AY 2015-2016

INNOVATION LOST: THE TRAGEDY OF UCLASS

SENIOR ACQUISITION COURSE

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"The U.S. military will invest as required to ensure its ability to operate effectively in anti-access and area denial (A2/AD) environments."
2012 Defense Strategic Guidance[1]

"At stake here is not just the operational relevance of the carrier air wing in the future, but, really, the strategic relevance of the aircraft carrier for decades to come."
Robert Martinage[2]

The stunning defeat of the superior and better-equipped French army at Agincourt 600 years ago by an exhausted and vastly outnumbered English force offers many lessons to military planners, not the least of which regards the adoption of innovation. For several weeks preceding the battle, the English army had endured a forced march across the contested French countryside and faced France's area denial measures. But when they finally met the French army on an October morning after a cold, sleepless night on an open muddy field, the English archers used their new longbow technology to devastating effect against the French. It was employment of the longbow--an innovation that permitted a faster firing rate at a longer range than the previously dominant cross bow--that proved crucial in the success of that few, that happy few, that band of brothers on the fields of Agincourt.

The Navy faces a challenge in the Pacific that would not be unfamiliar to Henry V in Normandy. US strategic guidance expects China to continue to invest in anti-access, area denial (A2/AD) technology that undermines the ability of the US Navy to project power in the Pacific.[3] The Unmanned Carrier-Launched Airborne Surveillance and Strike (UCLASS) system was conceived as a key next-generation capability to provide a means to penetrate and persist in A2/AD environments. However, despite 15 years of research and development (R&D), a well-funded transition path over the valley of death,[4] and clear guidance from the Secretary of Defense and Congress, the Navy is reluctant to embrace the innovation that a fully-capable unmanned strike aircraft could bring to naval forces. Consistent with common theories that bureaucracies have difficulty with innovating on their own, the Navy steadily diluted the requirements for UCLASS over the course of five years from a full-stealth combat system to a less stealthy surveillance platform before finally settling on an unmanned tanker largely confined to uncontested airspace. Shakespeare's Henry V boldly proclaimed before Agincourt that "All things are ready if our minds be so." When it comes to innovation via UCLASS, the Navy's mind is not yet ready.

This paper examines the origins of the UCLASS program and describes the interaction between Congress, the joint requirements process, and the Navy. It also briefly outlines and explores the natural resistance military services have against innovation. It argues that the Navy needs a strong UCLASS advocate to lead the program through development and initial operational capability if the aircraft carrier is to avoid obsolescence in the coming decades.

In search of the next Offset

The UCLASS program is widely considered a representative component of DoD's oft-touted Third Offset Strategy. Then Secretary of Defense Hagel's comments in 2014 that "Our long-term security will depend on whether we can address today's crises while also planning and preparing for tomorrow's threats" could have been made by President Eisenhower in 1953 when he initiated the New Look that focused on nuclear weapons as America's competitive advantage vis-à-vis the Soviet Union. Hagel continued that security under resource constraints "requires making disciplined choices and meeting all our nation's challenges with long-term vision."[5] The Eisenhower administration did exactly that in making the acquisition choices leading to the development of the nuclear triad. The Atlas intercontinental ballistic missile (ICBM) program became operational in 1959 after having been given the highest national priority in 1954.[6] The B-52 entered service in 1955[7], and the Polaris submarine-launched ballistic missile (SLBM) followed in 1960 after only four years of development.[8] These technological advances and strategic shift of Eisenhower's New Look would later be branded as the First Offset. The First Offset is best characterized as requirements pulling technology development. In other words, the focused development and acquisition of major programs that built the nuclear triad began *after* the New Look strategy of nuclear deterrence was adopted.

