Unmanned Aerial Vehicles and the Future of Air Combat

Brasher, Nathan . Brasher, Nathan.

ABSTRACT (ABSTRACT)

The development of a carrier-capable naval variant would give the Navy the first-day, deep-strike capability it has been lacking. To date, the only Navy weapon has been the expensive, difficult-to-reload Tomahawk. (Reloading the launchers on board a submarine or surface combatant is a lengthy procedure, requiring a properly equipped naval facility.)

FULL TEXT

Headnote

Unmanned Aerial Vehicles (UAVS), and their counterparts Unmanned Combat Aerial Vehicles (UCAVs), have been touted as the next big thing in aerial warfare-but this is only the beginning.

Proponents argue that their ability to deliver weapons and conduct reconnaissance without putting a human pilot at risk will revolutionize warfare, and they certainly present considerable advantages over current weapons. Remote robotic weapons, however, will never replace the human's ability to adapt and respond to a fluid combat environment. They will augment U.S. air power in the future, but they will never completely replace the fighter pilot and manned aircraft.

Less than a decade ago, the idea that unmanned robotic aircraft could identify, target, and destroy an enemy vehicle was relegated to science fiction. Yet, during Operation Enduring Freedom, when a Hellfire missile was mated with an RQ-1 Predator, armed unmanned vehicles became a reality.1 U.S. Central Command's General Tommy Franks, U.S. Army, called the Predator his main tool for tracking down al-Qaeda. The top military brass quickly recognized the value of this new technology. It is clear that this technology will play a significant role in future combat.

Of the myriad of unmanned vehicles employed during Operation Enduring Freedom in Afghanistan and Iraqi Freedom, the RQ-1 Predator and the RQ-4A Global Hawk were center stage.

The RQ-1 was initially designed as a surveillance and reconnaissance drone, but quickly acquired a combat capability with the Hellfire missile. Its typical payload includes multiple electro-optical and infrared sensors, as well as an on-board synthetic aperture radar for ground target visualization.

The RQ-4A is, by comparison, a much longer range and duration reconnaissance platform, entered service in 2000.

The Global Hawk advertised capabilities include conducting surveillance of an area the size of Illinois in a 24-hour period. In addition, its ability to divert to targets as they appear gives it the advantage over surveillance satellites. It is a precise and effective tool for locating enemy targets, but has no combat capabilities.

Enter the X-45 unmanned combat aerial vehicle (UCAV) and future systems. When Boeing lost the Joint Strike Fighter contract to Lockheed in 2001, the company began looking for new sources of revenue in the defense industry and created an unmanned systems division.

The X-45, the first unmanned vehicle specifically designed for combat, conducted its first autonomous weapons launch on 18 April 2004. Following a preprogrammed flight path, the X-45A flew to its target, released an inert practice bomb, and successfully hit the target-all without controller input. The capability to deliver precision-guided weapons without risk to a human pilot should make it the first choice for heavily defended targets. Its anticipated low-cost and miniscule radar signature give it further advantages over manned tactical fighters. It is likely that vehicles like the X-45 will play a large role in future air campaigns. Planners debate pros and cons but the question of how best to employ the X-45 and its follow-on unmanned combat aircraft remains to be answered.

The payoff of an effective UCAV system would be enormous. With the high stealth capabilities demonstrated by the X-45A concept aircraft, such systems could one day surpass the Tomahawk land-attack missile as the best deep-strike weapon.

The X-45 also enjoys substantial cost advantages over the Tomahawk and the U.S. Air Force's AGM-86C conventional air-launched cruise missile (CALCM). Tomahawks cost about $1.4 million and AGM-SoCs cost approximately $1.8 million. By contrast, it costs a meager $18,000 for an X-45 to drop a joint direct attack munition (JDAM) on the same target, and the X-45 also shows advantages when compared to manned aircraft. It eliminates any threat to a human and the absence of a cockpit removes what is a major source of radar return on manned aircraft, even stealthy ones, according to Air Force Magazine. Combined with this and its relatively small size, the level of stealth achievable by vehicle like the X-45 far exceeds that achievable by a full-size fighter aircraft like the F-117 or F-22.

