DRONES IN THE DEFENSE BUDGET

Navigating the Fiscal Year 2018 Budget Request

Dan Gettinger

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About the Center for the Study of the Drone

The Center for the Study of the Drone at Bard College is an interdisciplinary research institution founded in 2012 that examines the novel and complex opportunities and challenges presented by unmanned technologies in both the military and civilian sphere.

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Introduction

The U.S. military's spending on drones is set to reach a five-year high. The Department of Defense Fiscal Year 2018 budget request contains $6.97 billion for drone-related procurement, research and development, and system-specific construction. The President's Budget 2018 maintains funding for existing unmanned aircraft at roughly the same level as the previous year and increases funding for research and development. It lays the groundwork for programs that will develop new unmanned ground and maritime drones, as well as the next generation of unmanned aircraft.

This report examines the U.S. military's proposed budget for drones in Fiscal Year 2018. It considers underlying trends and recent developments that will affect the future development of unmanned systems in the air, ground, and sea. The report compares the President's Budget 2018 to the past five years of military drone spending in order to understand how drone spending has evolved over time. The report is based on a catalogue of over 400 budget line items and projects that have collectively received a total of $34.6 billion in funding between Fiscal Year 2013 and 2018.

In order to gauge how much the U.S. military spends on drones, we take a holistic approach to studying the Pentagon's budget requests. Reports of drone spending are frequently based on the budgets of a few prominent platforms such as the Air Force's Reaper or the Navy's Triton. For example, the Pentagon's annual summary of funding for major defense systems notes that $2.6 billion has been allocated to existing unmanned aircraft in FY 2018. However, that estimate excludes certain items such as the procurement of spare parts for existing drone systems, as well as the panoply of emerging drone systems and capabilities. By studying budget items both large and small—half of the drone line items in our PB18 dataset are allocated $10 million or less—this report provides the closest complete public account of how much the Pentagon has allocated to drone systems and to capabilities such as autonomous drones, swarms, and advanced robotics.

While the Fiscal Year 2018 budget request funds some of these emerging technologies and capabilities, the future of some of these programs is not a done deal. Congress is currently debating spending levels for existing unmanned platforms and for new drones like the MQ-25 Stingray, a carrier-based aerial refueler drone, and the Large Displacement Unmanned Undersea Vehicle. These debates could delay plans to begin some programs or prolong the life of others. This report offers stakeholders and the public a guide to understanding how funding is divided between different, at times competing priorities and what changes to these programs could mean for their future.

The future drone force may not look too much like the military drones of today. Small quadrotor drones and bulky, pack-carrying robots could accompany infantry while jet-powered strike drones may serve as wingmen to future fighter pilots. Submarine-like underwater drones equipped with aerial drones could stalk enemy fleets or patrol coastlines. All of these scenarios are backed by millions in DoD funding in the President's Budget 2018. Later this year, the Pentagon will release a new strategy document that will map its plans for the acquisition and use of military drones, the first since 2013. As the Department of Defense looks to the future, our data offers a baseline from which to view new developments in drone spending.

Key Takeaways

- The Department of Defense is requesting approximately $6.97 billion for drone procurement, research and development, and system-specific construction for Fiscal Year 2018.
- The DoD is requesting more in FY 2018 than any year since FY 2013 and $3.3 billion more than previously predicted.
- Drone spending in PB18 is 21 percent greater than the enacted FY 2017 drone budget.
- The single largest item in the DoD request is the MQ-9 Reaper, which is allocated $1.23 billion in the FY 2018 request.

Scope and Methodology

The data presented in this report is largely collected from the procurement, research and development, and military construction budgets of the three main services—the Navy and Marine Corps, Air Force, and Army—and what is known as Defense Wide spending, which covers the budgets of around 20 smaller agencies and departments, including the Defense Advanced Research Projects Agency and Special Operations Command. The data includes allocations from both the base budget and Overseas Contingency Operations, a budget that funds costs associated with ongoing operations in Afghanistan, Iraq or Syria, and elsewhere in the world. This document is only concerned with the development and acquisition of drones, and so does not include data from the Pentagon's operation and maintenance or military personnel budgets, which pay for equipment upkeep and personnel salaries.

This report includes all identifiable DoD programs and projects that appear to support the acquisition and development of unmanned systems. That means that we included both funding that is for specific drones like the Reaper and Triton, as well as funding for the development of unmanned systems capabilities and technologies. We also include funding that, although it might be located in the budget in a project unrelated to drones, appears to support unmanned systems acquisition or development. For example, in 2015, the Pentagon allocated $45 million for the AH-64 Apache manned helicopter program to add manned-unmanned teaming capabilities to the system. We did not include funding for space-based systems or for supporting systems such as the Distributed Common Ground System and satellite communications.

It is not possible to identify all drone spending in the Pentagon's public justification books. Some spending items are classified and not available to the public. Other drone spending is impenetrably intertwined with funding for many other projects unrelated to drones. This is mostly the case in the research and development budgets, where some bulk line items like the Navy's Defense Research Sciences project include an undefined amount of funding for drones amidst funding for other initiatives. Early-stage research projects and general research initiatives are harder to isolate than system-specific funding or more mature research projects. In order to obtain the most accurate estimate of drone spending possible, this report is based on budget lines that appear to be mostly or wholly dedicated to drone systems and capabilities.

The limitations of the public budget data produce two unavoidable consequences. The first is that the actual amount that the Pentagon intends to invest in drones in Fiscal Year 2018 is likely greater than the figures represented in this report. Secondly, observable trends in spending—particularly in research spending—and historical budget data should be considered within the context of these limitations. Research projects frequently move within the budget. As such, while we may include a mature drone research project in PB18, an early-stage version of that same project from FY 2013 may not be included due to its location in a general research fund in the budget.

The final Fiscal Year 2018 budget will be approved by Congress later this year and will differ in some respects from the President's Budget 2018. (The enacted Fiscal Year 2017 defense budget includes $162 million more for drones than the Pentagon initially requested.) Although these changes are unlikely to influence overall trends in drone spending, they could have an effect on specific programs. By publishing this report now we hope that it offers stakeholders and researchers a means to engage in these ongoing and immediate conversations about the future of drones.

Notes

- This report refers to the Department of Defense's budget request for Fiscal Year 2018 as the "President's Budget 2018" or "PB18."
- The Research, Development, Test & Evalutation budgets are referred to as "RDT&E" or "research and development."
- The abbreviation "YoY" represents year-over-year change.
- The FY 2017 figures in this report are the enacted budgets; they are not the FY 2017 figures included in DoD's PB18.
- Unless otherwise stated, all PB18 figures were obtained from the DoD justification books. All figures are expressed in Then-Year Dollars and in millions.

Budget Analysis

Summary

Category	FY13	FY14	FY15	FY16	FY17	PB18
Procurement	2,521.1	1,947.8	2,042.6	3,631.8	2,757.1	3,341.1
Research and Development (RDT&E)	3,001	2,451	2,899.9	2,922.1	2,760.8	3,554.5
Military Construction	107.1	152.5	149.3	139.3	228.2	79.1
Total	5,629.2	4,551.2	5,091.8	6,693.2	5,746.1	6,974.6
YoY Change of Drone Spending		*-19.2%*	*11.9%*	*31.5%*	*-14.2%*	*21.4%*
*YoY Change of the Entire DoD Budget**		*-4.14%*	*0%*	*14.1%*	*-4.3%*	*16.7%*
*Drones as a Percent of the DoD Budget**	*3.3%*	*2.8%*	*3.1%*	*3.4%*	*3.1%*	*3.2%*

**Based on the enacted DoD procurement, research and development, and military construction budgets. Does not include operations or personnel budgets.*

$6.97B

The DoD has requested at least $6.97 billion to drone procurement, research, and system-specific military construction in FY 2018.

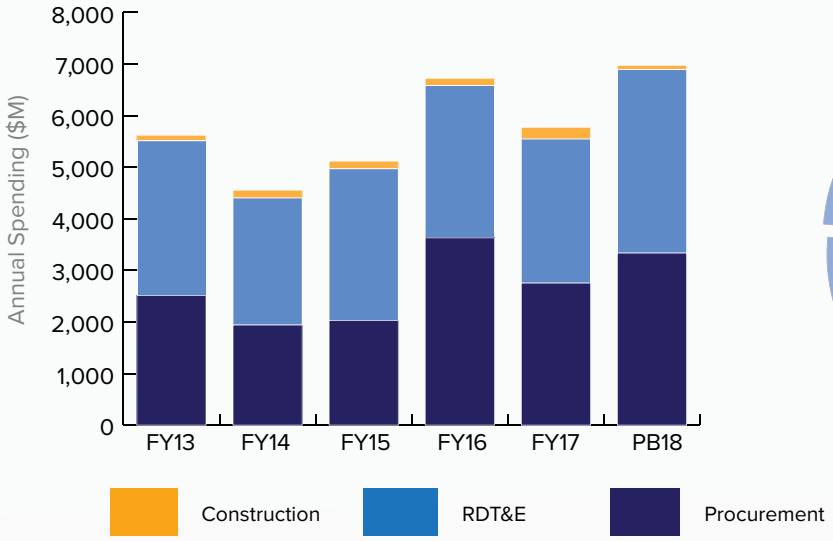
21%

The requested amount for drones in FY 2018 is 21.4 percent greater than the enacted FY 2017 defense drone budget.

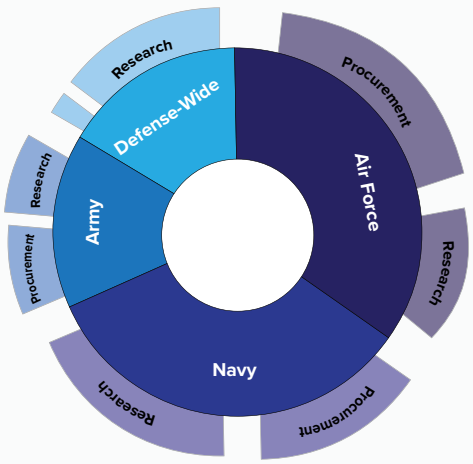
$951.9M

Around 13.6 percent, or $951.9 million, of drone spending draws from the Overseas Contingency Operations fund instead of the base budget.

Annual Drone Spending



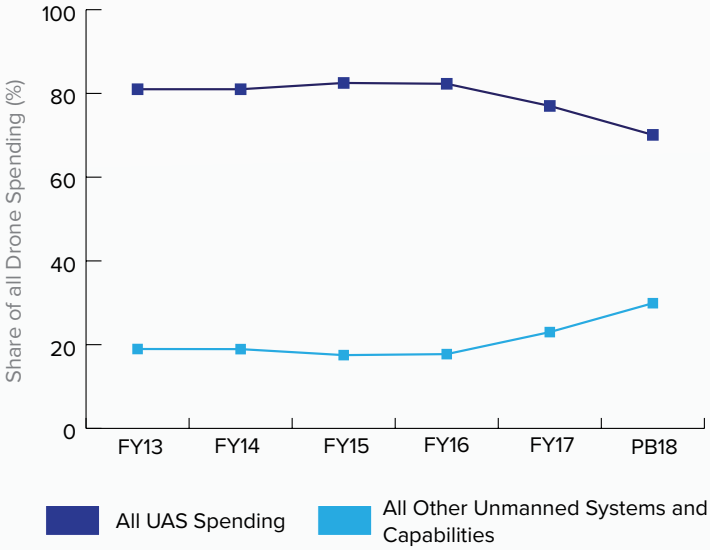
PB18 According to Department



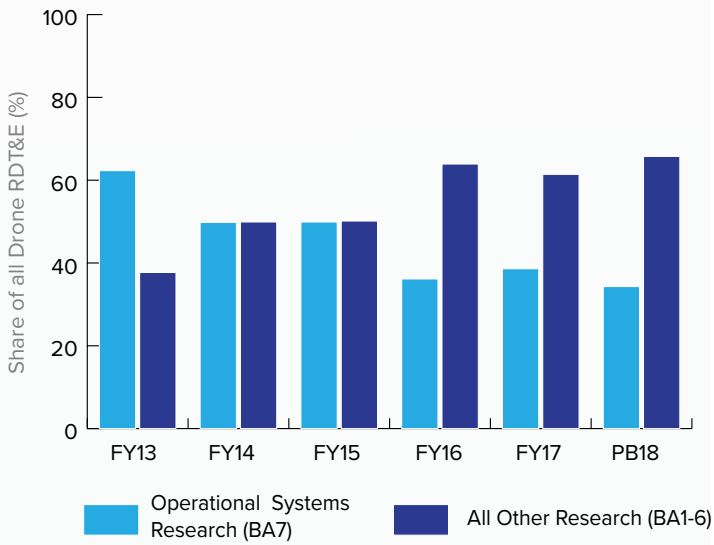
Branch	FY13	FY14	FY15	FY16	FY17	PB18
Air Force	2,435.3	1,672.1	2,003	2,662.9	2,018.4	2,468.1
YoY Change		*-31%*	*19.8%*	*32.9%*	*-24.2%*	*22.3%*
Navy and Marine Corps	1,827.3	1,254.7	1,663.7	2,418.7	1,984.6	2,368
YoY Change		*-31.3%*	*32.6%*	*45.4%*	*-17.9%*	*19.3%*
Army	1,091.5	1,181.3	989.9	868.3	927.9	1,037.2
YoY Change		*8.2%*	*-16.2%*	*-12.3%*	*6.9%*	*11.8%*
Defense Wide	275.2	443.1	435.2	743.4	815.2	1,101.1
YoY Change		*61%*	*-1.8%*	*70.8%*	*9.7%*	*35.1%*

Category	FY13	FY14	FY15	FY16	FY17	PB18
Unmanned Aircraft	4,553.5	3,671.4	4,197.5	5,498.7	4,420.3	4,887.9
YoY Change		*-19.4%*	*14.3%*	*31%*	*-19.6%*	*10.6%*
Unmanned Ground Systems and Robotics	263	230.7	192.5	208.1	199.8	339.6
YoY Change		*-12.3%*	*-16.5%*	*8.1%*	*-4%*	*70%*
Unmanned Maritime Systems (Surface and Undersea)	491	308.9	293.5	390.1	533.8	882.9
YoY Change		*-37%*	*-5%*	*32.9%*	*36.8%*	*65.4%*
Autonomy, Teaming, Swarms	211.1	236.6	322.1	394.9	431.4	457
YoY Change		*12.1%*	*36.2%*	*17.8%*	*13.7%*	*5.9%*
Counter-UAS	67.2	64.1	67.8	109.9	147.2	401.2
YoY Change		*-4.6%*	*5.8%*	*62.1%*	*34%*	*172.5%*
Other	32.7	17.3	14	82.8	7.3	4

Division of the Drone Budget



RDT&E Budget Activity Comparison



System-Specific Spending

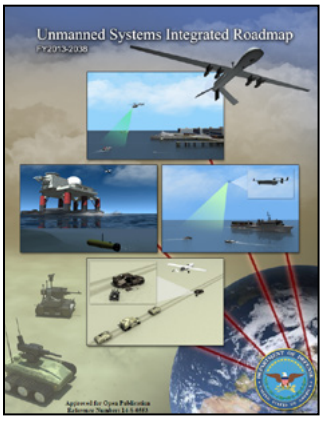
Category	PB18
MQ-9 Reaper	1,234.8
RQ-4 Global Hawk and AGS	427.9
MQ-8 Fire Scout	164.6
MQ-4 Triton	988.2
RQ-21A Blackjack	115.8
MQ-1C Gray Eagle	358
RQ-7 Shadow	126.4
MK 18 Family UUV	63.1
MTRS II Robot	53.5

Drone RDT&E Budget Activity Breakdown

Budget Activity	PB18
BA 1, Basic Research	66.7
BA 2, Applied Research	478.4
BA 3, Advanced Technology Development	452
BA 4, Demonstration and Validation	928.7
BA 5, Engineering and Manufacturing Development	403.3
BA 6, RDT&E Management Support	8.1
BA 7, Operational System Development	1,217.6

Overview of Annual Drone Budgets

In December 2013, the Department of Defense published a 25-year strategy for the acquisition, development, and use of unmanned systems. In the "Unmanned Systems Integrated Roadmap FY 2013-2038," the Pentagon concluded that, after years of growing its fleets of aerial drones, military budgets for unmanned systems had peaked.[1] Future budgets, particularly in the area of research and development, would be limited by overall constraints on military spending. The Pentagon predicted that between Fiscal Year 2013 and 2018, it would spend $22.8 billion on unmanned air, ground, and sea systems procurement and research. Yearly spending on unmanned systems, the report predicted, would decrease from $4.2 billion in FY 2015 to $3.7 billion in FY 2018.



