



Statement before the House Committee on Armed Services Subcommittee on Cyber, Innovative Technologies, and Information Systems on “Can it work? Outside Perspectives on DOD's Replicator Program”

DOD's Replicator Program:

Challenges and Opportunities

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DOD's Replicator Initiative: Challenges and Opportunities

Chairman Gallagher, Ranking Member Khanna, and other distinguished members of the subcommittee, I would like to thank you for the opportunity to testify this morning on DOD's Replicator initiative.

On August 28, 2023, Deputy Secretary of Defense Kathleen Hicks announced a Pentagon initiative to "field attritable autonomous systems at scale of multiple thousands, in multiple domains, within the next 18-to-24 months." This is the Replicator attritable drone initiative, which may seem compelling (although perhaps lagging or reactive) given the disruptive qualities that inexpensive air, ground, and sea-based drones have already demonstrated in Nagorno-Karabakh, Ethiopia's civil war, and Ukraine. Reports of Hamas's use of drones to drop grenades on Israeli surveillance towers illustrates what terrorists can now do with the technology. For the cost of as little as a few hundred dollars, tens of millions of dollars in military capability and many lives can be put at risk. The means and economics of warfare are changing and the ability of autonomous aircraft and naval vessels to provide persistent surveillance and deliver ordnance undetected will likely be seen as a revolutionary step in military technology development.

Specific details of Replicator remain publicly elusive and indications are that it is still in its formative phase. Still, this is a good time for Congress to begin asking questions to ensure that, if DOD does embark on this effort, it is on the correct path and it can achieve its objectives. It is my hope to outline not only some of the challenges and pitfalls that await the Department, but also the opportunities and tools that it already has at its disposal to make substantial progress if it moves forward. I will predominantly focus on managerial, industrial, and business process challenges and solutions needed.

Unfortunately, the Department's culture and business practices stack the odds against the Replicator effort succeeding. Several iterations of serial prototyping of deployed capability are likely needed before a significant difference is made in the INDOPACOM theater by attritable drones and during that time senior advocates will have moved on and urgency could be lost. Supporters might argue that an initiative such as this should have already begun several decades ago and may be arriving too late. A Replicator-type program has the potential to be a significant game-changer and may well be worth pursuing, but only if it is done correctly and it does not crowd out funding for near term munitions and other critical requirements, given

rising threats and tensions.

I will first outline the stated goals of the initiative and some of the challenges facing it, and then identify the authorities and tools that will be needed to overcome these challenges.

What are the goals of Replicator? DOD's first stated goal is for Replicator drones to be attritable, or in other words, cheap enough to lose. One should be able to lose contact with a drone or have it shot down without worry – either from a cost or technology perspective. If operators have to track down and recover a downed exquisite and expensive drone in enemy territory because of a concern about the technology getting in the wrong hands, it is doubtful they will want to use the technology in the first place. Examples of that happening in Afghanistan and Iraq drive home the drawbacks of using such exquisite technology.

DOD's next goal is to produce Replicator drones in the thousands. Economies of scale are needed not only from a production standpoint but, more importantly, to overwhelm defenses. Establishing a layered defense for dozens of incoming cruise or ballistic missiles is still much easier than seeing those defenses try to address thousands of targets all at once. As an aside, counter-unmanned aerial systems (C-UAS) technologies and integrated air and missile defenses will become ever more important no matter what the US does in its offensive drone programs as adversaries learn and adopt lessons from drone warfare in Ukraine.

The Department wants to explore multi-domain solutions i.e., air, ground, sea-surface, and underwater autonomous systems. As the Congressional Research Service has pointed out, unmanned air systems can perform a variety of missions including intelligence, surveillance, and reconnaissance; close air support; cargo and resupply; communications relay, aerial refueling; air-to-air combat; strategic bombing; battle management and command and control (BMC2); suppression and destruction of enemy air defenses; and electronic warfare (EW). Similar and other additional missions can be performed using ground robots and surface and undersea autonomous systems. Any of these missions could be appropriate for Replicator.

Replicator is currently China-theater focused. In her original speech, Secretary Hicks outlined that Replicator is expressly designed to help the US overcome China's numerical advantage in ships, missiles, forces and anti-access/area denial systems. The goal is to provide a lot more targets that are expensive for China to destroy, but it could also lead to the destruction of Chinese targets either directly or serving as jammers or by providing targeting information.