In contrast, the Second Offset was more technology push than requirements pull. The Second Offset is used to describe the combination of stealth and precision that was developed in the 1970s and fielded in the 1980s. DARPA's Have Blue program, launched in 1974, would lead to the development of the F-117 Stealth Fighter (IOC 1983) and Tacit Blue, started in 1978, would lead to the B-2 Stealth Bomber (IOC 1997).[9,10] The precision-guided PAVEWAY II & III laser-guided bomb (LGB) systems begun development in the mid-70s, but the real *coup de grâce* for precision was the Global Positioning System (GPS) which had launched its first four test satellites by 1978.[11] Unlike the weapons systems that supported Eisenhower's New Look, the stealth and precision technologies of the 1970s emerged independently and only after they were proven did they become part of a coherent strategy under the Reagan administration to counter the Soviet's in Europe who by this point enjoyed parity in nuclear deterrence and a marked numerical advantage in conventional arms.

It is noteworthy and currently relevant that both of the first two strategic offsets occurred during periods of budget austerity following post-war budget reductions. After more than a decade of flush spending due to the wars in Afghanistan and Iraq, the Department of Defense is again facing budget reductions on the order of those in the post-Korean and post-Vietnam eras

(Figure 1). As then Secretary of Defense Chuck Hagel observed, these reductions take place in the context of "countries like Russia and China… heavily investing in military modernization programs to blunt our military's technological edge, fielding advanced aircraft, submarines, and both longer range and more accurate missiles."[12] This motivates DoD's search for a Third Offset to increase "the competitive advantage of our American forces and our allies over the coming decades."[13] As such, the DoD is looking to technological advances in "robotics, autonomous operating guidance and control systems, visualization, biotechnology, miniaturization, advanced computing and big data, and additive manufacturing" to create a "technological overmatch against potential adversaries whenever or wherever we encounter them."[14]

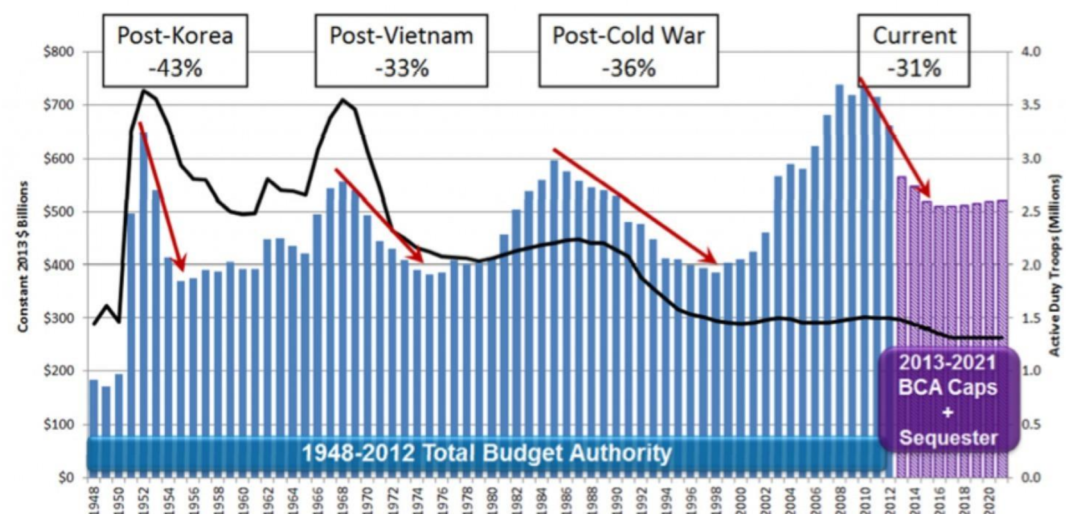

Figure 1. Historic post-war Defense Budget reductions.[15]

Former Undersecretary of the Navy Robert Martinage and fellow at CSBA argues that "a new Offset Strategy must take account of America's fiscal circumstances but, at its core, it must address the most pressing military challenge that we face: maintaining our ability to project power globally to deter potential adversaries and reassure allies and friends despite the emergence of A2/AD threats."[16] This underscores the primary motivation behind the UCLASS system: a next-generation system designed to deliver a needed capability against an emerging a threat by a fiscally affordable means. In a white paper arguing for a new offset strategy, Martinage explains the potential for reduced life-cycle costs promised by UCLASS:

