CSBA
Center for Strategic and Budgetary Assessments

FY 2017 WEAPON SYSTEMS FACTBOOK

JACOB COHN
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ABOUT THE CENTER FOR STRATEGIC AND BUDGETARY ASSESSMENTS (CSBA)

The Center for Strategic and Budgetary Assessments is an independent, nonpartisan policy research institute established to promote innovative thinking and debate about national security strategy and investment options. CSBA's analysis focuses on key questions related to existing and emerging threats to U.S. national security, and its goal is to enable policymakers to make informed decisions on matters of strategy, security policy, and resource allocation.

ABOUT THE AUTHORS

Jacob Cohn is a senior analyst at the Center for Strategic and Budgetary Assessments, conducting research and analysis for both the Strategic Studies and the Budgetary Studies programs. His primary areas of interest concern trends in the overall defense budget and specific acquisition programs, long-range strategic planning, and the utilization of wargames to develop future operational concepts. Prior to joining CSBA in 2014, Mr. Cohn served as a Peace Corps Volunteer in West Africa, worked in the Special Operations/Low Intensity Conflict office at the Pentagon, and was a grants and budget manager for CARE USA. Mr. Cohn holds a B.A. in Economics and Math with Highest Honors from Emory University and an M.A. in Strategic Studies and International Economics from Johns Hopkins University's School of Advanced International Studies (SAIS).

Jesse Sloman is an analyst at the Center for Strategic and Budgetary Assessments. Prior to joining CSBA, Mr. Sloman worked for the Council on Foreign Relations and served as an intelligence officer in the U.S. Marine Corps. He holds a B.A. in Political Science from Tufts University and is a recipient of the Marine Corps Association's MajGen Michael E. Ennis Award for Literary Excellence.

Maureen Smolskis is a research assistant at the Center for Strategic and Budgetary Assessments. Prior to joining CSBA, Ms. Smolskis worked for CACI as a contractor at the U.S. Attorney's Office for Washington, DC. She holds a B.A. in International Relations from Connecticut College and a certificate from the college's Toor Cummings Center for International Studies and the Liberal Arts.

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Introduction

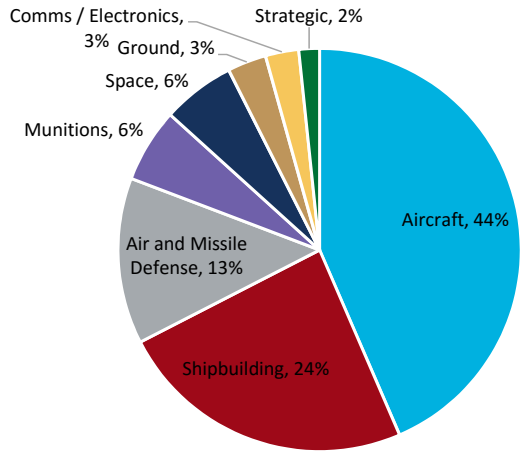
Each year, the Department of Defense (DoD) submits Selected Acquisition Reports (SARs) to Congress detailing the status, plans, and funding requirements for almost eighty Major Defense Acquisition Programs (MDAPs). MDAPs are defined as programs where total projected expenditures exceed $480 million in FY 2014 dollars for research, development, and test and evaluation (RDT&E) or $2.79 billion in FY 2014 dollars for procurement.[1] The most recent unclassified SARs, which were submitted in December 2015 and are consistent with the President's FY 2017 budget request, project funding and quantities for major acquisition programs extending more than thirty years into the future. The SARs project that these programs, in then-year dollars, will need roughly $321 billion over the Future Years Defense Program (FYDP) spanning FY 2017 to FY 2021 and an additional $410 billion in FY 2022 and beyond.

This report summarizes the program plans and funding for each of the major acquisition programs with a SAR and four additional programs: the new B-21 bomber; the Long Range Standoff Missile (LRSO); and the Ground Based Strategic Deterrent (GBSD), the future replacement for the Minuteman III, programs in the Air Force's budget and the Navy's Ohio-class replacement program. These four programs do not have public SARs, but as significant acquisition programs in DoD's portfolio, CSBA believes it is important to include known information about the programs. Funding reported for each of these programs reflects a summation of data from official DoD sources only and are not intended to suggest total program cost estimates. The SARs included in this report represent 34 percent of the total modernization budget in the FY 2017 FYDP.[2] The remaining 66 percent of funding is used for hundreds programs that are too small or too early in development to have its own SAR.

