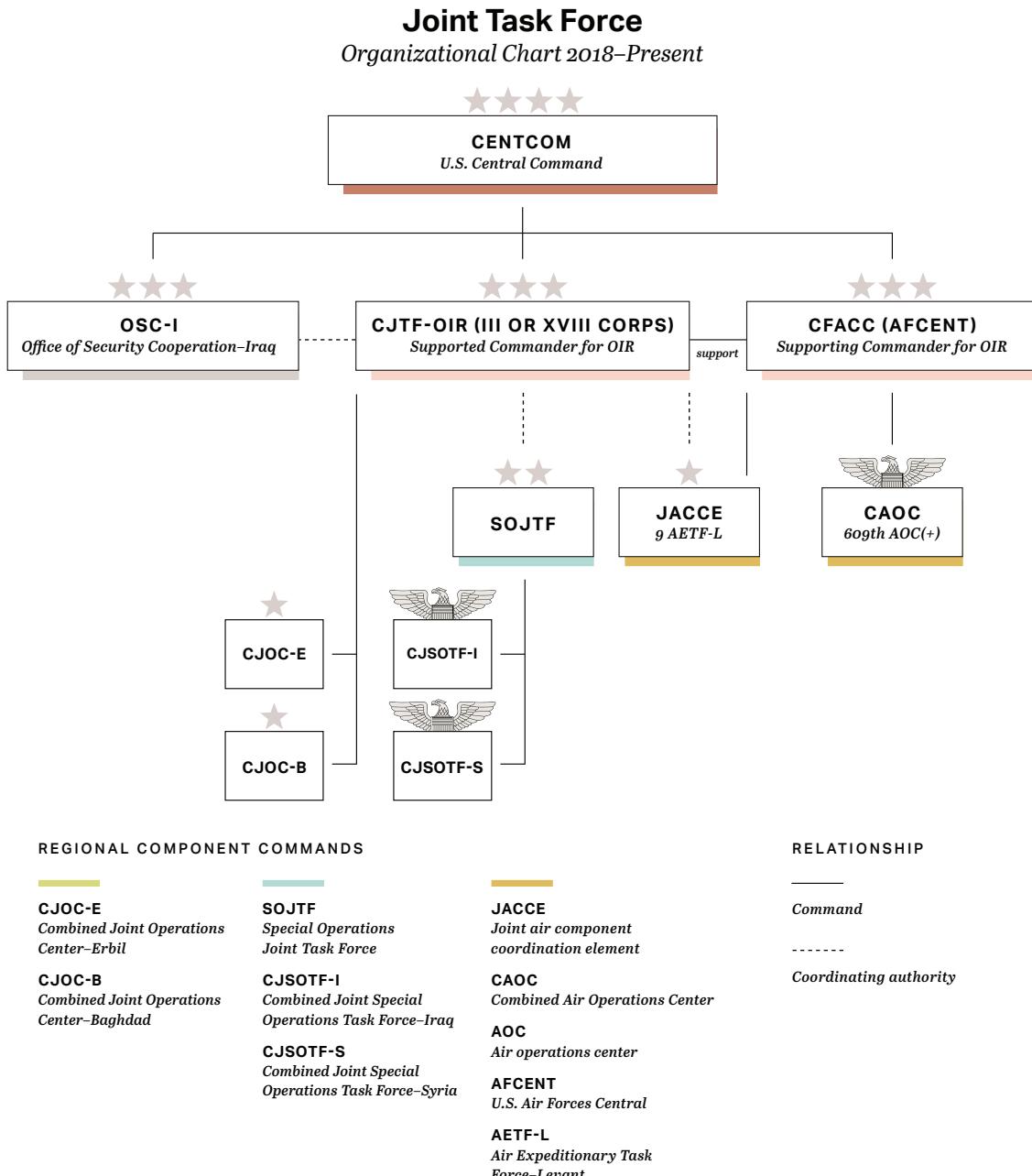
¹⁸ Ash Carter, “A Lasting Defeat: The Campaign to Destroy ISIS,” Belfer Center for Science and International Affairs, Harvard Kennedy School, October 2017, pp. 5, 15, 18; RAND interview with U.S. Army officer, March 31, 2020.

Figure B.2
CJTF-OIR Command Relationships, 2015–2017



After major ground operations against ISIS were completed in 2018, the command construct was modified again (see Figure B.3). In March 2018, CJFLCC was

Figure B.3
CJTF-OIR Command Relationships, 2018–2019



deactivated as a separate command, and much of its staff was incorporated into the CJTF-OIR headquarters.¹⁹ The CJOCs were similarly reorganized under CJTF-OIR.²⁰

¹⁹ Chad Garland, “Land Component Command Deactivates as Counter-ISIS Fight in Iraq Shifts,” *Stars and Stripes*, April 30, 2018.

²⁰ RAND interview with Maj Gen Alexus Grynkevich, December 10, 2019.

APPENDIX C

Operation Inherent Resolve Air Order of Battle

Table C.1 lists fixed-wing aircraft assigned to the 2014–2019 OIR air campaign, excluding unmanned aviation assets organic to land forces. Table C.2 lists the dates and locations of in-theater deployments of aircraft carriers and amphibious assault ships carrying fixed-wing aircraft.

Table C.1
Aircraft Participating in or Supporting OIR

Owner	Asset	Ground or Sea Base	Dates	Source
Australia				
	F/A-18F Super Hornet	Al Minhad AB, UAE	September 2014–March 2015	Australian Air Force, "Operation OKRA," webpage, undated; "Australian Operation Okra Air Combat Mission to End," <i>Australian Aviation</i> , December 22, 2017; David Eyre, "RAAF F/A-18F Super Hornets Return Home: 22–24 January 2018," <i>AviationWA</i> , January 24, 2018; "RAAF Headed Back to Iraq," <i>Australian Aviation</i> , September 14, 2014; "The RAAF in Operation Okra—'The Highest Levels of Skill, Courage and Professionalism,'" <i>Australian Aviation</i> , April 25, 2018.
	F/A-18A Hornet	Al Minhad AB, UAE	March 2015–June 2017	Australian Air Force, "Operation OKRA," webpage, undated; "Australian Operation Okra Air Combat Mission to End," <i>Australian Aviation</i> , December 22, 2017; David Eyre, "RAAF F/A-18F Super Hornets Return Home: 22–24 January 2018," <i>AviationWA</i> , January 24, 2018; "RAAF Headed Back to Iraq," <i>Australian Aviation</i> , September 14, 2014; "The RAAF in Operation Okra—'The Highest Levels of Skill, Courage and Professionalism,'" <i>Australian Aviation</i> , April 25, 2018.
	F/A-18F Super Hornet	Al Minhad AB, UAE	June 2017–January 2018	Aram S., "Operation Okra: Australia's War Against Daesh," <i>Fulda Gap</i> , March 2, 2017.

Table C.1—Continued

Owner	Asset	Ground or Sea Base	Dates	Source
E-7A Wedgetail	Al Minhad AB, UAE	September 2014–June 2018	Australian Air Force, "Operation OKRA," webpage, undated; "RAAF Headed Back to Iraq," <i>Australian Aviation</i> , September 14, 2014.	
E-7A Wedgetail	Al Minhad AB, UAE	October 2018–February 2019	Second Line of Defence, "RAF Wedgetail Returns Home from the Middle East," February 16, 2019.	
KC-30A MRTT	Al Minhad AB, UAE	September 2014–October 2018	Australian Air Force, "Operation OKRA," webpage, undated; "RAAF Headed Back to Iraq," <i>Australian Aviation</i> , September 14, 2014; Australian Department of Defence, "KC-30A Aircraft Returns from the Middle East," October 25, 2018.	
Bahrain				
F-16C Fighting Falcon	Muwaffaq Salti AB, Jordan	September 2014–February 2015	Slobodan Lekic, "Jordan Assumes Leading Role vs. Islamic State Militants," <i>Stars and Stripes</i> , February 23, 2015; Eric Schmitt and Michael R. Gordon, "As U.S. Escalates Air War on ISIS, Allies Slip Away," <i>New York Times</i> , November 7, 2015.	
F-16C Fighting Falcon	Isa AB, Bahrain	September 2014–February 2015	Eric Schmitt and Michael R. Gordon, "As U.S. Escalates Air War on ISIS, Allies Slip Away," <i>New York Times</i> , November 7, 2015.	
Belgium				
F-16AM Fighting Falcon	Muwaffaq Salti AB, Jordan	September 2014–July 2015	Philip Blenkinsop, "Belgium Set to Send Six F-16 Jets to Anti-Islamic State Coalition," Reuters, September 24, 2014; "Luftwaffe Tornados Moving to Jordan," <i>AirForces Monthly</i> , August 14, 2018; "Netherlands to Pull F-16 Fighter Jets from ISIS Mission in Iraq and Syria," <i>Defense Post</i> , September 14, 2018.	
F-16AM Fighting Falcon	Muwaffaq Salti AB, Jordan	July 2016–December 2017	"Belgian F-16 Jets Complete Their Mission in Syria and Iraq," <i>Blog Before Flight</i> , December 27, 2017; "Luftwaffe Tornados Moving to Jordan," <i>AirForces Monthly</i> , August 14, 2018.	
Canada				
CF-18A Hornet	Ahmed Al Jaber AB, Kuwait	October 2014–February 2016	Government of Canada, "Operation IMPACT," webpage, undated; Government of Canada, "Canada's CF-18 Hornets Depart for Operation Impact," press release, Ottawa, October 21, 2014.	

Table C.1—Continued

Owner	Asset	Ground or Sea Base	Dates	Source
CP-140M Aurora	Ali Al Salem AB, Kuwait	October 2014–December 2017		Government of Canada, “Operation IMPACT,” webpage, undated; Government of Canada, “Canada’s CF-18 Hornets Depart for Operation Impact,” press release, Ottawa, October 21, 2014.
CC-130J Hercules	Ali Al Salem AB, Kuwait	July 2017 ^b		Chris Barling, “Favourite Photo January 10, 2020,” <i>Canadian Military Family Magazine</i> , January 10, 2020; “Canada Extends Military Support to Global Coalition Against ISIS,” <i>Air Forces Technology</i> , July 3, 2017; Government of Canada, “Operation IMPACT,” webpage, undated; Government of Canada, “Canadian Armed Forces CC-130J Hercules Conducts First Sortie Under Operation IMPACT,” press release, Ottawa, July 12, 2017.
CC-150T Polaris	Al Mubarak AB, Kuwait	October 2014–January 2019		Government of Canada, “Operation IMPACT,” webpage, undated; Government of Canada, “Canada’s CF-18 Hornets Depart for Operation Impact,” press release, Ottawa, October 21, 2014.
Denmark				
F-16AM Fighting Falcon	Ahmed Al Jaber AB, Kuwait	October 2014–October 2015		Danish Ministry of Defence, “The Effort Against ISIL,” webpage, last updated March 4, 2020; Claire Mills, <i>ISIS/Daesh: The Military Response in Iraq and Syria</i> , London: House of Commons Library, Briefing Paper No. 06995, March 8, 2017.
F-16AM Fighting Falcon	Incirlik AB, Turkey	June 2016–December 2016		Danish Ministry of Defence, “The Effort Against ISIL,” webpage, last updated March 4, 2020; Claire Mills, <i>ISIS/Daesh: The Military Response in Iraq and Syria</i> , London: House of Commons Library, Briefing Paper No. 06995, March 8, 2017.
C-130J Super Hercules	Ahmed Al Jaber AB, Kuwait	August 2014–December 2014		Danish Ministry of Defence, “The Effort Against ISIL,” webpage, last updated March 4, 2020; Claire Mills, <i>ISIS/Daesh: The Military Response in Iraq and Syria</i> , London: House of Commons Library, Briefing Paper No. 06995, March 8, 2017.
C-130J Super Hercules	Incirlik AB, Turkey	June 2016–December 2016		Danish Ministry of Defence, “The Effort Against ISIL,” webpage, last updated March 4, 2020; “Denmark to Pull Fighter Jets Out of Syria and Iraq,” <i>The Local</i> , December 2, 2016.

Table C.1—Continued

Owner	Asset	Ground or Sea Base	Dates	Source
	C-130J Super Hercules	Al Dhafra AB, UAE	October 2018 ^b	Danish Ministry of Defence, "The Effort Against ISIL," webpage, last updated March 4, 2020; Claire Mills, <i>ISIS/Daesh: The Military Response in Iraq and Syria</i> , London: House of Commons Library, Briefing Paper No. 06995, March 8, 2017.
France—Air Force				
	Mirage 2000D	Prince Hassan AB, Jordan	November 2014–August 2016	French Ministry of Armed Forces, "Opération Chammal," press release, October 2019; "French President Visits Troops in Iraq," <i>Air and Cosmos International</i> , January 3, 2017; Aram S., "Opération Chammal: The French War Against Daesh (Part 1)," <i>Fulda Gap</i> , March 13, 2017.
	Mirage 2000N	Prince Hassan AB, Jordan	May 2016–August 2016	French Ministry of Armed Forces, "Opération Chammal," press release, October 2019; "French President Visits Troops in Iraq," <i>Air and Cosmos International</i> , January 3, 2017.
	Rafale B/C	Al Dhafra AB, UAE	September 2014 ^b	AsianDefence, "French Rafale Armed with SCALP Missiles Taking Off at Al-Dhafra Airbase in UAE," <i>Asian Defence News</i> , YouTube video, December 19, 2015; Henry Boyd, "Syria Strike: French, British and US Combat Assets," International Institute for Strategic Studies, April 12, 2018; David Cenciotti, "French Rafale Jets Conduct First Reconnaissance Mission over Iraq," <i>The Aviationist</i> , September 16, 2014; French Ministry of Armed Forces, "Opération Chammal," press release, October 2019; Laurent Lagneau, "Irak: L'aviation américaine a largué près de 40 tonnes de bombes sur une île 'infestée' par l'État islamique," <i>Zone Militaire</i> , September 12, 2019; Aram S., "Opération Chammal: The French War Against Daesh (Part 1)," <i>Fulda Gap</i> , March 13, 2017; Kareem Salem, "Comment la France peut peser davantage en Irak en cette période de pandémie," <i>Le courrier du soir</i> , April 22, 2020.

Table C.1—Continued

Owner	Asset	Ground or Sea Base	Dates	Source
Rafale B	Prince Hassan AB, Jordan	Prince Hassan AB, Jordan	August 2016–July 2018	Jeremy Binnie, "Rafale Seen with UAV Kill Marking," <i>Jane's Defence Weekly</i> , August 16, 2019; Henry Boyd, "Syria Strike: French, British and US Combat Assets," International Institute for Strategic Studies, April 12, 2018; Clement Charpentreau, "First Mission for the French A330 'Phénix,'" <i>AeroTime Hub</i> , March 29, 2019; "Drone-Killer Rafale," <i>AirForces Monthly</i> , September 17, 2018; French Ministry of Armed Forces, "Chammal: Destruction de caches d'armes de Daech," press release, September 7, 2018; French Ministry of Armed Forces, "Opération Chammal," press release, October 2019; "French President Visits Troops in Iraq," <i>Air and Cosmos International</i> , January 3, 2017; French Senate, "La Jordanie, clé de voûte de la stabilité d'un Moyen-Orient en crise," webpage, undated; Nathalie Guibert, "'L'objectif qui était de vaincre Daech n'est pas atteint': Retour sur cinq ans d'engagement de la France en Irak et en Syrie," <i>Le Monde</i> , September 18, 2019; Loïc Lauze, "French Air Force deployed six Rafale on Prince Hassan air base (Jordan), against #ISIS," Twitter post, August 28, 2016; Loïc Lauze [@DefensAero], "French Air Force Rafale C based at Prince Hassan Air base, Jordan. Bomb markings : 6 SCALP-EG cruise missile + 16/19 AASM/GBU guided bombs," Twitter post, December 29, 2016.

Table C.1—Continued

Owner	Asset	Ground or Sea Base	Dates	Source
Rafale C	Prince Hassan AB, Jordan	July 2018– ^b		Jeremy Binnie, "Rafale Seen with UAV Kill Marking," <i>Jane's Defence Weekly</i> , August 16, 2019; Henry Boyd, "Syria Strike: French, British and US Combat Assets," International Institute for Strategic Studies, April 12, 2018; Clement Charpentreau, "First Mission for the French A330 'Phénix,'" <i>AeroTime Hub</i> , March 29, 2019; "Drone-Killer Rafale," <i>AirForces Monthly</i> , September 17, 2018; French Ministry of Armed Forces, "Chammal: Destruction de caches d'armes de Daech," press release, September 7, 2018; French Ministry of Armed Forces, "Opération Chammal," press release, October 2019; "French President Visits Troops in Iraq," <i>Air and Cosmos International</i> , January 3, 2017; French Senate, "La Jordanie, clé de voûte de la stabilité d'un Moyen-Orient en crise," webpage, undated; Nathalie Guibert, "'L'objectif qui était de vaincre Daech n'est pas atteint': Retour sur cinq ans d'engagement de la France en Irak et en Syrie," <i>Le Monde</i> , September 18, 2019; Loïc Lauze, "French Air Force deployed six Rafale on Prince Hassan air base (Jordan), against #ISIS," Twitter post, August 28, 2016; Loïc Lauze [@DefensAero], "French Air Force Rafale C based at Prince Hassan Air base, Jordan. Bomb markings : 6 SCALP-EG cruise missile + 16/19 AASM/GBU guided bombs," Twitter post, December 29, 2016.
Atlantique 2	Al Dhafra AB, UAE	September 2014–February 2016		French Ministry of Armed Forces, "Opération Chammal," press release, October 2019; Aram S., "Opération Chammal: The French War Against Daesh (Part 1)," <i>Fulda Gap</i> , March 13, 2017.
Atlantique 2	Prince Hassan AB, Jordan	February 2016– ^b		French Ministry of Armed Forces, "CHAMMAL: Fin de Mission pour un ATL2 Déployé au Levant," May 20, 2019; French Ministry of Armed Forces, "Chammal—En Mission avec l'Atlantique 2," September 13, 2019; French Ministry of Armed Forces, "Opération Chammal," press release, October 2019; "French President Visits Troops in Iraq," <i>Air and Cosmos International</i> , January 3, 2017; Jean-Marc Tanguy, "La Discrète Base Depuis Laquelle on Pilonne Daech," <i>L'Édition du soir</i> , February 6, 2017.