> Significantly reduced life-cycle costs are possible with unmanned systems by obviating the need to procure large numbers of platforms for a training "pipeline," as well as reduced operations and maintenance costs associated with training and maintaining combat readiness in peacetime and personnel savings…. With N-UCAS[17], there would be no need to train pilots, so the Navy would only need to buy the number required to equip the maximum number of deployable carriers (typically 2-3 carriers are deployed on a steady-state basis and another 2-3 carriers can be "surged" in a crisis), and they would generally fly these aircraft only when deployed. As a result, compared to manned aircraft, the Navy could buy about half as many carrier-based UAS and fly them less than half as often, potentially generating billions of dollars in saving in procurement as well as operations and support.[18]

The UCLASS system was thus proposed as part of a deliberate strategy built around a requirement to project power in contested and denied airspace and in the context of expectations for continued constraints on future defense spending. In this sense, the Third Offset is reminiscent of the First: requirements preceded and defined the development of the major weapons programs which were deemed a more affordable force structure for countering expected threats. But in terms of technology maturity and readiness, the UAS systems of the Third Offset more closely resemble the Second Offset. As we shall see, the similarity between the Second and Third Offsets are stronger given the service's initial reluctance to embrace the innovation.

Technology Demonstrators: The Origins of UCLASS

The seeds of UCLASS are traced back to a flurry of UAV technology demonstration programs at the turn of the century. The 2000 and 2002 DoD UAV Roadmaps identified more than 20 UAV programs then in development and promised "profound opportunities to transform the manner in which this country conducts a wide array of military and military support operations."[19] DARPA and the Air Force began development of the Boeing X-45 as part of the Unmanned Combat Air Vehicle (UCAV) program in 1999. Soon thereafter, DARPA launched the UCAV-N program with the Navy which led to the demonstration of carrier-capable technology in the Boeing X-46 and Northrup-Grumman X-47A. These UCAV-N aircraft had their respective first flights in May 2002 and Feb 2003. In June 2003, the Undersecretary of Defense for Acquisition Technology and Logistics (USD AT&L) directed DARPA to merge the UCAV and UCAV-N programs.[20] The consolidated Joint Unmanned Combat Air Systems (J-UCAS) technology demonstration program was a "joint DARPA-Air Force-Navy effort to demonstrate the technical feasibility, military utility and operational value of a networked system of high performance, weaponized unmanned air vehicles to effectively and affordably prosecute 21st century combat missions."[21]

Compared to the original UCAV timeline, the J-UCAS program timeline delayed the start of system development in order to provide more time to mature the technology, but innovation was still at the heart of the program with several new requirements and enhanced capabilities.[22] But almost from the beginning, J-UCAS met headwinds. Funding for J-UCAS was cut by more than $1 billion in early 2004 and leadership was transitioned to the Air Force with "Navy participation." The Department of Defense "restructured" the J-UCAS program again in the 2006 Quadrennial Defense Review (QDR).[23] The Air Force decided to shift focus to pursue an unmanned, penetrating, long-range bomber to modernize its bomber force. (The contract for the B-21, née Next-Gen Bomber before designation as the Long Range Strike Bomber (LRS-B), was finally awarded in October 2015.[24])