1 Under Secretary of Defense (AT&L), *Operation of the Defense Acquisition System*, DOD Directive 5000.2 (Washington, DC: Under Secretary of Defense (AT&L), 2015).

2 Modernization funding refers to the FYDP projections for RDT&E and procurement in the FY17 Greenbook, Table 6.8. OUSD (Comptroller), National Defense Budget Estimates for FY 2017, FY 2017 Greenbook (Washington, DC: DoD, March 11, 2016), available at http://comptroller.defense.gov/Portals/45/Documents/defbudget/fy2017/FY17_Green_Book.pdf.

SELECTED ACQUISITION REPORT FUNDING BY CATEGORY IN 2017 FYDP



The *Weapon Systems Factbook* presents a long-term projection of Department of Defense modernization programs beyond the five-year horizon of the FYDP. By presenting the entire projected life of a program, the *Factbook* displays trends in program spending, shows the rate of change in future financing, and highlights deviations within a program that may merit further scrutiny. Moreover, it helps to identify the systems or categories of systems that will absorb the largest portions of the Department of Defense's modernization budget.

As a reference book, the *Factbook* also provides a big-picture look at current and projected major acquisition programs that goes beyond the year-to-year variations seen in successive FYDP plans. Finally, it can help to identify years or periods where fiscal demands on modernization accounts will be particularly extreme.

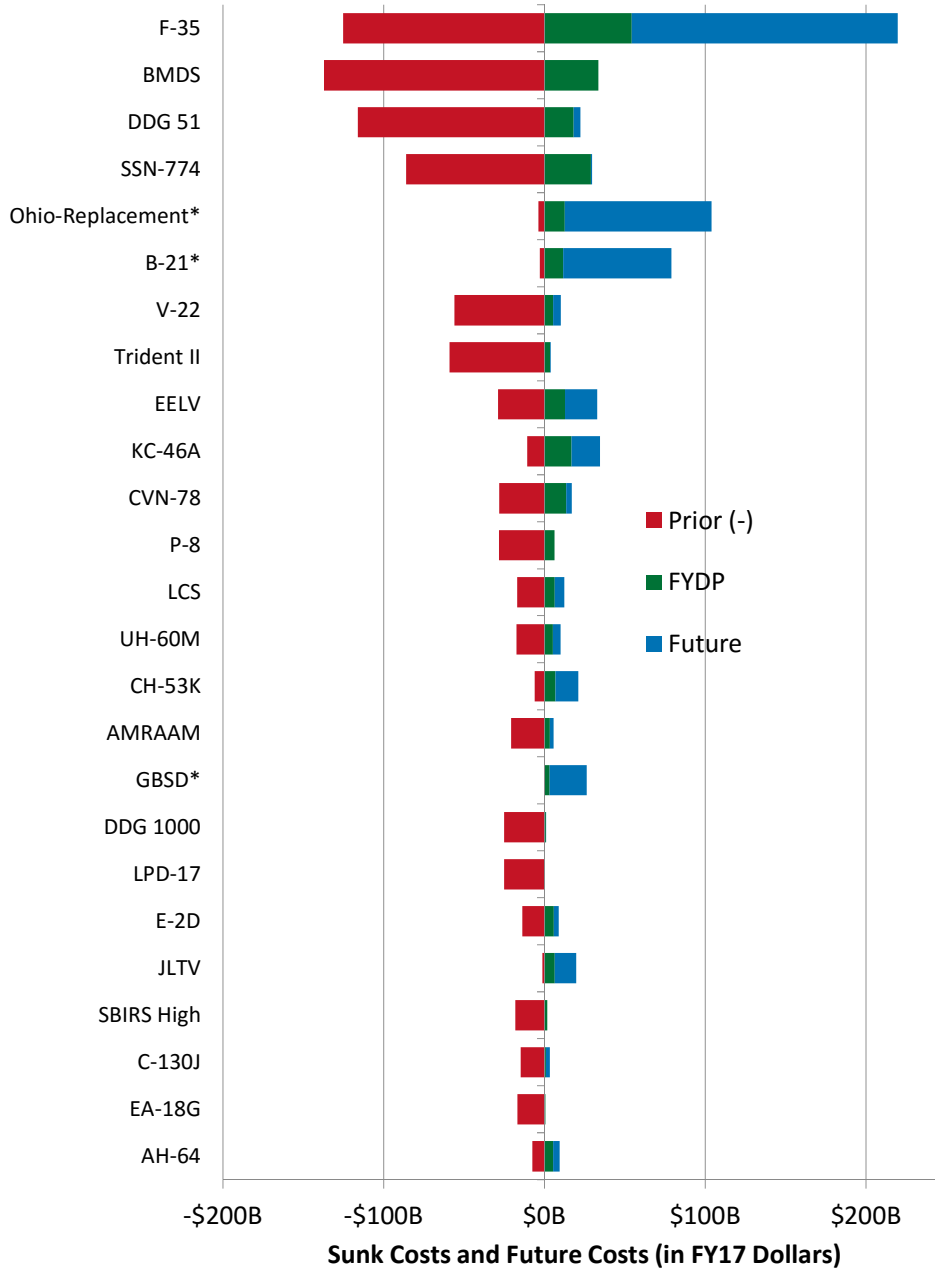
The *Weapon Systems Factbook* is divided by categories of weapon systems into: aircraft, air and missile defense, communications and electronics, ground systems, missiles and munitions, nuclear forces, shipbuilding, and space systems. The aircraft category is the largest among these, both in terms of the number of programs and the total funding projected. It includes fixed-wing, rotary-wing, and manned and unmanned aircraft from all four Services.