Table C.1—Continued

Owner	Asset	Ground or Sea Base	Dates	Source
E-3F Sentry	Al Dhafra AB, UAE	Temporary deployments in 2014, 2015, 2017, and 2019		Ian D'Costa, "These Aircraft Took Part in the Strike on Syria," <i>We Are the Mighty</i> , April 19, 2018; French Ministry of Armed Forces, "Opération Chammal," press release, October 2019; Aram S., "Opération Chammal: The French War Against Daesh (Part 1)," <i>Fulda Gap</i> , March 13, 2017.
C-135FR Stratotanker	Al Dhafra AB, UAE	Temporary deployments in 2014, 2015, and 2017		French Ministry of Armed Forces, "Chammal: Première Frappe en Syrie," press release, September 28, 2015; French Ministry of Armed Forces, "Opération Chammal," press release, October 2019; Aram S., "Opération Chammal: The French War Against Daesh (Part 1)," <i>Fulda Gap</i> , March 13, 2017.
France—Navy				
Rafale M	<i>Charles de Gaulle</i>	February 2015–April 2015		Agence France-Presse, "French Aircraft Carrier in Gulf for IS Fight," <i>DefenseNews</i> , February 23, 2015.
Super Etendard	<i>Charles de Gaulle</i>	February 2015–April 2015		Agence France-Presse, "French Aircraft Carrier in Gulf for IS Fight," <i>DefenseNews</i> , February 23, 2015.
E-2C Hawkeye	<i>Charles de Gaulle</i>	February 2015–April 2015		Mohammed Mahmoud, "French Forces Continue Fight Against ISIS in the Region," <i>Diyaruna</i> , April 24, 2019; Dylan Malyasov, "US and French Carrier Strike Groups Take Part in Maritime Exercise in Red Sea," <i>Defence Blog</i> , April 2019; Xavier Vavasseur, "French Carrier Strike Group Underway for 'Mission Clemenceau,'" <i>Naval News</i> , March 9, 2019.
Rafale M	<i>Charles de Gaulle</i>	November 2015–March 2016		"French Carrier Strike Group to Deploy to Eastern Mediterranean with Largest Airwing Ever," <i>Navy Recognition</i> , November 16, 2015; Sam LaGrone, "France Sending Carrier Charles de Gaulle Back to ISIS Fight Later This Year," <i>USNI News</i> , July 14, 2016.
Super Etendard	<i>Charles de Gaulle</i>	November 2015–March 2016		"French Carrier Strike Group to Deploy to Eastern Mediterranean with Largest Airwing Ever," <i>Navy Recognition</i> , November 16, 2015; Sam LaGrone, "France Sending Carrier Charles de Gaulle Back to ISIS Fight Later This Year," <i>USNI News</i> , July 14, 2016.

Table C.1—Continued

Owner	Asset	Ground or Sea Base	Dates	Source
E-2C Hawkeye	<i>Charles de Gaulle</i>		November 2015–March 2016	"French Carrier Strike Group to Deploy to Eastern Mediterranean with Largest Airwing Ever," <i>Navy Recognition</i> , November 16, 2015; Sam LaGrone, "France Sending Carrier Charles de Gaulle Back to ISIS Fight Later This Year," <i>USNI News</i> , July 14, 2016.
Rafale M	<i>Charles de Gaulle</i>		September 2016–December 2016	Chris Church, "Anti-Islamic State Coalition Losing French Flattop," <i>Stars and Stripes</i> , November 30, 2016; Fred Pleitgen, "On Board the French Nuclear Carrier Battling ISIS," CNN, October 17, 2016.
E-2C Hawkeye	<i>Charles de Gaulle</i>		September 2016–December 2016	Mohammed Mahmoud, "French Forces Continue Fight Against ISIS in the Region," Diyaruna, April 24, 2019; Dylan Malyasov, "US and French Carrier Strike Groups Take Part in Maritime Exercise in Red Sea," <i>Defence Blog</i> , April 2019; Xavier Vavasseur, "French Carrier Strike Group Underway for 'Mission Clemenceau,'" <i>Naval News</i> , March 9, 2019.
Rafale M	<i>Charles de Gaulle</i>		February 2019 ^b	Mohammed Mahmoud, "French Forces Continue Fight Against ISIS in the Region," Diyaruna, April 24, 2019; Dylan Malyasov, "US and French Carrier Strike Groups Take Part in Maritime Exercise in Red Sea," <i>Defence Blog</i> , April 2019; Xavier Vavasseur, "French Carrier Strike Group Underway for 'Mission Clemenceau,'" <i>Naval News</i> , March 9, 2019.
E-2C Hawkeye	<i>Charles de Gaulle</i>		February 2019 ^b	Mohammed Mahmoud, "French Forces Continue Fight Against ISIS in the Region," Diyaruna, April 24, 2019; Dylan Malyasov, "US and French Carrier Strike Groups Take Part in Maritime Exercise in Red Sea," <i>Defence Blog</i> , April 2019; Xavier Vavasseur, "French Carrier Strike Group Underway for 'Mission Clemenceau,'" <i>Naval News</i> , March 9, 2019.
Germany				
Tornado IDS/ ECR	Incirlik AB, Turkey		December 2015–September 2017	"Germany to Start Moving Anti-ISIS Planes to Jordan in July," <i>Military Times</i> , June 18, 2017.
Tornado IDS/ ECR	Muwaffaq Salti AB, Jordan		October 2017–April 2020	Nicholas Fiorenza and Paolo Valpolini, "Germany to End Anti-IS Tornado Reconnaissance Mission," <i>Jane's Defence Weekly</i> , March 17, 2020; "Germany to Start Moving Anti-ISIS Planes to Jordan in July," <i>Military Times</i> , June 18, 2017; "Tornados der Bundeswehr zurück in Deutschland," <i>Deutsche Welle</i> , April 2, 2020.

Table C.1—Continued

Owner	Asset	Ground or Sea Base	Dates	Source
A310-304 MRTT	Incirlik AB, Turkey	December 2015–June 2017	"Germany to Start Moving Anti-ISIS Planes to Jordan in July," <i>Military Times</i> , June 18, 2017.	
A310-304 MRTT	Muwaffaq Salti AB, Jordan	July 2017 ^b	Nicholas Fiorenza and Paolo Valpolini, "Germany to End Anti-IS Tornado Reconnaissance Mission," <i>Jane's Defence Weekly</i> , March 17, 2020; "Germany to Start Moving Anti-ISIS Planes to Jordan in July," <i>Military Times</i> , June 18, 2017; "Tornados der Bundeswehr zurück in Deutschland," <i>Deutsche Welle</i> , April 2, 2020.	
Iraq				
Su-25	Al Rasheed AB, Iraq	June 2014 ^b	Loaa Adel, "Iraq Has 21 Sukhoi Aircraft," <i>Iraqi News</i> , September 5, 2016; David Donald, "Iran and Russia Send Sukhois to Iraq," <i>AIN Online</i> , July 2, 2014; Rod Nordland, "Russian Jets and Experts Sent to Iraq to Aid Army," <i>New York Times</i> , June 29, 2014.	
F-16C Fighting Falcon	Balad AB, Iraq	September 2015 ^b	Agence France-Presse, "Iraq Uses New F-16 Jets for First Time in Raids Against Islamic State," <i>The Guardian</i> , September 6, 2015; Ellen Ioanes and Lara Seligman, "Iraqi F-16s Could Be in Jeopardy amid Iran Tensions," <i>Foreign Policy</i> , January 30, 2020.	
Italy				
Tornado IDS	Ahmed Al Jaber AB, Kuwait	October 2014–June 2016	David Cenciotti, "Italian Typhoons Deployed to Kuwait Celebrated 2,000 Flight Hours with a Cool 'Tetris Challenge,'" <i>The Aviationist</i> , March 11, 2020; Italian Air Force, "Kuwait," webpage, undated.	
A-11B Ghibli	Ahmed Al Jaber AB, Kuwait	June 2016–March 2019	David Cenciotti, "Italian Typhoons Deployed to Kuwait Celebrated 2,000 Flight Hours with a Cool 'Tetris Challenge,'" <i>The Aviationist</i> , March 11, 2020; Italian Air Force, "Kuwait," webpage, undated.	
Typhoon	Ahmed Al Jaber AB, Kuwait	March 2019 ^b	David Cenciotti, "Italian Typhoons Deployed to Kuwait Celebrated 2,000 Flight Hours with a Cool 'Tetris Challenge,'" <i>The Aviationist</i> , March 11, 2020; Italian Air Force, "Kuwait," webpage, undated.	
MQ-1C Predator	Ali Al Salem AB, Kuwait	October 2014 ^b	David Cenciotti, "Italian Typhoons Deployed to Kuwait Celebrated 2,000 Flight Hours with a Cool 'Tetris Challenge,'" <i>The Aviationist</i> , March 11, 2020; Italian Air Force, "Kuwait," webpage, undated.	

Table C.1—Continued

Owner	Asset	Ground or Sea Base	Dates	Source
	EC-27J Jedi	Ahmed Al Jaber AB, Kuwait	July 2016– ^b	David Cenciotti, "Italian Typhoons Deployed to Kuwait Celebrated 2,000 Flight Hours with a Cool 'Tetris Challenge,'" <i>The Aviationist</i> , March 11, 2020; Italian Air Force, "Kuwait," webpage, undated.
	KC-767A	Al Mubarak AB, Kuwait	October 2014– ^b	David Cenciotti, "Italian Typhoons Deployed to Kuwait Celebrated 2,000 Flight Hours with a Cool 'Tetris Challenge,'" <i>The Aviationist</i> , March 11, 2020; Italian Air Force, "Kuwait," webpage, undated; Italian Ministry of Defence, "Italian Air Force: A KC-767A Aircraft Completes First Refueling Operations in Support of the Anti-ISIS Coalition," press release, October 29, 2014; Italian Ministry of Defence, "Kuwait: 3000 ore di volo per i KC-767 rischierati presso la Task Force Air," press release, January 10, 2017.
Jordan				
	F-16AM/BM Fighting Falcon	Muwaffaq Salti AB, Jordan	October 2014–August 2015	"Luftwaffe Tornados Moving to Jordan," <i>AirForces Monthly</i> , August 14, 2018; Kathleen J. McInnis, <i>Coalition Contributions to Countering the Islamic State</i> , Washington, D.C.: Congressional Research Service, August 24, 2016; Eric Schmitt and Michael R. Gordon, "As U.S. Escalates Air War on ISIS, Allies Slip Away," <i>New York Times</i> , November 7, 2015.
Morocco				
	F-16C/D Fighting Falcon	Al Dhafra AB, UAE	December 2014–March 2015 ^a	"Moroccan F-16 Carry Out Airstrikes Against ISIS," <i>Morocco World News</i> , December 10, 2014.
NATO				
	E-3A Sentry	FOB Konya, Turkey	February 2016– ^b	Eliot E. G. Jordan, "NATO Deploys E-3 Sentry AWACS Aircraft to Turkey," <i>UK Defence Journal</i> , February 11, 2016.
Netherlands				

Table C.1—Continued

Owner	Asset	Ground or Sea Base	Dates	Source
	F-16AM Fighting Falcon	Muwaffaq Salti AB, Jordan	October 2014–July 2016	Thomas Escritt, "Dutch Jets to Join Bombing of Islamic State Targets in Syria," Reuters, January 29, 2016; Government of the Netherlands, "Netherlands to Make Military Contribution to Fight Against ISIS," press release, September 24, 2014; "Luftwaffe Tornados Moving to Jordan," <i>AirForces Monthly</i> , August 14, 2018.
	F-16AM Fighting Falcon	Muwaffaq Salti AB, Jordan	June 2017–December 2018	"Netherlands to Pull F-16 Fighter Jets from ISIS Mission in Iraq and Syria," <i>Defense Post</i> , September 14, 2018.
New Zealand				
	C-130H Hercules	Al Minhad AB, UAE	June 2016–December 2016	Michael Brissenden, "Al Minhad Air Base: A Closer Look at Australia's Base for Operations in the Middle East," ABC News, September 15, 2014; New Zealand Defence Force, "Middle East," webpage, undated; New Zealand Defence Force, "NZDF Contributes to 'Lifeblood' of Coalition Operations in Middle East," Medium, August 12, 2018.
	C-130H Hercules	Al Minhad AB, UAE	May 2018–December 2018	Michael Brissenden, "Al Minhad Air Base: A Closer Look at Australia's Base for Operations in the Middle East," ABC News, September 15, 2014; New Zealand Defence Force, "Middle East," webpage, undated; New Zealand Defence Force, "NZDF Contributes to 'Lifeblood' of Coalition Operations in Middle East," Medium, August 12, 2018.
Poland				
	F-16C Fighting Falcon	Ahmed Al Jaber AB, Kuwait	July 2016–December 2016	Kurdistan Regional Government Representation in Poland, "Poland Sent F-16 Fighter Aircraft, 200 Soldiers to Iraq and Kuwait," press release, June 19, 2016; U.S. Department of Defense, "Carter Lauds Poland's Expansion, New Zealand's Extension of Counter-ISIL Roles," June 21, 2016.
Qatar				
	Mirage 2000-5EDA	Doha International AB, Qatar	September 2014–February/April 2015	"Emiri Air Force Transferred £1m of Support for Anti-IS Operation," <i>The Peninsula</i> , November 24, 2017; "Qatar Emiri Air Force Marks Milestone in Fight Against ISIS," <i>Qatar Tribune</i> , November 23, 2017; U.S. Department of Defense, "Mattis, Qatari Minister Discuss Defeat-ISIS Campaign," July 7, 2017.

Table C.1—Continued

Owner	Asset	Ground or Sea Base	Dates	Source
	C-17A Globemaster III	AUAB, Qatar	June 2017 ^b	"Emiri Air Force Transferred £1m of Support for Anti-IS Operation," <i>The Peninsula</i> , November 24, 2017; "Qatar Emiri Air Force Marks Milestone in Fight Against ISIS," <i>Qatar Tribune</i> , November 23, 2017; U.S. Department of Defense, "Mattiis, Qatari Minister Discuss Defeat-ISIS Campaign," July 7, 2017.
	C-130J-30 Super Hercules	AUAB, Qatar	June 2017 ^b	Interview with UK Foreign Office official, April 16, 2020.
Saudi Arabia				
	Tornado IDS	King Abdulaziz AB, Saudi Arabia	September 2014–September 2015	Tom Sykes, "Saudi Prince Joins ISIS Bombing Run," <i>Daily Beast</i> , April 14, 2017.
	F-15S Strike Eagle	King Abdulaziz AB, Saudi Arabia	September 2014–September 2015	Jon Lake, "Gulf Air Forces Display New-Found Confidence," <i>Janes</i> , February 22, 2015.
	F-15S Strike Eagle	Incirlik AB, Turkey	February 2016–June 2018 ^a	Medul Srivastava and Sam Jones, "Saudi War Planes Begin Arriving at Turkey's Incirlik Air Base," <i>Financial Times</i> , February 25, 2016.
	Typhoon	King Fahad AB, Saudi Arabia	February 2015–September 2015	Andrew Chuter, "Saudi Typhoons Use Paveway IV Bombs on ISIS," <i>Defense News</i> , February 25, 2015.
Singapore				
	KC-135R Stratotanker	AUAB, Qatar	November 2014–February 2015	Agence France-Presse, "Singapore to Join Coalition Against Islamic State," <i>inSing.com</i> , November 4, 2014.
	KC-135R Stratotanker	AUAB, Qatar	May 2015–August 2015	"Parliament: SAF to Deploy Imagery Analysis Team for Another Year to Help Anti-ISIS Coalition," <i>Straits Times</i> , January 28, 2016.
	KC-135R Stratotanker	AUAB, Qatar	May 2016–August 2016	Alexander W. Riedel, "Powering Partnerships: Singapore Tankers Boost Coalition Forces, Bring Fuel to Fight, Air Combat Command," <i>Air Combat Command</i> , September 7, 2017.

Table C.1—Continued

Owner	Asset	Ground or Sea Base	Dates	Source
	KC-135R Stratotanker	AUAB, Qatar	June 2017–September 2017	Fabian Koh, "RSAF Completes Three-Month Deployment to Help Fight ISIS in Middle East," <i>Straits Times</i> , September 4, 2017; Dario Leone, "Republic of Singapore Air Force KC-135R Completes Three-Month in Support of Operation Inherent Resolve," <i>Aviation Geek Club</i> , September 23, 2017.
Turkey				
	F-16C/D Fighting Falcon	Diyarbakir AB, Turkey	July 2015– ^b	Jon T. Rymer, Steve A. Linick, and Catherine M. Trujillo, <i>Operation Inherent Resolve</i> , report to Congress, Washington, D.C.: Lead Inspector General for Overseas Contingency Operations, September 30, 2015; "Şehit Yalçın kimdir? IŞİD'e operasyonun adı Şehit Yalçın oldu!" <i>Sözcü</i> , July 25, 2015; Ceylan Yeginisu, "Turkey, Anticipating Attack, Strikes 3 ISIS Targets in Syria with Jets," <i>New York Times</i> , July 24, 2015.
	F-16C/D Fighting Falcon	Incirlik AB, Turkey	July 2015– ^b	Jon T. Rymer, Steve A. Linick, and Catherine M. Trujillo, <i>Operation Inherent Resolve</i> , report to Congress, Washington, D.C.: Lead Inspector General for Overseas Contingency Operations, September 30, 2015; "Şehit Yalçın kimdir? IŞİD'e operasyonun adı Şehit Yalçın oldu!" <i>Sözcü</i> , July 25, 2015; Ceylan Yeginisu, "Turkey, Anticipating Attack, Strikes 3 ISIS Targets in Syria with Jets," <i>New York Times</i> , July 24, 2015.
	TB2	Batman AB, Turkey	July 2015– ^b	Chris Biggers, "Turkish Bayraktar TB2 Flying from Batman," <i>Bellingcat</i> , October 13, 2016; Tim Ripley, "Turkish UAVs Played Leading Role in Idlib Battle," <i>Janes</i> , March 6, 2020; Jon T. Rymer, Steve A. Linick, and Catherine M. Trujillo, <i>Operation Inherent Resolve</i> , report to Congress, Washington, D.C.: Lead Inspector General for Overseas Contingency Operations, September 30, 2015; "Şehit Yalçın kimdir? IŞİD'e operasyonun adı Şehit Yalçın oldu!" <i>Sözcü</i> , July 25, 2015; Ceylan Yeginisu, "Turkey, Anticipating Attack, Strikes 3 ISIS Targets in Syria with Jets," <i>New York Times</i> , July 24, 2015.

