

## Our Own Worst Enemy

Institutional Inertias and the Internal Challenges of Embracing Robotics

*By Nathan Hughes*

The promise of robotics for the future of warfare is widely recognized and acknowledged across all the service branches. Even in the seemingly low-tech world of counterinsurgency, unmanned systems have proven their utility and adaptability in operational efforts. Meanwhile, American industrial expertise in unmanned and particularly autonomous systems is among the best in the world. Relatively small start-ups are providing meaningful, innovative and low-cost competition to established defense contractors – and there are opportunities to further expand that industrial base in terms of depth, breadth and diversity.

This is not to say that all is well. The long-overdue and desperately necessary reform of procurement and the military-industrial complex is a widely recognized issue and will have bearing on the development and operational fielding of robotics. Already, even some of the premier robotics projects like the RQ-4 Global Hawk are experiencing all-too-familiar issues with cost growth and timeline slippages.<sup>1</sup>

But at the same time, the fundamentals are there. American universities, entrepreneurs and corporations are conducting cutting-edge research in robotics research that has clear and direct military applications. In 2008 at Aberdeen Proving Grounds, a Defense Advanced Research Projects Agency (DARPA)-funded effort ejected first forty percent and then sixty percent of one wing from a scale-model F/A-18 Hornet, leaving the autonomous damage tolerance software to independently account for the radical (and potentially catastrophic) changes to the aircraft's handling characteristics. In each case, the software rapidly adapted and guided the 'damaged' aircraft back for a successful landing.<sup>2</sup> Two years before that, NASA and DARPA conducted the first autonomous probe and drogue airborne refueling with the pilot and flight test engineer 'hands off' in a real F/A-18.<sup>3</sup> NASA is now working on a demonstrating a probe and drogue refueling from one modified Global Hawk to another.<sup>4</sup> MIT researchers are hard at work at demonstrating that a fixed-wing aircraft can execute a stall maneuver and land on a wire, akin to a bird coming to a perch.<sup>5</sup> With the Navy Unmanned Combat Aerial System, even autonomous carrier landings are no longer inconceivable – they are only a few years away.

At the heart of the immense American promise for developing robotics for military uses is not just research and development spending, but the intellectual heft and capacity for innovation that the nation's unequalled institutions of higher learning and its entrepreneurial enterprises provide. In other words, the ingredients for successful integration of robotics into the national defense enterprise outside the Department of Defense not only exist, but exist in spades.

In terms of the greatest barriers to the development and operational fielding of robotics, it is not outside the Department of Defense that we need look. It is within. And the military establishment is not merely the single largest barrier to the theme of this essay contest; it presents a robust and layered series of barriers to that theme.

With dozens of unmanned aerial vehicle (UAV) orbits over Iraq and Afghanistan alone and unmanned systems being such a central component of the Littoral Combat Ship (LCS) concept for the Navy, this hardly seems to be the case. After all, the American military is the most modern and advanced in the world, and the U.S. certainly has the lead in both development and operational integration of robotic systems. But it is also rumored that the LCS was only forced on the Navy in backroom dealings with the Office of the Secretary of Defense in order to secure funding for the DDG-1000. Indeed, if it had not been for Congress, the U.S. Navy would not have four converted Ohio SSGNs, but only two.<sup>6</sup> In other words, two of the most innovative and out-of-the-box decisions that the Navy has made in a generation are arguably the result of outside forces.

The real heart of the challenge for the Pentagon moving forward is not about the lead it has in existing capabilities or how it got that lead, but how it will capitalize on that lead, how it will leverage that lead to consolidate a generational lead against potential competitors for the long term and how it will cultivate robotics in an era of increasing fiscal austerity. This is an especially difficult question for a Department that has not proven particularly adept at innovation.

The good news is that robotics can be an essential part of doing more with less in the years ahead, especially as the costs of human personnel continue to mount and each individual Soldier, Sailor, Marine, Airman and Coastguardsman

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becomes more and more important to the Department – and the defense budget's bottom line. Done right, robotics will allow the U.S. military to maintain a generational lead in military technology and the application of military force, to maximize the utility and effectiveness of the individual serviceman and servicewoman and conduct many missions far more cheaply than currently possible.