Unless otherwise noted, the cost and quantity figures used in this report are from the December 2015 SARs obtained through a Freedom of Information Act (FOIA) request. These are referenced as "2015 SARs" in the footnotes and available at: http://www.dod.mil/pubs/foi/Reading_Room/Selected_Acquisition_Reports/.

The SARs do not include complete funding projections for some programs, as noted throughout the report. Unlike other CSBA budget analyses, cost figures in this report are shown in then-year dollars unless otherwise noted. Then-year dollars are used to show the projected funding levels of programs when a comparison is not being made to any other program. When programs are compared to one another, as in the figure on p. iii, FY 2017 dollars are used to adjust for the effects of inflation.

CSBA will continue to conduct analysis on the December 2015 SARs and will periodically release updates, including additional graphs, on our website: www.csbaonline.org.

TOP 25 ACQUISITION PROGRAMS BY TOTAL FUNDING[3]

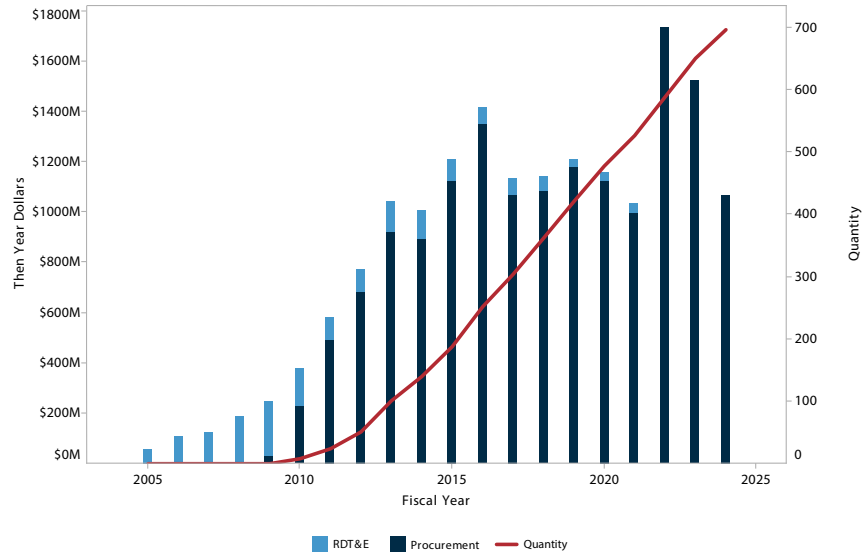


3 Programs marked by an "*" do not have public SARs and reflect a summation of data from official DoD sources only. They are not intended to suggest total program cost estimates.