The development of a carrier-capable naval variant would give the Navy the first-day, deep-strike capability it has been lacking. To date, the only Navy weapon has been the expensive, difficult-to-reload Tomahawk. (Reloading the launchers on board a submarine or surface combatant is a lengthy procedure, requiring a properly equipped naval facility.) The Air Force B-2 Spirit stealth bomber, by contrast, can reach similar first-day targets with low-cost JDAMs because of its aerial-refueled long range and stealth capabilities. The introduction of the F35 joint strike fighter in the coming years will give naval aviation some of this capability, but in normal operations the aircraft's range will not match that of a B-2 or Tomahawk; a naval unmanned combat air vehicle could change all this. The Global Hawk, already operational, has a range of 1,200 nautical miles (nm) including 24 hours of battlefield loiter time (a figure that no doubt would be reduced when carrying a weapons load). The F/A-18E/F Super Hornet, however, has a combat radius of barely 400 nm with very little loiter time. Clearly, the cost benefits and deep-strike abilities of unmanned systems are important. Even the opponents of UAV development grudgingly admit many of the potential benefits.

The battlefield is ever changing. To survive requires fluid thinking and the ability to adapt to the evolving situation. Fifty years ago the United States and the Soviet Union were developing guided air-to-air missiles. Proponents of the new technology argued that air-to-air missiles would render air combat, and dog-fighting skills, obsolete. No longer would fighter pilots engage at close range, maneuvering their aircraft for a gun shot. Fighters would simply launch their missiles at standoff distance and destroy the enemy. Air combat during the Vietnam War exposed the utter futility of this thinking. In his book And Kill MiGs, author Lou Drendel writes:

"One of the most significant military lessons of the Vietnam War was that control of the air over an enemy's homeland must be wrested from him by men specifically trained for that purpose. On the face of it, that would sound like a redundant statement. After all, hasn't the same lesson been learned from all the previous wars of the twentieth century? Of course it has, but recent technological preoccupations somehow seem to have blinded us to the

importance of the man in the cockpit, and to the fact that air-to-air combat boils down to the man and his tactics against the other man and his tactics."

The programmed thinking of a robotic aircraft cannot match, or even approach, man's ability to adapt and reason on the fly. Some would argue that having a remote controller mitigates or even eliminates this problem. The vehicle, however, can communicate to a controller only what it detects with its limited sensor package. One fighter pilot, First lieutenant Jeff Mustin, told Aerospace Power that remote piloting of a UAV in air-to-air combat is "like having a knife fight in a phone booth looking through a toilet-paper tube. You can try and flail all you want, but eventually you are going to die." UAVs cannot deliver the situational awareness of a pilot in the cockpit. Until artificial intelligence can match the human ability to think fluidly, or a pilot's ability to assess combat situations, UAVs will play a secondary role in air-to-air combat.

Unmanned combat systems may realize their greatest utility, however, as robotic wingmen for piloted aircraft, greatly increasing the air-to-ground and air-to air capabilities of a single jet. They could be sent in slightly ahead of the main force to suppress enemy air defenses, for example. From a programmed low-altitude flight path, an unmanned vehicle could take out the known air-defense sites and loiter around the battlefield destroying enemy missile sites as they appear. Mobile missile batteries pose a particular threat because conventional first-strike weapons, such as Tomahawks, cannot target them-but the UCAVs can. Manned aircraft would then be able to strike targets, which require more discretion, such as a terrorist safe house within a major city, while the UCAVs search for and destroy the air defenses.