Table C.1—Continued

Owner	Asset	Ground or Sea Base	Dates	Source
Heron	Batman AB, Turkey		July 2015– ^b	Chris Biggers, "Turkish Bayraktar TB2 Flying from Batman," Bellingcat, October 13, 2016; Tim Ripley, "Turkish UAVs Played Leading Role in Idlib Battle," Janes, March 6, 2020; Jon T. Rymer, Steve A. Linick, and Catherine M. Trujillo, <i>Operation Inherent Resolve</i> , report to Congress, Washington, D.C.: Lead Inspector General for Overseas Contingency Operations, September 30, 2015; "Şehit Yalçın kimdir? IŞİD'e operasyonun adı Şehit Yalçın oldu!" Sözcü, July 25, 2015; Ceylan Yeginisu, "Turkey, Anticipating Attack, Strikes 3 ISIS Targets in Syria with Jets," <i>New York Times</i> , July 24, 2015.
Anka	Batman AB, Turkey		July 2017– ^b	Chris Biggers, "Turkish Bayraktar TB2 Flying from Batman," Bellingcat, October 13, 2016; Arun Mathew, "TAI Anka MALE UAV Conducts First Air Strike," <i>DefPost</i> , July 17, 2017; Jon T. Rymer, Steve A. Linick, and Catherine M. Trujillo, <i>Operation Inherent Resolve</i> , report to Congress, Washington, D.C.: Lead Inspector General for Overseas Contingency Operations, September 30, 2015; "Şehit Yalçın kimdir? IŞİD'e operasyonun adı Şehit Yalçın oldu!" Sözcü, July 25, 2015; Ceylan Yeginisu, "Turkey, Anticipating Attack, Strikes 3 ISIS Targets in Syria with Jets," <i>New York Times</i> , July 24, 2015.
United Arab Emirates				
F-16E/F Desert Falcon	Al Dhafra AB, UAE	September 2014–December 2014		Jason Hanna and Tim Lister, "UAE Resumes Anti-ISIS Strikes," CNN, February 10, 2015; "Islamic State Crisis: UAE Sends F-16 Squadron to Jordan," BBC, February 5, 2015; Jon Lake, "Gulf Air Forces Display New-Found Confidence," Janes, February 22, 2015; Eric Schmitt and Michael R. Gordon, "As U.S. Escalates Air War on ISIS, Allies Slip Away," <i>New York Times</i> , November 7, 2015.
F-16E/F Desert Falcon	Muwaffaq Salti AB, Jordan	February 2015–March 2015		Jason Hanna and Tim Lister, "UAE Resumes Anti-ISIS Strikes," CNN, February 10, 2015; "Islamic State Crisis: UAE Sends F-16 Squadron to Jordan," BBC, February 5, 2015; Jon Lake, "Gulf Air Forces Display New-Found Confidence," Janes, February 22, 2015; Eric Schmitt and Michael R. Gordon, "As U.S. Escalates Air War on ISIS, Allies Slip Away," <i>New York Times</i> , November 7, 2015.

Table C.1—Continued

Owner	Asset	Ground or Sea Base	Dates	Source
United Kingdom				
	Tornado GR4	RAF Akrotiri, Cyprus	September 2014–February 2019	Richard Norton-Taylor, "RAF Steps Up Iraq and Syria Spying Missions in 'New Battle of Britain,'" <i>The Guardian</i> , July 16, 2015; Royal Air Force, "The End of an Era: RAF Tornado Returns from Operations for the Last Time," press release, February 5, 2019; UK House of Commons Defence Committee, <i>UK Military Operations in Syria and Iraq</i> , London, September 13, 2016.
	Typhoon FGR4	RAF Akrotiri, Cyprus	December 2015 ^b	"RaF Jets Leave Scotland to Join Syria Action," BBC, December 3, 2015; UK House of Commons Defence Committee, <i>UK Military Operations in Syria and Iraq</i> , London, September 13, 2016.
	E-3D Sentry AEW1	RAF Akrotiri, Cyprus	January 2015 ^b	Craig Hoyle, "UK Details Extent of Combat Activity over Iraq," FlightGlobal, March 2, 2015; Carla Prater, "The E-3D Sentry Arrives in RAF Akrotiri," Forces.net, January 28, 2015; UK House of Commons Defence Committee, <i>UK Military Operations in Syria and Iraq</i> , London, September 13, 2016.
	MQ-9A Reaper	Ali Al Salem AB/Ahmed Al Jaber AB, Kuwait	October 2014–November 2016 ^a	Chris Biggers, "More and More Killer Drones Take Aim at Islamic State's Bosses," <i>War Is Boring</i> , March 17, 2015; Thomas Newdick, "Fighting Fascism," <i>Armada International</i> , June–July 2016; Mark Nicol, "Seconds from Oblivion: How an RAF Pilot in a UK Aircraft Hanger Diverted a £50,000 Missile Shot from a Drone to Avoid a Passer-By in the Iraqi Desert," <i>Daily Mail</i> , September 24, 2016; Chris Pocock, "UK Will Pay \$1 Billion to Bolster Reaper UAV Fleet," AIN Online, November 22, 2016.
	MQ-9A Reaper	RAF Akrotiri, Cyprus	October 2014 ^b	Simond de Galbert, "After the Paris Attacks, a European Anti-ISIS Coalition Comes Together," Center for Strategic and International Studies, December 3, 2015; Craig Hoyle, "UK Details Extent of Combat Activity over Iraq," FlightGlobal, March 2, 2015; Richard Norton-Taylor, "RAF Steps Up Iraq and Syria Spying Missions in 'New Battle of Britain,'" <i>The Guardian</i> , July 16, 2015; Beth Stevenson, "RAF Reapers to Operate over Iraq," FlightGlobal, October 16, 2014; UK House of Commons Defence Committee, <i>UK Military Operations in Syria and Iraq</i> , London, September 13, 2016.

Table C.1—Continued

Owner	Asset	Ground or Sea Base	Dates	Source
	RC-135W Airseeker	AUAB, Qatar/RAF Akrotiri, Cyprus	September 2014 ^b	Richard Norton-Taylor, "RAF Prepares Jets to Strike Isis Targets in Iraq," <i>The Guardian</i> , September 23, 2014; Richard Norton-Taylor, "RAF Steps Up Iraq and Syria Spying Missions in 'New Battle of Britain,'" <i>The Guardian</i> , July 16, 2015; UK House of Commons Defence Committee, <i>UK Military Operations in Syria and Iraq</i> , London, September 13, 2016; "What Is the UK's Military Commitment in Iraq?" BBC, August 18, 2014.
	Sentinel R.1	RAF Akrotiri, Cyprus	March 2015 ^b	Government of the United Kingdom, "UK Troops to Train Moderate Syrian Opposition," March 26, 2015; Richard Norton-Taylor, "RAF Steps Up Iraq and Syria Spying Missions in 'New Battle of Britain,'" <i>The Guardian</i> , July 16, 2015; UK House of Commons Defence Committee, <i>UK Military Operations in Syria and Iraq</i> , London, September 13, 2016.
	A330 Voyager	RAF Akrotiri, Cyprus	December 2015 ^b	Tom Batchelor and John Ingham, "It's WAR: RAF Tornados Bomb ISIS Strongholds in Syria in Two Waves Just 57 Mins After Vote," <i>The Express</i> , December 29, 2015; Craig Hoyle, "UK Details Extent of Combat Activity over Iraq," <i>FlightGlobal</i> , March 2, 2015; UK House of Commons Defence Committee, <i>UK Military Operations in Syria and Iraq</i> , London, September 13, 2016.
	C-130J Hercules	RAF Akrotiri, Cyprus	August 2014 ^b	Robert Beckhusen, "The A-10 Warthog Is Back in Iraq—and Just in Time: Attack Jets Prep for War as Ramadi Defenders Make Do Without Air Support," <i>War Is Boring</i> , November 26, 2014; David Cenciotti, "These Stunning Images of the US A-10 Thunderbolts in Kuwait Say a Lot About Their Missions Against ISIS," <i>The Aviationist</i> , March 3, 2015; Tom Philpott, "A-10 Pilot Talks About War on ISIS Forces," <i>Military.com</i> , April 9, 2015; Jeff Schogol, "A-10 Attacking Islamic State Targets in Iraq," <i>Military Times</i> , December 18, 2014.
United States—USAF	A-10 Thunderbolt II	Ahmed Al Jaber AB, Kuwait	November 2014–May 2015	Ramon A. Adelan, "Cleared Hot: Red Tails A-10 Pilot Spits Fire in the Fight Against ISIS," <i>U.S. Air Forces Central</i> , July 17, 2017; Chad Garland, "A-10 Warthog Drops 2K Pound Bunker-Buster on ISIS Sniper Nest in Raqqqa," <i>Military.com</i> , August 31, 2017; Jeff Schogol, "A-10s Deploy to Turkey to Fight ISIS," <i>Air Force Times</i> , October 20, 2015; Ceaira Young and Andrea Jenkins, "74th Fighter Squadron Returns Home," <i>Ninth Air Force</i> , January 19, 2018.

Table C.1—Continued

Owner	Asset	Ground or Sea Base	Dates	Source
A-10 Thunderbolt II	Incirlik AB, Turkey	October 2015–January 2018	Ian Duncan, "Maryland Air National Guard Deploying to Fight ISIS," <i>Baltimore Sun</i> , February 20, 2016; Brian W. Everstine, "The A-10 Operations Tempo Against ISIS," <i>Air Force Magazine</i> , April 13, 2017; Todd Miller, "Mission Ready A-10s of the 104th Fighter Squadron Deploy to the Middle East," Second Line of Defense, October 17, 2016.	
A-10 Thunderbolt II	Ahmed Al Jaber AB, Kuwait	October 2016–January 2017	"AF Week in Photos," <i>Mirage News</i> , March 21, 2020; Michael R. Gordon, "Kurds, Heading into the Teeth of ISIS, Open a New Front," <i>New York Times</i> , October 20, 2016; James Gordon Meek and Lee Ferran, "Secret Mission to Rescue US Hostages 'Flawless,' Except for the Rescue," ABC News, August 21, 2014; Jack Murphy, "Kurdish YPG Gets American AC-130 Gunship Support in Syria," <i>SOFREP</i> , April 27, 2015; Kris Osborn, "The Upgraded AC-130 Is the Ultimate Gunship," <i>National Interest</i> , December 20, 2019; Kyle Rempfer, "AC-130 Gunships Are Using This Rifle Sight to 'Zero-In' on Bad Guys," <i>Military Times</i> , August 7, 2018; Brian Schatz, "More Bombs, More Boots: The US War on ISIS Is Heating Up," <i>Mother Jones</i> , February 5, 2016; Joseph Trevithick, "American General Says 'Adversaries' Are Jamming AC-130 Gunships in Syria," <i>The Drive</i> , April 25, 2018.	
AC-130U Spooky	Ali Al Salem AB, Kuwait	August 2014– ^b	Brad Lendon, "B-1 Bombers Pulled from ISIS Fight," CNN, February 20, 2016; Joe Pappalardo, "Year One: Inside the Air War Against ISIS," <i>Popular Mechanics</i> , September 21, 2015.	
B-1B Lancer	AUAB, Qatar	September 2014–September 2016	Brian W. Everstine, "No Bombers Deployed to CENTCOM After B-1s Return Home," <i>Air Force Magazine</i> , March 29, 2019; Oriana Pawlyk, "The US Air Force's B-1B Bomber Is Headed Join the Fight Against ISIS and the Taliban," <i>Business Insider</i> , April 2, 2018.	

Table C.1—Continued

Owner	Asset	Ground or Sea Base	Dates	Source
B-1B Lancer	AUAB, Qatar		March 2018–March 2019	Associated Press, "B-52 Bomber Jets from Minot Deployed to Middle East," <i>Rapid City Journal</i> , March 16, 2017; Ben Brimelow, "The B-52 Bomber Is Leaving the Middle East After a Record-Breaking Run Against ISIS," <i>Business Insider</i> , April 17, 2018; Jordan Castelan, "Cockpit Colors," photograph, U.S. Department of Defense, February 13, 2017; Eloise Ogden, "Minot Air Force Base B-52 Bombers Fight ISIS in Middle East," <i>Minot Daily News</i> , October 14, 2017; Oriana Pawlyk, "Inside the Air Force's Largest Fuel Farm in Fight vs. ISIS," Military.com, August 19, 2017; Lex Talamo, "Barksdale Airmen Return from Qatar Anti-Terrorist Operation," <i>Shreveport Times</i> , September 19, 2016; U.S. Air Forces Central, "B-52 Stratofortress Joins Coalition Team," April 9, 2016.
B-52H Stratofortress	AUAB, Qatar		April 2016–April 2018	"F-15 Eagles to Return from Incirlik," <i>AMSCOM</i> , December 16, 2015; "F-15Es Arrive at Incirlik Air Base," U.S. Air Forces in Europe–Air Forces Africa, November 12, 2015; Richard Sisk, "US Air Force Begins Withdrawing F-15 Fighter Jets from Turkey," Military.com, December 16, 2015.
F-15C Eagle	Incirlik AB, Turkey		November 2015–December 2015	Kentavist P. Brackin, "Maintainers Brave Halon, Fire to Save F-15 Aircrew," U.S. Air Forces Central, February 18, 2016; Rajiv Chandrasekaran, "In the UAE, the United States Has a Quiet, Potent Ally Nicknamed 'Little Sparta,'" <i>Washington Post</i> , November 9, 2014; Brian W. Everstine, "F-22s Take Break from Middle East Combat to Increase Readiness, Reassess Basing," <i>Air Force Magazine</i> , March 5, 2019; Stephen Losey, "F-15E Strike Eagles Deploy to Al Dhafra," <i>Air Force Times</i> , October 24, 2019; Lukas Mikelionis, "US Squadron of F-15E Fighters Arrive in UAE amid Iran Tensions," Fox News, June 18, 2019; "Picture of the Day: Air Force F-22 to Receive Fuel from a KC-10 Extender over Syria," SOFREP, March 15, 2018; Tyler Rogoway, "Nearly All F-15Es Photographed Arriving in Middle East Carried Dragon's Eye Radar Pods," <i>The Drive</i> , July 10, 2019; Tactical Blueprint, "F15-E Taxi and Take Off Stringer, Al Dhafra Air Base," YouTube video, December 1, 2019; Chris Thornbury, "ADAB Strike Eagles Demonstrate Agility and Enhance Regional Defense," U.S. Air Forces Central, September 18, 2019; U.S. Air Forces Central, "380th Air Expeditionary Wing," May 17, 2017.

Table C.1—Continued

Owner	Asset	Ground or Sea Base	Dates	Source
F-15E Eagle	Al Dhafra AB, UAE		September 2014 ^b	Öynü Altuntas, "Inside Incirlik Airbase: Life Goes on Between Combat and Consort with Allies," <i>Hurriyet Daily News</i> , December 20, 2015; "F-15 Eagles to Return from Incirlik," <i>ARMSCOM</i> , December 16, 2015; Richard Sisk, "US Air Force Begins Withdrawing F-15 Fighter Jets from Turkey," <i>Military.com</i> , December 16, 2015.
F-15E Eagle	Incirlik AB, Turkey		November 2015–December 2015 ^a	Henry Boyd, "Syria Strike: French, British and US Combat Assets," <i>International Institute for Strategic Studies</i> , April 12, 2018; <i>International Institute for Strategic Studies, Military Balance 2014</i> , London: Routledge, 2014; <i>International Institute for Strategic Studies, Military Balance 2015</i> , London: Routledge, 2015; <i>International Institute for Strategic Studies, Military Balance 2016</i> , London: Routledge, 2016; <i>International Institute for Strategic Studies, Military Balance 2017</i> , London: Routledge, 2017; <i>International Institute for Strategic Studies, Military Balance 2018</i> , London: Routledge, 2018; <i>International Institute for Strategic Studies, Military Balance 2019</i> , London: Routledge, 2019; Joshua Kleinholtz, "336th EFS Sets Tone for New Phase of OIR," <i>Seymour Johnson Air Force Base</i> , November 15, 2017; Samir [@obretix], "332nd AEW F-15E Strike Eagles at Al-Azraq/Muwaffaq Salti Air Base in Jordan https://google.com/maps?ll=31.82794,36.79768&q=31.82794,36.79768&hl=en&t=h&z=15... https://dvidshub.net/video/618801/332nd-aew-night-time-operations ," Twitter post, August 14, 2018; Samir [@obretix], "USAF F-15E and F-35A at Muwaffaq Salti Air Base - Azraq in Jordan https://maps.google.com/maps?ll=31.825898,36.796370&q=31.825898,36.796370&hl=en&t=h&z=16... (27 Feb 2020)," Twitter post, March 22, 2020; <i>Scramble Magazine</i> , "Heads up . . . RAF Lakenheath!" Facebook post, April 6, 2019; <i>Scramble Magazine</i> , "On Saturday 7 April 2018, the first wave of F-15Es Strike Eagles," Facebook post, April 7, 2018.