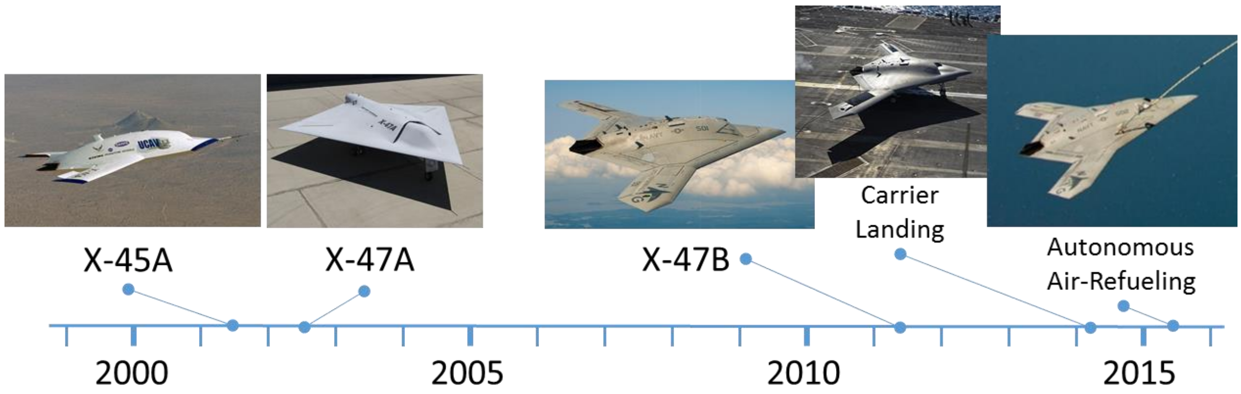

Figure 2. Demonstration systems contributing to the development of the UCLASS system concept. Beginning with the DARPA UCAV X-45A, the Air Force and Navy were partnered for a short period under J-UCAS. The Navy took up the reigns under N-UCAS which led to the development UCAV-D X-47B that served it well through an impressive series of demonstrations that included carrier take-off and landing and autonomous aerial refueling.

On the Navy side, J-UCAS became N-UCAS and the Navy was directed to develop an "unmanned longer-range carrier-based aircraft capable of being air-refueled to provide greater standoff capability, to expand payload and launch options, and to increase naval reach and persistence."[25] In 2007, the Navy awarded the Unmanned Combat Air System Demonstration (UCAS-D) contract to Northrup Grumman for development of the X-47B which first flew in 2011 and made the first carrier-based arrested landing in July 2013.[26]

On the basis of more than a decade of technology development (see Figure 1) and the experience gained from the UCAS-D program, the Navy was ready to begin formal acquisition of a carrier-based unmanned aircraft system in 2011. The Unmanned Carrier-Launched Airborne Surveillance and Strike (UCLASS) system was born with great promise for innovation. But soon thereafter, turmoil and debate over the UCLASS requirements plagued the pre-acquisition phase of the program.

To Strike or Not to Strike: The UCLASS Requirements Maelstrom

The Navy's original 2011 UCLASS request for information (RFI) conceived UCLASS as an unmanned vehicle designed "to address a capability gap in sea-based surveillance and to enhance the Navy's ability to operate in highly contested environments defended by measures such as integrated air defenses or anti-ship missiles."[27] This initial vision was consistent with the 2006 and 2010 QDRs that both called for developing power projection capability in A2/AD environments. The Joint Requirements Oversight Council (JROC) approved the Navy's Initial Capabilities Document (ICD) in June 2011 which included penetration of A2/AD airspace and a robust strike capability, but disagreement over the initial capabilities started shortly thereafter. The Navy, concerned about the price tag accompanying the capabilities in the ICD, developed an acquisition strategy with a reduced initial capability for UCLASS that could be improved later. Among the reported Key Performance Parameters (KPP) for the program was a cost cap on the resulting system of $150 million per 24-hour orbit developed within a constrained 2013-2017 budget of $2.3 billion.[28] There was likely significant concern over the degree to which the program could meet the objectives of endurance, payload capacity, stealth, and aerial refueling in an autonomous, carrier-compatible configuration within these constraints. Back of the envelope estimates for a pair of platforms derived from the UCAV-D configuration that would be needed to cover a 24-hour orbit would cap the cost at $75 million apiece and have the signature performance characteristics similar to current 5th-generation manned platforms costing substantially more[29,30] and having benefited from more development efforts in excess of several $100 billion.