Unmanned vehicles equipped with air-to-air missiles might enhance the air-to-air capabilities of manned aircraft in specific scenarios. Currently, air-to-air combat happens too fast and requires too much mental agility to be handled by a robotic or even remotely piloted vehicle. Orbiting UCAVs protecting high-value targets might be able to ambush incoming fighters if they could be lured within range. Surprise and stealth would enable them to fire on enemy aircraft without detection, a first shot tactic that would avoid the complex high-speed maneuvers that the unmanned vehicles cannot emulate. Once surprise was given away however, the UCAV would be at a decided disadvantage against a manned fighter aircraft.

While the idea of UCAV as an ideal weapon for the suppression mission is not new, the simultaneous manned aircraft/UAV strike has not been explored to my knowledge. Nor has the idea of synergy between UAVs and manned aircraft in an air combat role. I believe they have merit and should be investigated.

Armed and unarmed vehicles have the potential to redefine the way the U.S. military conducts aerial warfare. The technology could have the biggest impact on air power since the introduction of guided weapons during the Vietnam War. Even guided weapons, however, did not lessen the importance of the individual pilot in battle. In some ways, the improved target destruction capability actually increased the need for human judgment and discretion. The fighter pilots are here to stay, but the role of the unmanned air vehicle can only increase.

Sidebar

Northrop Grumman's Navy Fire Scout (opposite), one of two versions being produced for the Army and the Navy with different sensors and avionics, is scheduled to achieve an initial operational capability in 2007. Boeing's joint unmanned combat air systems X-45C (full-scale model above) is scheduled to begin flight tests in 2007.

Sidebar

A pair of Boeing X-45A technology demonstrator unmanned aircraft (above) have been flying out of NASA's Dryden Flight Research Center at Edwards Air Force Base, California, using Block 3 software. An X-45A demonstrator for the

Joint Unmanned Combat Air System, or J-UCAS (below) dropped its first weapon on 20 March 2004.

Sidebar

Not all good things come in big packages. Corporal Richard Derby, a Dragon Eye operator with Headquarters &Service Company, 3d Battalion, 3d Marines, hand-launched the unmanned air vehicle on a reconnaissance mission in Afghanistan. Commanders have tried for centuries to see what was going on "over the hill" and small vehicles like this one now offer small-unit leaders a chance to see just that. The Dragon Eye weighs about five pounds and can stay aloft for about an hour transmitting data through a line-of-sight link. It cannot attack targets, but it can find them.

References

1 FAS. "RQ-1 Predator," http://www.fas.org/irp/program/collect/predator.hlm

AuthorAffiliation

Ensign Nathan Brasher, U.S. Navy

AuthorAffiliation

Ensign Brasher is a 2005 graduate of the U.S. Naval Academy.

DETAILS

Subject:	Unmanned aerial vehicles; Electronic warfare; Military weapons; Defense industry
Business indexing term:	Subject: Defense industry
Company / organization:	Name: Navy-US; NAICS: 928110
Identifier / keyword:	Unmanned aerial vehicle; Air Combat; Aerial
Publication title:	United States Naval Institute. Proceedings; Annapolis
Volume:	131
Issue:	7
Pages:	36-39
Number of pages:	4
Publication year:	2005
Publication date:	Jul 2005
Section:	Commander William Earl Fannin, Class of 1945, Capstone Essay Contest
Publisher:	United States Naval Institute
Place of publication:	Annapolis

Country of publication:	United States
Publication subject:	Earth Sciences--Oceanography, History, Engineering, Military, Transportation--Ships And Shipping, Public Administration
ISSN:	0041798X
CODEN:	XNIPAN
Source type:	Trade Journal
Language of publication:	English
Document type:	Commentary
Document feature:	Photographs
ProQuest document ID:	205983056
Document URL:	https://may.idm.oclc.org/login?url=https://www.proquest.com/trade-journals/unmanned-aerial-vehicles-future-air-combat/docview/205983056/se-2?accountid=12309
Copyright:	Copyright United States Naval Institute Jul 2005
Last updated:	2024-10-04
Database:	ProQuest One Academic

LINKS

Search for full text at Maynooth University, Search for full-text at Maynooth University