Table C.1—Continued

Owner	Asset	Ground or Sea Base	Dates	Source
F-15E Eagle	Undisclosed	October 2017 ^b	35th Fighter Wing Public Affairs, "13 FS Returns to Misawa," November 4, 2014; Brigitte N. Brantley, "Airmen Wrap Up 'Eager Lion' over Jordan Skies," U.S. Air Force, June 10, 2014; Robert Burns, "PHOTO: US F-16 Fighters Fly First Missions from Turkey," <i>Business Insider</i> , August 13, 2015; Dana J. Cable, "SCANG Deploys to 407th AEG," U.S. Air Forces Central, July 17, 2018; Dana J. Cable, "407th AEG and the 'Fighting Fifty-Fifth,'" U.S. Air Forces Central, October 17, 2018; Dana J. Cable, "Swamp Fox Send Off," U.S. Air Forces Central, October 23, 2018; Joshua Edwards, "F-16 Hits 8,000 Flying Hours," photograph, U.S. Air Forces Central, October 31, 2017; "Germany Sees 'Potential' in Jordan Base to Replace Turkey's Incirlik—Defense Minister," <i>RT</i> , May 20, 2017; Christopher Maldonado, "55th FS 'Shooters' Return from Deployment," Shaw Air Force Base, S.C., May 14, 2019; Joe W. McFadden, "Welcome Back: Record-Breaking F-16 Squadron Returns," U.S. Air Forces Central, October 14, 2016; Adam Silverman, "Air Guard Members Due Home Soon from Middle East," <i>Burlington Free Press</i> , February 15, 2017.	
F-16C/D Fighting Falcon	Undisclosed	August 2014 ^b	Oriana Pawlyk, "Air Force Tanker Saves Pilot from Ejecting over ISIS territory," <i>Air Forces Times</i> , February 11, 2016; Cheryl Pellerin, "Air Force F-16s Arrive in Turkey to Join ISIL Fight," U.S. Department of Defense, August 10, 2015.	
F-16C/D Fighting Falcon	Incirlik AB, Turkey	August 2015–October 2015	"Alabama National Guard F-16s Return from Southwest Asia," <i>Military Aviation Review</i> , January 23, 2018; Clifton Atkins, "Propulsion Techs Perform F-16 Engine Ops Check," photograph, 332nd Air Expeditionary Wing Public Affairs, Defense Visual Information Distribution Service, March 16, 2019; Dana J. Cable, "179th EFS Redeploys to Minnesota," U.S. Air Forces Central, S.C., July 20, 2018.	
F-16C/D Fighting Falcon	Ahmed Al Jaber AB, Kuwait	October 2017 ^b	John Wilkes, "Triple Nickel Completes Historic Deployment to AUAB," U.S. Air Forces Central, February 29, 2020.	

Table C.1—Continued

Owner	Asset	Ground or Sea Base	Dates	Source
F-22A Raptor	Al Dhafra AB, UAE	September 2014–March 2019		104th Fighter Wing, "Langley Raptors Return Home," October 12, 2017; David Cenciotti, "The Most Up to Date F-22 Raptor Jets Are Currently Fighting Daesh," <i>The Aviationist</i> , July 5, 2017; David Cenciotti, "US F-22 Raptor Jets Perform First Ever Air Strike in Afghanistan Employing Small-Diameter Bombs," <i>The Aviationist</i> , November 20, 2017; Rajiv Chandrasekaran, "In the UAE, the United States Has a Quiet, Potent Ally Nicknamed 'Little Sparta,'" <i>Washington Post</i> , November 9, 2014; Brian W. Everstine, "F-22s Take Break from Middle East Combat to Increase Readiness, Reassess Basing," <i>Air Force Magazine</i> , March 5, 2019; Dan Lamothe, "The Air Force Wants the F-35 Jet to Fight ISIS: Whether That Will Happen Is in Question," <i>Washington Post</i> , February 24, 2017; Amy McCullough, "With the Raptors over Syria," <i>Air Force Magazine</i> , February 2015; Barbara Opall-Rome, "Pentagon Eyes Intimate R&D Tie-Up with UAE Based on US-Israel Model," <i>Defense News</i> , November 15, 2017; Cotton Puryear, "192nd Wing Airmen Return from Middle East Deployment," Virginia National Guard, October 22, 2018; Shawn Snow, "US F-22s Intercept Russian Fighter Jets, Fire Warning Flares," <i>Air Force Times</i> , December 14, 2017.
F-22A Raptor	Undisclosed	Temporary deployments in 2015 and 2018		Tyler Rogoway, "Stealth Pushes Forward: B-2s Refuel on Wake Island, F-22s Fly from Austere Base in Mideast," <i>The Drive</i> , September 20, 2018; Kerr Simmons and Alastair Jamieson, "Jordan Fighter Jets Launch Fresh Bombing Raids on ISIS," NBC News, February 7, 2015.
MQ-1B Predator	Ali Al Salem AB, Kuwait	August 2014–July 2017		Damon Kasberg, "332nd AEW Bids Farewell to the Predator," U.S. Air Forces Central, July 7, 2017; Aaron Stein, "Nice updated imagery of the MQ-1 at Ali Al Salem in Kuwait 29°20'14.74"N 47°31'56.31"E cc: @OSIMINT," Twitter post, June 29, 2015; Mark Thompson, "Armed U.S. Drones Flying over Baghdad," <i>Time</i> , June 27, 2014.
MQ-1B Predator	Undisclosed	March 2016 ^a –May 2017 ^a		"Predators Join Reapers at Jordan's Muwaffaq," Offiziere.ch, June 7, 2016.

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Owner	Asset	Ground or Sea Base	Dates	Source
MQ-1B Predator	Incirlik AB, Turkey		August 2014–March 2018	Burak Ege Bekdil, "US Drone Crashes in Turkey," <i>Defense News</i> , February 3, 2016; International Institute for Strategic Studies, <i>Military Balance 2014</i> , London: Routledge, 2014; International Institute for Strategic Studies, <i>Military Balance 2015</i> , London: Routledge, 2015; International Institute for Strategic Studies, <i>Military Balance 2016</i> , London: Routledge, 2016; International Institute for Strategic Studies, <i>Military Balance 2017</i> , London: Routledge, 2017; International Institute for Strategic Studies, <i>Military Balance 2018</i> , London: Routledge, 2018; International Institute for Strategic Studies, <i>Military Balance 2019</i> , London: Routledge, 2019; Thomas Newdick, "Fighting Fascism," <i>Armada International</i> , June–July 2016; Cheryl Pellerin, "Air Force F-16s Arrive in Turkey to Join ISIL Fight," U.S. Department of Defense, August 10, 2015; "USAF Officially Retires MQ-1 Predator UAV," <i>Warnsey's World</i> , March 11, 2018; "US Drone Crashes in Southern Turkey After Leaving Incirlik Air Base," <i>Military.com</i> , August 18, 2017; Craig Whitlock, "U.S. Military Drone Surveillance Is Expanding to Hot Spots Beyond Declared Combat Zones," <i>Washington Post</i> , July 20, 2013.
MQ-9A Reaper	Undisclosed		March 2015 ^{a–b}	Bellingcat, "Reaper Drones Revealed to Be Operating from Jordan," February 25, 2016; "Predators Join Reapers at Jordan's Muwaffaq," <i>Offiziere.ch</i> , June 7, 2016; Samir [@obretix], "9 MQ-9 Reaper drones deployed in 18 shipping containers at Al-Azraq/Muwaffaq Salti Air Base in Jordan? (9 engine shipping and storage containers neatly lined up too..) https://google.com/ma ps?ll=31.833884,36.791162&q=31.833884,3 6.791162&hl=en&t=h&z=18 ," Twitter post, September 19, 2018.

Table C.1—Continued

Owner	Asset	Ground or Sea Base	Dates	Source
MQ-9A Reaper	Ali Al Salem AB, Kuwait		March 2015 ^b	Chris Biggers, "More and More Killer Drones Take Aim at Islamic State's Bosses," <i>War Is Boring</i> , March 17, 2015; Emily Kind [emilykind_], "Reaper Drone at Ali Al Salem Air Base, Kuwait," photograph, Virtual Globetrotting, January 29, 2019; Michael Mason and Mozer O. Da Cunha, "Eye in the Sky: Prepping the MQ-9 Reaper," U.S. Air Forces Central, August 19, 2019; Thomas Newdick, "Fighting Fascism," <i>Armada International</i> , June–July 2016; Babak Taghvaee, "#BREAKING: All reports about the MQ-9 Reaper drone of #USAF which hunted #Soleimani being flown from #Qatar is absolutely #FakeNews. According to #CENTCOM & #AFCENT, #USAF has No MQ-9 Reaper drone based anywhere in #Qatar. They are based only in Ali Al-Salem Air Base in #Kuwait," Twitter post, January 4, 2020; Jason Winegar, "Jason Winegar," LinkedIn page, undated.
RQ-4A Global Hawk	Al Dhafra AB, UAE		November 2015 ^b	Marjorie A. Bowlden, "U.S. Air Force Pilots: Masters of the Sky," U.S. Air Forces Central, September 25, 2017; Mya M. Crosby, "Crew Chiefs: The First and the Last for the Mission," U.S. Air Forces Central, December 24, 2018; Stephen Losey, "F-15E Strike Eagles Deploy to Al Dhafra," <i>Air Force Times</i> , October 24, 2019; Frank Miller, "UAV Reaches New Milestone in Fight Against Daesh," U.S. Air Forces Central, November 12, 2015; Oriana Pawlyk, "Inside the Air Force's Largest Fuel Farm in Fight vs. ISIS," Military.com, August 19, 2017; Oriana Pawlyk, "Air Force Acknowledges Clandestine Base in UAE," Military.com, August 28, 2017; Planetpix/Alamy Live News, photograph of a U.S. Air Force RQ-4 Global Hawk, February 20, 2017; Joseph Trevithick, "How the US Air Force's Biggest Drones Help Set Up Attacks on ISIS," <i>Vice</i> , January 23, 2017; Joseph Trevithick and Tyler Rogoway, "U.S. Air Force RQ-4 Global Hawk Drone Crashes in California," <i>The Drive</i> , June 21, 2017.

Table C.1—Continued

Owner	Asset	Ground or Sea Base	Dates	Source
E-3 Sentry	Al Dhafra AB, UAE	August 2014– ^b		Air Force Historical Research Agency, "968 Expeditionary Airborne Air Control Squadron (ACC)," October 17, 2016; Gregory Brook, "908th Expeditionary Air Refueling Squadron Supports E-3 AWACS and A-10 Warthogs Conducting Airstrikes in Iraq and Syria," photograph, U.S. Air Forces Central Public Affairs, Defense Visual Information Distribution Service, November 24, 2017; Tara Copp, "Air Force Part of the 'More' for Islamic State Fight, Carter Says," <i>Stars and Stripes</i> , April 17, 2016; Mya M. Crosby, "Crew Chiefs: The First and the Last for the Mission," U.S. Air Forces Central, December 24, 2018; Mya M. Crosby, "The E-3 Fleet: The Eyes and Ears from ADAB," 380th Air Expeditionary Wing Public Affairs, Defense Visual Information Distribution Service, January 5, 2019; Defense Flash News, "E-3 Sentry B-Roll AL DHAFRA, UNITED ARAB EMIRATES 03.18.2019," YouTube video, March 18, 2019; Brandon Gifford, "The Mission of the AWACS," photograph, 380th Air Expeditionary Wing Public Affairs, Defense Visual Information Distribution Service, July 28, 2017; Jennifer Hlad, "Managing the CENTCOM Air Battle," <i>Air Force Magazine</i> , September 28, 2017; Stephen Losey, "F-15E Strike Eagles Deploy to Al Dhafra," <i>Air Force Times</i> , October 24, 2019; U.S. Air Forces Central, "380th Air Expeditionary Wing," May 17, 2017.
E-8C Joint STARS	AUAB, Qatar	August 2014– ^b		Diana Stancy Correll, "Air Force JSTARS Wrap Up 18-Year Middle East Deployment," <i>Air Force Times</i> , November 6, 2019; Brian W. Everstine, "Heat from the Desert," <i>Air Force Magazine</i> , October 9, 2017; Jennifer Hlad, "The All-in-One Kill Chain," <i>Air Force Magazine</i> , June 4, 2018; James Hodgman, "Storied Career of a Flight Engineer," U.S. Air Force, December 14, 2015; MiliSource, "USAF B-52, C-17, E-8C and KC-135 Takeoffs at Al Udeid Air Base, Qatar," YouTube video, September 26, 2017; Bradly Schneider, "The E-8C JSTARS Provides Big Eyes in the Sky in Support of Operation Inherent Resolve and Operation Freedom's Sentinel," photograph, 379th Air Expeditionary Wing Public Affairs Defense Visual Information Distribution Service, August 4, 2017.

Table C.1—Continued

Owner	Asset	Ground or Sea Base	Dates	Source
EC-130H Compass Call	Ali Al Salem AB, Kuwait		August 2014– ^b	Air Force Historical Research Agency, "386 Air Expeditionary Wing," June 3, 2018; Daniel Martinez, "43rd EECS Inactivates, Holds Ceremony Reflecting on Legacy," 386th Air Expeditionary Wing Public Affairs, September 30, 2019; Joseph Trevithick, "U.S. Air Force Planes Jam Signals, Back Up Iraqi Offensives," <i>War Is Boring</i> , January 4, 2016; Joseph Trevithick, "EC-130H Compass Call Operations Against Daesh," YouTube video, June 7, 2017.
RC-135V/W Rivet Joint	AUAB, Qatar		August 2014– ^b	Ian Dean, "Rivet Joint: On Watch for 29 Years," U.S. Air Forces Central, December 8, 2019.
U-2S Dragon Lady	Al Dhafra AB, UAE		August 2014– ^b	David Axe, "The Cold War Spy Plane Fighting ISIS," <i>Daily Beast</i> , August 12, 2016; Adam Entous, Julian E. Barnes, and Siobhan Gorman, "Intelligence Gaps Crippled Mission in Syria to Rescue Hostages James Foley, Steven Sotloff," <i>Wall Street Journal</i> , September 4, 2014; Brian W. Everstine, "DOD IG: US, Coalition Aircraft Facing Interference, Limited ISR Capability in ISIS Fight," <i>Air Force Magazine</i> , May 7, 2019; Christopher Harress, "The U-2 and Global Hawk, the US Spy Planes That Will Help Hunt ISIS in Syria," <i>International Business Times</i> , August 27, 2014; Oriana Pawlyk, "Inside the Air Force's Largest Fuel Farm in Fight vs. ISIS," Military.com, August 19, 2017; Fred Pleitgen, "U2 'Dragonlady' Pilots Spy on ISIS from the Edge of Space," CNN, July 18, 2017; "Spy Plane in the Desert: U-2 Dragon Lady in UAE," US Military Update, October 16, 2019; U.S. Air Force, "A 99th Expeditionary Reconnaissance Squadron U-2 Dragon Lady pilot drives a high-performance chase car on the runway to catch a U-2 performing a low-flight touch & go at Al Dhafra Air Base, United Arab Emirates. U.S. Air Force photo by Senior Airman Gracie Lee #ReadyAF," Twitter post, April 25, 2020; "War Against ISIS: Meet the U.S. Military Spy Plane Known as the Dragon Lady," video, ABC News, March 30, 2016.

Table C.1—Continued

Owner	Asset	Ground or Sea Base	Dates	Source
KC-10A Extender	Al Dhafra AB, UAE	September 2014 ^b		60th Air Mobility Wing Public Affairs, "Travis Tankers Extend the Fight Against ISIS," Travis Air Force Base, June 7, 2017; 60th Air Mobility Wing Public Affairs, "Tankers Critical to Sustaining Air Campaign Against ISIS," Travis Air Force Base, June 28, 2017; Marjorie A. Bowlden, "U.S. Air Force Pilots: Masters of the Sky," U.S. Air Forces Central, September 25, 2017; David Cenciotti, "Check Out the Damage Done to an A-10 Warthog's Nose by a Refueling Tanker's 'Flying Boom,'" <i>Business Insider</i> , February 4, 2020; Mya M. Crosby, "Crew Chiefs: The First and the Last for the Mission," U.S. Air Forces Central, December 24, 2018; International Institute for Strategic Studies, <i>Military Balance 2014</i> , London: Routledge, 2014; International Institute for Strategic Studies, <i>Military Balance 2015</i> , London: Routledge, 2015; International Institute for Strategic Studies, <i>Military Balance 2016</i> , London: Routledge, 2016; International Institute for Strategic Studies, <i>Military Balance 2017</i> , London: Routledge, 2017; International Institute for Strategic Studies, <i>Military Balance 2018</i> , London: Routledge, 2018; International Institute for Strategic Studies, <i>Military Balance 2019</i> , London: Routledge, 2019; Stephen Losey, "F-15E Strike Eagles Deploy to Al Dhafra," <i>Air Force Times</i> , October 24, 2019; Amy McCullough, "With the Raptors over Syria," <i>Air Force Magazine</i> , February 2015; Anthony Nelson Jr., "180213-F-RE693-0199," photograph, U.S. Air Forces Central, February 3, 2018; Anthony Nelson Jr., "380th Supports Operation Inherent Resolve with Mobile Gas," U.S. Air Forces Central, March 2, 2018; Oriana Pawlyk, "Inside the Air Force's Largest Fuel Farm in Fight vs. ISIS," <i>Military.com</i> , August 19, 2017.