The Navy sought and received approval from the JROC for the diluted requirements in a 2012 memorandum that approved the Navy's desire to reduce strike capacity from approximately

6000 pounds to 1000 pounds of payload and only operate in permissive airspace (vice penetrating A2/AD airspace).[31] The Navy had some, though not universal, support in OSD. The ISR Director in the office of USD (AT&L) defended the JROC decision to reduce initial capability on the basis of fiscal constraints: "we can't afford to start programs that we can't finish."[32]

Congress disagreed. In his opening remarks at a hearing of the House Armed Services Committee (HASC) Subcommittee on Seapower and Projection, Chairman Randy Forbes stated unequivocally that "I believe strongly that the Nation needs to procure a UCAV platform that can operate as a long-range surveillance and strike asset in the contested and denied A2/AD environments of the future."[33] Congressman Forbes continued, "this committee has concluded the UCLASS air system segment requirements will not address the emerging anti-access/area-denial challenges to U.S. power projection that originally motivated creation of the Navy Unmanned Combat Air System program."[34] Senator John McCain, Chairman of the Senate Armed Services Committee (SASC), is of the same mind. In an open letter to Secretary of Defense Ashton Carter, Senator McCain expressed his concern over the Navy's "strategically misguided" approach and that the Navy's UCLASS requirement "would result in an aircraft design with serious deficiencies in both long-term survivability and internal weapons payload capacity."[35]

Several prominent strategists and national security experts agree with McCain and Forbes. Robert Martinage, a former Undersecretary of the Navy and now a Senior Fellow at the Center for Strategic and Budgetary Assessments (CSBA), testified that "UCLASS should be the next step in the evolution of the carrier air wing and must be able to provide sea-based surveillance and strike capacity in anticipated anti-access and area-denial environments."[36]

Martinage went even further arguing that “a truly capable UCLASS” is essential to maintaining the strategic relevance of the aircraft carrier for decades. Shawn Brimley from the Center for a New American Security expressed his concern that Navy’s UCLASS “program does not fully exploit the opportunity the Navy has… to lock in what could be a decisive advantage in future warfare, the ability to employ long-range, stealthy, unmanned strike platforms from the aircraft carrier.”[37] Another defense strategist and retired naval officer, Bryan McGrath, argued that “If the air wing of the future does not evolve in a way that enables the kind of unmanned strike that a truly capable UCLASS would bring, the aircraft carrier might indeed become obsolescent.”[38]

For its part, the Navy does not disagree outright, but thinks it can initially field a less-capable UCLASS and then upgrade it to a more capable UCLASS system over time. Secretary of the Navy Ray Mabus claims that “the [UCLASS] end state is an autonomous aircraft capable of precision strike in a contested environment, and it is expected to grow and expand its missions.”[39] Several experts dispute this, arguing that achieving affordability and endurance by trading off stealth, payload, and survivability results in design changes that cannot be altered later. For example, the Navy set a threshold requirement (key performance parameter) for UCLASS unrefueled endurance of at least 14 hours in order to bridge the canonical 12-hour deck day on the carrier. In the view of Martinage, “Meeting the threshold requirement of 14 hours of unrefueled endurance necessarily results in sacrificing survivability, weapons carriage/flexibility and the number of weapons you can carry, and growth margins for future mission payloads.”[40]

The draft UCLASS capability development document (CDD) with the reduced capability was signed in April 2013 by the Chief of Naval Operations (CNO) and the Navy’s acquisition strategy was approved in June 2013.[41] The Navy released a formal draft of the RFP a year later in April 2014. Though classified, the Chief of Naval Research explained the draft RFP required operations in an uncontested environment without precluding the option to grow capability to achieve operations in contested airspace.[42] Four companies received the draft RFP and were expected to offer competing UCLASS designs: Boeing, General Atomics, Lockheed Martin and Northrop Grumman.[43] Release of the final RFP was repeatedly delayed from the summer of 2014, to the spring of 2015, to the fall of 2015, and finally early 2016. The delays were explained in the context of ongoing ISR portfolio reviews, but were more likely intended to solidify Congressional support behind the Navy's less-capable UCLASS design. The support in Congress never materialized.