But we need look no further than what it took to get the UAV orbits over Iraq and Afghanistan. Secretary of Defense Robert Gates forced the resignation of U.S. Air Force (USAF) Chief of Staff Gen. T. Michael Moseley (as well as USAF Secretary Michael Wynne) in 2008.<sup>7</sup> Though the proximate cause may have been the mishandling of nuclear weapons, the heart of the issue was the so-called 'fighter mafia,' of which Moseley was a disciple. Moseley and Gates had clashed for essentially all of Gates' tenure over the ending of F-22 Raptor procurement. Moseley was prepared to reduce the size of the USAF in terms of airmen and shutter innovative battle labs in order to buy more F-22s above and beyond the 183 set to be procured.<sup>8</sup>

Moseley was replaced with Gen. Norton Schwartz – a C-130 and special operations pilot and the first non-fighter pilot to serve as the head of the USAF in a quarter century. Under Schwartz's tenure – indeed, almost certainly a term of his elevation to the post given Gates' position on the matter – the procurement and operational fielding of RQ-1 Predator and MQ-9 Reaper drones was quickly accelerated.

This is not to engage in any sort of personal attack or character assassination. Moseley undoubtedly made the choices he made because of his training, expertise and a profound, deep-seated belief that he was doing the right thing for the USAF and for his country. Vietnam, more than four decades ago, was the last time the U.S. waged a sustained war without the air superiority – if not air dominance – that we have come to accept today. It is easy to forget that we do not own the skies by default, but only through the efforts and sacrifice of our airmen and women. And when you, as an individual, are charged with providing and ensuring that air superiority, one can hardly be faulted for desiring more F-22s.

But there are two issues at hand when it comes to the future of robotics and the U.S. military: choice and priority. And this is why it becomes essential to discuss not just office and bureaucratic role, but individual.

After World War I, there was much discussion about the implications of the invention of the tank and its appropriate role on the battlefield. As any player of the game Risk can attest, there were three main elements of a (previous) turn-of-the-century army: the infantry, the cavalry and the artillery. The decision was taken to divide the forbearers of modern armor between the infantry and the cavalry. There was certainly acknowledgement of the value of the tank by both sub-branches, but it was always clearly and explicitly defined in a supporting role. And in the immense fiscal austerity that followed World War I and subsequently mandated by the Great Depression, armor in America became a secondary priority. Funding its development and refinement was desirable, but every dollar came at the expense of sustaining the size of the infantry and the horse cavalry, both under very real threat due to that fiscal austerity.<sup>9</sup>

Thus, in 1938 while the Nazi Wehrmacht was secretly refining tank design and armored doctrine in the Soviet Union – including armored formations still taught today – the U.S. appointed one of its most established and respected horsemen, Major General John K. Herr, as the Chief of Cavalry. Herr set out to secure the future of horse cavalry.<sup>10</sup> In the years after war broke out in Europe, Herr and the disciples of the horse were not only unable to recognize the obvious truths of the German mechanized and armored blitzkrieg, but saw the rest of the military establishment as naively failing to understand the incontrovertible importance of the horse.

But Herr – again, not as a character attack, but undoubtedly acting as a patriot – attempted to defend the discipline in which he had been trained and which had come to define the prism through which he saw warfare. It was hardly his doing that the U.S. went to war in North Africa and Europe with the M4 Sherman, a tank that, while eminently mass-producible, was undergunned and inferior to German designs. This was the product of more than a decade of armor being starved of funding and institutionally neglected. The result was that the American soldier went to war under-equipped and ill-prepared for the more advanced and developed German armored doctrine not because of Herr but because of institutional inertia.

The world's oceans provide the United States with immense insulation from the world. In terms of counterterrorism, this no longer holds. By virtue of globalization and modern transportation infrastructure, Islamist extremists from the other side of the world can turn up in Detroit with an improvised explosive device concealed in their underwear. But in another sense it remains very true. Our naval forces spend a great deal of time in transit to and from theaters of

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operation. Admittedly, large elements of our ground combat forces – not only Soldiers and Marines, but the Corpsmen and other Sailors, Airmen and Coastguardsmen that also wage the counterinsurgency and counterterrorism campaign and support those efforts – are heavily engaged and rapidly adapting to a very real and innovative adversary. But on the other hand, many essential aspects of American national military power have gone untested for many years (and this is a testament to the deterrent they provide). But the role and the nature of that deterrent inevitably slip into increasingly abstract thought.

It almost goes without saying that a force engaged in combat on the field of battle evolves, adapts and learns more rapidly – that force must do so if it is to survive and prevail. Reality serves as a whipping ground for operational and doctrinal concepts that simply cannot be replicated in the abstract. This was clearly demonstrated in 2002 when a red team led by Lt. Gen. Paul K. Van Riper (USMC, Ret.) took out 16 U.S. capital ships in the Strait of Hormuz – including an aircraft carrier – in a matter of minutes in a wargame. It took an actual incident at the beginning of 2008 before many in the Navy really digested the implications of Van Riper's attack.<sup>11</sup>

So there are two aspects to the delineation. The first belongs to the established force emerging from a war and subjected to an era of fiscal austerity. The costs of reset and rebalancing the force are not insignificant, and the nature and trajectory of that reset and that rebalance are inherently defined by the war from which those forces have emerged. That war is inevitably a prism through which they view future threats. By virtue of operational experience, some forms of robotics have been operationally proven. And through that prism and the paradigm of the 'last war,' other forms seem absurd and out-of-touch with reality. But the last war is almost never the appropriate paradigm through which to view the next.