Aircraft

AH-64E Apache

The AH-64E Apache Attack Helicopter integrates upgraded sensors, advanced munitions, and other modernized systems such as an improved engine and transmission. It will also incorporate manned/unmanned teaming capabilities allowing AH-64E crews to control sensors and weapons on unmanned platforms.[4] Some AH-64E helicopters are remanufactured versions of existing aircraft, and others are newly built through the program. The AH-64E is fully network-centric capable and interoperable with current and future Army forces while having a smaller logistics footprint and lower operating costs than previous iterations of the Apache.[5] The AH-64E entered full-rate production in March 2014.[6] A total of $7.12 billion has been appropriated through FY 2016 for 240 remanufactured and seventeen new helicopters. An additional $5.68 billion was requested over the FY 2017 FYDP for 275 remanufactured helicopters and no new helicopters. $4.32 billion for 124 remanufactured and forty-six newly built systems is planned for beyond the FYDP.[7]



4 Richard Whittle, "MUM-T Is The Word For AH-64E: Helos Fly, Use Drones," *Breaking Defense*, January 28, 2015.

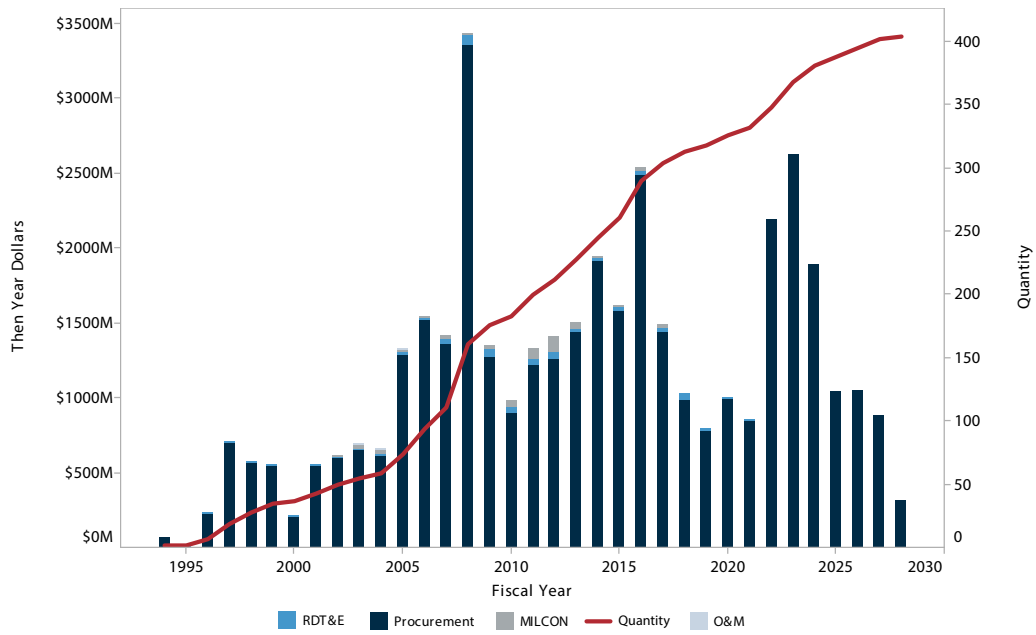
5 2015 SARs.