In many ways, the opposite has occurred. Public budget data indicates that funding for drones in Fiscal Year 2018 is significantly greater than what the Pentagon predicted four years ago. Buoyed by orders for additional multi-role strike drones and burgeoning research and development budgets, funding for drones in the President's Budget 2018 is around $3.3 billion more than what the Pentagon predicted it would spend on drones in Fiscal Year 2018. Overall spending on drone procurement and research between FY 2013 and FY 2018 is estimated to be over $10.8 billion more than predicted in the 2013 roadmap. Even though additional purchases of new unmanned aircraft have slowed since 2013, this decline has not had a negative effect on overall spending on drones. Growing modernization budgets for legacy unmanned aircraft and plans for future drones have helped stabilize spending on unmanned systems.

The Pentagon's 2013 roadmap overestimates the proportion of drone spending allocated to unmanned aircraft and underestimates funding for unmanned ground and sea vehicles. According to our data, DoD is on track to spend $968 million more in FY 2018 on unmanned ground and sea vehicles than it initially projected in 2013. The Pentagon believed that around 87 to 89 percent of funding for drones would be spent on air systems.

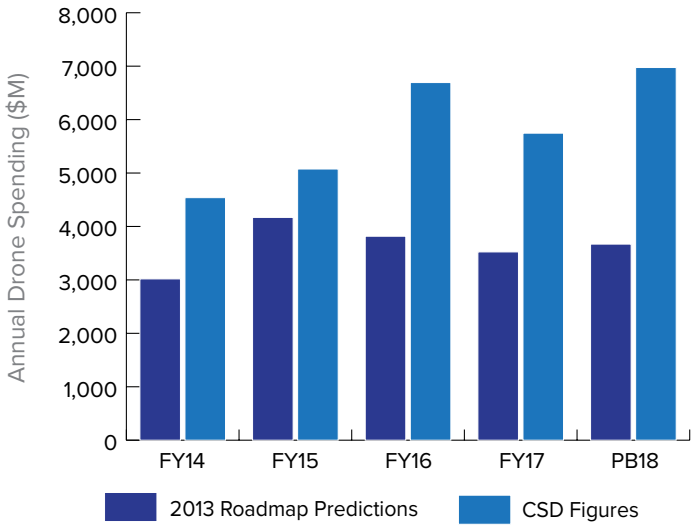
Public budget data indicates that funding for drones in Fiscal Year 2018 is significantly greater than what the Pentagon predicted four years ago.

Our data suggests that on average, the military has spent on average around 79 percent of the drone budget on air systems—66 percent on legacy aircraft and 13 percent on UAS capabilities and future systems—between FY 2013 and PB18.

One factor that is driving continued investment in drones is the Pentagon's research and development budgets for existing and future unmanned systems and related technologies. In PB18, research and development spending is 51 percent of the drone budget, while procurement is at 48 percent, a split that, according to our data, is roughly consistent with the average since FY 2013. (The remainder is comprised of system-specific military construction.) This procurement-development ratio differs from the Pentagon's 2013 projections, which pegged the drone research and development budget as half that of the procurement budget in FY 2018. The fact that research and development budgets for drones are consistently high is an indicator of future growth in unmanned systems spending.

Some of the Pentagon's observations in the roadmap do ring true today. The ups and downs of the drone budget since 2013 have generally tracked with the overall military budget and reflect

Annual Spending Comparison



constraints on military spending. Our data shows that funding for drones was at a low in Fiscal Year 2014, potentially a consequence of the broader cuts enacted by the Budget Control Act of 2013—also known as sequestration. Research into new unmanned aircraft in PB18 is limited to the development of a select few systems. Then, as now, the Pentagon has expressed concern about the survivability of existing unmanned aircraft. In the roadmap, it recommended that future systems should be "low-cost, disposable platforms" that are better suited to contested environments better than the expensive, multi-role drones like the Reaper and Gray Eagle.

Legacy Unmanned Aircraft Systems

Of the $4.9 billion allocated to unmanned aircraft in Fiscal Year 2018, $4.1 billion is allocated to operational systems like the RQ-11 Raven, RQ-4 Global Hawk, and MQ-8 Fire Scout. These legacy drones were mostly developed in the 1990s and early 2000s and, in PB18, are the largest portion of the Pentagon's budget request. The Pentagon is requesting $383 million more for legacy unmanned aircraft platforms than it received for the same programs in 2017, an increase of 11 percent. However, the FY 2018 request reflects a gradual decline in funding for legacy unmanned aircraft platforms as a proportion of all military unmanned systems spending. In spite of a consistently large budget since FY 2013, funding for unmanned aircraft as a proportion of all drone spending is at its lowest point in five years. The FY 2018 request illustrates both persistent need for legacy drones and DoD's evolving priorities when it comes to unmanned systems.

In Fiscal Year 2013, legacy unmanned aircraft comprised 71 percent of the drone budget. In PB18, it is down to 59 percent.

The Pentagon plans to spend more on legacy unmanned aircraft in FY 2018 than it had predicted. According to the 2015 Selected Acquisition Reports—assessments of the largest military acquisition programs—the Army and Air Force did not expect to purchase new MQ-1C Gray Eagles or MQ-9 Reapers in 2018.[2] But the proposed budget includes requests for 16 additional MQ-9 Reapers for the Air Force and 11 new MQ-1C Gray Eagles for the Army. If approved by Congress, most of these aircraft will be purchased using Overseas Contingency Operations (OCO) funding. The increase to the unmanned aircraft budgets over predicted spending levels is largely due to U.S. reliance on these drones to carry out counterterrorism missions in Afghanistan, Iraq, Syria, and elsewhere in the world. According to Air Force figures, the MQ-1 Predator and MQ-9 Reaper flew 351,000 combat hours in 2016.[3] In one battle in Iraq, Predators and Reapers accounted for 40 percent of all U.S. airstrikes.[4]

In addition to new aircraft buys, the military plans to invest more in FY 2018 in modernizing its existing fleets of drones than in previous years. Each of the four major unmanned aircraft programs—the Air Force's MQ-9 Reaper, Navy's MQ-4C Triton and MQ-8 Fire Scout, and Army's MQ-1C Gray Eagle—have new or significantly larger modernization budgets in PB18. In spite of plans to purchase fewer than half as many Reaper drones in FY 2018, the MQ-9's budget in PB18 is roughly the same as it was in FY 2013. This is partly due to upgrades for the Reaper like extended range systems and new Raytheon DAS-4 EO/IR Sensor

An RQ-11B Raven is launched during a December 2016 exercise in Djibouti. Photo by 1st Lt. Adam Miller/U.S. Marine Corps.

kits. Even the modernization budget lines for relatively young procurement programs like the MQ-4C Triton surveillance drone are higher in PB18 than in previous years. The 2016 MQ-4C Triton Selected Acquisition Report found that additional modernization efforts accounted for a $1.2 billion (17 percent) hike in the overall lifetime cost of the program.[5]

In PB18, the procurement, research, and construction budgets for legacy unmanned aircraft amount to 59 percent of military drone spending. This is down from over 71 percent of all drone-related spending enacted in Fiscal Year 2013. There are a few reasons why funding for unmanned aircraft platforms as a proportion of the entire military drone budget is declining. For one thing, in spite of several unplanned orders, the procurement period for many of these programs is coming to a close. The Pentagon's 2013 "Unmanned Systems Integrated Roadmap" correctly forecasted that the peak acquisition years for most of the existing unmanned aircraft had already passed and that the budgets for existing unmanned aircraft would focus on modernization efforts. In 2012, the military purchased 1,232 drones. Most of these—1,140—were hand-launched RQ-11 Ravens. But the military also ordered 48 MQ-9 Reapers, 29 MQ-1C Gray Eagles, 12 MQ-8 Fire Scouts, and three RQ-4 Global Hawks. In the intervening years, orders for unmanned aircraft have dropped off. In PB18, the military is requesting funds to purchase 30 of these aircraft and four RQ-21A systems.

The research and development budgets also illustrate the decline of funding for legacy unmanned aircraft systems relative to funding for other drone systems. In PB18, 34 percent of all drone research funding is allocated to operational systems (Budget Activity 7), most of which are legacy unmanned aircraft. This is down from 62 percent of all drone research in FY 2013. Although it still outranks other research categories, the budgets for other types of research are on the upswing. Funding for demonstration systems and technologies (Budget Activity 4), which include systems like the Air Force's Low-Cost Attritable Aircraft Technology and the Navy's large underwater drones, has jumped from 16.7 percent in FY 2017 to 26 percent of all drone research in PB18.

Some legacy drones are already ageing into retirement, while others suffer from persisting technical issues. Fiscal Year 2018 will mark the end of MQ-1 Predator's service in the Air Force, capping a more than two decade legacy. (Although the Navy has recently floated the possibility of recommissioning some of the Air Force's Predators for an as yet undisclosed mission.)[8] Meanwhile, in a December 2016 report, DoD's department for Operational Test and Evaluation found that the MQ-9 Block 5, an upgrade to the Block 1 version of the Reaper, is "not operationally effective and not operationally suited."[9] According to the report, the MQ-9 Block 5 aircraft tends to overheat in hot weather and "experience high abort rates." The Air Force has said that it has remedied the overheating issue by requesting that General Atomics install an air conditioner in the fuselage.[10] Still, in the House version of the FY 2018 National Defense Authorization Act, lawmakers have asked the Air Force to reconsider upgrading the Reaper to the Block 5.[11]

Counter-Drone Systems

Fiscal Year 2018 promises to be a banner year for counter-drone systems. In PB18, the Pentagon has allocated over $400 million to counter-drone systems. In PB18, counter-drone systems are 5.9 percent of the entire military drone budget, up from 3.9 percent in the enacted Fiscal Year 2017 budget. These funds could go to developing and procuring a variety of counter-drone weapons. In recent months, the Air Force has purchased shotgun shells filled with nets and the Army has snatched up the Dronebuster, a device used to jam the communications of consumer drones.[6] Meanwhile, on the other end of the spectrum, the Army and Navy are developing lasers to take down drones.[7]

MDAPs Unit Cost

System	PAUC ($M)*
MQ-1C Gray Eagle	127
MQ-9 Reaper	35.3
MQ-8 Fire Scout	43.3
MQ-4C Triton	241.2

Source: December 2016 DoD Selected Acquisition Reports

**For more information about unit cost, visit page 31.*

FY18 Projected Aircraft Inventory**

	Navy and Marines				AF		Army		
Aircraft	MQ-4	RQ-21/3A*	RQ-7*	MQ-8B/C	MQ-9	RQ-4	MQ-1C	RQ-7*	RQ-11
FY18	9	34	49	48	267	36	105	104	2,535

*Multiple aircraft per system. **Based on figures available in the budget documents. Does not represent total DoD UAV inventory.

PB18 Aircraft Orders

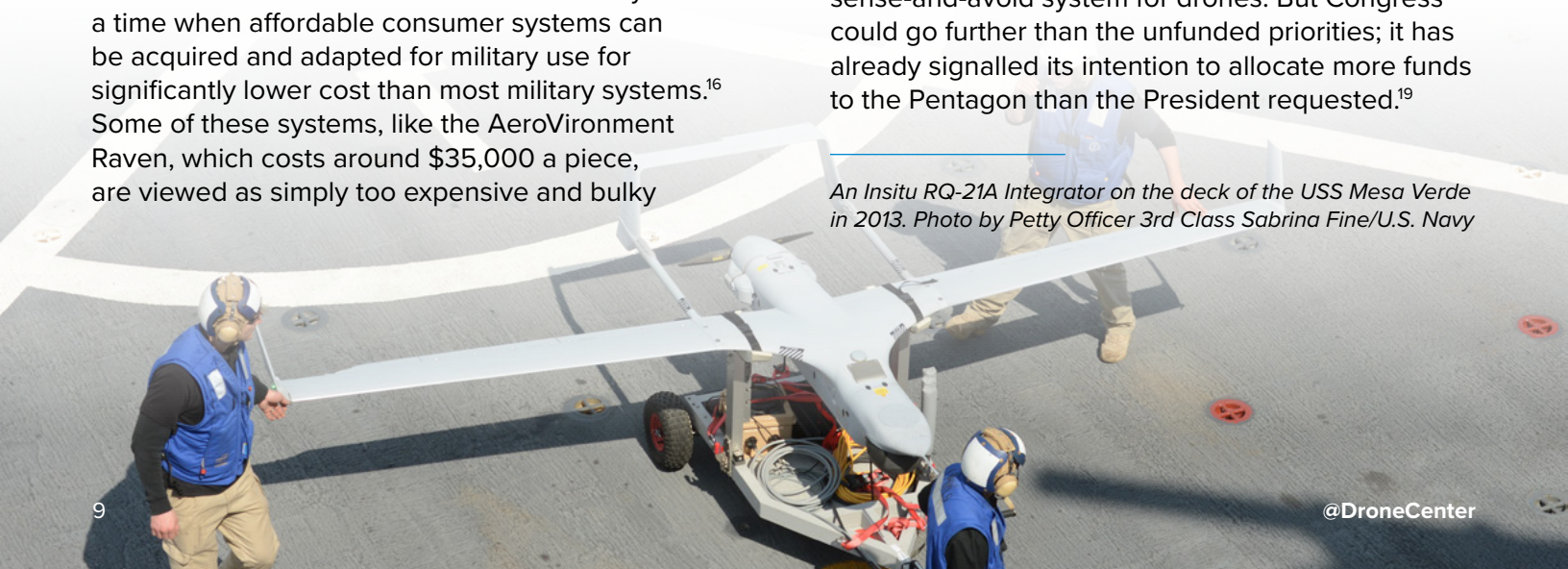
	Navy and Marines		AF	Army		SOCOM		DoD
Aircraft	MQ-4C	RQ-21A*	MQ-9	MQ-1C	SBS**	RQ-20*	ScanEagle*	Quadcopter
PB18	3	4	16	11	300	6	2	450

*Multiple aircraft per system. **The Soldier Borne Sensor (SBS) program. Undetermined small UAS.