The next goal is speed to capability. Secretary Hicks called for deployment of Replicator in the next 18-24 months. This timeframe should encourage off-the-shelf existing technology that will likely primarily rely on commercial information systems, sensors, and software solutions.

Yet another goal of Replicator is for it to serve as an innovation playbook, or as Secretary Hicks imagines, "replicate and inculcate how we will achieve this goal, so we can scale what's relevant in the future again and again and again." Repeating successful business practices could be done in each of the 14 emerging technology areas that the Department has identified as critical for

its future. In autonomy, as in the vast majority of these technologies, competence and innovation reside in the commercial market rather than in the traditional defense industry.

Finally, in what may be the toughest and most daunting goal, the Deputy Secretary has outlined that “Replicator will use existing funding, existing programming lines, and existing authorities to accelerate production and delivery at scale.” This would be done by pulling together already-funded programs from across the services with the goal of overcoming, in Hick’s words, “the production valley of death.”

Challenges: Each of the Replicator goals face significant challenges, and the issue for Congress to consider is whether any of this is realistically achievable in the short term. It could be.... but the odds may well be stacked against this initiative becoming anything more than a buzzword or a new lightning bolt on a Joint Staff PowerPoint briefing chart.

The first set of challenges revolve around DOD’s culture. DOD’s culture and the management systems that derive from that culture are stuck in a 1960s paradigm that has consistently rejected new approaches and commercial technology that does not conform to DOD’s engrained thinking. Just as was the case in the Soviet Union, centrally-planned, linear, predictive processes and mindsets continue to destroy innovation and creativity. These processes originally took root at DOD under former Secretary of Defense McNamara and have had over 60 years to engrain themselves in culture.

The greater defense innovation problem is multi-faceted. First, there is no sense of urgency. Defense management systems were first created to conform to the ideology of predictive systems analysis and then optimized for a peacetime cadence after 30 years without a great power competition or conflict. It took years to get to this point and without focused leadership it will be difficult to adjust to a different set of circumstances. Process compliance is the most valued objective in the acquisition and budgeting system, rather than time. Time to operational capability as described in the report “Competing in Time” that I wrote with Dan Patt has been the primary historical forcing function for disruptive innovation, and yet it is little valued in DOD. Replicator needs to be a time-based approach and thus will be a threat to the traditional acquisition and budgeting bureaucracies’ approach.

Budget inflexibility in year of execution and long lead times to allocate resources are at the root cause of DOD’s declining competitiveness and innovation failures (especially in the many versions of the Valley of Death that Secretary Hicks is attempting to address with Replicator). The predictive and lumbering military-controlled requirements process forecloses innovation opportunities from the start as it is the gateway to the acquisition and budgeting system. Operational interests are not aligned or supported within the acquisition and budgeting systems – both at the combatant command and service component command levels. Replicator will need both agile budgeting and constant operator feedback or it will fail.

The defense contracting system has become more of an enforcer of rules than an enabler of capability. Unique non-market rules keep out non-traditional and commercial companies and

solutions and drive-up costs. These are the exact companies that are needed to make Replicator a reality, but they find the defense contracting system a morass filled with excess overhead and financial disincentives. There has been a constant undermining by the contracting community of the authorities designed to attract non-traditional commercial contractors such as commercial item contracting and Other Transaction Authority (OTA) that Congress has given the Department. Finally, the authority and ability of program officials to do their jobs has been limited by adversarial oversight. Testing, technology, and auditing bureaucracies double down on time-consuming “gotcha” check the box oversight rather than provide cooperative insights and proactive value add.

The result of these problems manifests itself in the extensive time it takes to solve them. The system is based on a planned linearity so everything is a step-by-step predictive process that takes decades to deploy anything of substance. This is diametrically opposed to what happens in the commercial market which is the main reason why the commercial market and its time-based development culture is now leading in most of the technologies the DOD will need in the future. By contrast, in the traditional defense acquisition system, it normally takes many years for a technology to be considered mature and then 2-3 years for a requirement to use such a technology to make its way through the Joint Capabilities Integration and Development System (JCIDS) process. Then such an effort can enter the Planning, Programming, Budgeting, and Execution (PPBE) process and take another 3 years to work its way through the overarching budget process to be included in a defense appropriations bill. Once those appropriations are released, a full and open competition can take almost 2 years to select an industry partner to get on contract to obligate the money to start the program. Industry will start the process to tool up only once they have the money, then spending 18-24 months to build a production line. Typically, it takes 5 years after obtaining funds to produce something incrementally different than before and 10-20 years for something that is still in development. The enormity of the obstacles that a time driven program such as Replicator faces within the DOD acquisition system is daunting.