Table C.1—Continued

Owner	Asset	Ground or Sea Base	Dates	Source
KC-135 Stratotanker	AUAB, Qatar	August 2014– ^b	"Al Udeid: Home to 11,000 US Troops and Critical to Winning the War on Terror," <i>Politico</i> , July 8, 2019; David Asbra, "185th Returns from Al Udeid: In-Air Refueling Integral to Operation Inherent Resolve," Air National Guard, June 9, 2016; David Cenciotti, "Video Shows US Air Force B-1 Bomber Taking Gas During Syria Air Strikes Through NVG's," <i>The Aviationist</i> , September 29, 2014; David Cenciotti, "Air War on Isis Coalition Aircraft Refuel from US KC-135 over Iraq," <i>The Aviationist</i> , October 27, 2017; David Cenciotti, "Let's Have a Look at the US F-22 Raptors Returning Home from Short Notice Deployment in Qatar," <i>The Aviationist</i> , February 25, 2020; James Hodgman, "Airfield Management Airmen Support Combat Sorties," U.S. Air Force, April 1, 2016; Corey Hook, "Mission Ready," photograph, U.S. Department of Defense, January 6, 2016; Johnathan Hoover, "Army, Air Force Dominate the Sky," <i>USA Patriotism</i> , October 12, 2018; Terrica Y. Jones, "KC-135s Surpass 100,000 Combat Hours," U.S. Air Force, January 8, 2016; Amy M. Lovgren, "Sunset Pre-Flight Checks at Al Udeid," U.S. Air Forces Central, June 10, 2017; Ryan Maass, "U.S. Air Force KC-135 Tankers Surpass 100,000 Combat Hours," UPI, January 8, 2016; MiliSource, "USAF B-52, C-17, E-8C and KC-135 Takeoffs at Al Udeid Air Base, Qatar," YouTube video, September 26, 2017; Oriana Pawlyk, "Air Force Tanker Saves Pilot from Ejecting over ISIS territory," <i>Air Forces Times</i> , February 11, 2016; Alan Ricker, "Tanker Team: The Crew of Python 62," McConnell Air Force Base, August 3, 2018; Charles Rivezzo, "Coalition Launches Largest Airstrike of the Year Against ISIL," U.S. Central Command, December 19, 2016; Bradly A. Schneider, "Fueling the AOR," Air Mobility Command, July 25, 2017; Phil Speck, "Following the Fuel," Defense Logistics Agency, February 3, 2018; U.S. Central Command, "Iraqi Air Force F-16 Refuels Using a U.S. Air Force KC-135 Stratotanker," May 30, 2019.	

Table C.1—Continued

Owner	Asset	Ground or Sea Base	Dates	Source
KC-135 Stratotanker	Incirlik AB, Turkey	Incirlik AB, Turkey	August 2015– ^b	Öynü Altuntaş, "Inside Incirlik Airbase: Life Goes on Between Combat and Consort with Allies," <i>Hurriyet Daily News</i> , December 20, 2015; Bipartisan Policy Center, "The Alternatives to Incirlik," webpage, undated; Meteor Blades, "Those 50 US Nukes Stored in Turkey Aren't Needed," <i>Daily Kos</i> , October 23, 2019; Combat Aircraft, "447th AEG Refueling Mission from Incirlik Air Base Turkey," January 24, 2018; Andrew deGrandpre and Shawn Snow, "In Turkey, New Demands to Evict US Forces from Incirlik Air Base," <i>Military Times</i> , May 14, 2017; Jim Garamone, "Incirlik Airmen Feel Sense of Accomplishment in Counter-ISIS Battle," U.S. Department of Defense, February 17, 2017; Jason Huddleston, "332nd AEW Commander Visits 447th AEG Airmen," Incirlik Air Base, November 16, 2017; McConnell Air Force Base, "The KC-35 remains the backbone of the tanker fleet," Facebook post, August 15, 2015; Brittany E. N. Murphy, "Without Tanker Gas, There Is No Fight," Incirlik Air Base, November 26, 2018; Oriana Pawlyk, "Air Force General Downplays Possible Restrictions at Incirlik," <i>Military.com</i> , March 18, 2018; Cheryl Pellerin, "Air Force F-16s Arrive in Turkey to Join ISIL Fight," U.S. Department of Defense, August 10, 2015; Jon Quinlan, "Tinker Citizen Airmen Deploy to Turkey," U.S. Central Command, January 3, 2017; Kyle Rempfer, "The US May Cozy Up with Someone Else as a Spat with Turkey over Russian Weapons Gets Worse," <i>Business Insider</i> , May 1, 2019; Trevor Rhynes, "22nd EARS Enables Airpower During the Fight Against ISIS," Incirlik Air Base, December 19, 2017; Trevor Rhynes, "Third Air Force Leadership Team Visits Incirlik Air Base," photograph, 39th Air Base Wing Public Affairs, Defense Visual Information Distribution Service, February 22, 2019; Richard Ryan, "Desert Storm to Inherent Resolve: Twenty-Five Years of Coalition Ops at Incirlik," Incirlik Air Base, March 1, 2016; John A. Tirpak, "Who's Paying Their Share in NATO?" <i>Air Force Magazine</i> , February 1, 2020.

Table C.1—Continued

Owner	Asset	Ground or Sea Base	Dates	Source
C-17A Globemaster III	AUAB, Qatar	September 2014 ^b		Agence France-Presse, "Qatar, US Launch Plan for Expansion of Al-Udeid Airbase," <i>Times of Israel</i> , July 24, 2018; Kia Atkins, "U.S., Qatari Air Traffic Controllers Manage CENTCOM's Busiest Airfield," U.S. Air Forces Central, February 19, 2015; Gregory Brook, "816th EAS Moves Cargo Through Syria," photograph, U.S. Department of Defense, October 27, 2017; Robert Cloys, "Multi-Team Effort Keeps Equipment Moving Forward," U.S. Air Forces Central, March 4, 2019; "Deployed C-17 Globemaster III Mission," <i>US Defense Story</i> , January 25, 2020; James Hodgman, "Keeping the C-17 in the Fight," U.S. Air Force, February 29, 2016; International Institute for Strategic Studies, <i>Military Balance 2014</i> , London: Routledge, 2014; International Institute for Strategic Studies, <i>Military Balance 2015</i> , London: Routledge, 2015; International Institute for Strategic Studies, <i>Military Balance 2016</i> , London: Routledge, 2016; International Institute for Strategic Studies, <i>Military Balance 2017</i> , London: Routledge, 2017; International Institute for Strategic Studies, <i>Military Balance 2018</i> , London: Routledge, 2018; International Institute for Strategic Studies, <i>Military Balance 2019</i> , London: Routledge, 2019; Terrica Y. Jones, "Airborne Gas Stations," 379th Air Expeditionary Wing Public Affairs, December 21, 2015; Ted Nichols, "Al Udeid-Based C-17s Link AFRICOM, CENTCOM," 446th Airlift Wing, September 5, 2018; Oriana Pawlyk, "This C-17 Crew Broke Diplomatic Protocol to Save a Life: Now They're Up for Awards," Military.com, June 12, 2019; Tyler Rogoway, "Watch This C-17 Haul 9000 Gallons of Gas to a Base Fighting ISIS," Jalopnik, May 14, 2015; U.S. Department of Defense, "U.S. Air Force Col. Christopher Colbert Checks the Deck of a C-17 Globemaster III After a Humanitarian Airdrop over the Area of Amirli, Iraq Aug. 31, 2014," photograph, August 31, 2014; Miles Wilson, "816th EAS Airmen Prepare for Flight," photograph, U.S. Central Command, January 31, 2017; Miles Wilson, "US, Qatar Emiri Air Forces Build Relations, Fix Aircraft," Robins Air Force Base, March 15, 2017; MiliSource, "USAF B-52, C-17, E-8C and KC-135 Takeoffs at Al Udeid Air Base, Qatar," YouTube video, September 26, 2017.

Table C.1—Continued

Owner	Asset	Ground or Sea Base	Dates	Source
C-17A Globemaster III	Ali Al Salem AB, Kuwait		November 2014 ^b	Thomas Barger and Daniel Martinez, “Tanks’ for the Lift,” U.S. Air Forces Central, November 26, 2019; Jonathan Hehnly, “ATOC Works Around the Clock to Keep Cargo and Personnel Moving,” U.S. Air Forces Central, August 16, 2017; Stephen Hudson, “Air National Guard Supports Airlift Operations at Ali Al Salem,” photograph, U.S. Central Command, July 10, 2019; Jared Marquis, “332nd Air Expeditionary Group Reactivates,” U.S. Air Forces Central, November 25, 2014; Tryphena Mayhugh, “721st AMXS Aids the Mission in Kuwait,” photograph, 86th Airlift Wing, Defense Visual Information Distribution Service, September 29, 2016; Red Intel Panda [@RedIntelPanda], “Two USAF C-17s out of Ali al-Salem Air Base, #Kuwait,” Twitter post, March 30, 2020.
C-130 Hercules	AUAB, Qatar		August 2014 ^b	908th Airlift Wing, “First Combat Airdrop in More Than a Decade,” June 7, 2018; Air Force Reserve Command, “Flying Jennies, Wing Members Return from Deployment,” May 22, 2018; “Deployed C-17 Globemaster III Mission,” <i>US Defense Story</i> , January 25, 2020; Ashley L. Gardner, “Al Udeid AB Drives Largest Sustainment Airdrop in CENTCOM History,” U.S. Air Force, July 17, 2019; Corey Hook, “C-130 Loading,” photograph, U.S. Department of Defense, February 11, 2016; Christopher Hubenthal, “C-130 Aircrack Exercises Combat Airdrop Capability,” Defense Logistics Agency, November 23, 2018; Alexandre Montes, “CAPS Does Its Part, Keeps CENTCOM in the Fight,” U.S. Air Forces Central, May 29, 2015; Alexandre Montes, “Reserve Airmen Maintain C-130’s Keeping AFCENT Air Operations Steady,” U.S. Air Forces Central, September 11, 2015; Janelle Patiño, “914th AW’s C-130s Say Final Goodbye to AUAB,” U.S. Air Forces Central, August 19, 2016; Robert Burnsadam Schreck, “Tiny Qatar Plays Outsize Role in US War Strategy,” <i>Washington Examiner</i> , September 15, 2014.

Table C.1—Continued

Owner	Asset	Ground or Sea Base	Dates	Source
C-130 Hercules	Ali Al Salem AB, Kuwait		August 2014– ^b	Alaska Department of Military and Veterans' Affairs, <i>2016 Annual Report</i> , Anchorage, 2016; Jim Greenhill, "Lengyel: Every Service Member Has Role in Building Readiness, Lethality," U.S. Army, November 26, 2018; Stephen Hudson, "Air National Guard Supports Airlift Operations at Ali Al Salem," photograph, U.S. Central Command, July 10, 2019; Dalton Smith, "Erbil International Airport—U.S. Air Force Airmen Load a C-130 Hercules at Ali Al Salem, Kuwait, on February 2, 2017," photograph, February 7, 2017; U.S. Department of Defense, "U.S. Air Force Airmen Work Around an Aircraft Cargo Loading and Unloading Vehicle, Carrying Four Tons of Holiday Mail onto a C-130 Hercules Cargo Plane on Ali Al Salem Air Base, Kuwait, Dec. 23, 2014," photograph, December 23, 2014.
HC-130J Hercules	Diyarbakir AB, Turkey	September 2015–August 2018 ^a		39th Air Base Wing Public Affairs, "A Day in the Life: Pararescue," Defense Visual Information Distribution Service, video by Senior Airman Daniel Asselta, March 29, 2016; Daniel Asselta, "HC-130J Crew in Diyarbakir," video, 39th Air Base Wing Public Affairs, Defense Visual Information Distribution Service, April 12, 2016; Cory W. Bush, "USAFCENT Personnel Recovery Aircraft, Support Airmen Arrive in Turkey," Ramstein Air Base, October 9, 2015; Keith James, "1st Expeditionary Rescue Group Conducts Combat Search and Rescue Exercise," U.S. Air Forces Central, August 28, 2018; okrajoe, "USAF HC-130J Crew in Diyarbakir, Turkey," YouTube video, May 11, 2016.
MC-130H Combat Talon II	Ali Al Salem AB, Kuwait		October 2014– ^b	"AF Week in Photos," <i>Mirage News</i> , March 21, 2020; Terri Moon Cronk, "Terrorist Leader's Death Disrupts Group's Expansion Efforts, DoD Spokesman Says," U.S. Department of Defense, July 17, 2017; Inherent Resolve, "A @usairforce MC-130 crew prepares for a resupply airdrop over an undisclosed location in #Syria," Twitter post, June 25, 2017; Sebastien Roblin, "REVEALED: Inside the Black 'Nightstalker' Special Ops Helicopters Used in the Raid that Killed Baghdadi," <i>National Interest</i> , November 3, 2019; Joseph Trevithick, "U.S. Commandos Are Flying Around Iraq," <i>War Is Boring</i> , November 18, 2014.

Table C.1—Continued

Owner	Asset	Ground or Sea Base	Dates	Source
United States—USMC				
	AV-8B Harrier II	USS <i>Makin Island</i>	September 2014–October 2014	U.S. Carriers, homepage, undated.
	AV-8B Harrier II	Isa AB, Bahrain	September 2014–April 2015.	3rd Marine Aircraft Wing, "History," webpage, U.S. Marine Corps, undated.
	AV-8B Harrier II	USS <i>Essex</i>	August 2015–October 2015	U.S. Carriers, homepage, undated.
	AV-8B Harrier II	USS <i>Kearsarge</i>	November 2015–December 2015	U.S. Carriers, homepage, undated.
	AV-8B Harrier II	USS <i>Boxer</i>	June 2016–July 2016	U.S. Carriers, homepage, undated.
	EA-6B Prowler	AUAB, Qatar	August 2014–February 2015 ^a	David Cenciotti, "Marine Corps EA-6B in Afghanistan," <i>The Aviationist</i> , February 4, 2015.
	EA-6B Prowler	Incirlik AB, Turkey	April 2016–April 2018	Edward Chang, "Why the Marine Corps and Navy Will Miss the EA-6B Prowler," <i>National Interest</i> , December 1, 2018.
	EA-6B Prowler	AUAB, Qatar	April 2018–November 2018	Edward Chang, "Why the Marine Corps and Navy Will Miss the EA-6B Prowler," <i>National Interest</i> , December 1, 2018; "How the U.S.-Led Airstrikes in Syria Hit Their Targets Before Assad's Missile Defenses Even Fired," <i>Haaretz</i> , April 17, 2018; Christopher Hubenthal, "VAQ-135 Arrives at Al Udeid," photograph, U.S. Central Command, November 13, 2018; Ted Nichols, "EA-6B Prowler's Final Chapter Being Written at Al Udeid," U.S. Air Forces Central, September 28, 2018; Shawn Snow, "The Sun's Setting on Corps' Last EA-6B Prowler Squadron with End of Final Deployment," <i>Marine Corps Times</i> , November 4, 2018.
	F/A-18C/D Hornet	Kuwait	February 2015–October 2015	Marine Corps Air Station Miramar, "VMM-165 and VMFA-232 Homecoming," photograph, Defense Visual Information Distribution Service, October 16, 2015.
	F-35B Lightning II	USS <i>Essex</i>	September 2018–December 2018	Daniel Sanderson, "US Air Force Sends Next Generation Fighter Jets to UAE," <i>The National</i> , April 17, 2019; Jeff Schogol, "On Its First Combat Deployment, the Marine Corps' F-35 Bombed Both the Taliban and ISIS," <i>Business Insider</i> , February 25, 2019; U.S. Carriers, homepage, undated.

Table C.1—Continued

Owner	Asset	Ground or Sea Base	Dates	Source
KC-130J Hercules	Ahmed Al Jaber AB, Kuwait	November 2014–May 2016 ^a	Hope Hodge Seck, "Marines Launched Rescue Mission for Pilot Killed by ISIS," <i>Marine Corps Times</i> , May 19, 2015; Richard Whittle, "SP-MAGTF Commander Details ISIL Strikes; Notes 1st Marines 'Could Clear' Iraq," <i>Breaking Defense</i> , May 20, 2015; Richard Whittle, "The Unprecedented Way America Is Fighting ISIS," <i>New York Post</i> , May 28, 2016.	
United States—Navy				
F/A-18E/F Super Hornet	USS George H.W. Bush	June 2014–October 2014	U.S. Carriers, homepage, undated.	
EA-18G Growler	USS George H.W. Bush	June 2014–October 2014	U.S. Carriers, homepage, undated.	
E-2C Hawkeye	USS George H.W. Bush	June 2014–October 2014	U.S. Carriers, homepage, undated.	
C-2A Greyhound	USS George H.W. Bush	June 2014–October 2014	U.S. Carriers, homepage, undated.	
F/A-18E/F Super Hornet	USS Carl Vinson	October 2014–April 2015	U.S. Carriers, homepage, undated.	
EA-18G Growler	USS Carl Vinson	October 2014–April 2015	U.S. Carriers, homepage, undated.	
E-2C Hawkeye	USS Carl Vinson	October 2014–April 2015	U.S. Carriers, homepage, undated.	
C-2A Greyhound	USS Carl Vinson	October 2014–April 2015	U.S. Carriers, homepage, undated.	
F/A-18E/F Super Hornet	USS Theodore Roosevelt	April 2015–October 2015	U.S. Carriers, homepage, undated.	
EA-18G Growler	USS Theodore Roosevelt	April 2015–October 2015	U.S. Carriers, homepage, undated.	
E-2D Hawkeye	USS Theodore Roosevelt	April 2015–October 2015	U.S. Carriers, homepage, undated.	
F/A-18E/F Super Hornet	USS Harry S. Truman	December 2015–June 2016	U.S. Carriers, homepage, undated.	
EA-18G Growler	USS Harry S. Truman	December 2015–June 2016	U.S. Carriers, homepage, undated.	
E-2C Hawkeye	USS Harry S. Truman	December 2015–June 2016	U.S. Carriers, homepage, undated.	
C-2A Greyhound	USS Harry S. Truman	December 2015–June 2016	U.S. Carriers, homepage, undated.	