The MQ-9's mechanical issues notwithstanding, the Reaper is at the heart of a debate over the future of armed unmanned aircraft. Some policymakers in the Pentagon have expressed doubts about the long-term viability of today's unmanned aircraft.[12] In the event of a conflict where the U.S. does not have unrestricted access to the skies, large, multi-role drones like the Reaper might be easy prey for enemy fighters or air defenses. Others argue that the Reaper is the best persistent intelligence platform available, and will remain so for some time.[13] While that may be remain true, the Reaper is already 15 years old and, as the Air Force notes in its "SUAS Flight Plan 2016-2036" report, many of the capabilities that once required a large aircraft are today much smaller and cheaper.[14] In PB18, the Air Force has allocated an unspecified amount in at least three budget lines that support the development of "attritable" aircraft—small, low-cost armed drones. The Air Force envisions that these systems could perform some of the same missions as a Reaper and, ideally, work together with manned platforms.[15]

The long-term viability of legacy small, hand-launched drones also faces uncertainty at a time when affordable consumer systems can be acquired and adapted for military use for significantly lower cost than most military systems.[16] Some of these systems, like the AeroVironment Raven, which costs around $35,000 a piece, are viewed as simply too expensive and bulky for infantry to carry around.[17] The Army's Soldier Borne Sensor program is one effort being made to come up with an alternative. In PB18, the Army has allocated $3 million to purchase 300 Soldier Borne Sensors. Although the Army has not selected what type of drones it will purchase as part of this program, they could be something like the DJI Spark drone, which can be easily stored and carried, or The Nibbler, a 3-D-printed drone created by the Marine Corps.[18] The Pentagon has also allocated $650,000 to acquire 450 quadrotor drones for U.S. allies in the counter-ISIS campaign.

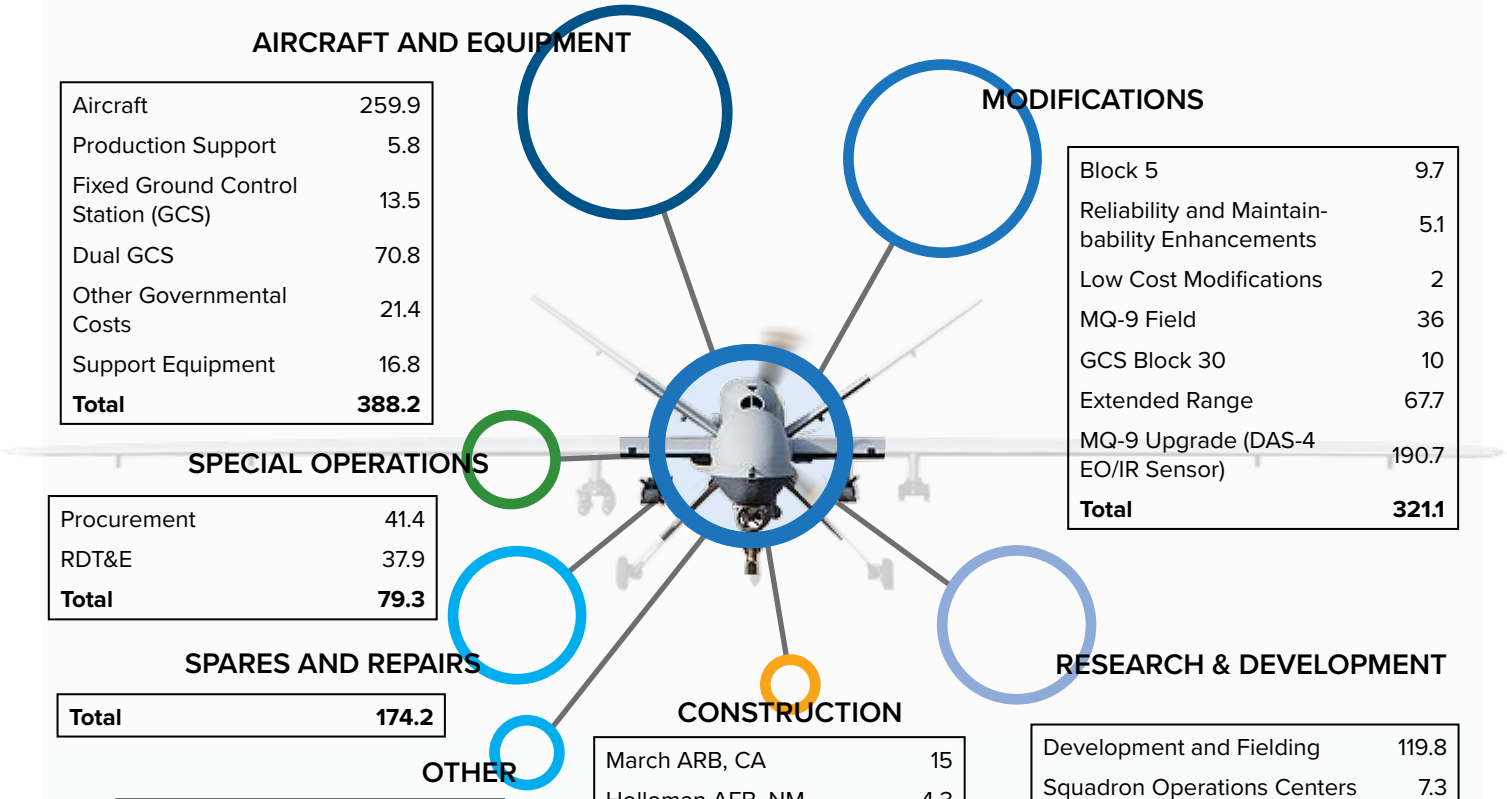
Based on lists of unfunded priorities submitted to Congress in June, Congress is likely to boost the Fiscal Year 2018 budgets for some unmanned aircraft procurement in the final defense appropro-priations bill. After the Army requested additional funds for MQ-1C Gray Eagle replacements in 2016, lawmakers added an additional $195 million for 12 more drones in the Fiscal Year 2017 appropriations bill. For FY 2018, the Marine Corps has requested $16.2 million for a Long Endurance Small UAS for special operations, and the Air Force is asking for an additional $1.5 million for the development of a sense-and-avoid system for drones. But Congress could go further than the unfunded priorities; it has already signalled its intention to allocate more funds to the Pentagon than the President requested.[19]



An Insitu RQ-21A Integrator on the deck of the USS Mesa Verde in 2013. Photo by Petty Officer 3rd Class Sabrina Fine/U.S. Navy

The $1.23B MQ-9 Reaper Budget

Division of the Budget in PB18



AIRCRAFT AND EQUIPMENT

Aircraft	259.9
Production Support	5.8
Fixed Ground Control Station (GCS)	13.5
Dual GCS	70.8
Other Governmental Costs	21.4
Support Equipment	16.8
Total	**388.2**

MODIFICATIONS

Block 5	9.7
Reliability and Maintainability Enhancements	5.1
Low Cost Modifications	2
MQ-9 Field	36
GCS Block 30	10
Extended Range	67.7
MQ-9 Upgrade (DAS-4 EO/IR Sensor)	190.7
Total	**321.1**

SPECIAL OPERATIONS

Procurement	41.4
RDT&E	37.9
Total	**79.3**

SPARES AND REPAIRS

Total	**174.2**

CONSTRUCTION

March ARB, CA	15
Holloman AFB, NM	4.3
Hancock Field, NY	6.8
Total	**26.1**

RESEARCH & DEVELOPMENT

Development and Fielding	119.8
Squadron Operations Centers	7.3
Upgrade	74.4
Total	**201.4**

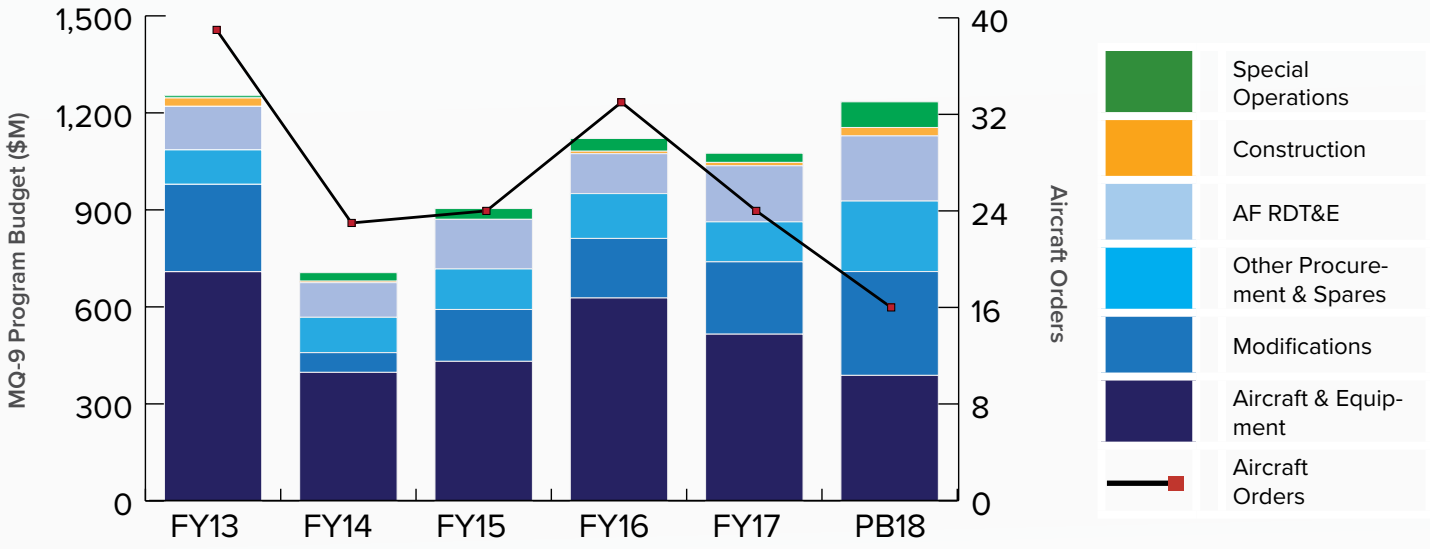
OTHER

Base Comm Infrastructure	7.5
Other Production Charges	36.7
Total	**44.2**

RELATED:

HELLFIRE Missile (AF)	329.4
Specialized Undergraduate Flight Training (RDT&E)	0.76

Annual MQ-9 Budget



Future Unmanned Maritime Systems

Unmanned maritime air and sea systems feature heavily in the Department of Defense's proposed budget for Fiscal Year 2018. The Navy's MQ-4C Triton surveillance drone, the second largest single budget item in the FY 2018 drone budget request, is set to dominate unmanned aircraft spending in the coming years. With additional funding allocated to programs that will develop new unmanned aircraft and underwater drones, PB18 has the potential to shape the long-term viability of unmanned maritime systems concepts. Still, Congress will likely scrutinize the proposed FY 2018 budgets for unmanned maritime systems more than other types of unmanned systems, placing the short-term future of some of these programs in doubt.

If it makes it through Congress, funding for the the Navy's MQ-25 Stingray, one of the largest maritime drone programs in the defense budget, will accelerate in Fiscal Year 2018. The Navy has allocated $222 million in PB18 to the MQ-25, also known as the Carrier Based Aerial Refueling System (CBARS), a 188 percent increase over the enacted Fiscal Year 2017 budget. Navy policymakers hope that the MQ-25 will enable the F/A-18E/F Super Hornet manned fighters to carry out longer-range strike missions before returning home to aircraft carriers. The Navy will solicit proposals from industry for the development of the MQ-25 in Fiscal Year 2017 and intends to select a design in Fiscal Year 2018. The Navy forecasts that it will spend up to $2.4 billion on the development of the MQ-25 by Fiscal Year 2022 and expects to field the Stingray by the mid-2020s.

Whether the Stingray proceeds as planned could depend on how the Navy navigates doubts about the program in Congress.

But whether the Stingray proceeds as planned could depend on how the Navy navigates doubts about the program in Congress. The MQ-25 is the successor to the Unmanned Carrier-Launched Airborne Surveillance and Strike drone (UCLASS), a program to develop a prototype stealth fighter drone. In early 2016, the Pentagon decided to shed the strike capability and convert the UCLASS into an unmanned fuel tanker for manned fighters.[20] Some lawmakers, including Senator John McCain and Representative Randy Forbes, have pushed back against the Navy's desire to reimagine the next-generation drone and urged the Navy to retain the UCLASS's stealthy strike capability.[21] The proposed budget for the MQ-25 is already engendering debate in Congress. In the House version of the FY 2018 National Defense Authorization Act, lawmakers propose withholding 25 percent of the $222 million for the MQ-25 until the Navy proves that an unmanned, carrier-based tanker is really necessary and that the concept is feasible.[22]

U.S. Navy sailors launch an MK 18 MOD 2 Kingfish underwater drone during exercises in the Persian Gulf in 2016. Photo by MCS 1st Class Blake Midnight/U.S. Navy

In addition to futuristic unmanned aircraft, the President's Budget 2018 also advances the Navy's plans for the next generation of unmanned undersea vehicles. The Navy is seeking $60.2 million for the Snakehead Large Displacement Unmanned Undersea Vehicle program (LDUUV) and $66.5 million for the development of the Extra Large Unmanned Undersea Vehicle (XLUUV). Unlike UUVs intended for a specific mission such as detecting sea mines, these larger UUVs are designed to have multiple mission types, including persistent intelligence gathering capabilities and payload delivery. The LDUUV will have an endurance measured in weeks, while the XLUUV, which could be as large as 50 feet long, will be deployed for long range missions, potentially traveling for months at a time.[23]

Combined funding for the LDUUV and XLUUV is up 55 percent in PB18 over the enacted Fiscal Year 2017 budget, although that increase is due in part to cuts made by lawmakers to the LDUUV program. Over the past year, the Navy has reconsidered its approach to developing the LDUUV, a program that started in FY 2013. In June 2016, the Navy restructured the LDUUV program by choosing to keep most of the development in house instead of farming it out to competing defense contractors.[24] This choice may have contributed to a decision by the Navy's financial office to cut $19.8 million from the LDUUV program in FY 2018 budget request. Still, Navy leaders have projected confidence in the program and expressed a desire to move quickly on developing the LDUUV.[25] (The Navy has said that it hopes to field a squadron of LDUUVs by the early 2020s.)[26]

Some lawmakers in Congress have taken a dim view of unmanned undersea and surface vehicle procurement and research programs in the past, thanks in part to a program that took too long and became too expensive. The Remote Minehunting System (RMS) program began in the 1990s and was designed to field an autonomous UUV that could be deployed from a Littoral Combat Ship to help search for sea mines. By 2015, however, the RMS had drawn the ire of U.S. senators for engineering difficulties and a ballooning unit cost.[27] The RMS was officially cancelled in 2016.[28] In its place, the Navy intends to field several different unmanned surface and undersea vehicles to fulfill the mine countermeasures requirement.[29] In Fiscal Year 2017, the Navy had planned to purchase several Knifefish unmanned undersea vehicles and Unmanned Influence Sweep Systems, an unmanned surface vehicle. But Congress cut funding for these procurement programs in the Fiscal Year 2017 defense appropriations bill citing "early to need," meaning that the budget allocation did not meet a pressing requirement for that fiscal year and is better suited for future budgets.