The second aspect belongs to the opposite realm – where forces designed and tailored for combat have gone untested in a conflict and paradigms have gone unchallenged and unchecked by reality. In the inter-war period, unlike armor, the Army Air Corps carved out its own existence. But it also drank its own Kool-Aid and believed that a properly designed and equipped bomber formation could not only bomb accurately but defend itself and become essentially an unopposable force in modern warfare. It took the loss of many bombers and airmen to adjust that paradigm to reality.

If we are to talk about profound institutional change (as we must if we are to consider truly capitalizing on what robotics have to offer) we must begin with the institutional capacity to deal with and accept – indeed encourage and cultivate – that change. The U.S. Department of Defense is the size of and enjoys the budget of a multi-national corporation.

But it is a fairly well established truth that the offices and personalities that such a large entity requires to function also invariably create a series of very real institutional inertias that serve as meaningful purveyors of the status quo and as impediments to change. Despite profound progress with getting 'on the same team' and 'joint-ness,' fiscal austerity almost inherently brings an embattled mentality where entrenched interests attempt to defend their own turf – not necessarily in opposition to other interests so much as to ensure that those other interests are not funded from a certain share of the pot.

At the end of the day, robotics is no more a 'competitor,' than tanks or airplanes. But just like tanks and airplanes, it is also more than a competitor – it is a dictate of reality. Every aspect of every branch of service must experiment with, embrace and fund the greater use of robotics if it is to position itself to adapt those benefits in order to maintain the competitive edge that the American warfighter enjoys. That edge will not maintain itself, and it will inescapably be eroded if we continue to function within old paradigms.

When we conceive of that edge, it is helpful to conceive of not the obsolescence of weapon systems, but of their senility. It is a term coined by Dr. George Friedman in *The Future of War*, where the measure is not so much ineffectiveness (a single modern carrier air wing is larger and more powerful than the entire air force of many NATO allies), but the mounting expense of it.<sup>12</sup> No one disputes the value and efficacy of a carrier strike group. But in an era of fiscal austerity, it is not merely a question of efficacy. What is the cost – and more to the point, what is the opportunity cost – of the deployment patterns and maintenance of the carrier fleet as it exists today and what is the cost of the escorts required to defend it?

The modern American carrier strike group is an unequalled and unprecedented expression of national power. This essay is not challenging that. But in terms of the expense required to field four squadrons of short-range combat aircraft, this essay would argue that it is an increasingly senile expression of national power as gauged by its

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expense. The point of this essay is not to suggest the abolishment of the carrier fleet, but to implant the seed of the question of what we could achieve in robotics at the sacrifice of the expense of even one of eleven carrier strike groups. And more importantly, the seed of the question of what we sacrifice in terms of generational revolution if we decline to re-allocate money from traditional disciplines of warfare.

At the end of the day, by virtue of the historical examples provided by the past, the argument for the maintenance of capabilities conceived in a previous era is far more visceral and concrete than the arguments made to move beyond those capabilities to something unproven. Indeed, not only the delineation of career paths within the branches of service, but those career paths themselves are defined by and expressions of conceptions of the past. While there is inherently a voice and advocacy for legacy capabilities, the military's problem – and the problem for the future of robotics – is that there is no position, no pathway and no career for the insurgent, the malcontent and the dreamer.

This is at the heart of the challenge for robotics. Robotics is the next revolutionary leap. It holds the promise of challenging China's hundreds of late-model Sukhoi "Flanker"-series combat aircraft – and indigenous copies – not with ever more, and *more* expensive, F-22s (which we have declined to buy, and one can argue we cannot support at that range with existing airfields)", but by *less* expensive unmanned systems. It turns the military and economic balance on its head and fundamentally shifts the military balance. That is what robotics ultimately promises. Not to remove the human nature of war, but to once again rebalance it.