Table C.1—Continued

Owner	Asset	Ground or Sea Base	Dates	Source
F/A-18C/D Hornet	USS <i>Dwight D. Eisenhower</i>	June 2016–December 2016	U.S. Carriers, homepage, undated.	
F/A-18E/F Super Hornet	USS <i>Dwight D. Eisenhower</i>	June 2016–December 2016	U.S. Carriers, homepage, undated.	
EA-18G Growler	USS <i>Dwight D. Eisenhower</i>	June 2016–December 2016	U.S. Carriers, homepage, undated.	
E-2C Hawkeye	USS <i>Dwight D. Eisenhower</i>	June 2016–December 2016	U.S. Carriers, homepage, undated.	
C-2A Greyhound	USS <i>Dwight D. Eisenhower</i>	June 2016–December 2016	U.S. Carriers, homepage, undated.	
F/A-18E/F Super Hornet	USS <i>George H.W. Bush</i>	February 2017–June 2017	U.S. Carriers, homepage, undated.	
EA-18G Growler	USS <i>George H.W. Bush</i>	February 2017–June 2017	U.S. Carriers, homepage, undated.	
E-2C Hawkeye	USS <i>George H.W. Bush</i>	February 2017–June 2017	U.S. Carriers, homepage, undated.	
C-2A Greyhound	USS <i>George H.W. Bush</i>	February 2017–June 2017	U.S. Carriers, homepage, undated.	
F/A-18C/D Hornet	USS <i>Nimitz</i>	July 2017–October 2017	U.S. Carriers, homepage, undated.	
F/A-18E/F Super Hornet	USS <i>Nimitz</i>	July 2017–October 2017	U.S. Carriers, homepage, undated.	
EA-18G Growler	USS <i>Nimitz</i>	July 2017–October 2017	U.S. Carriers, homepage, undated.	
E-2D Hawkeye	USS <i>Nimitz</i>	July 2017–October 2017	U.S. Carriers, homepage, undated.	
C-2A Greyhound	USS <i>Nimitz</i>	July 2017–October 2017	U.S. Carriers, homepage, undated.	
F/A-18C/D Hornet	USS <i>Theodore Roosevelt</i>	December 2017–March 2018	U.S. Carriers, homepage, undated.	
F/A-18E/F Super Hornet	USS <i>Theodore Roosevelt</i>	December 2017–March 2018	U.S. Carriers, homepage, undated.	
EA-18G Growler	USS <i>Theodore Roosevelt</i>	December 2017–March 2018	U.S. Carriers, homepage, undated.	
E-2C Hawkeye	USS <i>Theodore Roosevelt</i>	December 2017–March 2018	U.S. Carriers, homepage, undated.	

Table C.1—Continued

Owner	Asset	Ground or Sea Base	Dates	Source
	F/A-18E/F Super Hornet	USS Harry S. Truman	May 2018–May 2018	U.S. Carriers, homepage, undated.
	EA-18G Growler	USS Harry S. Truman	May 2018–May 2018	U.S. Carriers, homepage, undated.
	E-2C Hawkeye	USS Harry S. Truman	May 2018–May 2018	U.S. Carriers, homepage, undated.
	C-2A Greyhound	USS Harry S. Truman	May 2018–May 2018	U.S. Carriers, homepage, undated.
	F/A-18E/F Super Hornet	USS John C. Stennis	December 2018– ^b	U.S. Carriers, homepage, undated.
	EA-18G Growler	USS John C. Stennis	December 2018– ^b	U.S. Carriers, homepage, undated.
	E-2C Hawkeye	USS John C. Stennis	December 2018– ^b	U.S. Carriers, homepage, undated.
	C-2A Greyhound	USS John C. Stennis	December 2018– ^b	U.S. Carriers, homepage, undated.
P-3C Orion		Isa AB, Bahrain	April 2015–September 2015	Michael Choe, "VP-26 Provides Eyes in the 5th Fleet Area of Responsibility," <i>Florida Times-Union</i> , April 1, 2015.
P-3C Orion		Isa AB, Bahrain/Incirlik AB, Turkey	February 2015–September 2015	Matt Nemetz, "Job Done Well for the Final P-3C Deployment from East Coast," <i>Florida Times-Union</i> , September 2, 2015.
P-3C Orion		Isa AB, Bahrain/Incirlik AB, Turkey	March 2016–September 2016	Patrol Squadron Forty, "Official History of the Fighting Marlins," webpage, U.S. Navy, undated.
P-3C Orion		Isa AB, Bahrain/AUAB, Qatar	April 2017–October 2017	Commander, Naval Air Forces, "Patrol Squadron Forty-Six Command History," webpage, U.S. Navy, undated.
P-3C Orion		Isa AB, Bahrain	September 2018–February 2019	Commander, Naval Air Forces, "Patrol Squadron Forty-Six Command History," webpage, U.S. Navy, undated.

NOTES: This list is based on unclassified reporting; some additional aircraft types may have been deployed to OIR. Deployment dates prior to August 2014 are not shown.

^a Aircraft are known to have been deployed at this location during the period indicated but may have been present earlier or later.

^b Aircraft deployment continued beyond March 31, 2019.

Table C.2
Deployed Aircraft Carriers and Amphibious Assault Ships in Theater

Ship	Type	Location	Navy	Deployment in Theater
<i>Charles de Gaulle</i>	CVN	Arabian Gulf	FR	February 2015–April 2015
<i>Charles de Gaulle</i>	CVN	Eastern Mediterranean	FR	November 2015–March 2016
<i>Charles de Gaulle</i>	CVN	Eastern Mediterranean	FR	September 2016–December 2016
<i>Charles de Gaulle</i>	CVN	Eastern Mediterranean	FR	February 2019–April 2019
USS <i>George H.W. Bush</i>	CVN	Arabian Gulf	U.S.	June 2014–October 2014
USS <i>Carl Vinson</i>	CVN	Arabian Gulf	U.S.	October 2014–April 2015
USS <i>Theodore Roosevelt</i>	CVN	Arabian Gulf	U.S.	April 2015–October 2015
USS <i>Harry S. Truman</i>	CVN	Arabian Gulf	U.S.	December 2015–May 2016
USS <i>Harry S. Truman</i>	CVN	Eastern Mediterranean	U.S.	May 2016–June 2016
USS <i>Dwight D. Eisenhower</i>	CVN	Arabian Gulf	U.S.	June 2016–December 2016
USS <i>George H.W. Bush</i>	CVN	Eastern Mediterranean	U.S.	February 2017–March 2017
USS <i>George H.W. Bush</i>	CVN	Arabian Gulf	U.S.	March 2017–June 2017
USS <i>Nimitz</i>	CVN	Arabian Gulf	U.S.	July 2017–October 2017
USS <i>Theodore Roosevelt</i>	CVN	Arabian Gulf	U.S.	December 2017–March 2018
USS <i>Harry S. Truman</i>	CVN	Eastern Mediterranean	U.S.	May 2018–May 2018
USS <i>John C. Stennis</i>	CVN	Arabian Gulf	U.S.	December 2018–April 2019
USS <i>Makin Island</i>	LHD	Arabian Gulf	U.S.	September 2014–October 2014
USS <i>Essex</i>	LHD	Arabian Gulf	U.S.	August 2015–October 2015
USS <i>Kearsarge</i>	LHD	Arabian Gulf	U.S.	November 2015–December 2015
USS <i>Boxer</i>	LHD	Arabian Gulf	U.S.	June 2016–July 2016

SOURCE: U.S. Carriers, homepage, undated.

NOTE: CVN = aircraft carrier (nuclear propulsion); LHD = landing helicopter dock; FR = French.

Data Collection, Assumptions, and Application

The analysis in this report draws on data detailing strikes, targets, sorties, and other airpower activities that occurred in OIR. The RAND CJTF-OIR strike release data set and the RAND AFCENT airpower summary data set are derived from two publicly available sources: the CJTF-OIR strike releases and the AFCENT airpower summaries.¹ The CJTF-OIR strike releases provide the number of strikes launched, the number and description of targets engaged, and the strikes' effect on each target by nearest city each day. The AFCENT airpower summaries give monthly updates on the number of sorties, weapons released, pounds of fuel and cargo delivered, and other airpower activity supporting OIR. The data available from each source are presented in Table D.1.

The CJTF-OIR and AFCENT data complement one another, but they are not directly comparable. The remainder of this appendix will describe the data from each source in greater detail, along with caveats and assumptions made, and provide some summary snapshots of the data.

CJTF-OIR Strike Releases: Scope and Limitations

Since the United States first launched air strikes against ISIS in 2014, CENTCOM—and subsequently CJTF-OIR (referred to as *the coalition*)—has published daily (or near daily) strike releases. Strike releases prior to the establishment of the coalition were published by CENTCOM, but, from 2015 onward, the coalition has released standardized reports that are publicly available. Each strike release reports, by nearest city, the number of strikes, the number and description of targets engaged, and the strikes' effect on each target that occurred over the listed day. We collected the strike releases that fell within the time period of our study and then aggregated the data from each for analysis.

¹ The RAND CJTF-OIR strike release data set is compiled from CJTF-OIR, “Strike Releases,” webpage, undated; the RAND AFCENT airpower summary data set is compiled from CENTCOM, “Airpower Summaries,” webpage, undated.

Table D.1
Data Available by Source

		CJTF-OIR Strike Releases	AFCENT Airpower Summaries
Scope	All CJTF-OIR strikes	USAF and other coalition aircraft under CFACC control	
Report frequency	Daily	Monthly	
Geographic detail	By city	Not provided	
Data	Number of strikes	Number of CAS/escort/interdiction sorties	
	Target type	Number of sorties with at least one weapon release	
	Effect on target	Number of weapons released	
	Number of targets affected	ISR sorties	
	Aircraft type used (by country) ^a	Airlift and airdrop sorties Airlift cargo (short tons) Airlift passengers Supplies air-dropped (lbs) Tanker sorties Fuel offloaded (millions of lbs)	
		Aircraft refuelings	

^a Aircraft type used reported only through February 2017.

It is worth noting that the information provided in the coalition strike releases was not uniform, despite the standardized format of the releases. Some strike releases include strikes that had taken place on other days and were reported late, noting which date the strike occurred. Others aggregate three to four days' worth of strikes. Inconsistencies appear over time as well. Releases from 2014 report strikes the day they occurred, whereas releases from 2015 onward cover the previous day's strikes. Additionally, strike releases before February 16, 2017, list the type of aircraft used each day and identify the country in which these platforms were used. After that date, the strike releases no longer report the type of aircraft used.

The most significant inconsistency within the strike releases is in the breadth of the platforms covered. Initially, the strike releases included only strikes delivered by coalition-manned aircraft or RPAs. Strikes from rocket artillery first appear in October 2015, followed by strikes with rotary-wing aircraft starting in September 2016, as those forces joined the fight against ISIS. In February 2017, the coalition began to include other ground-based artillery fire, excluding counterfire or fire support to

maneuver forces, as strikes. A further shift came in April 2017, when the coalition classified all ground-based tactical artillery fire as strikes.

The addition of ground-based fires in the strike releases significantly limits the comparison of strikes. The number of strikes per month doubled within four months of the 2017 inclusion of all artillery types in the data, which also corresponded with rapidly shrinking ISIS territory that allowed for greater use of tube artillery. Because there is no way to discern which strikes were conducted by aircraft versus ground-based systems, comparison of strike releases over time must take into account the more inclusive CJTF-OIR reporting.

Despite these inconsistencies, the aggregate data from the CJTF-OIR strike releases provide useful information about coalition operations, albeit with clear limitations. First, the data detail strikes and targets but do not tie specific strikes to specific targets. Instead, the strike releases aggregate strikes and targets by city. Figure D.1 is an example CJTF-OIR strike release from December 28, 2015, the day the ISF captured the city center of Ramadi. For instance, the strike release states,

Near Ramadi, three strikes struck two separate ISIL tactical units and destroyed seven ISIL heavy machine guns, two ISIL RPG positions, an ISIL bulldozer, two ISIL buildings, an ISIL staging area, an ISIL VBIED staging area, denied ISIS access to terrain, and wounded 12 ISIL fighters.

Figure D.1
Example CJTF-OIR Strike Release



December 28, 2015
Release # 20151228-01
FOR IMMEDIATE RELEASE

Military Strikes Continue Against ISIL Terrorists in Syria and Iraq

SOUTHWEST ASIA: On Dec. 27, coalition military forces continued to attack ISIL terrorists in Syria and Iraq. In Syria, coalition military forces conducted 16 strikes using attack and remotely piloted aircraft. In Iraq, coalition military forces conducted 21 strikes coordinated with and in support of the Government of Iraq using rocket artillery and fighter, attack, bomber, and remotely piloted aircraft against ISIL targets.

The following is a summary of the strikes conducted against ISIL since the last press release:

Syria

- Near Hasakah, two strikes struck an ISIL tactical unit and destroyed an ISIL vehicle and an ISIL building.
- Near Ar Raqqah, one strike struck an ISIL tactical unit and destroyed an ISIL vehicle.
- Near Manbij, eleven strikes struck seven separate ISIL tactical units and destroyed an ISIL vehicle, an ISIL vehicle home improvised explosive device (VBIED), an ISIL building, cratered two ISIL-used roads, and damaged an ISIL fighting position.
- Near Mar'a, two strikes struck two separate ISIL tactical units and destroyed an ISIL staging area.

Iraq

- Near Al Baghdadi, one strike struck an ISIL tactical unit and destroyed an ISIL weapons cache.
- Near Fallujah, one strike struck a large ISIL tactical unit and destroyed an ISIL building and an ISIL vehicle.
- Near Kirkuk, three strikes struck two separate ISIL tactical units and destroyed an ISIL fighting position and an ISIL bulldozer.
- Near Mosul, eight strikes struck six separate ISIL tactical units and destroyed three ISIL vehicles, six ISIL fighting positions, an ISIL heavy machine gun, an ISIL checkpoint, and an ISIL tactical vehicle.

-MORE-

For additional information contact:
CJTF-OIRmedia@mail.mil

COM: U.S. 1-803-885-8265 or in Southwest Asia
COM: 00-965-221-6340, then dial 430-5193#
<https://twitter.com/CJTFOIR>
<https://www.facebook.com/CJTFOIR>



Combined Joint Task Force
Operation Inherent Resolve
APO AE 09306

- Near Ramadi, three strikes struck two separate ISIL tactical units and destroyed seven ISIL heavy machine guns, two ISIL RPG positions, an ISIL bulldozer, two ISIL buildings, an ISIL staging area, an ISIL VBIED staging area, denied ISIS access to terrain, and wounded 12 ISIL fighters.

- Near Sirjar, one strike struck an ISIL tactical unit and destroyed an ISIL fighting position.
- Near Sultan Abdallah, one strike struck an ISIL tactical unit and destroyed three ISIL fighting positions.

- Near Tal Afar, three strikes struck two separate ISIL tactical units and destroyed an ISIL vehicle and an ISIL assembly area.

Strike assessments are based on initial reports. All aircraft returned to base safely.

A strike, as defined in the CJTF releases, means one or more kinetic events that occur in roughly the same geographic location to produce a single, sometimes cumulative effect for that location. So having a single aircraft deliver a single weapon against a lone ISIL vehicle is one strike, but so is multiple aircraft delivering dozens of weapons against a group of buildings and vehicles and weapon systems in a compound, for example, having the cumulative effect of making that facility (or facilities) harder or impossible to use. Accordingly, CJTF-OIR does not report the number or type of aircraft employed in a strike, the number of munitions dropped in each strike, or the number of individual munition impact points against a target.

The strikes were conducted as part of Operation Inherent Resolve, the operation to eliminate the ISIL terrorist group and the threat they pose to Iraq, Syria, and the wider international community.

The destruction of ISIL targets in Syria and Iraq further limits the group's ability to project terror and conduct operations. Coalition nations which have conducted strikes in Iraq include Australia, Belgium, Canada, Denmark, France, Jordan, Netherlands, the United Kingdom, and the United States. Coalition nations which have conducted strikes in Syria include Australia, Bahrain, Canada, France, Jordan, Saudi Arabia, Turkey, United Arab Emirates, the United Kingdom, and the United States.

-30-

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COM: U.S. 1-803-885-8265 or in Southwest Asia
COM: 00-965-221-6340, then dial 430-5193#
<https://twitter.com/CJTFOIR>
<https://www.facebook.com/CJTFOIR>

SOURCE: CJTF-OIR, "Military Strikes Continue Against ISIL Terrorists in Syria and Iraq," press release, December 28, 2015.

tions, an ISIL bulldozer, two ISIL buildings, an ISIL staging area, an ISIL VBIED staging area, denied ISIS access to terrain, and wounded 12 ISIL fighters.²

Given the information provided, it is not feasible to determine which targets were engaged by which of the three strikes.

In regard to targeting, the CJTF-OIR strike releases describe what targets the coalition engaged but not what the coalition's primary targets were in each strike. For instance, the coalition's primary targets in the example in Figure D.1 might have been the two tactical units, making some or all of the weapon systems destroyed incidental to the primary targets. Therefore, the strike releases should not be used to assess what the coalition primarily intended to hit but rather what it did hit throughout the campaign.

Additionally, one strike is not necessarily the same magnitude as another. The CJTF-OIR definition of *strike* captures a cohesive effect, which can differ from strike to strike. It does not correspond to the number or type of aircraft, the number or type of munitions, the number of aimpoints, or the number of engagements to deliver the cumulative effect, as noted in the example release. A CJTF-OIR strike might be a single aircraft delivering a single munition against one target or a number of aircraft delivering multiple munitions over several engagements for a cumulative effect.