Congress exerted its influence over the process and attempted to force its UCLASS vision in the only way that it could, through authorizations and appropriations. As discussed above, the Navy had successfully used the Joint Capabilities Integration and Development System (JCIDS) process to gain approval for a reduced ICD and had developed a spiral acquisition strategy in an attempt to placate Congress, but Congress continued to press the Navy for a more capable platform. The 2016 National Defense Authorization Act (NDAA) more than doubled the Navy's budget request for UCLASS and gave the Navy strict direction to "develop penetrating, air-refuelable, UCLASS air vehicles capable of performing a broad range of missions in a non-permissive environment."[44] Additionally, Congress continued to authorize funding for the Navy's X-47B UCAS-D program--funding the Navy explicitly did not want--as a means of continuing R&D for a penetrating UCLASS system.[45]

The Office of the Secretary of Defense (OSD) finally settled matters in February 2016 with the President's 2017 budget submission. UCLASS appeared to be dead. The penetrating combat system that was originally conceived to provide deep strike capability in A2/AD airspace, but was subsequently reduced to a surveillance and light strike mission in uncontested airspace, was now going to become an unmanned tanker.

Transformed to a Tanker: UCLASS becomes CBARS

The long steady degradation of the Navy's next-generation combat vehicle became final in OSD's FY2017 budget submission: the Carrier Based Aerial Refueling System (CBARS) became the newest incarnation of the UCLASS system. Along with the demise of UCLASS went any hope of real innovation in the manner by which the Navy conducts power projection. It is perhaps telling that the change from UCLASS to CBARS was made in conjunction with the Navy's plan to buy additional F-18E/F Super Hornets and an accelerated purchase of F-35 Joint Strike Fighters (JSF).[46] That is, when choosing between innovation and traditional mission sets, *i.e.* strikes by manned fighters, the Navy chose to continued existing missions rather than seek innovation. It is also noteworthy that OSD's acquiescence to the Navy's steady erosion of UCLASS requirements takes place in the context of the final months of the current administration. Some have speculated that this is may be the best deal that those who wish to innovate the Navy with unmanned systems could get before their tenure in OSD is over when the current administration leaves office.[47]

The failure for a truly innovative, fully-capable unmanned combat system to emerge is surprising at the outset. All three corners of the military-industrial iron triangle--Congress, services, and industry--were aligned behind UCLASS when it was first conceived in 2011. The requirements were square: the original JROC memorandum and ICD endorsed the warfighter requirement for an innovative approach to operating in A2/AD airspace. A bridge was built over the acquisition "valley of death" by continued funding for the UCAS R&D (more than $1 billion had been invested through FY2016). Support for UCLASS from both the Senate and House Armed Services Committees was unequivocal. Industry was excited with four potential prime contractors eager to bid for the lucrative UCLASS contract. With fair winds and smooth seas, how did an innovative UCLASS system designed for the emerging A2/AD environment get turned into a non-stealthy tanker whose only real function is to support traditional missions?

Failure to Innovate: Blame the Bureaucracy

In his seminal and classic examination of bureaucracies, James Q Wilson argues that organizations readily accept innovations that support the status quo. "It is striking, however, how many technical inventions whose value seems self-evident to an outsider are resisted to varying degrees because their use changes operator tasks and managerial controls."[48] As an alternate option to outright resistance, innovations are sometimes misapplied to maintain existing mission sets without realizing their full potential for new ways of accomplishing missions. Wilson offers several examples:

> Many navies purchased airplanes before World War II bust most viewed them simply as an improved means of reconnaissance. Thus the first naval planes were launched by catapults from battleships in order to extend the vision of the battleship's captain. The organizational innovation occurred when aviation was recognized as a new form of naval warfare and the aircraft were massed on carriers deployed in fast-moving task forces.[49]

The parallel with the Navy's refusal to embrace the innovation offered by UCLASS is striking. Rather than accept a UCLASS system that would extend the operational reach of the carrier and permit combat operations in contested and denied airspace, the Navy has chosen CBARS, an unmanned system whose only real function is to refuel manned aircraft. Furthermore, the Super Hornet and JSF systems do not have the signature of the original UCLASS requirement to permit persistence in A2/AD airspace.

