

WAR ON THE ROCKS

The “Bow Wave” And The Military Balance

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April 5, 2016

Most defense policy watchers have heard of it. They know it is coming. And while it is the kind of thing many Pentagon officials, military leaders, and members of Congress might wish to ignore, it will be here before they know it. “It,” of course, is the modernization “bow wave” the U.S. military will encounter beginning in the early 2020s.

“A modernization bow wave typically forms as the overall defense budget declines and modernization programs are delayed or stretched in the future,” writes [Todd Harrison](#) of the Center for Strategic and International Studies. He continues: “As this happens the underlying assumption is that funding will become available to cover these deferred costs.” These delays push costs into the future, like a ship’s bow pushes a wave forward at sea. Veteran defense reporter Bill Sweetman [described it in more acerbic terms](#): “If the Pentagon was a family, the parents would be buying new cars every other year and eating out three times a week while blithely planning to put all five kids through Harvard.” Yet unlike waves at sea, these costs cannot be pushed off forever. With the bill for these plans coming due, many are wondering [how to pay](#) for what Harrison [recently estimated](#) will require a \$130-billion cumulative defense spending increase between fiscal years 2017 and 2022.

This raises two questions: First, how will the Pentagon pay for these programs? Second, given the size of the price tag, are these programs the right ones to ensure U.S. military superiority into the middle part of the 21st century?

New Technology and the Military Balance

The acquisition programs at the heart of the bow wave are legacy systems — new platforms that are costly and technologically advanced incremental improvements on existing platforms. According to a recent Cato Institute policy analysis by [T.X. Hammes](#), new technologies could enable states and non-state actors to generate military power that negates U.S. military advantages at far lower cost than the Department of Defense will pay to upgrade its current force. The result is that the United States will have to either rethink the wisdom of a grand strategy that requires it to project power globally, or to rethink the current, increasingly expensive, way it does so.

Hammes, a retired U.S. Marine Corps colonel and analyst at the National Defense University, examines the role of 3D printing, unmanned systems, nanotechnology, and artificial intelligence in making deadly force more accessible. He argues that these technologies, when combined, provide an inexpensive means to produce military power on a large scale — potentially negating the advantages in power projection the U.S. military has enjoyed since the end of the Cold War. According to Hammes, smaller states, non-state actors, and even individuals will soon be able to exploit dramatic improvements in these technologies to produce “small, smart, and cheap weapons” that can be used in any domain of warfare.

If Stalin was right that quantity has a quality of its own and if technology continues to advance, large numbers of 3D-printed autonomous unmanned systems could qualitatively change the global balance of military power. Hammes argues that defense will once again dominate the battlefield because “waves” of smart drones operating at long distances as mobile improvised explosive devices (enabled by nanoenergetics) will render battlefield mobility difficult, if not impossible. Airbases and large-deck aircraft carriers will be vulnerable to similar waves, meaning a \$13-billion *Ford*-class aircraft carrier and \$100-million F-35s, will be overwhelmed by swarms of disposable pilotless systems before ever launching. Similarly, unmanned underwater systems will be able to travel transoceanic distances to act as “smart mines” at ports of debarkation and embarkation and threaten undersea lines of communication.

Hammes suggests that these developments will produce a world that gives defensive tactics the advantage over offensive capabilities, thus requiring a fundamental rethinking of American strategy. If he is right, the type of weapons systems Harrison identifies as the cause of the impending bow wave will be anachronistic. Spending ever-increasing amounts of money on incremental improvements to current systems will matter little if large numbers of inexpensive systems overwhelm them. Deepening deficits to pay for exquisite capabilities of questionable utility would be actively counterproductive to American security.

While there is a thread of questionable technological determinism running through Hammes’ analysis, we have reason to believe the new capabilities he describes will indeed proliferate. According to Michael C. Horowitz, a University of Pennsylvania political scientist, financial and organizational factors determine the likelihood that international actors will convert new technologies into military power. Horowitz’s “adoption capacity theory” posits that the ability of a military to exploit a new military innovation depends on its “financial intensity” and the “organizational capital” required to change existing practices of a military organization in line with the new development. If a new military capability is inexpensive and the military organization can absorb the disruption its adoption will cause, the spread of the capability becomes more likely.

The first part of Horowitz’s theory is particularly important with regard to Hammes’ argument. Financial intensity is a product of both the cost of the technological capability itself and of potential commercial applications that allow for economies of scale in production. 3D printing, sometimes termed additive manufacturing, represents the key component in the diffusion of military power Hammes presents. This manufacturing process boasts widespread commercial applications and has become increasingly affordable since its introduction three decades ago. If Hammes’ analysis holds, then the financial barriers to entry will be almost entirely nonexistent — increasing the chances that these capabilities will rapidly proliferate.