Congress cut $123.8 million from unmanned surface and undersea vehicle procurement and research programs in the Fiscal Year 2017 defense appropriations bill. Among the cuts was the Snakehead LDUUV research and development program, which saw its budget dropped by $45 million in Fiscal Year 2017. Lawmakers directed the Navy to focus on the Snakehead's "risk reduction and technology maturation efforts," signalling that it did not believe that the technology underpinning the LDUUV had progressed far enough to warrant additional funding. These reservations regarding the LDUUV are not new; in 2015, the Senate Armed Services Committee expressed concern that the LDUUVs are "too large and expensive to deploy in quantity but are likely too small to host the systems needed for long-endurance independent operations."[30] In October 2016, the Defense Science Board also worried that the LDUUV was heading down the path of the Remote Minehunting System in that it could end up being too expensive to purchase in great numbers, curbing its effectiveness.[31] As it debates the President's budget request for 2018, Congress will consider the Navy's spending proposal for the LDUUV. The Navy's list of unfunded priorities also includes a request for an additional $23 million for the Snakehead LDUUV.[32]

A large unmanned undersea vehicle with the Submarine Development Squadron in 2014. Photo by Breanna Zinter/ U.S. Navy

The Rise of Defense Wide Programs

Defense Wide departments have a growing stake in funding the future of military drones. Together, four Defense Wide departments—Special Operations Command (SOCOM), the Defense Advanced Research Projects Agency (DARPA), the Office of the Secretary of Defense (OSD), and the Missile Defense Agency (MDA)—have allocated $1.09 billion for drones in PB18, more than the Army's entire drone budget. Since Fiscal Year 2014, the Defense Wide departmental drone budgets have grown from 9 percent of all drone-related military spending to over 15 percent in PB18.

Most of the individual projects in these budgets generally peak at anywhere between $20 and $40 million and involve a partner service department such as the Navy or Air Force. The DARPA drone budget is the largest with $456.7 million allocated in PB18. DARPA funds some of the most well-known futuristic drone research programs like Gremlins, a program to develop swarming drones, and the Sea Hunter, a submarine-hunting unmanned ship. The Office of the Secretary of Defense has allocated $332.6 million to drone projects in PB18, 157 percent more than what it received for drones from Congress in Fiscal Year 2017. The Missile Defense Agency has two active drone-related line items in PB18, both involving the Agency's effort to develop a laser-equipped drone capable of shooting down ballistic missiles.

(Above) A concept drawing of DARPA's Gremlins air vehicles. Credit: DARPA.

More for Special Ops

The Special Operations Command's $166.5 million PB18 budget for unmanned aircraft platforms is significantly larger than prior years. SOCOM plays a major role in drone operations and the development of emerging drone technology. The Air Force's special operations wing (AFSOC), which is part of SOCOM, is responsible for flying 10 MQ-9 Reaper Combat Air Patrols and has taken the lead on integrating advanced payloads on the Reaper and other drones. SOCOM's PB18 drone budget is $77.9 million larger than the enacted Fiscal Year 2017 drone budget, an increase of 88 percent. Its procurement and research funding request for the MQ-9 Reaper in PB18 is 149 percent larger than the average enacted budget for the program between Fiscal Year 2014 and 2017.

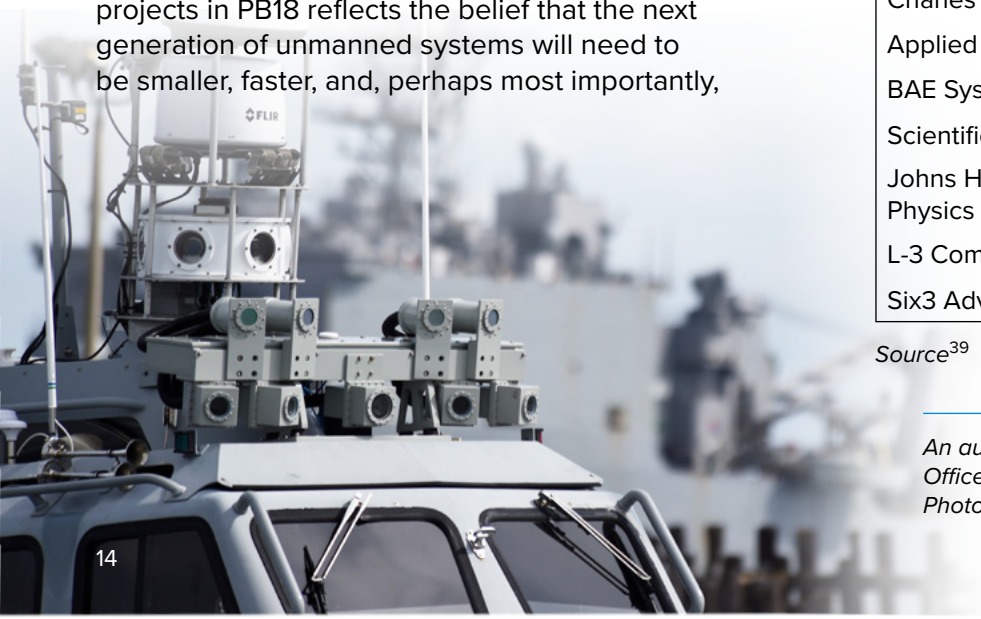
SOCOM's budget justification books are, as usual, thin on the details as to what exactly where these extra funds will be spent. SOCOM will generally allocate funds for specialized payloads for special operations-operated drones like the MQ-9 Reaper, as well as for small and medium-sized unmanned aircraft. At least part of the MQ-9 Reaper PB18 funds—$19.8 million in Overseas Contingency Operations funding—is allocated to purchase two TONTO pods and a Sante Fe pod, two payloads unique to SOCOM. Special operations is seeking to purchase two additional Insitu Scan Eagle surveillance drones. However, the extra funding for drones in the PB18 could be a temporary surge to meet immediate requirements for ongoing operations in Syria, Iraq, and elsewhere. The funding may not signal a long-term trend towards a large special operations drone budget.

The OSD and DARPA budgets reflect growing interest in manned-unmanned teaming, swarms, and uninhabited autonomous vehicles. These projects are seeking to develop technologies for unmanned vehicles in the air, sea, or on the ground that work side-by-side with manned vehicles and troops. The OSD's AVATAR program, a new project allocated $25 million in PB18, would enable fighter pilots to control converted manned aircraft and target drones. Similarly, DARPA's Gremlins, allocated $37.8 million in PB18, is developing small, reusable drones that can be deployed en masse by

manned aircraft to collaboratively carry out missions like intelligence collection.[33] Squad X, a DARPA project allocated $36 million in PB18, is working to integrate unmanned air and ground vehicles into small infantry units.[34] Collaborative Operations in Denied Environments (CODE), allocated $30 million in PB18, is developing the algorithms and software that will enable drones to operate collaboratively, autonomously, and with relatively little oversight by nearby fighter pilots.[35]

And then there's Ghost Fleet. Allocated $204 million, it is the single largest drone research project in the Defense Wide 2018 budget request and around one-third of OSD's drone research budget. Details of the project are classified, but according to William Roper, the head of the Strategic Capabilities Office at the Pentagon, the project aims to convert "existing vessels into autonomous, collaborative 'ghost fleets' . . . capable of dangerous missions without putting critical ships at risk."[36] The Navy's Office of Naval Research has a similar project, albeit on a smaller scale.[37] Using an autonomous vehicle control architecture developed by NASA for the Mars rover, ONR converted manned patrol boats into uninhabited, autonomous vessels. These boats could be deployed in a swarm to protect a manned vessel as it moves into port or to intercept an incoming ship. The OSD project shares the name with a book by P.W. Singer and August Cole.

Some of DARPA's previous big-ticket drone programs—TERN, ACTUV, and ARES—all sought to develop large, capable, multi-role unmanned vehicles. These projects still receive funding in PB18, but have largely migrated from DARPA and OSD to the Army, Navy, or Air Force budgets. The thrust of the big DARPA and OSD-funded research projects in PB18 reflects the belief that the next generation of unmanned systems will need to be smaller, faster, and, perhaps most importantly, able to work collaboratively with humans and other drones. This view is not restricted to OSD and DARPA. The Air Force is developing low-cost attritable drones—armed unmanned aircraft that could accompany and protect a manned fighter jet.[38] Future drone procurement budgets could include a mix of resource-heavy drones like the MQ-25 Stingray carrier-based drone refueler, low-cost drone systems, and equipment like conversion kits to turn traditionally manned systems into uninhabited vehicles.



An autonomous boat participating in the U.S. Navy's Office of Naval Research swarm demonstration in 2016. Photo by John Williams/Office of Naval Research.

DARPA Contracts

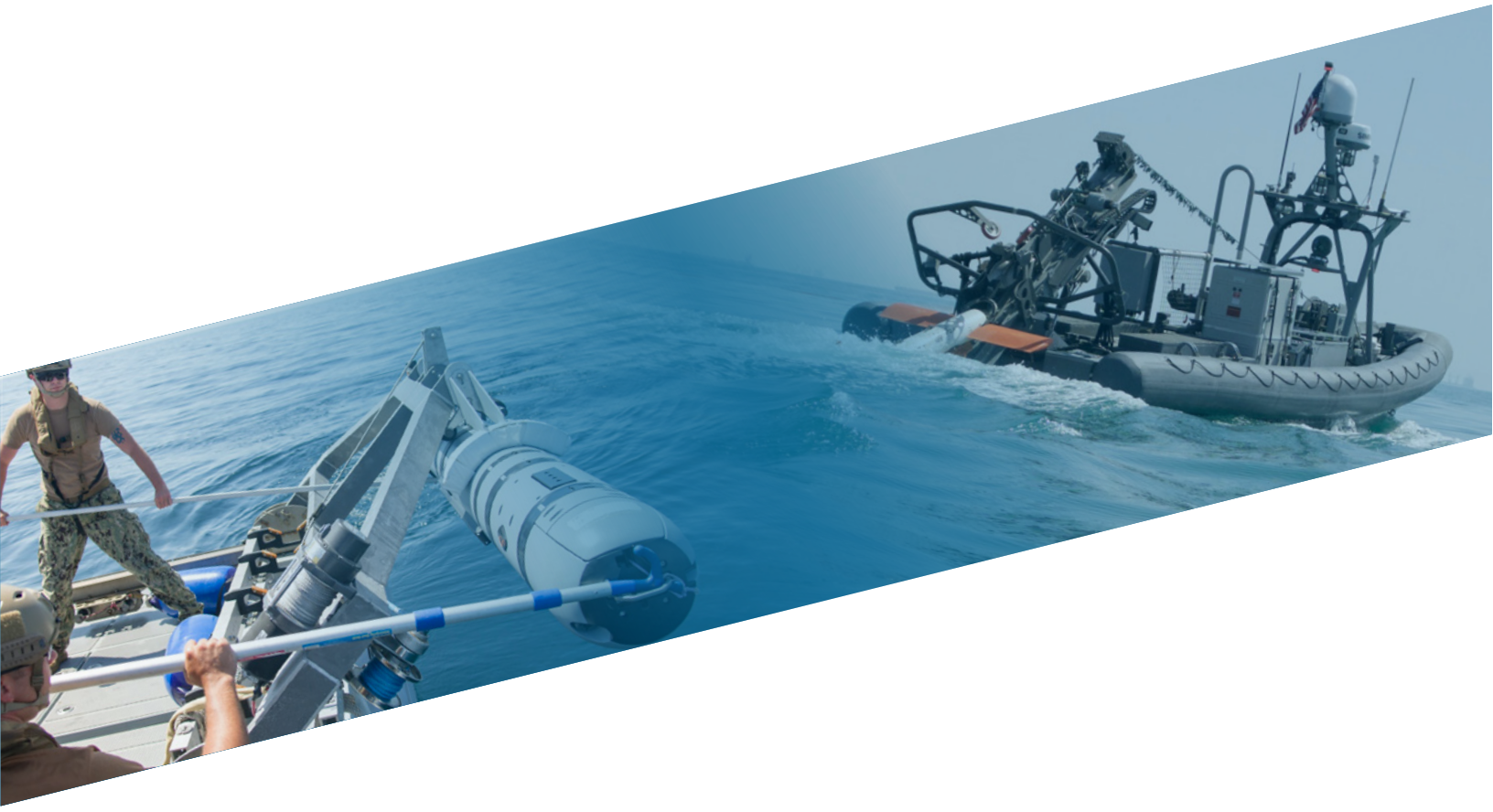
In FY 2015 and FY 2016, DARPA issued 77 companies and institutions contracts for 16 different drone-related research programs. These contracts were detailed in two Freedom of Information Act disclosures and offer some insights into the organizations that are involved in developing the next generation of unmanned platforms and capabilities.

Top 15 DARPA Unmanned Systems Contract Recipients in FY 2015 and FY 2016

Company/Institution	Total ($M)
Aurora Flight Sciences	81
Lockheed Martin	55.7
Northrop Grumman	53.4
Raytheon	51.1
Leidos	34.8
Boeing	15.2
Sikorsky	14.7
AeroVironment	13
Charles Stark Draper Laboratory	11.6
Applied Physical Sciences Laboratory	10.6
BAE Systems	10.1
Scientific Systems Company	9.4
Johns Hopkins University Applied Physics Laboratory	8.7
L-3 Communications	7.7
Six3 Advanced Systems	6.7

Source[39]

Budget Data



Note: *These tables include drone spending in the DoD's FY 2018 budget request. For additional data, please visit our website, dronecenter.bard.edu.*

Air Force Summary

Category	FY13	FY14	FY15	FY16	FY17	PB18
Procurement	1,462.6	865.1	1,110.1	1,886.8	1,198.3	1,671.1
Research and Development (RDT&E)	946.7	781.6	871.6	718.3	782.1	771
Military Construction	26	24.7	21.3	58.9	38.1	26.1
Total	2,435.3	1,672.1	2,003	2,662.9	2,018.4	2,468.1
YoY Change (%)		*-31%*	*19.8%*	*32.9%*	*-24.2%*	*22.3%*

Air Force Procurement

Line Item/Program Element	Project	Subtitle	PB18 ($M)	Source
PRDTB1 / MQ-9			388.2	APAF I
PRDTB2 / MQ-9 MODS			321.1	APAF II
PRDTA2 / Predator Hellfire Missile			329.3	MPAF
HAWK00 / RQ-4 MODS			44	APAF II
RQ4DIS / RQ-4 Post Production Charges			86.7	APAF II
000075 / Other Production Charges	RQ-4 UAV		8.8	APAF I
000075 / Other Production Charges	MQ-9 UAV		36.4	APAF I
000999 / Initial Spares/Repair Parts	PRDT01 / MQ-1 Predator A UAV		0.1	APAF I
000999 / Initial Spares/Repair Parts	HAEUAV / RQ-4 UAV [252]		28.9	APAF I
000999 / Initial Spares/Repair Parts	PRDTB1 / MQ-9 UAV [424]		174.2	APAF I
834130 / Air Force Physical Security System	2 / Counter small - UAS		136	OPAF
837300 / Base Comm Infrastructure	P-40a MQ-9 UAV		7.5	OPAF
10TRGT / Target Drones	QF-16 and BQM-167A		109.8	APAF I