DOD's culture and processes have also impacted its historical approach to autonomy and commercial development practices. The not-invented or predicted here syndrome has precluded the adoption of commercial and outside innovation for decades. The US was the original leader in unmanned systems almost by accident beginning with Abe Karem's Amber in the 1980s and the Gnat that eventually became the Predator in the 1990s. Karem's capability was developed with DARPA support in a garage and outside of the DOD acquisition process. The pushback on adoption of this technology was a leading indicator that something was seriously wrong with DOD's innovation system over 30 years ago. The lack of follow on support for drones by DOD eventually bankrupted Karem's company and led to the selling of his Predator technology to General Atomics. The Predator experience is one of those innovation case studies that Congress should spend time exploring as it is highly relevant to not only Replicator but all future innovation efforts led by small entrepreneurial companies. The takeaway is that historically for DOD, autonomy is nice as long as it doesn't disrupt or replace anything the Department is currently invested in.

Congress has been for decades (starting with former SASC Chairman John Warner) disappointed by DOD's lack of support for autonomous systems and even set a goal in the 2001 NDAA "for the Armed Forces to achieve the fielding of unmanned, remotely controlled technology such that— (1) by 2010, one-third of the aircraft in the operational deep strike force aircraft fleet are unmanned; and (2) by 2015, one-third of the operational ground combat vehicles are unmanned." That none of that ever happened and Karem's and many others' subsequent ideas for more advanced autonomous systems were never pursued is a testimony to DOD's entrenched culture. If DOD would have listened more to Congress, we would likely be much farther along than we are in this technology and the US would have an overwhelming lead rather than be reacting to new technological advancements.

The lesson from past innovation efforts for the Replicator program is that if it is not taken outside of the acquisition/budget bureaucracy and rules it will undoubtedly fail. The outside innovation entities and hubs in Special Operations Command, the service WERXs, the relevant combatant commands, DIU, and CDAO do not have the authority or budget to do what is needed to do at scale. Giving the acquisition chain, any route is likely problematic as the Pentagon's acquisition system is simply not capable of acting on the proposed timelines contemplated in the Replicator program except in very limited circumstances and then only when conducted outside the normal rules of acquisition and budgeting.

The budget issue is more than just process time and inflexibility as it has also become a zero-sum game. An important question for Congress is whether this initiative will stall or rob other programs that are vitally needed in preparing to deter a fight against China or other adversaries. The announcement that this will be done under existing budgets and authorities appears to require Congress to suspend belief that preparing for any potential war with China will be cost-free. More ships, munitions, space and surveillance assets are already needed in the INDOPACOM theater and those programs cannot become bill-payers for the pursuit of a future technology that may or may not work as intended. More resources are vitally needed to fund multiyear procurements of munitions. We have run out of time with regards to China and first need to produce at scale what we already have developed but don't have enough of.

The need to fund Replicator through existing funds instill some contrary incentives via the PPBE budget process. Rather than focus on new efforts that are achievable within an 18- 24-month time-frame (two of which have already gone by since the announcement of the program) the services may not be able to help themselves as they try to include in Replicator their own version of complex technologies they would like to develop but are not yet ready for near term production and deployment. Even worse, the services may hold back existing near-term efforts that are ready for production for fear of "not making the cut" and see their program become the bill payer for something else. The machinations in the competition for budget resources could doom the effort from the start.

On the industrial base side there are other causes for concern. The US defense industrial base is a microcosm of DOD and optimized for a peacetime cadence. The barriers to civil-military integration of the industrial base have continued to widen as DOD prefers to dictate solutions

to defense-unique monopoly providers rather than incentivize commercial innovation. Replicator needs the commercial base and greater civil-military integration but barriers to bringing that base into the DOD acquisition system remain.