CJTF-OIR Strike Releases: Data Collection, Assumptions, Groupings

To collect and aggregate the CJTF-OIR strike releases for analysis, we individually reviewed each release and then collected the data. Although almost all strike releases contain the same level of data in a standardized format, some ambiguous and idiosyncratic entries appear. To ensure a standardized data entry format, we noted these non-uniform occurrences and developed a standard process for addressing them. Similarly, we grouped the granular target data, with approximately 1,000 distinct target descriptions, into a smaller number of categories to enable assessments of each operation as needed. Our assumptions and rules for standardizing the data, as well as our target categories, are described in this section.

Data Assumptions

As noted earlier, there are inconsistencies in the presentation of the data in the CJTF-OIR strike releases. The following list details the assumptions and rules used when collecting data from the CJTF-OIR strike releases:

² CJTF-OIR, "Military Strikes Continue Against ISIL Terrorists in Syria and Iraq," press release, December 28, 2015.

- We found that 61 out of the nearly 33,000 strikes delivered by the coalition had no effect or inconclusive results. Because they constituted only approximately 0.2 percent of strikes, we removed these inconclusive strikes from the data. Similarly, the strike releases do not describe the target of 21 strikes. These strikes are counted in the strike totals but not in our analysis of targets.
- If the release list “multiple” or “several” as the number of targets engaged, we assumed that at least two targets must have been engaged and record that two targets were engaged. The use of *multiple* and *several* occurs only in 2014 and early 2015 and is limited to small numbers of target entries (e.g., 27 target entries in 2015).
- If two cities are listed as receiving the same strikes (e.g., “near Al-Hasakah and Deir ez-Zur”), we recorded the first city listed. This issue seldom occurs. The only exception is in 2018–2019, when Abu Kamal and Hajin are listed together; we recorded the strikes as near Hajin.
- A strike may be listed near a city and seemingly the wrong country (e.g., a strike in Syria, near Al-Qaim). Although this may seem to be an error in the release, the cities that are occasionally listed outside their home country—Waleed, Abu Kamal, Sinjar, Rabiyah, and Al-Qaim—are near the border of Iraq and Syria. A strike near one of these cities may occur in either country, and we recorded the country as reported. This issue occurs eight times.
- For strike releases in 2014, the date of the strike release is the same as the date of the strikes, which we recorded as such. For 2015, the strike releases cover the previous day’s strikes. Under this structure, the December 31, 2014, and January 1, 2015, strike releases both record strikes for December 31, 2014. Because the releases contain different strikes, we recorded the strikes of both releases as occurring on December 31.
- For a strike release that covers multiple days of strikes and does not list the strikes separately for each day, we recorded all of the strikes as occurring on the last day listed in the strike release. This issue occurs only in November 2014 and early December 2014 across 16 strike releases.
- If the number of strikes is listed only by country but the targets are listed by city, we determined the number of strikes for each location by the proportion of targets engaged at each city along with a qualitative assessment of targets. If no daily strike total is provided but targets are listed, we assessed the language and target descriptions to determine the strike totals for each city. In these cases, the cumulative numbers of strikes to date were available in the releases, which allowed us to determine the total number of strikes to allocate. These issues arose at least twice and only in August–September 2014.

Grouping the Data

Once the data were aggregated, we found approximately 1,000 different target descriptions across the strike releases. Some differences were small, such as plural versus singular descriptions or different phrasing of the same target. We matched similar target descriptions and reduced the number of distinct target types to 773. From this list, we grouped the targets into four bins for our primary analysis: facilities and resources, military forces, terrain and LOCs, and vehicles. These four bins are described in Table D.2. We use these target groups, as well as their underlying targets, when assessing the strike releases for a given operation or time period.

Where possible, we also grouped strikes and targets to explore the nuances of specific operations and validated our results with outside sources. For example, we devised a target grouping and methodology to count strikes in support of Operation Tidal Wave II, the coalition's effort to degrade ISIS oil and gas assets. We created bins to condense the more than 170 distinct oil and gas targets found across the releases: production, processing and refining, and distribution and storage. These bins are described in Table D.3.

It is worth noting that the strike releases do not identify which operations strikes supported, which means that, for example, we were unable to track the precise number of strikes or targets struck in Operation Tidal Wave II. Nonetheless, we were able to

Table D.2
Main Target Groups: Definitions and Examples

Target Group	Definition	Example Targets
Facilities and resources	ISIS-controlled facilities and resources that do not directly enable combat forces but that are fixed targets that support ISIS fighters, economy, governance, or recruiting	Weapon facilities or factories, weapon caches, staging and assembly areas, buildings, barracks, C2 centers, caves, tunnels, communication towers and facilities, bunkers, storage centers, oil, gas, fuel equipment, resupply points
Military forces	Combat forces or weapons in the open. These targets have direct military capabilities or intent. Active IEDs and armed vehicles are included but weapons in storage are not.	Tactical units, fighters, artillery, machine guns, mortar sites, rockets, counterfire, heavy weapon systems, snipers, IEDs, VBIEDs, tactical vehicles
Terrain and LOCs	Terrain features, natural or manmade, that ISIS can use as fighting positions, as defensive positions, or to directly enable ISIS fighters or that are used to move forces, assets, or information. These targets may be occupied or unoccupied.	Fighting positions, trenches, berms, culverts, access to terrain, logistics routes, obstacles, roadblocks, bridges, supply roads, UAS launch sites, communication lines
Vehicles	All noncombat vehicles, including construction equipment. These targets have the capability to move ISIS personnel, equipment, and assets. VBIEDs or tactical vehicles are not included.	Vehicles, oil trucks, earth movers, dump trucks, boats, trailers

Table D.3
Oil and Gas Target Groups: Definitions and Examples

Target Group	Definition	Example Targets
Production	Equipment or sites that enable the extraction of oil and gas	Oil wellheads, drilling rigs, gas and oil separation wellheads, oil pumps and pump jacks, oil stills
Processing and refining	Equipment or facilities that enable the processing or refining of oil and gas	Modular oil refineries, oil processing equipment, oil-gas separation plants, oil refinement stills, separator tanks, petroleum, oil, and lubrication sites
Distribution and storage	Equipment, facilities, or vehicles that enable the distribution of oil and gas; includes oil administrative facilities and equipment, facilities, or sites used to store oil and gas	Oil tanker trucks, oil trailers, oil manifolds, pipelines, fuel trucks, oil headquarters, crude oil collection points, tanks, oil drums, reservoirs, fuel storage facilities

approximate the number of strikes in support of this operation and validate our results against official counts of Operation Tidal Wave II strikes and targets publicly released by the coalition and U.S. government officials at various times during the operation (see Table D.4).

We assumed that if a target set for a given city on a given day contained only oil or gas targets, then all strikes that day were in support of Operation Tidal Wave II. If more than one oil or gas target existed in the set of targets but the set also contained non-oil and -gas targets, we also assumed that all strikes near that city were strikes in support of the operation. If only one oil or gas target existed in a set with non-oil and -gas targets and only one of the oil and gas targets listed was engaged, then we assumed that only one of the strikes near that city on that day was in support of Operation Tidal Wave II. Although this approximation overestimates the number of strikes—target sets that contain multiple oil and gas targets and multiple non-oil and -gas targets likely split the strikes—most oil and gas targets were concentrated near a few cities and were often the only targets engaged there, increasing our confidence in the veracity of our assumptions. Including all strikes when multiple oil and gas targets were engaged provided an approximation that was closer to the publicly stated metrics than would be provided by removing these strikes or basing our count on the proportion of oil targets struck.

Table D.4 compares Operation Tidal Wave II strike and target counts reported at various points in the operation and our analysis of the relevant data over the same periods in question from the CJTF-OIR data. Almost all data points listed in press releases or other DoD sources, which are mostly rounded figures, are within 10 percent of the CJTF-OIR data. When the difference is greater than 10 percent (twice), it is no more than 30 percent different from the rounded DoD figures. The greatest error comes from the data point counting strikes between September 2014 and June 2016, a date range that covers almost a two-year span and starts about a year before Operation

Table D.4
Validating Strike and Target Data Methodology for Operation Tidal Wave II

Date Range	Press Release or Other Official Source	Analysis of the RAND CJTF-OIR Strike Release Data Set
October 25, 2015–December 1, 2015	Coalition destroyed 400 oil tanker trucks	Coalition destroyed 402 oil tanker trucks
October 25, 2015–March 21, 2016	Coalition destroyed 117 oil and gas targets (other than vehicles)	Coalition destroyed 130 targets (other than vehicles)
September 1, 2014–June 29, 2016	Coalition conducted about 300 strikes against oil and gas targets	Coalition launched 390 strikes against oil and gas targets
January 1, 2017–March 31, 2017	Coalition conducted more than 700 strikes against about 1,300 oil and gas targets	Coalition launched 759 strikes against 1,248 oil and gas targets
April 1, 2017–June 30, 2017	Coalition conducted about 500 strikes against about 1,200 oil and gas targets	Coalition launched 516 strikes against 1,136 oil and gas targets
July 1, 2017–September 30, 2017	Coalition conducted about 300 strikes against about 1,300 oil and gas targets	Coalition launched 376 strikes against 1,344 oil and gas targets

Tidal Wave II officially began. The CJTF-OIR strike count is slightly higher than that of the DoD sources, as expected, which suggests that the strike releases contain nearly all of the Operation Tidal Wave II strikes.

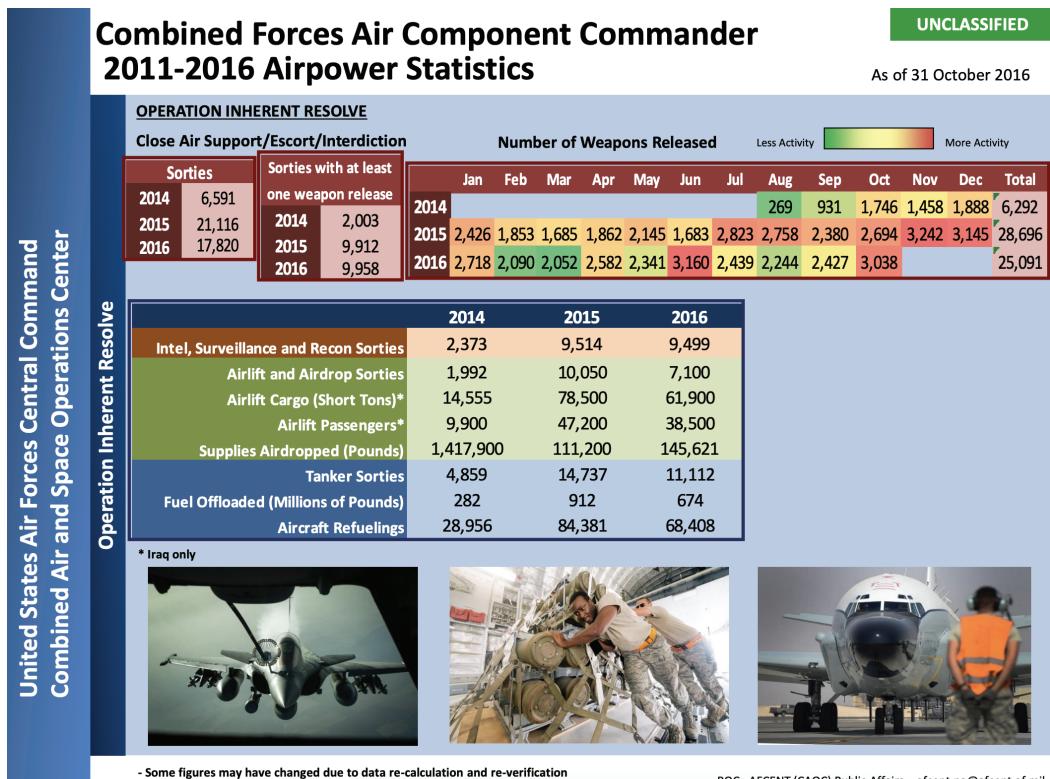
AFCENT Airpower Summaries: Scope and Limitations

AFCENT publicly released monthly airpower summaries for OIR from August 2014 through March 2019, the end date of the analysis in this report. These summaries contain the number of various sorties, types of sorties, weapons released, and other metrics of airpower activity. For each data field except weapons released, which is listed by month on each report, the monthly summaries report the cumulative data from the start of the year through the release date. To obtain monthly totals, we took the difference of each month's summary total to disaggregate by month. This calculation gave us the newly added numbers for each month, and, therefore, the statistics by month.

Figure D.2 shows an example AFCENT airpower summary, from October 2016, the month that the Mosul campaign officially began. The cumulative number of sorties and other statistics are provided for each year, as well as the 2016 totals through October 31, the summary release date. To determine how many sorties occurred during October 2016, we subtracted the cumulative totals in the September summary from the totals in the October 2016 release. The difference provided the number of new sorties that AFCENT reported in October 2016.

Like the CJTF-OIR strike releases, the AFCENT airpower summaries contain discrepancies and limitations on their use. First, the scope of the statistics is not uni-

Figure D.2
Example AFCENT Airpower Summary



SOURCE: AFCENT, Combined Air and Space Operations Center, "Airpower Effects," October 31, 2016, p. 3.

form within the summaries. Statistics on CAS sorties and weapons released come from aircraft under CFACC control, which includes both U.S. and other coalition members' aircraft but not all aircraft in the AOR. Second, the quantities of airlift cargo and passengers are for Iraq only, whereas all other statistics cover both Syria and Iraq. Discrepancies appear across summaries as well. For instance, a note on the use of coalition statistics for CAS sorties and weapon releases first appears in February 2017 but may be applicable to prior summaries. Likewise, CAS sorties are reported as only manned sorties from February 2018 onward, whereas no distinction was made beforehand.

The most significant limitation to analyzing the airpower summaries is that AFCENT could modify the cumulative totals each month, because of reverification and recalculation, without updating prior months' summaries. If sorties from a previous month are reverified or recalculated, they are not added to the month's summary in which they occurred. Instead, they are added to the next published summary as a part of the new cumulative total. With no distinction of how many new sorties versus

reverified or recalculated sorties are added to the cumulative total each month, the difference between two summaries is not guaranteed to record the actual activity that occurred between those two summaries. In turn, unusual spikes and drops appear in the monthly data. Although this issue is a concern across all summaries, only a few actually exhibit these swings. Depending on the time frame of analysis, the possibility of these distorted statistics should be noted.

AFCENT Airpower Summaries: Data Collection, Assumptions, Groupings

To assess the airpower summaries over time, we reviewed each airpower summary and generated monthly totals by subtracting the cumulative totals of each month from those of the following month. When data discrepancies appeared, we made assumptions and rules to mitigate these issues and standardize the data. Similarly, we created a methodology to group and evaluate the summaries. These are described in this section.

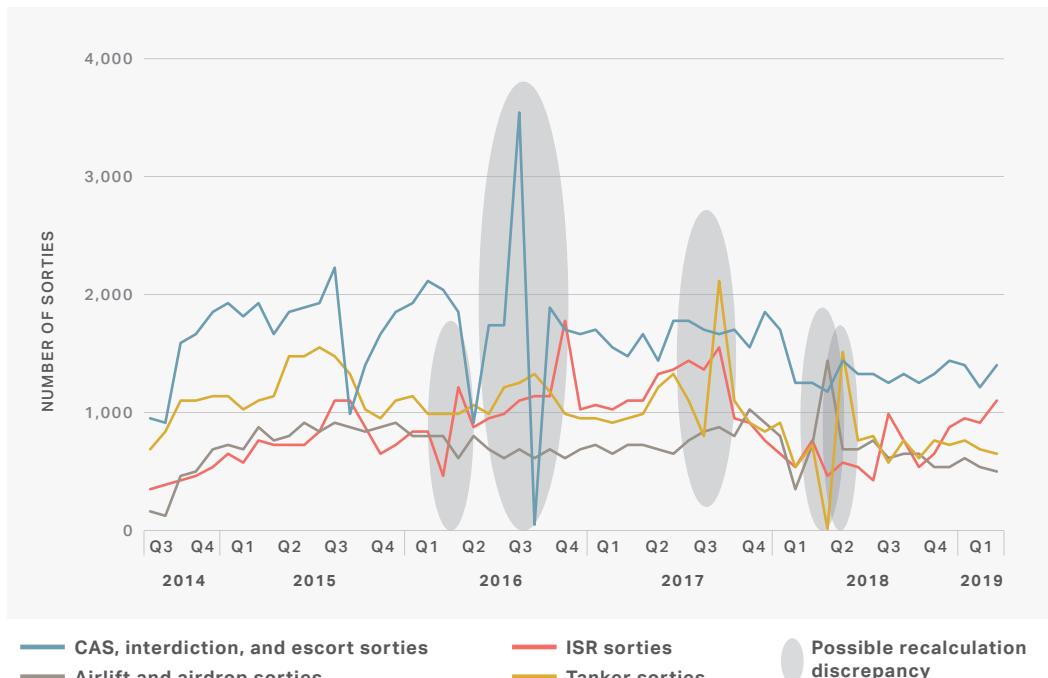
Data Assumptions

As mentioned, the most significant data limitation for the airpower summaries is that reverified and recalculated statistics are adjusted for in the cumulative totals of the most recent summary, not the month when the reverified or recalculated sortie or activity occurred. As a result, large swings in the data occur. These swings are typically a large decline followed by a large increase over a two-month period (see Figure D.3), suggesting that some amount of the first month's activity was captured in the second. For instance, the difference between the July 2017 and August 2017 summaries showed that there were 802 tanker sorties in August. However, between the August and September summaries, there were 2,109 sorties. Considering that tankers averaged 1,000 sorties per month in 2017 before and after these two months, it is likely that August's count was underreported and partially accounted for in the September 2017 summary.