Air Force RDT&E

Line Item/Program Element	Project	Subtitle	PB18 ($M)	Source
PE 0205219F / MQ-9 UAV			201.4	RDT&E V3A
PE 0304260F / Airborne SIGINT Enterprise	675186 / Special Programs (Airborne SIGINT Development - Special Platforms)		24.7	RDT&E V3B
PE 0305116F / Aerial Targets	675136 / Target Systems Development		5	RDT&E V3B
PE 0305116F / Aerial Targets	675366: QF-16		16.3	RDT&E V3B
PE 0305206F / Airborne Reconnaissance Systems	675092 / JTC/SIL MUSE	Air Force Synthetic Environment for Reconnaissance and Surveillance (AFSERS) Development	3.4	RDT&E V3B
PE 0305219F / MQ-1 Predator A UAV				RDT&E V3B
PE 0305220F / RQ-4 UAV			214.8	RDT&E V3B
PE 0305236F / Common Data Link Executive Agent (CDL EA)	641334 / Common Data Link (CDL)	Marine CDL for Tactical UAS	2.9	RDT&E V3B
PE 0305238F / NATO AGS			44.7	RDT&E V3B
PE 0601102F / Defense Research Sciences	613003 / Mathematics, Information and Life Sciences	Decision Making	20.3	RDT&E V1
PE 0601102F / Defense Research Sciences	613003 / Mathematics, Information and Life Sciences	Dynamical Systems, Optimization, and Control	26.8	RDT&E V1

Line Item/Program Element	Project	Subtitle	PB18 ($M)	Source
PE 0602201F / Aerospace Vehicle Technologie	622404 / Aeromechanics and Integration	Aerodynamic Systems Technologies	7.8	RDT&E V1
PE 0602201F / Aerospace Vehicle Technologies	622403 / Flight Controls and Pilot-Vehicle Interface	Advanced Flight Controls Technologies	6.9	RDT&E V1
PE 0602201F / Aerospace Vehicle Technologies	622403 / Flight Controls and Pilot-Vehicle Interface	Flight Controls Technologies Modeling and Simulation	5.3	RDT&E V1
PE 0602201F / Aerospace Vehicle Technologies	622403 / Flight Controls and Pilot-Vehicle Interface	Manned and Unmanned Teaming Technologies	17.9	RDT&E V1
PE 0602202F / Human Effectiveness Applied Research	625328 / Human Dynamics Evaluation	Human Analyst Augmentation	9.3	RDT&E V1
PE 0602202F / Human Effectiveness Applied Research	625328 / Human Dynamics Evaluation	Human Trust and Interaction	8.1	RDT&E V1
PE 0602202F / Human Effectiveness Applied Research	625329 / Sensory Evaluation and Decision Science	Human Role in Semiautonomous Systems	5.8	RDT&E V1
PE 0602203F / Aerospace Propulsion	623066 / Turbine Engine Technolog	Missile and Remotely Piloted Aircraft Engine Technologies	4.7	RDT&E V1
PE 0602204F / Aerospace Sensors	626095 / Sensor Fusion Technology	Sensor Management for ATR	16.4	RDT&E V1
PE 0602788F / Dominant Information Sciences and Methods	625317 / Information Decision Making Tech	Campaign Planning Technologies	5.4	RDT&E V1
PE 0603211F / Aerospace Technology Dev/ Demo	634920 / Flight Vehicle Tech Integration	Advanced Aerospace Structure Technologies	9.4	RDT&E V1
PE 0603211F / Aerospace Technology Dev/ Demo	634927 / Flight Systems Control	Autonomous Systems Control	17.5	RDT&E V1
PE 0603216F / Aerospace Propulsion and Power Technology	634921 / Aircraft Propulsion Subsystems Int	Missile/Remotely Piloted Aircraft Engine Performance	10.7	RDT&E V1
PE 0603270F / Electronic Combat Technology	634335 / Cyber Concepts	Avionics Cyber Protections	2.7	RDT&E V1
PE 0603456F / Human Effectiveness Advanced Technology Development	635327 / Warfighter Interfaces	Human Role in Semiautonomous Systems	12.1	RDT&E V1
PE 0604233F / Specialized Undergraduate Flight Training	674101: Undergraduate Remotely Piloted Aircraft Training		0.8	RDT&E V3A
PE 0604257F / Advanced Technology and Sensors	645148 (BA4 0604257F) / CommonAirborne Sense and Avoid (C-ABSAA)		21.6	RDT&E V2
PE 0604257F / Advanced Technology and Sensors	646025 / Data Compression	Reduction of Data Using Compression Enhancements (RDUCE)	1.5	RDT&E V2
PE 0604287F / Physical Security Equipment		Counter Small Unmanned Aerial Systems (Cs-UAS) Joint Emergent Operational Need (JEON)	10.5	RDT&E V1
PE 0604445F / Wide Area Surveillance			16.2	RDT&E V3A
PE 0604617F / Agile Combat Support	652895 / CE Readiness	Airfield Damage Repair (Multiple UXO Removal Robotics)	21.8	RDT&E V2
PE 0604858F / Tech Transition Program	645351 / Prototyping	Low-Cost Attritable Aircraft Technology Prototyping	12.2	RDT&E V2
PE 0604257F / Advanced Technology and Sensors	644818 / Imaging and Targeting Support	(MTS-B Track Through Launch Transient; DRACO 4.0; Full Spectrum HSI MQ-9 Pod; Agile Pod Harvest Reaper)	4.8	RDT&E V2

Air Force Military Construction

Line Item/Program Element	Project	Location	PB18 ($M)	Source
25219	RPA Fixed Ground Control Station Facility	Holloman Air Force Base, New Mexico	4.25	AF MilCon
53218F	TFI - Construct RPA Flight Training Unit	March Air Reserve Base, California	15	ANG MilCon
53218F	Add to Flight Training Unit, Building 641	Hancock Field, New York	6.8	ANG MilCon

Army Summary

Category	FY13	FY14	FY15	FY16	FY17	PB18
Procurement	769.3	802.3	515.4	594.4	523.3	510.9
Research and Development (RDT&E)	322.2	341.8	346.5	273.9	352.5	473.7
Military Construction	0	37.2	128	0	52	53
Total	1,091.5	1,181.3	989.9	868.3	927.8	1,037.2
YoY Change (%)		*8.2%*	*-16.2%*	*-12.3%*	*6.9%*	*11.8%*

Army Procurement

Line Item/Program Element	Project	Subtitle	PB18 ($M)	Source
A00005 / MQ-1 UAV			117.5	APA
A00018 / RQ-7 UAV MODS			83.2	APA
A01001 / MQ-1 Payload (MIP)			47.3	APA
A01002 / UAS MODS - A00121 / OSRVT			26.1	APA
A02706 / Universal Ground Control Equipment (UAS)			15.0	APA
AA0723 / Comms, Nav Surveillance	AMF-A A-Kits		4.2	APA
AA6601 / Gray Eagle Mods2			74.3	APA
BL5287 / Family Of Persistent Surveillance Capabilities			16.9	OPA V2
BZ0501 / Indirect Fire Protection Family Of Systems	H30505 / Counter Aerial Unmanned Systems (CUAS)		67.5	OPA V2
C88001 / LETHAL MINIATURE AERIAL MISSILE SYSTEM (LMAMS)			8.7	MPA
M80400 / Robotic Combat Support System (RCSS)			4.5	OPA V3
R64001 / HUSKY MOUNTED DETECTION SYSTEM (HMDS)			21.7	OPA V3
R68260 / AREA MINE DETECTION SYSTEM (AMDS)			10.6	OPA V3
W12001 / EOD Robotics Systems Recapitalization			10.1	OPA V3
W12002 / Robotics and Applique Systems	Soldier Borne Sensor		3.0	OPA V3

Army RDT&E

Line Item/Program Element	Project	Subtitle	PB18 ($M)	
PE 0202429A / Aerostat Joint Project - COCOM Exercise		JLENS	6.7	RDT&E V7
PE 0203744A / Aircraft Modifications/ Product Improvement Programs			39.4	RDT&E V7
PE 0203752A / Aircraft Engine Component Improvement Program	106 / A/C Compon Improv Prog	UAV Engine	0.1	RDT&E V7
PE 0203801A / Missile/Air Defense Product Improvement Program	DT5 / Stinger Product Improvement	Proximity Fuze (PROX) Development and Integration	8.5	RDT&E V7
PE 0305204A / Tactical Unmanned Aerial Vehicles			16.9	RDT&E V7
PE 0305219A / MQ-1 Gray Eagle UAV			9.6	RDT&E V7
PE 0305232A / RQ-11 UAV			2.2	RDT&E V7
PE 0305233A / RQ-7 UAV			12.8	RDT&E V7

Line Item/Program Element	Project	Subtitle	PB18 ($M)	Source
PE 0601101A / In-House Laboratory Independent Research	91A / ILIR-AMC	Tank-Automotive Research, Development and Engineering Center	1.3	RDT&E V1
PE 0601102A	T63 / Robotics Autonomy, Manipulation, & Portability Rsh	Unmanned Air Vehicle Research	1.6	RDT&E V1
PE 0601102A	T63 / Robotics Autonomy, Manipulation, & Portability Rsh	Robotics Autonomy and Human Robotic Interface Research	1.9	RDT&E V1
PE 0601102A	T63 / Robotics Autonomy, Manipulation, & Portability Rsh	Intelligent Systems	5.3	RDT&E V1
PE 0601102A / Defense Research Sciences	305 / ATR Research	ATR Algorithms	2.1	RDT&E V1
PE 0601104A	H09 / Robotics CTA	Autonomous Systems	4.1	RDT&E V1
PE 0601104A / University and Industry Research Centers	H73 / Automotive Research Center (ARC)	Automotive Research Center (ARC)	3.2	RDT&E V1
PE 0602120A	TS2 / Robotics Technology	Robotics CTA	4.0	RDT&E V2
PE 0602120A	TS2 / Robotics Technology	Perception and Intelligent Control	4.6	RDT&E V2
PE 0602120A / Sensors and Electronic Survivability	TS2 / Robotics Technology	Ground Robotic Vehicle Mobility and Propulsion Technology	1.5	RDT&E V2
PE 0602211A / Aviation Technology	47B / Veh Prop & Struct Tech	Micro/Small Scale Unmanned Aerial Systems	4.1	RDT&E V2
PE 0602211A / Aviation Technology	47A / AERON & ACFT Wpns Tech	Unmanned and Optionally Manned Technologies	6.4	RDT&E V1
PE 0602303A / Missile Technology	214 / Missile Technology	Air Defense Missile Technologies (formerly Counter Unmanned Aerial Systems and Counter Cruise Missile)	5.4	RDT&E V2
PE 0602307A / Advanced Weapons Technology	042 / High Energy Laser Technology		28.8	RDT&E V2
PE 0602308A / Advanced Concepts and Simulation	C90 / Advanced Distributed Simulation	Training Effectiveness Research (Previously Future Autonomy – Optimizing Training Strategies)	1.3	RDT&E V2
PE 0602601A / Combat Vehicle and Automotive Technology	H91 / Ground Vehicle Technology	Advanced Non-Primary Power Systems	1.3	RDT&E V2
PE 0602601A / Combat Vehicle and Automotive Technology	H91 / Ground Vehicle Technology	Intelligent Systems Technology Research	9.9	RDT&E V2
PE 0602618A / Ballistics Technology	H80 / Survivability And Lethality Technology	Swarming Weapons Technologies	4.8	RDT&E V2
PE 0602705A / Electronics and Electronic Devices	EM8 / High Power And Energy Component Technology	Directed Energy (DE) /Electronic Attack Technologies/Spectrum Sensing and Exploitation	2.5	RDT&E V2
PE 0602716A / Human Factors Engineering Technology	H70 / Human Fact Eng Sys Dev	Human-Robot Interaction (HRI)	3.1	RDT&E V2
PE 0602716A / Human Factors Engineering Technology	H70 / Human Fact Eng Sys Dev	Brain-Computer Interaction	3.5	RDT&E V2
PE 0602784A / Military Engineering Technology	T40 / Mob/Wpns Eff Tech	Environmental Impacts on Sensor Performance	3.7	RDT&E V2
PE 0603001A / Warfighter Advanced Technology	543 / Ammunition Logistics	Automated Supply Point-Scalable	2.3	RDT&E V3
PE 0603003A	436 / Rotarywing MEP Integ	Unmanned and Optionally Manned Systems	6.8	RDT&E V3
PE 0603004A	232 / Advanced Lethality & Survivability Demo	Counter-Unmanned Aviation System (C-UAS) Technology	1.7	RDT&E V3
PE 0603005A / Combat Vehicle and Automotive Advanced Technology	497 / Combat Vehicle Electro	Autonomous Vehicle Architecture	1.4	RDT&E V3
PE 0603005A / Combat Vehicle and Automotive Advanced Technology	515 / Robotic Ground Systems		18.5	RDT&E V3
PE 0603125A / Combating Terrorism - Technology Development	DF5 / Agile Integration & Demonstration	Unmanned Teaming Technology Assessment	3.0	RDT&E V3

Line Item/Program Element	Project	Subtitle	PB18 ($M)	Source
PE 0603313A / Missile and Rocket Advanced Technology	704 / Advanced Missile Demo	Counter Rockets, Artillery, Mortars (RAM), Unmanned Aerial Systems (UAS), and Cruise Missile Tracking and Fire Control	7.5	RDT&E V3
PE 0603772A / Advanced Tactical Computer Science and Sensor Technology	243 / Sensors And Signals Processing	Omni-directional Situational Awareness (SA) Airborne radar technologies	4.8	RDT&E V3
PE 0604017A / Robotics Development	FD3: Battery Modernization & Interface Standardization		0.8	RDTE& V4
PE 0604017A / Robotics Development	FD2: Soldier Robotics Systems		1.5	RDTE& V4
PE 0604017A / Robotics Development	FD9: Robotics Systems		37.2	RDTE& V4
PE 0604258A / Target Systems Development	238 / Aerial Targets	Engineering and Manufacturing Development (EMD) phase contract activity for the Unmanned Aerial System - Target (UAST).	0.4	RDT&E V6
PE 0604270A / Electronic Warfare Development	DX6 / Multi-Function Electronic Warfare (MFEW)	Multi-Function EW (MFEW) Air	20.3	RDT&E V5A
PE 0604759A	984 / Major Developmental Testing Instrumentation	Engineering and Manufacturing Development (EMD) phase contract activity for Robotics/UAS Instrumentation Suite	3.2	RDT&E V6
PE 0604759A / Major T&E Investment	984 / Major Developmental Testing Instrumentation	System of Systems Cooperative Engagement Test Infrastructure (SCETI)	1.4	RDT&E V6
PE 0604808A Landmine Warfare/ Barrier	415 / Mine Neutral/Detection		19.8	RDT&E V5B
PE 0605053A / Ground Robotics	FB3: Robotics Architecture		2.0	RDT&E V5B
PE 0605053A / Ground Robotics	FB8: Soldier Borne Sensor (SBS)		2.3	RDT&E V5B
PE 0605053A / Ground Robotics	FB2: Man Transportable Robotic System (MTRS) Inc II		6.8	RDT&E V5B
PE 0605053A / Ground Robotics	FB7: Robotics Enhanced Program (REP)		8.0	RDT&E V5B
PE 0605053A / Ground Robotics	FB6: Squad Multipurpose Equipment Transport (SMET)		16.8	RDT&E V5B
PE 0605053A / Ground Robotics	FB4: Common Robotic Systems		31.3	RDT&E V5B
PE 0605053A / Ground Robotics	FB9: MTRS Standardization		36.6	RDT&E V5B
PE 0607143A / Unmanned Aircraft System Universal Products			38.5	RDT&E V7