There are also concerns that the US currently does not have the production capacity needed to produce Replicator's thousands of drones, specifically those most relevant to the Indo-Pacific's geography. Production capability is a key component to innovation and has been allowed to deteriorate both in the traditional defense and commercial industrial bases. DOD ignored the implications of the last two decades of commercial globalization and production outsourcing to China that has hollowed out the US industrial base. Just in time efficiency requirements and barely minimal sustainable production rates have also destroyed defense specific industrial capabilities and undermined military readiness.

When the autonomous system supply chain is analyzed as RAND recently did, we will continue to find that many parts required for Replicator are not in the US or allied supply chain. A more advanced commercial UAS base could have been relied upon but as RAND suggests that did not happen because of the impact of FAA policies that have limited the advancement of the US commercial drone industry. It is perhaps ironic that we may want to explore through the Defense Production Act or other authorities the need to secretly buy foreign parts necessary for Replicator drones. Otherwise, we may end up reliant on brokers with extremely high markups for parts to meet future demands.

Another continuing challenge for the industrial base will be the lack of information and demand signals coming from DOD about Replicator and drone programs in general. The lack of information on which drones are being selected could make it more difficult for industry to know where investments must be made ahead of time to scale production (and as a result, meet the initiative's aggressive timeline of 18-24 months). The Pentagon may well intentionally not provide many specifics on the drones being considered for the initiative so as to not tip off China but in doing so may further compresses the timeline for making Replicator a reality. Industry needs a demand signal and most importantly contracts before it will invest in new plants, equipment, workforce, and parts.

Another challenging area of inquiry for Congress is why the Chinese and the Turks have been able to dominate the export market for these capabilities. In addition to FAA's limited approvals for testing and the usage of unmanned systems in federal airspace one need look no further than the US State Department. State's interpretation of the requirements of the Missile Technology Control Regime (MTCR) has held back the ability to export drones from the US but also inflicted ITAR requirements on many future capabilities. It has also inhibited cooperation with our allies and lagging US investment. Security and technology control policies such as ITAR have been built around an era of US defense technological dominance that has long passed and now serve as barriers to innovation. Both commercial companies and allied cooperation will be needed to compete against China but outdated thinking and processes will hinder such cooperation. The degree that our allies are now pursuing their own ITAR-free air and undersea drone programs without US participation to include our closest AUKUS allies is a growing

concern.

Pathways to Success: The first step to a successful Replicator program is establishing a sense of urgency combined with a time-based innovation and acquisition strategy. This is what Secretary Hicks appears to be proposing. This approach needs to be executed from the top down but only in the sense that senior managers need to remove the barriers to those entrepreneurial and disruptive parts of the Department so they can be empowered to act. The naysayers need to be sidelined for the moment to allow for new capability to be produced quickly and be tested and used by the operators in the field.

The Department needs to establish and maintain a clear understanding of what it is creating. Replicator should not be a linear or predictable Major Defense Acquisition Program (MDAP) program or even a series of such programs. It should be an agile process that deploys capability quickly and at scale in such numbers that make China's calculations so difficult that they will not take aggressive action. To succeed, it will be necessary to restore many of the attributes of the time-based acquisition system from the 1950s. This approach has been used successfully on stealth programs in the 1970s, arguably in the B-21 bomber, in rapid acquisitions such as the MRAP and counter-IED systems that supported operations in Iraq and Afghanistan, in the development by NASA of SpaceX's Falcon 9, and most recently, with the COVID vaccine.

Replicator will require the adoption of agile acquisition and budgeting practices and the leveraging of commercial technology and companies that do not traditionally do business with the Department of Defense. This is an initiative that could have begun almost 10 years ago when the Pentagon was given new acquisition authorities by this Committee in the aftermath of the annexation of Crimea and the initial buildup of illegal Chinese military bases in the South China Sea. Understanding the history of the under-execution of these authorities is helpful in understanding why the Pentagon has been impervious to change and is falling behind its adversaries.

HASC and SASC in the 2016 and 2017 NDAs tried to create pathways to replicate the more agile time-based system of the past. These pathways began with flexible funding lines, OTA, Commercial Solutions Opening (CSO), and improved FAR Part 12 commercial contracting authorities, an updated Rapid Acquisition Authority (RAA) and a new Middle Tier Acquisition (MTA) authority to bypass the requirements and traditional acquisition system. The results to date have been marginal at best as these authorities have been undermined by the reimposition of old processes (particularly within the OTA and MTA authorities), the inability to achieve greater flexible funding that have been stymied at the DOD Comptroller, OMB, and appropriations committees. Without the use of flexible budgeting and acquisition authorities Replicator cannot happen on 18–24-month timeframes even before we consider the problems with the industrial base.