When these sharp declines and spikes appear in close proximity, as in Figure D.3, we assume that the spike in the later month is a result of AFCENT verifying activity or sorties that were intended for the previous month's summary. However, we do not reallocate counts in these instances unless the calculated statistic is negative, which we make zero, or the AFCENT summaries contain text that corrects the delayed or faulty reporting. AFCENT corrected the largest discrepancy—a 3,417 swing in CAS sorties between August 2016 and September 2016—but did not provide corrections otherwise. For those cases without a correction or other source for verification, we acknowledge the discrepancy and its likely cause when the data are discussed.

We also assume that the CAS sorties and weapon releases statistics come from coalition aircraft under CFACC control for the entire campaign. Even though this distinction is noted only in the summaries from February 2017 onward, the number of

Figure D.3
AFCENT Airpower Monthly Recalculation Discrepancies



SOURCE: RAND AFCENT airpower summary data set.

CAS sorties and weapons released does not significantly change after February 2017. If the summaries had not taken coalition aircraft into account before February 2017, we would have expected to see a significant increase in CAS sorties and weapons released around this time to account for the expanded criteria.

We further assume that CAS sorties and weapon releases included statistics from both manned and unmanned sorties before February 2018, which is when AFCENT switched the summaries' labeling from CAS sorties to strike sorties and noted that they were manned only. Unlike February 2017, the operational tempo in 2018 reduced the demands of airpower drastically from a year prior, making a change in reporting difficult to assess in the data. Because we cannot show with certainty whether the data remained consistent through this noted change, we assume that the reporting definition did occur after February 2018.

Grouping the Data

As with the CJTF-OIR data, we group the AFCENT data to assess specific parts of OIR, and, because of data limitations, we make some assumptions to do so. For example, we group all of the airpower statistics, such as CAS, ISR, tanker, and airlift

sorties, chronologically into the three phases of OIR. We group Phase I to include the August 2014–March 2016 summaries, Phase II as April 2016–July 2017, and Phase III as August 2017–March 2019. To mitigate the issue of reverification, we do not sum the monthly totals we calculated for the length of each phase. Instead, we find the cumulative sum for each statistic from the start of OIR through the end of each phase and then subtract the previous phase's cumulative totals from each. The totals for each phase use the most-recently available data and thus the most-recently verified data for each year. For example, the 2014 totals for each phase are taken from the December 2017 airpower summary—the last summary to carry 2014 data. Likewise, the 2015 totals for each phase are taken from the December 2019 summary, the last to contain the 2015 data. For the year in which a phase ends, we use the totals of the summary from that phase's last month to capture the remaining months of the phase.

With the most-recently verified totals for each year, we first calculated the cumulative number of sorties and other activities from the start of OIR through the end of each phase. Then, we subtracted the preceding phases' totals from each. To illustrate, we calculated the totals for Phase II by subtracting the totals of Phase I (August 2014–March 2016) from the cumulative totals from the start of OIR (August 2014) through the end of Phase II (July 2017). This calculation gave us the number of sorties and statistics from April 2016 through July 2017. Likewise, for Phase III, we subtracted the totals of Phase I and Phase II from the cumulative totals through the end of Phase III (March 2019) to obtain the statistics totals for August 2017 through March 2019. After these calculations, we had the most-recently verified totals of the airpower statistics for each OIR phase (see Table D.5).

Summary Snapshots

To demonstrate our analysis of the data and their possible uses, we have included several summary statistics and data snapshots for the CJTF-OIR releases and AFCENT airpower summaries that may prove useful.

CJTF-OIR Data Snapshots

According to the CJTF-OIR strike releases, the coalition delivered almost 33,000 strikes that engaged more than 81,000 targets between the start of OIR on August 8, 2014, and the end of Phase III on March 23, 2019. These strikes were distributed among more than 100 different cities and locations in Syria and Iraq but were concentrated around approximately 30 areas over the course of the operation. Figure D.4 lists the number of strikes for cities by country that received over 5 percent of total strikes in any quarter. The color gradations of cells within Figure D.4 show the relative number of strikes near a city in a quarter, from low to high. The significant number of gray cells, which highlight strike totals between the extremes, demonstrates that the

Table D.5
AFCENT Airpower Summaries by OIR Phase

Airpower Statistic	Phase I August 2014– March 2016	Phase II April 2016– July 2017	Phase III August 2017– March 2019	Total
CAS/escort/interdiction sorties	33,787	26,501	28,334	88,622
Sorties with one or more weapon release	14,696	16,288	4,997	35,981
Weapons released	41,718	51,739	24,076	117,533
ISR sorties	14,004	18,601	16,296	48,901
Airlift and airdrop sorties	14,442	10,973	14,555	39,970
Airlift cargo (short tons)	111,355	92,973	81,465	285,793
Airlift passengers	68,100	72,624	130,967	271,691
Supplies air-dropped (lbs)	1,529,100	1,055,991	1,383,106	3,968,197
Tanker sorties	22,725	17,398	16,594	56,717
Fuel offloaded (millions of lbs)	1,388	1,043	1,125	3,556
Aircraft refueling	134,321	98,638	98,495	331,454

SOURCE: RAND ACFENT airpower summary data set.

coalition often distributed its efforts over many cities rather than concentrating most of the strikes around one city at once. Only two cities received more than 30 percent of strikes in a quarter before Raqqa became the last major ISIS stronghold. Over the entire course of OIR, only Mosul and Raqqa, ISIS's twin capitals, received more than 10 percent of all coalition strikes.

The 81,000 targets engaged by the coalition were also distributed across cities and target groups (see Figures D.5 and D.6). Targets that we considered military forces, such as tactical units and weapons, were the most pervasive targets overall, constituting 35 percent of all targets hit. Military force targets were followed by terrain and LOC targets, facilities and resources, and then vehicles. At the city level, however, the primary target group could vary. For instance, facilities and resources targets were the most commonly engaged targets near Abu Kamal, where many oil and gas targets were struck during Operation Tidal Wave II. Others, such as Raqqa, had slightly more terrain and LOC targets engaged than military force targets.

The concentration of targets engaged also changed over time. Military forces were the most prominent target over time, but they peaked as a proportion of all targets in the first three months of OIR and the last three months of Phase III. In between, facilities and resources targets and terrain and LOCs targets had periods in

Figure D.4
CJTF-OIR Strikes by City and Quarter of Year

	CITY	2014		2015				2016				2017				2018				2019	Total
		Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	
IRAQ	Al Asad		19	82	35	3		3			3	4		3	3	1	2	2			160
	Al-Qaim	2	34	44	17	9	10	14	11	16	20	31	48	83	128	1	10	2			480
	Baghdad	22	6	4							5	2		5		2	3				49
	Baiji		67	62	277	139	39	10	40	18	32	38	46	40	16	2	2	1	1		830
	Erbil	28	1	3				1	1			2									36
	Fallujah	4	65	86	123	94	51	38	205	3	1		2	2							674
	Haditha Dam	20	1																		21
	Kirkuk	19	45	83	22	47	18	25	32		2	16	13	6	1	1	3	1	1		335
	Kisik					48	119	120	77	38	29	33	29	58			2	3			556
	Mosul	1	88	196	211	221	209	335	370	205	387	425	455	62	4	1	5	2	2		3,179
	Mosul Dam	101	66																		167
	N/A	8														1	1	15	126		151
	Other	10	105	123	168	439	229	308	404	249	123	63	45	186	55	36	31	48	35		2,657
	Qayyarah					9	32	87	202	134	22	8	5	23	22	10	6	1			561
	Ramadi		40	43	127	230	417	276	38	106	13			2	5	2					1,299
	Rawa		3	12	2	7	1		8	6	63	51	46	120	76		1	7			403
	Sinjar	21	50	50	122	156	306	128	59	37	23	29	32	1							1,014
	Tal Afar		30	84	148	102	89	40	57	36	43	72	52	168	1	3	5	2	1		933
SYRIA	Abu Kamal	16	2	4		11	29	20	22	70	77	107	184	155	269	449	354	338	164		2,271
	Al-Hasakah	5	13	84	219	282	93	81	1			2									780
	Al Shadaddi		1						22	56	85	48	44	96	30	12	104	7			505
	Ayn Isa		1			10	35	51	18	18	238	25									396
	Deir ez-Zur	18	39	27	37	43	65	43	15	113	105	289	330	275	146	4	3				1,552
	Hajin															2		1,282		1,284	
	Kobani	2	439	470	205	88	2	2													1,208
	Manbij	3				4	55	93	333	460	47	10									1,005
	Mar'a					38	116	94	164	145	74										631
	N/A																		469	1,875	2,344
	Other	15	29	11	55	142	121	101	33	17	63	130	42	12	7		4	1	10		793
	Raqqa	10	33	26	58	79	48	44	71	96	243	851	1,058	3,187	369	1					6,174
	Tabqah											41	339								380
	Grand total	305	1,177	1,494	1,826	2,201	2,084	1,914	2,183	1,823	1,698	2,275	2,772	4,484	1,132	526	537	416	1,980	2,001	32,828

Low High

SOURCE: RAND ACFENT airpower summary data set.

NOTE: N/A = only the country was specified in the strike release, not a city.

Figure D.5**Number of Targets Engaged by City and Target Group**

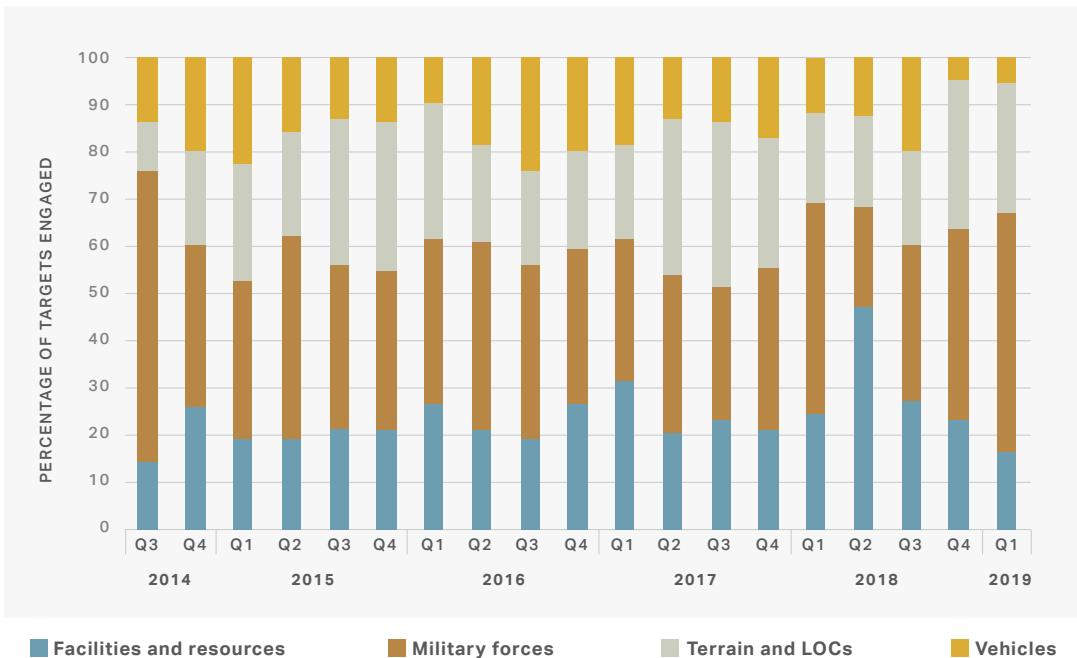
	CITY	FACILITIES AND RESOURCES	MILITARY FORCES	TERRAIN AND LOCS	VEHICLES	TOTAL
IRAQ	Al Asad	78	134	32	64	308
	Al-Qaim	404	180	131	217	932
	Baghdad	21	41	8	10	80
	Baiji	548	760	289	465	2,062
	Erbil	3	39	5	12	59
	Fallujah	292	857	537	270	1,956
	Haditha Dam	2	27	3	6	38
	Kirkuk	209	362	164	141	876
	Kisik	346	638	334	77	1,395
	Mosul	2,554	5,022	4,565	1,858	13,999
	Mosul Dam	10	144	23	28	205
	N/A	72	94	32	6	204
	Other	2,025	2,616	1,489	1,632	7,762
	Qayyarah	443	952	176	435	2,006
	Ramadi	980	1,505	975	490	3,950
	Rawa	359	237	44	91	731
	Sinjar	729	1,042	892	203	2,866
	Tal Afar	722	903	581	430	2,636
SYRIA	Abu Kamal	1,693	1,163	653	984	4,493
	Al-Hasakah	276	632	501	565	1,974
	Al Shadaddi	268	359	199	134	960
	Ayn Isa	105	306	227	85	723
	Deir ez-Zur	2,232	359	295	1,081	3,967
	Hajin	488	646	692	114	1,940
	Kobani	315	615	1,055	237	2,222
	Manbij	131	879	803	205	2,018
	Mar'a	112	654	374	106	1,246
	N/A	995	2,941	1,693	291	5,920
	Other	392	658	391	493	1,934
	Raqqa	1,678	3,687	4,602	1,275	11,242
	Tabqah	33	314	212	75	634
	Grand total	18,515	28,766	21,977	12,080	81,338

Low  High

SOURCE: RAND ACFENT airpower summary data set.

NOTE: N/A = only the country was specified in the strike release, not a city.

Figure D.6
Number of Targets Engaged by Target Group over Time



SOURCE: RAND CJTF-OIR strike release data set.

which they surpassed the number of military force targets engaged, achieving 47 percent and 35 percent of all targets engaged at their respective peaks. Across cities, Mosul and Raqqa were again the leading locations, with a combined 25,000 targets—30 percent of all targets engaged. Interestingly, although Mosul had fewer strikes than Raqqa (likely because of the inclusion of all ground-based fires in April 2017, when much of the battle for Mosul had already occurred), almost 4,000 more targets were struck near Mosul over the course of OIR. Mosul received a higher sustained rate of strikes than Raqqa through 2015 and 2016, giving more total opportunities for the coalition to strike targets around Mosul.

AFCENT Snapshots

From August 2014 through March 2019, AFCENT airpower summaries reported that the coalition generated 88,622 CAS/escort/air interdiction sorties in support of OIR, of which 35,981 released at least one weapon (see Table D.6). Likewise, the summaries reported a combined 145,000 ISR, tanker, and airlift sorties that supported coalition efforts on the ground or in the air. Of those sorties, tankers refueled receiver aircraft

Table D.6
AFCENT Airpower Summaries Overall

Airpower Statistic	Total
CAS/escort/interdiction sorties	88,622
Sorties with one weapon release	35,981
Weapons released	117,533
ISR sorties	48,901
Airlift and airdrop sorties	39,970
Airlift cargo (short tons)	285,793
Airlift passengers	271,691
Supplies air-dropped (lbs)	3,968,197
Tanker sorties	56,717
Fuel offloaded (millions of lbs)	3,556
Aircraft refuelings	331,454

SOURCE: RAND ACFENT airpower summary data set.

331,454 times, while transport aircraft delivered 285,793 short tons of cargo, moved 271,691 passengers, and air-dropped almost 4,000,000 pounds of supplies.

Generally, these airpower efforts increased in intensity from the start of the campaign through the fall of Raqqa in 2017 and then sharply declined through March 2019. However, each of these airpower metrics ebbed and flowed with the operational demands of the campaign. As an example of this fluctuation, the number of weapon releases did not increase or decrease steadily within each year (see Figure D.7). In 2015, monthly weapon releases fell from their January peak of around 2,400 releases, when coalition efforts at Kobani were most intense, until July, when efforts to liberate Ramadi increased. Throughout 2016, the number of weapons released fluctuated between about 2,000 and 3,000, in part because of the gap in bomber presence during the transition from B-1Bs to B-52s between February and April. As the coalition neared liberation of Mosul and Raqqa in 2017, the number of weapons released steadily grew from April through August—the longest continuous increase thus far—reaching its all-time high of 5,075 weapons in August. After ISIS forces were defeated in Raqqa and the pace of operations slowed, weapon releases dropped to just 10 percent of the August high by December 2017 and did not rise above 1,000 until efforts in late 2018 to retake Hajin.

Figure D.7
Weapons Released by Month

	January	February	March	April	May	June	July	August	September	October	November	December	Total
2014								269	931	1,746	1,458	1,888	6,292
2015	2,426	1,853	1,685	1,862	2,145	1,683	2,823	2,758	2,380	2,694	3,242	3,145	28,696
2016	2,718	2,090	2,052	2,582	2,341	3,160	2,439	2,244	2,427	3,038	2,709	2,943	30,743
2017	3,600	3,439	3,878	3,274	4,374	4,848	4,313	5,075	3,550	1,642	1,000	584	39,577
2018	780	747	294	254	431	356	241	338	758	876	1,424	2,214	8,713
2019	2,005	607	900										3,512

Low High

SOURCE: RAND ACFENT airpower summary data set.

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PROJECT AIR FORCE

Airpower played a pivotal role in the U.S.-led fight against the Islamic State in Iraq and Syria (ISIS) from 2014 to 2019 and contributed to the success of Operation Inherent Resolve. This report sheds light on the impact of the air operations in Operation Inherent Resolve and whether airpower could have been applied differently to achieve faster, more-sustainable outcomes. The authors incorporate interviews with U.S. and coalition personnel, primary-source documents, and U.S. and coalition strike and sortie data to document the operational history of the air war, assess the relationship between airpower effects, and analyze the strategic and operational impact of airpower in Operation Inherent Resolve.

The authors find that, although airpower played an essential role in combating ISIS, airpower alone would not have been likely to defeat the militant organization. Instead, the combination of airpower and ground forces—led by Iraqi and Syrian partners—was needed to destroy the Islamic State as a territorial entity. The overarching strategy of Operation Inherent Resolve, which put ground-force partners in the lead, created several challenges and innovations in the application of airpower, which have implications for future air wars. To be prepared to meet future demands against nonstate and near-peer adversaries, the U.S. Air Force and the joint force should apply lessons learned from Operation Inherent Resolve.

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