Army Military Construction

Line Item/Program Element	Project	Location	PB18 ($M)
22544A	Unmanned Aerial Vehicle Hangar	Kunsan Air Base, Korea	53

Navy and Marine Corps Summary

Category	FY13	FY14	FY15	FY16	FY17	PB18
Procurement	265.2	240	389.5	1,107	952.6	1,029.3
Research and Development (RDT&E)	1,482.8	932.9	1,274.2	1,230.1	919.6	1,338.9
Military Construction	79.3	81.7	0	81.6	112.4	0
Total	1,827.3	1,254.7	1,663.7	2,418.7	1,984.6	2,368.2
YoY Change (%)		*-31.4%*	*32.6%*	*45.4%*	*-17.9%*	*19.3%*

Navy and Marine Corps Procurement

Line Item/Program Element	Project	Subtitle	PB18 ($M)	Source
0442 / MQ-4 TRITON			577.8	APN
0443 / MQ-8 UAV			49.5	APN
0444 / STUASLO			4.8	APN
0588 / MQ-8 Series (MODS)			32.4	APN V2
0596 / MQ-4 Series			40.0	APN V2
0605 / Spares and Repair Parts	MQ-8		3.5	APN V3
0605 / Spares and Repair Parts	MQ-4		56.9	APN V3
0977 / Underwater EOD Programs	3 / Naval Special Warfare Forces		5.0	OPN V1
0977 / Underwater EOD Programs	2 / Expeditionary Mine Countermeasures (ExMCM)		15.4	OPN V1
0977 / Underwater EOD Programs	1 / Underwater EOD Programs	UQ034 - U/W EOD & MCM SYSTEM/ EQUIPMENT	35.2	OPN V1
1600 / LCS Common Mission Modules Equipment		LM016 - MVCS	1.2	OPN V1
1600 / LCS Common Mission Modules Equipment		LM012 - TRAINING EQUIPMENT	16.7	OPN V1
1601 / LCS MCM Mission Modules	Unmanned Influence Sweep System	UISS	11.8	OPN V1
2622 / Minesweeping System Replacement	3 / UNMANNED SYSTEMS [UNMAN]	UISS Trainers	3.0	OPN V2
2624 / Shallow Water Mine CM Ship	COBRA		8.8	OPN V2
4226 / Meteorological Equipment	Littoral Battlespace Sensors - Unmanned Undersea Vehicles (LBS-UUV)	Gliders	11.7	OPN V3
7000 / Spares and Repair Parts	RQ-21		11.0	APN V3
8128 / Physical Security Equipment	12) Counter UAS Technology		10.0	OPN V5
9020 / Spares and Repair Parts	0977/ Underwater EOD Programs		5.4	OPN V5
4640 / Air Operations C2 Systems	Remote Video Viewing Terminal (RVVT)		8.5	PMC
4737 / RQ-21 UAS			86.2	PMC
4757 / Unmanned Air Systems			10.2	PMC
4787 / UAS Payloads			14.2	PMC

Navy and Marine Corps RDT&E

Line Item/Program Element	Project	Subtitle	PB18 ($M)	Source
PE 0206313M / Marine Corps Comms Systems	2278 / Air Defense Weapons System	GBAD FWS/COUNTER UAS Product Development	20.9	RDT&E V5
PE 0304270N / Electronic Warfare Development - MIP	2260 / Specific Emitter ID	SYSTEM AUTOMATION	0.2	RDT&E V2
PE 0305204N / Tactical Unmanned Aerial Vehicles			7.8	RDT&E V5

Line Item/Program Element	Project	Subtitle	PB18 ($M)	Source
PE 0305205N / (U)UAS Integration and Interoperability			39.7	RDT&E V5
PE 0305220N / (U)MQ-4C Triton			84.1	RDT&E V5
PE 0305231N / MQ-8 UAV			62.7	RDT&E V5
PE 0305232M / RQ-11 UAV			2.0	RDT&E V5
PE 0305234N / (U)SMALL (LEVEL 0) TACTICAL UAS (STUASL0)			4.8	RDT&E V5
PE 0305239M / (U)RQ-21A			8.9	RDT&E V5
PE 0305242M / (U)Unmanned Aerial Systems (UAS) Payloads			18.6	RDT&E V5
PE 0305421N / (U)RQ-4 Modernization			229.4	RDT&E V5
PE 0602123N / Force Protection Applied Res	0000 / Force Protection Applied Res	AIRCRAFT TECHNOLOGY	39.5	RDT&E V1
PE 0602782N / Mine & Exp Warfare Applied Res	0000 / Mine & Exp Warfare Applied Res	SPECIAL WARFARE/EOD	10.8	RDT&E V1
PE 0602792N / (U)Innovative Naval Prototypes(INP) Applied Res	0000 / (U)Innovative Naval Prototypes(INP) Applied Res	Undersea Warfare	14.7	RDT&E V1
PE 0602792N / (U)Innovative Naval Prototypes(INP) Applied Res	0000 / (U)Innovative Naval Prototypes(INP) Applied Res	Unmanned and Autonomous Systems	48.4	RDT&E V1
PE 0603123N / Force Protection Advanced Technology	2912 / Force Protection Advanced Technology	AIRCRAFT TECHNOLOGY	6.0	RDT&E V1
PE 0603123N / Force Protection Advanced Technology	2912 / Force Protection Advanced Technology	SURFACE SHIP & SUBMARINE HULL MECHANICAL & ELECTRICAL (HM&E)	17.5	RDT&E V1
PE 0603261N / Tactical Airborne Reconnaissance			3.7	RDT&E V2
PE 0603382N / Advanced Combat Systems Tech	3423: LOCUST		3.5	RDT&E V2
PE 0603382N / Advanced Combat Systems Tech	3422: SHARC Surface Platform		6.8	RDT&E V2
PE 0603382N / Advanced Combat Systems Tech	3424: Heterogeneous Collaborative Unmanned Systems (HCUS)		8.0	RDT&E V2
PE 0603382N / Advanced Combat Systems Tech	0399 / Unmanned Rapid Prototype Development		15.4	RDT&E V2
PE 0603502N / Surface & Shallow Water MCM	0530 / Mine Hunt Systems		9.8	RDT&E V2
PE 0603502N / Surface & Shallow Water MCM	1234 / Unmanned Surface Vehicle (USV)		23.6	RDT&E V2
PE 0603502N / Surface & Shallow Water MCM	3123 / SMCM UUV		25.1	RDT&E V2
PE 0603502N / Surface & Shallow Water MCM	2094 / Unmanned Underwater Vehicle	(LDUUV)	60.2	RDT&E V2
PE 0603502N / Surface & Shallow Water MCM	2989: Barracuda		20.8	RDT&E V2
PE 0603561N / Advanced Submarine System Development	2096 / Payload Delivery Development	Universal Launch and Recovery Module (ULRM)	15.7	RDT&E V2
PE 0603596N / (U)LCS Mission Modules	3129 / LCS Mission Package Development	Mine Countermeasures (MCM) Mission Package	21.9	RDT&E V2
PE 0603640M / MC Advanced Technology Demo	2297 / Futures Directorate	FIRES, TARGETING, AND MANEUVER	6.1	RDT&E V1
PE 0603640M / MC Advanced Technology Demo	2297 / Futures Directorate	MARINE AIR-GROUND TASK FORCE (MAGTF) INTELLIGENCE, SURVEILLANCE, AND RECONNAISSANCE (ISR)	6.4	RDT&E V1
PE 0603654N / JT Service Explosive Ordn Dev	0377 / JT Service Expl Ord Disp System	EOD ROBOTICS	10.0	RDT&E V2

Line Item/Program Element	Project	Subtitle	PB18 ($M)	Source
PE 0603654N / JT Service Explosive Ordn Dev	4023 / VSW MCM/Force Protection UUV		19.1	RDT&E V2
PE 0603654N / JT Service Explosive Ordn Dev*		(C-UAS)	3.7	RDT&E V2
PE 0603782N / Mine and Expeditionary Warfare Advanced Technology	2917 / Shallow Water MCM Demos	Joint EOD Demos	2.0	RDT&E V1
PE 0603801N / (U) Innovative Naval Prototypes (INP) Adv Tech Dev	3400 / Innovative Naval Prototypes (INP) Adv Tech Dev	Undersea Warfare	13.2	RDT&E V1
PE 0603801N / (U) Innovative Naval Prototypes (INP) Adv Tech Dev	3400 / Innovative Naval Prototypes (INP) Adv Tech Dev	Unmanned and Autonomous Systems	37.5	RDT&E V1
PE 0603860N / JT Precision Approach & Ldg Sys	2329 / JPALS	MQ-25 Support	1.4	RDT&E V2
PE 0603925N / Directed Energy and Electric Weapon System	9823 / Lasers for Navy applicat	Solid State Laser (SSL) Low Power Module (LPM) Development	44	RDT&E V2
PE 0604218N / Air/Ocean Equipment Engineering	2345 / Fleet METOC Equipment	Littoral Battlespace Sensors - Unmanned Undersea Vehicle (LBS-UUV)	0.5	RDT&E V3
PE 0604230N / Warfare Support System*	3326 / NSW Rapid Capabilities Development for CIEC	Navy Irregular Warfare	1.9	RDT&E V3
PE 0604270N / Electronic Warfare (EW) Dev	3327 / MAGTF EW Aviation Development	Unmanned Aircraft System (UAS) Electronic Warfare (EW) Payload	6	RDT&E V3
PE 0604503N / SSN-688 & Trident Modernization	0742 / Sub Integrated Ant System	Antenna Transition Engineering	3.7	RDT&E V3
PE 0604536N / (U)Advanced Undersea Prototyping			66.5	RDT&E V2
PE 0604562N / Submarine Tactical Warfare System	0236 / SSN Comb Cont Sys Imprvmnt (ENG)	Unmanned Aerial System (UAS)	2.6	RDT&E V3
PE 0604601N / Mine Development	0267 / Mine Improvements	(Clandestine Delivered Mine [UUV])	9.9	RDT&E V3
PE 0605414N / (U) (U) Unmanned Carrier Aviation (UCA)			222.2	RDT&E V3
PE 0206313M / Marine Corps Comms Systems	2273 / Air Ops Cmd & Control (C2) Sys	RVVT: Preparation	1.2	RDT&E V5
PE 0304240M / (U)Advanced Tactical Unmanned Aircraft System			8	RDT&E V1

Defense Wide Summary

Category	FY13	FY14	FY15	FY16	FY17	PB18
Procurement	24.1	40.4	27.6	43.6	82.9	130.1
Research and Development (RDT&E)	249.3	394.6	407.6	699.8	706.5	971
Military Construction	1.8	8.1	0	0	25.8	0
Total	275.2	443.1	435.2	743.4	815.2	1,101.1
YoY Change (%)		*61.1%*	*-1.8%*	*70.8%*	*9.7%*	*35.1%*

Defense Wide Procurement

Department	Line Item/Program Element	Project	Subtitle	PB18 ($M)	Source
SOCOM	0201UMNISR / UNMANNED ISR			52.2	DWP
SOCOM	020400INTL / INTELLIGENCE SYSTEMS	16 / Unmanned Aerial Collection System Variant		0.2	DWP
SOCOM	1108MQ9 / MQ-9 UNMANNED AERIAL VEHICLE			41.4	DWP
SOCOM	0204OTHER / OTHER ITEMS <$5M	LRBS		3.4	DWP
Headquarters	31 / Major Equipment	C-UAS		10	DWP
ASFF	Scan Eagle	Sustainment		22.2	DWP
CTEF	Quadrotor UAS			0.65	DWP

Defense Wide RDT&E

Department	Line Item/Program Element	Project	Subtitle	PB18 ($M)	
DAPRA	PE 0603767E / SENSOR TECHNOLOGY	SEN-02 / SENSORS AND PROCESSING SYSTEMS	Dynamically Composed RF Systems	23.7	DARPA
DARPA	PE 0602303E / INFORMATION & COMMUNICATIONS TECHNOLOGY	IT-04 / LANGUAGE UNDERSTANDING AND SYMBIOTIC AUTOMATION	Explainable Artificial Intelligence (XAI)*	23.8	DARPA
DARPA	PE 0602702E / TACTICAL TECHNOLOGY	TT-04 / ADVANCED LAND SYSTEMS TECHNOLOGY	Mobile Force Protection (MFP)	31	DARPA
DARPA	PE 0602702E / TACTICAL TECHNOLOGY	TT-04 / ADVANCED LAND SYSTEMS TECHNOLOGY	Mobile Infantry (MI)	5	DARPA
DARPA	PE 0602702E / TACTICAL TECHNOLOGY	TT-04 / ADVANCED LAND SYSTEMS TECHNOLOGY	Squad X	38	DARPA
DARPA	PE 0602702E / TACTICAL TECHNOLOGY	TT-07 / AERONAUTICS TECHNOLOGY	Aircrew Labor In-cockpit Automation System (ALIAS)	19.4	DARPA
DARPA	PE 0602702E / TACTICAL TECHNOLOGY	TT-07 / AERONAUTICS TECHNOLOGY	Gremlins	36	DARPA
DARPA	PE 0602702E / TACTICAL TECHNOLOGY	TT-07 / AERONAUTICS TECHNOLOGY	OFFensive Swarm-Enabled Tactics (OFFSET)	10	DARPA
DARPA	PE 0602702E / TACTICAL TECHNOLOGY	TT-13 / NETWORK CENTRIC ENABLING TECHNOLOGY	Distributed Battle Management	21.3	DARPA
DARPA	PE 0602715E / MATERIALS AND BIOLOGICAL TECHNOLOGY	MBT-01 / MATERIALS PROCESSING TECHNOLOGY	Reconfigurable Systems*	20	DARPA
DARPA	PE 0602716E / ELECTRONICS TECHNOLOGY		Wireless Autonomous Vehicle Power Transfer (WAVPT)	9	DARPA
DARPA	PE 0603286E / ADVANCED AEROSPACE SYSTEMS		Advanced Aerospace System Concepts	3	DARPA
DARPA	PE 0603286E / ADVANCED AEROSPACE SYSTEMS		Collaborative Operations in Denied Environment (CODE)	30.1	DARPA
DARPA	PE 0603286E / ADVANCED AEROSPACE SYSTEMS		Tactically Exploited Reconnaissance Node (TERN)	5	DARPA