6 Jon Hemmerdinger, "Apache AH-64E enters full-rate production," *Flightglobal*, March 5, 2014.

7 Five remanufactured helicopters were procured with RDT&E funding but are not included in the quantity line.

C-130J Variants

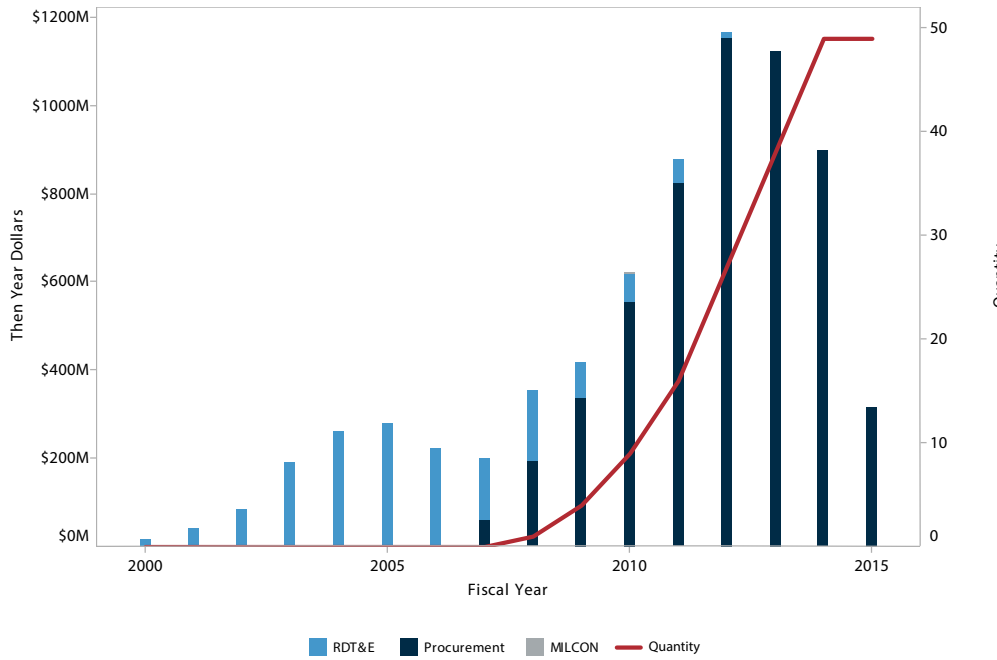
DoD is procuring several variants of the C-130J aircraft. The C-130J aircraft provides medium-range, tactical airlift to transport cargo and personnel within a theater of operations. It can carry more than 40,000 pounds of cargo or up to eighty-four paratroopers, and the stretched version has 30 percent more useable volume over previous versions. The HC/MC-130J variant provides aerial refueling as well as infiltration, supply, and recovery of specialized tactical ground units. It climbs faster and higher and can take off and land within a shorter distance than previous models. The KC-130J air-to-air refueling variant is being procured for the Marine Corps to replace the KC-130 F/R/T aircraft. The KC-130J can be configured to support refueling; troop transport; cargo delivery; medical evacuation; intelligence, surveillance, and reconnaissance activities; and close air support. A total of $25.25 billion has been appropriated through FY 2016 for the development and procurement of 151 C-130Js, eighty-four HC/MC-130Js, and fifty-five KC-130Js. An additional $5.16 billion was requested over the FY 2017 FYDP for three C-130Js, twenty-nine HC/MC-130Js, and ten KC-130Js. Beyond the FYDP, the services project an additional $10 billion in funding for fifteen C-130Js, eighteen HC/MC-130Js, and thirty-nine KC-130Js.[8]



8 2015 SARs.

C-5 Reliability Enhancement and Re-Engining Program (C-5 RERP)

The C-5 RERP program is the second phase of a two-part modernization effort for the C-5. The first phase adds modernized aircraft avionics, and the second phase will improve aircraft reliability and availability by replacing the current engine with a more reliable and powerful commercial engine. After the completion of the second phase, each C-5 will be designated a C-5M. Initial operating capability was declared in February 2014 after delivery of the sixteenth C-5M of the fifty-two currently planned.[9] A total of $7.07 billion has been appropriated for the entire program. The final lot buy for the program was awarded on August 13, 2015.[10]