Is it hopeless? No but this is what would need to happen.

Program decision time measured from requirement generation, obtaining funds and getting on contract has to comprise just a few months rather than the up to 8 years as under the current system. This will first require some type of initial flexible funding. Reprogramming existing funds is probably not practical for this effort given the timelines for Congressional approval, although some smaller efforts could be kickstarted through below threshold reprogramming. The one current authority DOD could consider using would be Rapid Acquisition Authority (RAA) which allows for rapid reprogramming of funds up to \$800 million in various categories with a subsequent notification to Congress. This authority has been successfully used since the aftermath of 9/11 and was enhanced on the 2016 and 2017 NDAA's.

If modifications to an MDAP are needed for such platforms as the P-8 and C-130s to deliver drones at scale, DOD and Congress should consider using the Defense Modernization Account (DMA) (10 U.S.C. 3136). This authority would allow for up to \$1 billion in expiring funds to be used for such purposes once approved by the configuration steering board of the program. Unfortunately, this authority has never been used as the DOD Comptroller refuses to execute it. The DMA is very similar budgetary authority to that which Chairman Gallagher has proposed in his FIRES Act. To the degree Replicator drones become munitions, FIRES Act authority could also be used if Congress were to adopt it. The FIRES Act is exactly the kind of budget authority that needs to be established if Congress and the DOD are really serious about meeting the threat from China.

To get on contract quickly, DOD should primarily use OTAs either through the CSO, the OTA consortium model, a direct OTA, or a newly configured OTA arrangement specifically designed for Replicator. Any such OTA should allow for an initial but time-limited competitive prototyping phase of just a few months so a follow-on production OTA could be awarded and executed in time. For any traditional contracts, Undefined Contracting Actions (UCAs) and sole source Competition in Contracting Act (CICA) waivers would need to be considered.

Ultimately, multiple programs and solutions and a rhythm of new capabilities should be created. Next generation Phase II and III Replicator programs could be established as MTAs to begin delivering operational prototypes to be tested in 3–5-year time frames so as to be ready for a subsequent ramp up to an 18–24-month production when needed.

Operational feedback is essential for this program to be successful. At the end of the day most of these capabilities would primarily be software driven. Iterative serial prototyping with adaptable, agile software modifications need to be a pillar of the program. Ultimately, these systems need to be able to be updated as fast as an iPhone or what was reported with the commercial Starlink system when it was jammed by the Russians in Ukraine. The Subcommittee may want to review the progress of the Autonomy Prime effort in AFWERX as well as other efforts both in DOD and the commercial market designed to achieve a continuous software updating system.

In addition, DOD and Congress should establish a different measure of success for these systems than for a traditional MDAP. Oversight criteria is a key driver of behavior and

innovation. Unfortunately, the traditional Director of Operational Test and Evaluation (DOTE) oversight criteria of operational suitability and effectiveness determined by a group within an outside testing bureaucracy is not the right criterion for the types of systems being contemplated in Replicator. Operational usefulness or having the operators themselves evaluate the usefulness of these systems over what they previously had may be more appropriate. The key takeaway for the commercial world is that software is never done so there is no final rigid operational program to test. Testing needs to be continuous and it is going to be the operators who need to drive the necessary software changes to ensure that these systems not only continue to perform but continue to improve. Software has been “eating the world” (in the words of Marc Andressen) for the last few decades and driving changes throughout the commercial market. DOD has been impervious to this trend and the old rigid DOT&E testing model will not work with software. It is long past time to adopt software commercial practices, technology, and testing approaches. If this is done on Replicator, it truly could offer a playbook that could be applied to many other future systems and technologies.

Conclusion: The objectives of Replicator can be achieved. It will take money, a culture change, and a leveraging of existing acquisition authorities. A bespoke industrial base can be built up to support the program but that will take time and DOD will likely continue to be dependent on fragile supply chains. Anything broader will take a whole of government approach like the US is taking with semiconductors and funding authorities comparable to those in the CHIPS Act to build a commercial industry that could support a US or allied- controlled supply chain.

Thank you again for the opportunity to testify on this important topic and thank you for your many years of service and support for our warfighters and national security. I welcome any questions you may have.