According to Wilson, "real innovations are those that alter core tasks."[50] He further argues, "The longer an agency exists the more likely that its core tasks will be defined in ways that minimize the costs to operators performing them, and thus in ways that maximize the costs of changing them."[51] Describing how and when military forces adopt innovation is a long-honored academic pursuit. The RAND Corporation recently summarized four of the leading theories on sources of military innovation.[52] The first, owing to Barry Posen, holds that military innovation must be imposed by civilians because military leaders are wedded to existing doctrine. The second, offered by Stephen Rosen, holds that military innovation comes from within, but is slow since it rests on a generation of young officers with new ideas to assume leadership positions (intra-service competition). The third theory, from Owen Cote and Harvey Sapolsky, argues that inter-service competition is the primary force leading to military innovation. The final and most recent theory argues that military innovation must be considered within the context of culture and how services react to opportunities. Common to all theories of innovation is the idea that it is a top-down process that has to be forced by leadership: "military organizations must be goaded into innovating."[53]

Congressman Randy Forbes would agree: "I believe the Congress has a unique role to help push the Department and the services in directions that, while challenging, will ultimately benefit our national security and defense policy."[54] Forbes clearly claims a responsibility "in cultivating, supporting, and protecting military innovation" in the context of UCLASS.[55] Similarly, Secretary of Defense Hagel argued that "the demand for innovation must be Department-wide and come from the top."[56] Nevertheless, in the case of UCLASS and the next-generation capability for the aircraft carrier, the Navy has successfully resisted the forces of innovation from both Congress and the civilian leadership at OSD. In an interview with

Congressman Forbes shortly after the announcement that CBARS would replace UCLASS, Forbes appeared to acquiesce commenting that "current cost constraints preclude [us] from making the investments for now."[57] The Navy ultimately proved to be the dominant apex in the iron triangle fight over UCLASS.

<u>Tis better to have loved and lost…?</u>

Secretary of Defense Chuck Hagel clearly directed the DoD to the pursue innovation in a 2014 memo: "We are entering an era where American dominance in key warfighting domains is eroding, and we must find new and creative ways to sustain, and in some areas expand, our advantages even as we deal with more limited resources. This will require a focus on new capabilities and becoming more efficient in their development and fielding."[58] UCLASS could have been the crown jewel in the development of next-generation naval combat capability and the first component of DoD's Third Offset. The UCAS technology development program that preceded UCLASS was well-funded and the required technology was proven ready for engineering and manufacturing development. At initiation of the UCLASS program, all corners of the iron triangle, to include the Navy, were firmly behind a fully-capable UCLASS that stood to transform the Navy's power projection from manned to unmanned systems in A2/AD airspace.

From such a promising start at innovation, UCLASS ran into resistance in the Navy that offers proof for an oft-cited claim that bureaucracies resist innovation that threaten the status quo. Over the course of five years, the Navy systematically eroded the requirements for UCLASS until they finally succeeded in converting the next-generation unmanned combat system into a tanker that supports traditional manned missions. Without an advocate from within the Navy leadership to champion transformation, further attempts at innovation will likely suffer the same fate as UCLASS. It seems clear through history that, due to bureaucratic inertia, the services will not deliver innovation without vision and leadership. Even in the midst of calls for a Third Offset strategy and generous support from Congress, the Navy suppressed the best promise for innovation in this generation. Inspiring and visionary leadership as well as the adoption of the innovative longbow were essential for Henry V's conquest of Northern France and his victory at Agincourt. Similarly, strong, visionary leadership is necessary if the Navy is going to adopt technologies that are essential for the next-generation of naval power projection. We might well ask: wherefore is our Prince Hal that will bring us innovation?

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