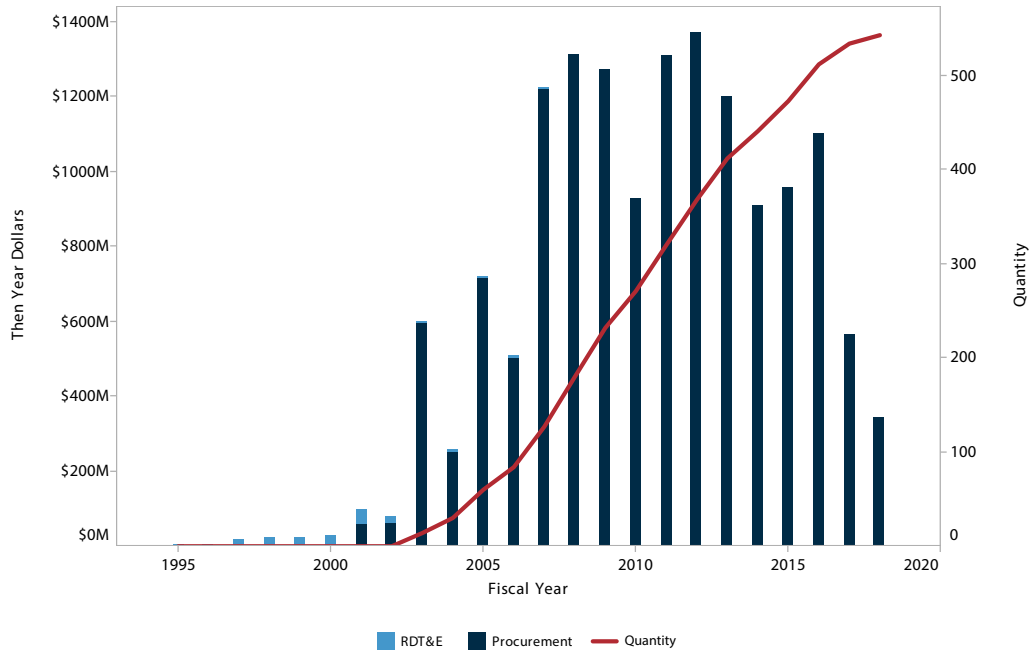


9 2015 SARs.

10 The modernization of three C-5 aircraft was funded with RDT&E spending and is not reflected in the quantity line.

CH-47F Improved Cargo Helicopter (CH-47F)

The CH-47F is a twin-engine, heavy-lift helicopter with a useful payload of up to 25,000 pounds. It is used to transport ground forces, supplies, and other battle-critical cargo in support of maneuver, fire support, air defense, and survivability missions. The program is composed of both remanufactured and new aircraft. New structural components and modifications have increased operating efficiency and crew endurance, as well as decreased the time required to deploy the CH-47F helicopter aboard C-5 or C-17 transport aircraft. The program is on schedule and in full-rate production.[11] A total of $13.97 billion has been appropriated through FY 2016 and $907.8 million was requested in the FY 2017 FYDP through the end of the program in FY 2018. A total of 545 helicopters are being procured.[12]

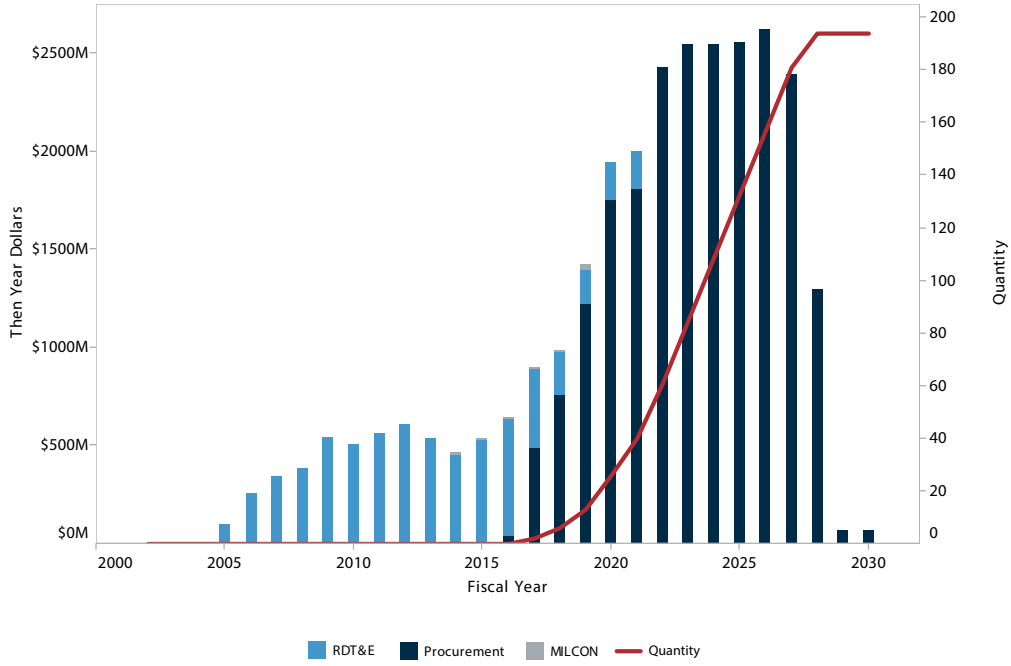


11 2015 SARs.