Ultimately, the Pentagon's ability to defer funding from entrenched interests – because that is the cost of embracing robotics – is the central battleground in the American military establishment's ability to embrace the future and thereby maintain a generational lead over competitors. If the Department continues to operate at the high end of a previous paradigm, it may yet succeed, but it cannot succeed as affordably and as innovatively as it might with the alternative embrace of robotics. Though there is no shortage of jokes to be made at the water cooler about the Russian attempt at a fifth-generation iteration of its successful Flanker design, it is not the high end of a current generation that truly maintains the competitive edge. It is the ability to move from one generation to the next faster than your competitors and change the rules of the game while one's competitors are still investing in a previous generation.

It is robotics that holds this promise, and that will define the generational lead in warfare for the foreseeable future. The choice is before the Department.

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<sup>1</sup> Putrich, Gayle. "Pentagon, Northrop Grumman square off over Global Hawk". [www.flightglobal.com](http://www.flightglobal.com/articles/2010/06/24/343633/pentagon-northrop-grumman-square-off-over-global-hawk.html). 100801  
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<sup>2</sup> "U.S. Aviation: Testing a Tolerance for Damage". [www.stratfor.com](http://www.stratfor.com/analysis/u_s_aviation_testing_tolerance_damage). 100801  
<[http://www.stratfor.com/analysis/u\\_s\\_aviation\\_testing\\_tolerance\\_damage](http://www.stratfor.com/analysis/u_s_aviation_testing_tolerance_damage)>.

<sup>3</sup> "Autonomous Airborne Refueling Demonstration (AARD)". [www.nasa.gov](http://www.nasa.gov/centers/dryden/multimedia/imagegallery/AARD/AARD_proj_desc.html). 100801  
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<sup>4</sup> Warwick, Graham. "Global Hawk Aerial Refueling - Which Way?". [www.aviationweek.com/aw/blogs/defense/index.jsp?](http://www.aviationweek.com/aw/blogs/defense/index.jsp?plckController=Blog&plckScript=blogScript&plckElementId=blogDest&plckBlogPage=BlogViewPost&plckPostId=Blog:27ec4a53-dcc8-42d0-bd3a-01329aef79a7Post:849f93ce-32ea-40ea-9b6c-4b20cb0d5bce). 100801  
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<sup>5</sup> Warwick, Graham. "MIT Shows Way to Perch a UAV". [www.aviationweek.com/aw/blogs/defense/index.jsp?](http://www.aviationweek.com/aw/blogs/defense/index.jsp?plckController=Blog&plckBlogPage=BlogViewPost&newspaperUserId=a68cb417-3364-4fbf-a9dd-4feda680ec9c&plckPostId=Blog:a68cb417-3364-4fbf-a9dd-4feda680ec9cPost:e178dc3a-861f-4902-afd3-dbdafa887303a&plckScript=blogScript&plckElementId=blogDest). 100801  
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<sup>6</sup> O'Rourke, Ronald. "Navy Trident Submarine Conversion (SSGN) Program: Background and Issues for Congress". Congressional Research Service 081002: 1-2.

<sup>7</sup> "U.S.: Fighter Pilots and the Future of the U.S. Air Force Read more: U.S.: Fighter Pilots and the Future of the U.S. Air Force | STRATFOR". [www.stratfor.com](http://www.stratfor.com/analysis/u_s_fighter_pilots_and_future_u_s_air_force). 100801  
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<sup>8</sup> "U.S.: A Break From the Air Force 'Fighter Mafia' Read more: U.S.: A Break From the Air Force 'Fighter Mafia' | STRATFOR". [www.stratfor.com](http://www.stratfor.com/analysis/u_s_break_air_force_fighter_mafia). 100801  
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<sup>9</sup> Johnson, David E.. *Fast Tanks and Heavy Bombers*. Ithaca: Cornell University, 1998. Johnson's work is comprehensive and compelling, and this essay owes the entire perspective of the inter-war period to his work. This particular book's sophistication and nuance cannot be reduced to a series of pages herein; the entire work is recommended.

<sup>10</sup> *ibid.* 136.

<sup>11</sup> Shanker, Thom. "Iran Encounter Grimly Echoes '02 War Game". [www.nytimes.com](http://www.nytimes.com). 100801  
<[http://www.nytimes.com/2008/01/12/washington/12navy.html?\\_r=1&adxnnl=1&pagewanted=print&adxnnlx=1280716403-nk4V0Vor/NHwTx/mBDrGWQ](http://www.nytimes.com/2008/01/12/washington/12navy.html?_r=1&adxnnl=1&pagewanted=print&adxnnlx=1280716403-nk4V0Vor/NHwTx/mBDrGWQ)>.

<sup>12</sup> Friedman, George and Meredith. *The Future of War: Power, Technology and American World Dominance in the Twenty-first Century*. New York: St. Martin's Press, 1996.

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