Organizing Military Power

If the technologies in question are cheap enough to be within reach of small states, terrorist groups, and individuals, then there is little doubt the United States can acquire them as well. But what about organizational capital? “While higher financial requirements generally mean that adoption patterns will benefit preexisting wealthy and powerful states,” Horowitz writes, “higher organizational change requirements can handicap the wealthiest and upset the balance of power toward newer and more nimble actors.” If at least some countries or groups hostile to the United States have the organizational capital to adopt these capabilities, the question then becomes whether the U.S. military has the organizational capital to adjust swiftly enough to meet the threat.

The Department of Defense is not blind to proliferation of these technologies, and some of the capabilities Hammes lists have a role in the Pentagon’s Third Offset Strategy. However, even at a recent event at the Cato Institute discussing Hammes’ paper, much of the conversation about defense innovation focused on the ability — or lack thereof — of the Pentagon’s outdated acquisition system to quickly procure new technologies. More importantly, how will the military services use new technologies? Will they return to doctrines that once again favor mass over precision, as Hammes recommends? Will they be willing to embrace tactical defensive doctrines when facing swarms of unmanned systems that make offensive warfare too risky? Or will they seek new ways to conduct offensive operations that account for an adversary’s ability to inexpensively counter current methods?

While the Pentagon is frequently criticized for its supposed technological conservatism, the U.S. military has more often been *too* enamored with technological fixes. Where the military services are resistant to change is in their doctrine and organizational hierarchies. When technology reinforces the status quo in both, the services are more likely to eagerly accept it. When technology disrupts doctrine and hierarchy, which could occur if these technological trends continue, then the services are likely to resist.

Historical precedents for this type of resistance are readily available. During the interwar period, the U.S. Army limited the role of tanks to existing cavalry and infantry scout missions until training maneuvers at home and the fall of France in 1940 abroad combined to demonstrate unequivocally the value of an independent combat arm for armor. Of more recent vintage, the U.S. military’s performance in Operation Desert Storm supposedly heralded an information-based Revolution in Military Affairs (RMA). Advanced networked sensors and precision munitions were supposed to foreshadow a discontinuity in the way war was waged. In theory, force structure changes should have followed to make the U.S. military lighter, faster, less hierarchical, and less expensive. In reality, little changed. As retired Army officer Richard Lacquement documented in his work on post-Cold War defense planning, after accepting a smaller version of its Cold War force structure as part of Gen. Colin Powell’s “Base Force,” the military services stonewalled every attempt at change, from Les Aspin’s 1993 “Bottom-Up Review” to Donald Rumsfeld’s ill-fated 2001 Quadrennial Defense Review. Instead of changing U.S. military doctrine or force structure, information-based RMA technology was largely incorporated into existing structures and grafted onto existing systems.

The defense industry, ever-eager to please its sole customer, and Congress, always fearful of developments that might take jobs away from home states and districts, are both likely to

reinforce existing doctrinal preferences since they undergird the current modernization plan. While the \$130-billion increase in defense spending necessary to contend with the bow wave is unlikely to materialize, recent legislative deals to raise the Budget Control Act spending limits suggest some increase in defense spending will probably occur — even if means kicking the can on some programs further down the road.

Answering the question of *how* the Pentagon will pay for its modernization plans is less important over the long term than deciding whether it *should* pay for them. Yet there remains a real risk that devoting too much political attention to the former question will impede discussion of the latter.

Is there a way forward?

The sensible approach to this problem would seem to be to follow the advice of analysts such as Jerry Hendrix of the Center for a New American Security. Instead of pursuing exquisite — and exquisitely expensive — versions of legacy systems that may be increasingly vulnerable to less expensive, more numerous capabilities, the Pentagon should pursue lower-tech systems that can be built at both lower cost and in greater numbers. Instead of increasing the defense budget to pay for bow wave, invest in research and development and keep procurement spending low until the picture of how new technologies will affect the military balance becomes clearer. Rather than centrally planning how the military might use new technologies, Defense Department leadership should facilitate competition among the services to encourage conceptual experimentation.

Given the interests aligned in favor of the status quo, it is possible that questions about whether to pursue current modernization plans at all will go unexamined. If that is the case, the impending bow wave might not only turn out to be costly to American taxpayers, but also leave America's military in a weaker position for the trouble.