Department	Line Item/Program Element	Project	Subtitle	PB18 ($M)	Source
DARPA	PE 0603286E / ADVANCED AEROSPACE SYSTEMS		Vertical Take-Off and Landing (VTOL) Technology Demonstrator	14.7	DARPA
DARPA	PE 0603739E / ADVANCED ELECTRONICS TECHNOLOGIES	MT-15 / MIXED TECHNOLOGY INTEGRATION	Radio Frequency Collaborative Unmanned Distributed System (RF CLOUDS)	10	DARPA
DARPA	PE 0603766E / NETWORK-CENTRIC WARFARE TECHNOLOGY	NET-02 / MARITIME SYSTEMS	Blue Wolf	5.5	DARPA
DARPA	PE 0603766E / NETWORK-CENTRIC WARFARE TECHNOLOGY	NET-02 / MARITIME SYSTEMS	Cross Domain Maritime Surveillance and Targeting (CDMaST)	29.7	DARPA
DARPA	PE 0603766E / NETWORK-CENTRIC WARFARE TECHNOLOGY	NET-02 / MARITIME SYSTEMS	Hunter	15	DARPA
DARPA	PE 0603766E / NETWORK-CENTRIC WARFARE TECHNOLOGY	NET-02 / MARITIME SYSTEMS	Hydra	7.6	DARPA
DARPA	PE 0603766E / NETWORK-CENTRIC WARFARE TECHNOLOGY	NET-02 / MARITIME SYSTEMS	Mobile Offboard Command, Control and Attack (MOCCA)	26	DARPA
DARPA	PE 0603766E / NETWORK-CENTRIC WARFARE TECHNOLOGY	NET-02 / MARITIME SYSTEMS	Positioning System for Deep Ocean Navigation (POSYDON)	23.7	DARPA
DARPA	PE 0603767E / SENSOR TECHNOLOGY	SEN-01 / SURVEILLANCE AND COUNTERMEASURES TECHNOLOGY	Aerial Dragnet	14.4	DARPA
Joint Staff	PE 0605126J / Joint Integrated Air & Missile Defense Organization (JIAMDO)		Black Dart Counter Unmanned Aircraft Systems Technology Demonstration	3	TJS
MDA	PE 0603178C / Weapons Technology	MD69 / Directed Energy Research		5.5	MDA
MDA	PE 0604115C / Technology Maturation Initiatives	MD99: Discrimination Sensor Demonstrator Development; MT99: Technology Maturation Initiatives Test; MT99: Technology Maturation Initiatives Test; MC98: Cyber Operations; MD40: Program Wide Support		128.4	MDA
OSD	PE / 0604400D8Z: Department of Defense (DoD) Unmanned Systems Common Development			4	OSD
OSD	PE 0602234D8Z / Lincoln Laboratory	P534 / Lincoln Laboratory	Autonomous Systems	3.9	OSD
OSD	PE 0603133D8Z / Foreign Comparative Testing	P313 / Foreign Comparative Testing	Asymmetric Force Application and Autonomous Systems Focus Areas	10.8	OSD
OSD	PE 0603161D8Z / Nuclear and Conventional Physical Security/ Countering Nuclear Threats	P162 / Nuclear and Conventional Physical Security	Harbor and Restricted Waterway Counter-UUV/ AUV System	1	OSD
OSD	PE 0603161D8Z / Nuclear and Conventional Physical Security/ Countering Nuclear Threats	P162 / Nuclear and Conventional Physical Security	Joint UAS Defeat Project	0.8	OSD
OSD	PE 0603618D8Z / Joint Electronic Advanced Technology	P619 / Joint Electronic Advanced Technology	Advanced Technology Development/Verification (ATD/V)	1.6	OSD
OSD	PE 0603648D8Z / Joint Capability Technology Demonstration (JCTD)	P648 / Joint Capability Technology Demonstration (JCTD)	Low Cost Cruise Missile (LCCM)	5	OSD
OSD	PE 0603680D8Z / Defense Wide Manufacturing Science and Technology Program	P350 / Manufacturing Innovation Institutes	Institute 8 - Robotics in Manufacturing Environment (RiME)	20	OSD

Department	Line Item/Program Element	Project	Subtitle	PB18 ($M)	Source
OSD	PE 0603699D8Z / Emerging Capabilities Technology Development	P795 / Emerging Capabilities Technology Development	Multi-domain Autonomous Learning Systems Focus Area	2.4	OSD
OSD	PE 0603699D8Z / Emerging Capabilities Technology Development	P795 / Emerging Capabilities Technology Development	Rapid Prototyping of Autonomous or Semi-Autonomous systems for Human-Machine Combat Teaming	2.3	OSD
OSD	PE 0603826D8Z / Quick Reactions Special Projects (QRSP)	P828 / Rapid Reaction Fund	Autonomous Systems and Behaviors Focus Area	5.1	OSD
OSD	PE 0603923D8Z / Coalition Warfare Program	P923 / Coalition Warfare	Improved Detect, Track, Defeat of Aerial Target Threats	0.8	OSD
OSD	PE 0603941D8Z / Test and Evaluation/ Science and Technology	7 / Unmanned and Autonomous System Test		9.9	OSD
OSD	PE 0604250D8Z / Advanced Innovative Technologies	P250 / Advanced Innovative Technologies	AVATAR	25.0	OSD
OSD	PE 0604250D8Z / Advanced Innovative Technologies	P250 / Advanced Innovative Technologies	Ghost Fleet	206.0	OSD
OSD	PE 0604250D8Z / Advanced Innovative Technologies	P250 / Advanced Innovative Technologies	Hornet's Nest	24.0	OSD
OSD	PE 0604250D8Z / Advanced Innovative Technologies	P250 / Advanced Innovative Technologies	Sea Mob	10.2	OSD
SOCOM	PE 1105219BB / MQ-9 Unmanned Aerial Vehicle (UAV)			37.9	RDT&E
SOCOM	PE 1160434BB / Unmanned ISR			34.8	RDT&E

Major Defense Acquisition Programs

As of July 2017, there are five active drone Major Defense Acquisition Programs (MDAP).[40] An MDAP is a program in which the total research and development expenditures are more than $480 million or for which the procurement budget exceeds $2.79 billion (in Fiscal Year 2014 dollars). The Defense Department has 78 active MDAPs in 2017. In PB18, the five unmanned aircraft MDAPs amount to $2.9 billion in procurement, RDT&E, and construction spending, approximately 42 percent of all drone-related spending. Every year, Defense Department officials assess the status of most MDAPs in a Selected Acquisition Report (SAR). The SARs summarize the progress of the program and track program and unit cost changes to identify overruns or other deficiencies. The SARs contain cost estimates; these numbers will fluctuate every year and should not be taken to mean the final cost for a system or program. The following tables combine CSD DoD budget and SAR data from four drone MDAPs to assess how these programs have changed over the years.*

Percent of Funds Appropriated

MQ-4C Triton	Navy		35%
MQ-8 Fire Scout	Navy		80%
MQ-1C Gray Eagle	Army		96%
MQ-9 Reaper	Air Force		67%

MQ-4C Triton

Summary

Category	FY13	FY14	FY15	FY16	FY17	PB18
Procurement	0	0	69.8	668.7	548.2	674.7
RDT&E	637.2	387.2	471.1	357.1	256.3	313.5
MILCON	73.7	81.7	0	51.9	71.9	0
Total	710.9	469	540.9	1,077.7	876.4	988.2
YoY Change		*-34%*	*15.3%*	*99.6%*	*-18.7%*	*12.8%*

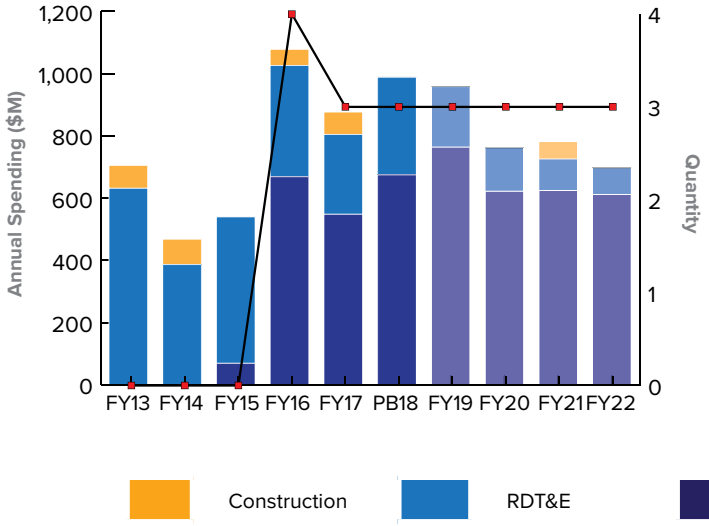
Program Background[41]

Total Acquisition Cost	$16.9B	Program Start Year	2008
Total Quantity Goal	70	Service End Year	2046
Program Acqusition Unit Cost (PAUC)	$213.4M	Primary Contractor	Northrop Grumman
Average Procurement Unit Cost	$171.2M	Avg. Annual Operations Cost per Aircraft	$32.9M

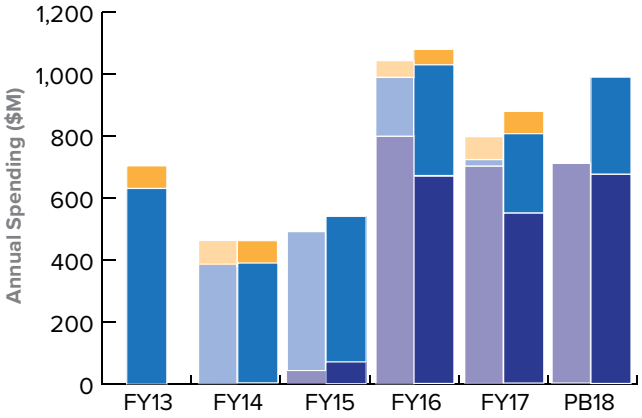
*Notes

- There is no Selected Acqusition Report (SAR) available for the fifth drone MDAP, the RQ-7B Shadow.
- The “Summary” tables are based on CSD data for each program. These figures may differ slightly from the data contained in the Selected Acqusition Report.
- The “Program Background” data is based on the latest publicly-available Selected Acqusition Report which, with the exception of the MQ-1C Gray Eagle, is from December 2016. Some figures may be out of date.
- The Operating and Support cost represents the combined costs that result from the deployment of the system such as maintenance, manpower, management, and sustainment.
- The “Program Budget and Quantity” graph combines the CSD budget data for FY 2013 to PB18 and the latest SAR predictions for FY 2019 to 2022. The “Predicted vs. Actual Funding” graph compares the data from the FY 2013 SAR with the CSD budget figures.
- All figures in Then-Year Dollars and in millions unless otherwise stated.

Program Budget and Quantity



Predicted vs. Actual Funding



MQ-8 Fire Scout

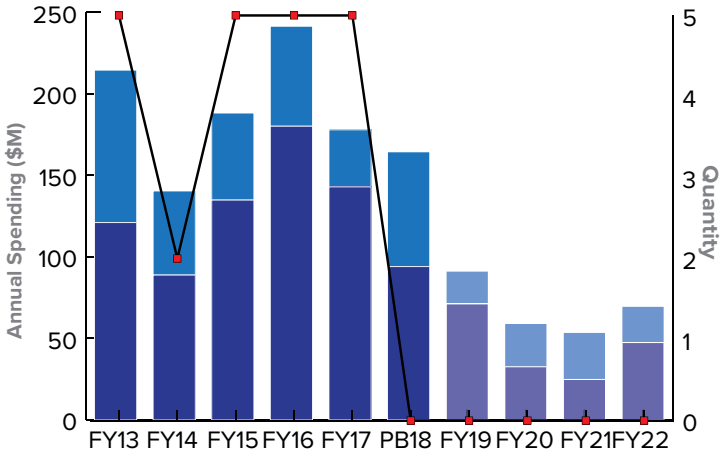
Summary

Category	FY13	FY14	FY15	FY16	FY17	PB18
Procurement	128.5	97.7	135.2	180.2	143	94.1
RDT&E	94.4	51.7	53.5	61.3	35	70.4
MILCON	0	0	0	0	0	0
Total	222.9	149.4	188.6	241.5	178	164.6
YoY Change		*-33%*	*26.2%*	*28.3%*	*-26%*	*-7.5%*

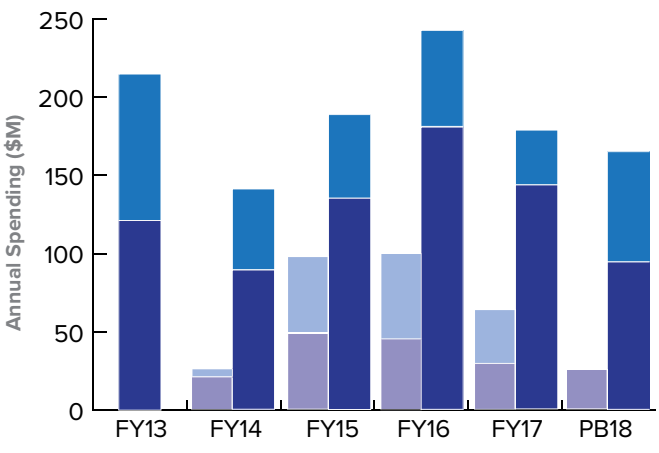
Program Background (MQ-8)[42]

Total Acquisition Cost	$2.8B	Program Start Year	2000
Total Quantity Goal	64	Service End Year	2042
Program Acqusition Unit Cost	$45.4M	Primary Contractor	Northrop Grumman
Average Procurement Unit Cost	$26.8M	Avg. Annual Operations Cost per Aircraft	$5.24M

Program Budget and Quantity



Predicted vs. Actual Funding



MQ-1C Gray Eagle

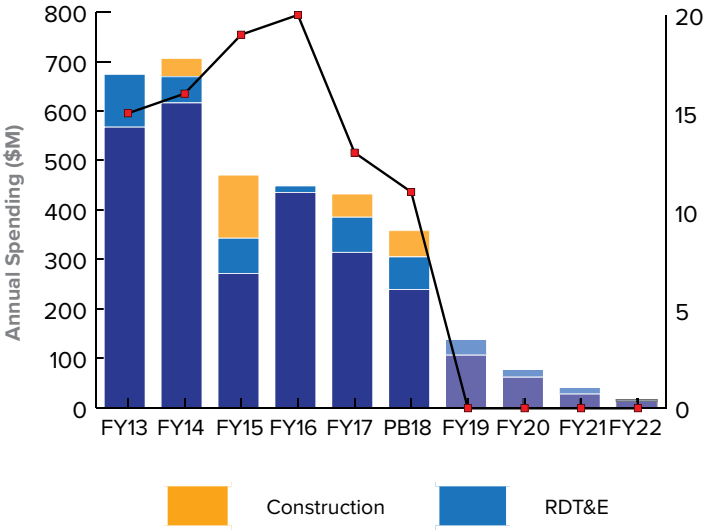
Summary

Category	FY13	FY14	FY15	FY16	FY17	PB18
Procurement	572.8	617.5	271.8	435.3	314.1	239.1
RDT&E	107.7	53	71.6	13.2	71.1	65.9
MILCON	0	37.1	128	0	47	53
Total	680.5	707.6	471.4	448.6	432.3	358
YoY Change		*4%*	*-33.4%*	*-4.8%*	*-3.6%*	*-17.2%*

