The Department of Defense's Roadmap to Mass Autonomy

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The adoption of mass autonomy as a critical warfighting capability has made significant headway since the announcement of the Replicator initiative in August 2023. While the Department of Defense has employed autonomous systems for decades, Replicator set the audacious goal "to field attritable autonomous systems at scale of multiple thousands, in multiple domains, within the next 18-to-24 months."[1] Private and public sector partners have shown broad support for this effort through strong capital investments and congressional funding,[2] but despite early successes, the production and employment of mass autonomy across domains remains nascent and barriers to implementation still remain. Considering the announced Inspector General investigation into the effectiveness of selected capabilities under the Replicator initiative and congressional language emphasizing the need to address doctrine, organization, training, material, leadership, personnel, facilities, and policy (DOTMLPF-P) for mass autonomy, it is evident that these areas are critical to the initiative's success but have not yet been fully considered.[3] The second-order impacts of mass autonomy on manning, logistics, basing, and acquisitions must be addressed more comprehensively.

First, manning of units employing mass autonomy, both in terms of overall personnel as well as personnel proficiency, remains an area of significant hand waving, and efforts to "equip" have overshadowed efforts to "man" and "train." Assumptions abound that mass autonomy will enable efficiencies in personnel count and that the decision support tools required for command and control of fleets of systems will evolve at the requisite pace to enable effective employment regardless of the end user or the commander.

While the services have taken steps to build pipelines of individuals ready to field mass autonomy, such as the Navy's new robotics warfare specialists, the insertion of a few technical experts at the edge fails to sufficiently prepare for mass system adoption.[4] Beyond the tactics, techniques, and procedures that are still in development, these systems will require users at the edge to reconfigure the systems and their payloads, via software and other technical means, rapidly and as missions in contested and degraded environments dictate.

Although software engineering skill sets are unlikely to be ubiquitous across military units, DoD must make the upskilling of basic line units a top priority when considering manning for mass autonomy. Generative AI will not be a panacea for this but does offer some hope in scaling the technical proficiency of operators and commanders.[5] To this end, DoD should create a training task force that is tied to all autonomous systems development to define rapid upskilling processes in parallel to mass autonomy adoption.

Second, considering that operations and support consume more than 60 percent of DoD's budget, logistics planning for mass autonomy continues to lag development, and uncertainty continues to face the full life cycle of mass autonomy.[6] The Navy, for example, established an unmanned squadron in early 2024 to field hundreds of small unmanned surface vessels while admitting "[there] is no guidance or reference we can turn to. . . . We collectively are writing the instruction manuals, qualifications standards, concepts of operations and developing tactics, techniques, and procedures for these platforms."[7] For the initial tranches, DoD will rely heavily on the system-producing contractors to work alongside operators to troubleshoot initial bugs and performance issues as well as develop sustainment and cantonment strategies.

The long tail of sustainment on these fleets will rapidly outpace the cost of procurement and could significantly reduce the cost efficiencies of mass autonomy. DoD cannot apply standard maintenance models to this problem and must develop new business models that are financially viable and sustainable. New models could include platform- and hardware-as-a-service, reducing ownership costs for the government while providing financial upside to partners such as annual recurring revenues, which are viewed favorably in the capital markets and could further induce capital investment in the industrial base. Alternatively, deeper adoption of "prototype warfare," in which "limited-production prototypes are deployed to operational environments as one-off weapon systems tailored to specific missions,"[8] could offset some of the burden and requirements for long-tail logistics planning, especially if coupled with manning concepts that promote rapid upskilling and the ability to employ new systems with limited specialized training.

Third, as unmanned and autonomous systems proliferate, the corresponding force structure changes set to take place will likely demand a reassessment of global basing requirements. This is not without precedent. In 1988, the U.S. Congress passed legislation that initiated commissions known as Base Realignment and Closure Boards (BRACs) that suggested changes to domestic DoD infrastructure in response to shifts in force structure due to the draw-down of the Cold War. The boards' recommendations in 1988, 1991, 1993, and 1995 resulted in billions of dollars in facilities cost reductions and were executed in a largely nonpartisan manner free of controversy.[9]

Though we're unlikely to see major force restructuring manifest in upcoming budget cycles, a BRAC should be convened to assess the impacts to basing requirements as unmanned systems support and supplant legacy formations. Access to contractor production and maintenance facilities, along with the civilian technical workforce capable of supporting these systems, will likely be emphasized, which will exacerbate long-standing national labor disparities. A crucial element of the original BRACs' success was the shared understanding that the cost savings derived from base closures would be earmarked for reinvestment into impacted communities.

This strategy can be applied to this scenario as well, with base closure savings earmarked for community workforce training programs, industry accelerators, and tax incentives for businesses to relocate to affected areas. A congressionally supported basing strategy will make it easier for DoD and lawmakers to make intelligent acquisition decisions with full knowledge that there is a plan to address their significant cascading impacts to domestic and global basing and force posture.

Calls for acquisition reform are a recurring theme across administrations, technology paradigms, and global security environments. However, the gap between large, system-based acquisitions with assumed twenty- to thirty-year life cycles and the technological realities of unmanned systems and modern developmental engineering processes cannot be ignored. In modern technology organizations, software and hardware systems development is an iterative process. It relies on continuous improvement, rapid prototyping, and access to a steady stream of capital to support it. Programs like Replicator and accelerators like Defense Innovation Unit cannot be a panacea for the classical challenges of DoD's approach to acquisitions, as their underlying purpose is to induce development in spite of existing frameworks.

Aggressive, intelligent adjustments to major systems acquisitions must be made to facilitate the types of innovation that are part and parcel of twenty-first century engineering practices. These approaches are not unheard of. Transitioning from fixed-price to cost-plus contracts, truly integrating agile development methodologies, and accepting technical risk so that small, innovative organizations can participate in the acquisitions process in earnest are well-studied and proven practices that only require champions at DoD's most senior levels for them to become truly enshrined.

Much has been written of the apparent advantages that strategic competitors such as the People's Republic of China hold over the United States, particularly in terms of raw manufacturing capacity for unmanned systems. It is frequently asserted that the next major conflict will be won by the side capable of first bringing the greatest force to bear and then sustaining that advantage. In the case of unmanned systems, that advantage, at first glance, appears to be the ability to throw as many drones as possible into the fight for as long as possible. However, this assumption fails to account for the importance of proper doctrine, manning, and suitable logistics, the true enablers of combat power. The national defense establishment faces incredible challenges in terms of developing production capacity and procuring the correct platforms quickly, but these barriers can be overcome with careful planning, with well-considered integration, and by leveraging the nation's incredible human capital to support the next revolution in military affairs.

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