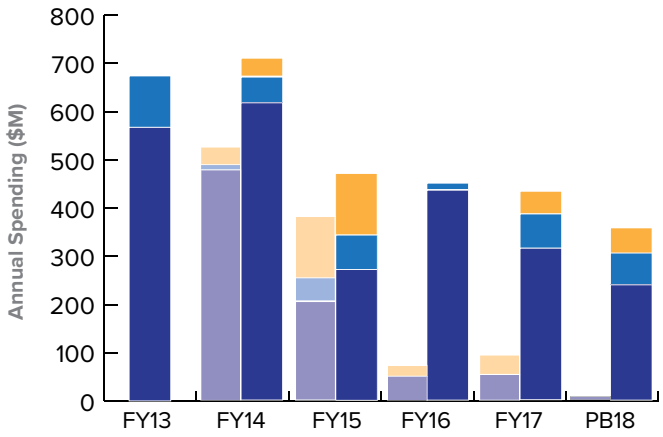
Program Background[43]

Total Acquisition Cost	$5.7B	Program Start Year	2005
Total Quantity Goal	167	Service End Year	2037
Program Acqusition Unit Cost	$127M	Primary Contractor	General Atomics
Avg. Annual Operations Cost per Aircraft	$22.5M	Percent of Funding Expended	62.3%

Program Budget and Quantity



Predicted vs. Actual Funding



MQ-9 Reaper

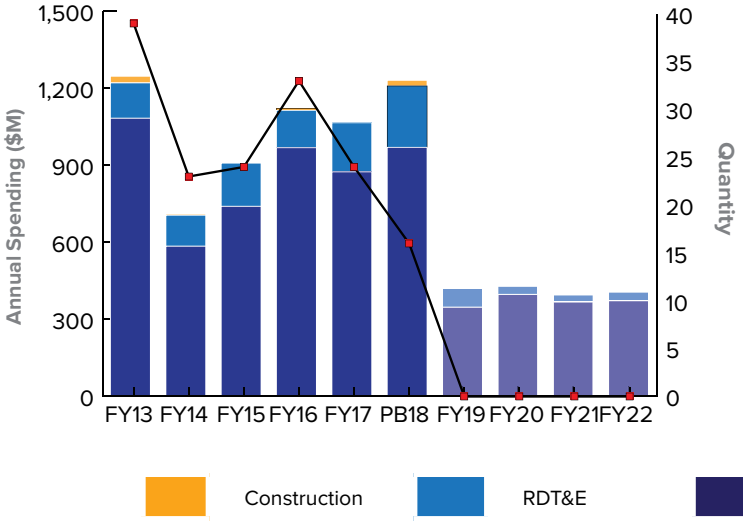
Summary

Category	FY13	FY14	FY15	FY16	FY17	PB18
Procurement	1,092	584.6	740.4	967.5	873.4	968.9
RDT&E	139.2	121	168.7	145.6	191.2	239.3
MILCON	26	6.2	0	7.7	0	21.8
Total	1,258	711.9	909.2	1,120.8	1,064.6	1,230
YoY Change		*-27.8%*	*28%*	*-3.6%*	*-5%*	*15.5%*

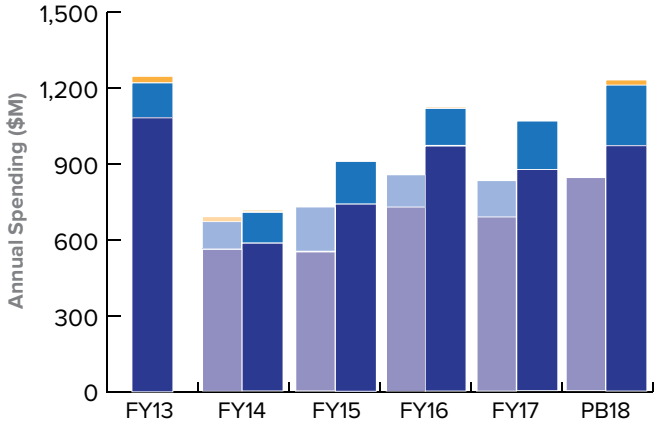
Program Background[44]

Total Acquisition Cost	$12.9B	Program Start Year	2002
Total Quantity Goal	366	Service End Year	2044
Program Acqusition Unit Cost	$35.3M	Primary Contractor	General Atomics
Average Procurement Unit Cost	$31.3M	Avg. Annual Operations Cost per Aircraft	$5.8M

Program Budget and Quantity



Predicted vs. Actual Funding



Program Performance[45]

The tables below represent changes in program and unit cost between the December 2015 and December 2016 Selected Acquisition Reports for each of the four major drone programs.

Program Cost Change 2015 to 2016

Program	2015 ($M)	2016 ($M)	Change ($M)	Percent
MQ-4C Triton	14,434.7	16,882.4	2,448.4	17%
MQ-8 Fire Scout	2,805.1	2,773.3	-37.7	-1.2%
MQ-1C Gray Eagle	5,121.4	5,712.9	591.5	11.6%
MQ-9 Reaper	12,015.5	12,923.1	872.1	7.2%

This table looks at the changes to the program acquisition cost—the estimated sum of the procurement, RDT&E, and military construction costs for the life of the program—between 2015 and 2016. It shows that the estimated total cost of the MQ-4C Triton program has increased 17 percent while the cost of the MQ-8 Fire Scout has decreased slightly. The Triton's program cost estimate increased due largely to an increase in the estimated cost of modernizing the system. The MQ-1C and MQ-9 program cost increases are due to an increase in the number of planned system purchases and, in the case of the MQ-1C, upgrades to the Gray Eagle.

Unit Cost Change 2015 to 2016

Program	Qty 2015	Qty 2016	2015 ($M)	2016 ($M)	Change ($M)	Percent
MQ-4C Triton	70	70	206.2	241.2	35	17%
MQ-8 Fire Scout	70	64	40.1	43.3	3.2	8.1%
MQ-1C Gray Eagle*	167	204	30.7	28	-2.7	-8.8%
MQ-9 Reaper	350	366	34.3	35.3	1	2.6%

This table measures changes to the Program Acquisition Unit Cost, which the Pentagon determines by dividing the total program acquisition estimate by the planned number of units ("Quantity") to be purchased *over the life of the program*.

**Determined using the quantity of the planned* aircraft *purchases over the life of the program. The Army, however, determines quantity by the number of planned system purchases, each of which include several aircraft. The Gray Eagle* system *PAUC is $127 million.*

Proposed Changes in Draft FY 2018 Appropriations Legislation

On July 27, 2017, the U.S. House of Representatives passed H.R. 3219, the Make America Secure Appropriations Act of 2018.[46] The bill details possible alterations of the Pentagon's budget request for FY 2018, including some changes to spending on drones. While the legislation is unlikely to make it through the U.S. Senate and the final appropriations will be different in some respects, the text offers one indication of where Congress is seeking to make changes. All told, H.R. 3219 reduces spending on drone systems and capabilities by $27.4 million.

Summary

Category	$M		Category	Name	Change $M	Change %
Change	-27.4		Most Positively Impacted Branch	Army	43.6	4.2%
Sum of Increases	147.4		Most Positively Impacted Category	C-UAS	30	7.5%
Sum of Decreases	174.9		Least Positively Impacted Branch	Navy	-91.4	-3.9%
Net Percent Change	-0.8%		Least Positively Impacted Category	UUV/USV	-30	-3.4%

Notable Line Item Increase	MQ-8 Fire Scout	79.3		Notable Line Item Decrease	LDUUV	-30.9

Air Force

Line Item/Program Element	Project	Subtitle	HR3219 Change ($M)	HR3219 Explanation
Procurement				
PRDTB2 / MQ-9 MODS			-3	Excess to need
RDT&E				
PE 0305206F / Airborne Reconnaissance Systems	675382: Wide Area Motion Imagery (WAMI)		+34.8	
PE 0305220F / RQ-4 UAV			-6.5	Delayed obligations (-12); Block 40 flexible payloads (+5.5)

Army

Line Item/Program Element	Project	Subtitle	HR3219 Change ($M)	HR3219 Explanation
Procurement				
A00005 / MQ-1 UAV			+15.1	Program increase one aircraft
A01001 / MQ-1 Payload (MIP)			+10	Program increase -target location accuracy
RDT&E				
PE 0202429A / Aerostat Joint Project - COCOM Exercise		JLENS	-6.75	JLENS program shutdown previously funded
PE 0602307A / Advanced Weapons Technology	042 / High Energy Laser Technology		+10	High energy laser development for all-terrain vehicles
PE 0602624A / Weapons and Munitions Technology			+20	Defense against small UAS
PE 0605053A / Ground Robotics			-7.75	Schedule slip
PE 0603004A / Weapons and Munitions Advanced Technology			+3	Gun-launched unmanned aerial system

Navy

Line Item/Program Element	Project	Subtitle	HR3219 Change ($M)	HR3219 Explanation
Procurement				
0442 / MQ-4 TRITON			-33.273	Other GFE excess growth (-7); Other costs excess growth (-6.8); Other ILS excess growth (-19.5)

Navy

Line Item/Program Element	Project	Subtitle	HR3219 Change ($M)	HR3219 Explanation
0443 / MQ-8 UAV			+79.3	Production line shutdown early to need (-4.7); Program increase- six aircraft (+84)
0588 / MQ-8 Series (MODS)			-4.89	Training previously funded (-3.4); Training previously funded (-1.4)
4737 / RQ-21 UAS			-3.6	Attrition air vehicles early to need
4757 / Unmanned Air Systems			-1.02	Insufficient budget justification
4787 / UAS Payloads			-7.14	Insufficient budget justification
RDT&E				
PE 0305205N / (U)UAS Integration and Interoperability			-3.681	Increment II excess growth
PE 0603382N / Advanced Combat Systems Tech	0399 / Unmanned Rapid Prototype Development		-5.361	Unmanned rapid protoype development excess growth
PE 0603502N / Surface & Shallow Water MCM	3123 / SMCM UUV	Knifefish	-2.26	Knifefish support excess growth
PE 0603502N / Surface & Shallow Water MCM	1234 / Unmanned Surface Vehicle (USV)		-16.163	MCM USV with AQS-20 product development delayed new start (-13.4); MCM USV with AQS-20 support delayed new start (-2.75)
PE 0603502N / Surface & Shallow Water MCM	2094. / Unmanned Underwater Vehicle (LDUUV)		-30.871	LDUUV product development hardware early to need (-27.9); LDUUV support excess growth (-3)
PE 0603596N / (U)LCS Mission Modules	3129 / LCS Mission Package Development	Mine Countermeasures (MCM) Mission Package	-5	Mine countermeasures mission packages integration of MCM USV early to need
PE 0604562N / Submarine Tactical Warfare System	0236 / SSN Comb Cont Sys Imprvmnt (ENG)	Unmanned Aerial System (UAS)	-1.5	Unmanned Aerial System delayed new start
PE 0604659N / (U)Precision Strike Weapons Development Program	3407 / Air Launched Decoy Development		-2.132	Miniature air launched decoy long lead material early to need
PE 0605414N / (U) Carrier Based Aerial Refueling System (CBARS)			-15.99	CVN segment product development ship installations early to need (-12.99); Training hardware early to need (-3)
PE 0304240M / (U)Advanced Tactical Unmanned Aircraft System			-7.979	Unjustified request

Defense Wide

Line Item/Program Element	Project	Subtitle	HR3219 Change ($M)	HR3219 Explanation
Procurement				
0201UMNISR / UNMANNED ISR			-10	Program decrease - special applications for contingencies

Proposed Changes in Draft FY 2018 Authorization Legislation

On September 18, 2017, the U.S. Senate passed H.R. 2810, the National Defense Authorization Act for Fiscal Year 2018.[47] The Senate version of the NDAA contains a substantial increase to drone spending for FY 2018, including a surprising addition of $131 million to purchase RQ-7 Shadow V2 Block III systems. Like the draft appropriations legistion in the House, the Senate takes aim at the Navy's large underwater drone programs, proposing a 80 percent cut to the Extra Large UUV program. This legislation is currently in conference while negotiators from the Senate and the House of Representatives iron out differences between their versions of the NDAA.[48] While the final authorization bill will differ in some respects, the Senate version of H.R. 2810 offers another look at the possible targets of Congressional action.

Category	$M		Category	Name	Change $M	Change %
Change	376.7		Most Positively Impacted Branch	Army	280.8	27%
Net Percent Change	5.4%		Most Positively Impacted Category	UGV/Robot	33.5	9.3%
Sum of Increases	455.6		Least Positively Impacted Branch	Defense Wide	13.5	1.24%
Sum of Decreases	78.9		Least Positively Impacted Category	UUV/USV	-59.7	-6.8%

Notable Line Item Increase	RQ-7 Shadow	$131M	Notable Line Item Decrease	XLUUV	$-53M

Air Force

Line Item/Program Element	Project	Subtitle	HR2810 Change ($M)	HR2810 Explanation
Procurement				
HAWK00 / RQ-4 MODS			39.6	UFR: Replace RQ–4 TFT Antennas

Army

Line Item/Program Element	Project	Subtitle	HR2810 Change ($M)	HR3219 Explanation
Procurement				
A00018 / RQ-7 UAV MODS			131	UFR: Procures Shadow V2 BLK III systems
A00005 / MQ-1 UAV			100	UFR: ER Improved Gray Eagle Air Vehicles
A00020 / MQ-1 Payload - UAS			16	UFR: Procures of Common Sensor Payloads
M80400 / Robotic Combat Support System (RCSS)			15.1	UFR: Procures M160s
W12001 / EOD Robotics Systems Recapitalization			11	UFR: Procures the Talon 5A robot
R64001 / HUSKY MOUNTED DETECTION SYSTEM (HMDS)			2.4	FR: Procures Husky Mounted Detection System
A01002 / UAS MODS - A00121 / OSRVT			0.32	UFR: Procures OSRVT system
RDT&E				
PE 0604017A / Robotics Development			5	UFR: Accelerate armed Robotic Wingman development

Navy

Line Item/Program Element	Project	Subtitle	HR2810 Change ($M)	HR2810 Explanation
Procurement				
0444 / STUASLO			59.2	UFR: Procure additional aircraft

Line Item/Program Element	Project	Subtitle	HR2810 Change ($M)	HR2810 Explanation
1601 / LCS MCM Mission Modules			34	UFR: Additional MCM USV
4757 / Unmanned Air Systems			13.5	UFR: Long Endurance Small UAS
RDT&E				
PE 0603801N / (U) Innovative Naval Prototypes (INP) Adv Tech Dev			15	Underwater unmanned vehicle prototypes
PE 0603502N / Surface & Shallow Water MCM			-10	PLUS experimentation (10); Reduce Snakehead (-20)
PE 0603502N / Surface & Shallow Water MCM			-16	Reduce Barracuda
PE 0604536N / (U)Advanced Under-sea Prototyping (XLUUV)			-52.9	Funding early to need

Defense Wide

Line Item/Program Element	Project	Subtitle	HR2810 Change ($M)	HR2810 Explanation
RDT&E				
PE 1105219BB / MQ-9 Unmanned Aerial Vehicle (UAV)			13.5	MQ–9 Capability Enhancement

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Correction: An earlier version of this report incorrectly stated the identification of the Raven UAS in the projected aircraft inventory table on page 9. The aircraft is the RQ-11, not the RQ-20.

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