12 Two CH-47F helicopters were procured with RDT&E funding but are not included in the quantity line.

CH-53K Heavy Lift Replacement Helicopter (CH-53K)

The CH-53K is intended to replace the heavy-lift function of the CH-53E, providing increased range, payload, survivability, force protection, reliability, maintainability, and coordination with other assets while reducing total ownership costs. [13] Flight testing began in October 2015, but ongoing design issues have slowed the delivery of test aircraft.[14] The CH-53K program breached the baseline timeline for the low-rate initial production decision. As a result, the program completed an exception SAR in September 2015. The revised low-rate initial production decision is expected in early 2017. The program expects to procure 200 helicopters through FY 2028. A total of $5.47 billion has been appropriated through FY 2016, $7.24 billion was requested over the FY 2017 FYDP, and $16.5 billion is planned for beyond the FYDP.[15]



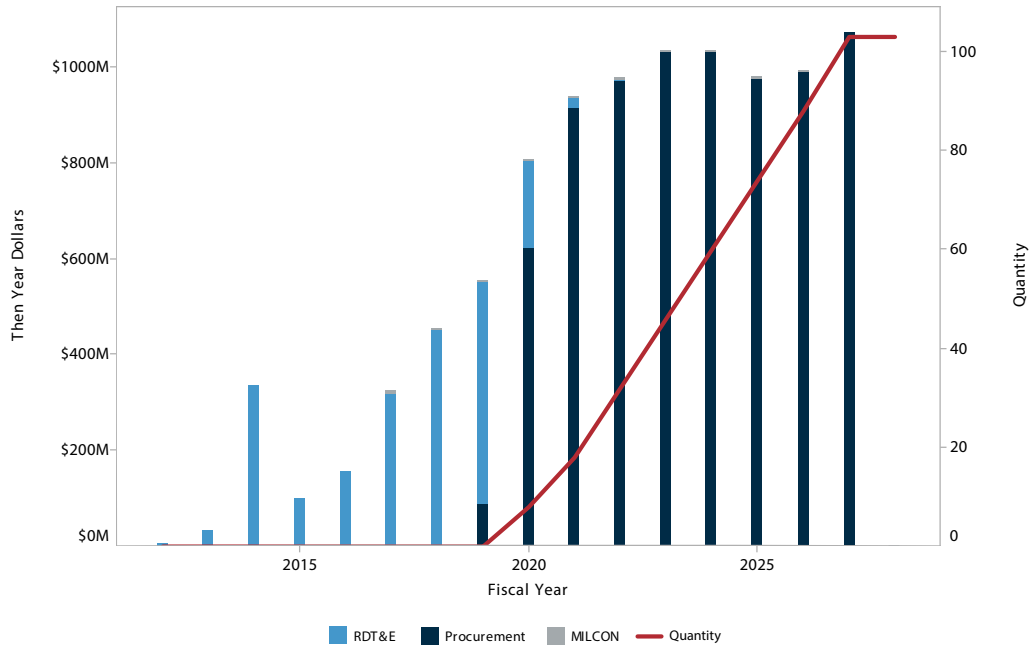
13 2015 SARs.

14 GAO, *Defense Acquisitions of Selected Weapon Programs* (Washington, DC: GAO, 2016), pp. 93–94.

15 Six CH-53K helicopters were procured with RDT&E funding and are not included in the quantity line.

Combat Rescue Helicopter (CRH)

The Combat Rescue Helicopter (CRH) will replace the HH-60G Pave Hawk helicopters performing the search and rescue mission for the Air Force. DoD waived the requirements for both competitive prototyping and demonstration of technology in a relevant environment, claiming that the program will rely on already proven technology. As such, there is an unknown level of additional risk facing the CRH as the program matures.[16] The low-rate initial production decision is expected in late 2019. A total of $628.5 million has been appropriated through FY 2016, an additional $3.08 billion was requested over the FY 2017 FYDP, and $6.09 billion is planned for beyond the FYDP. The Air Force plans on procuring 112 helicopters.[17]

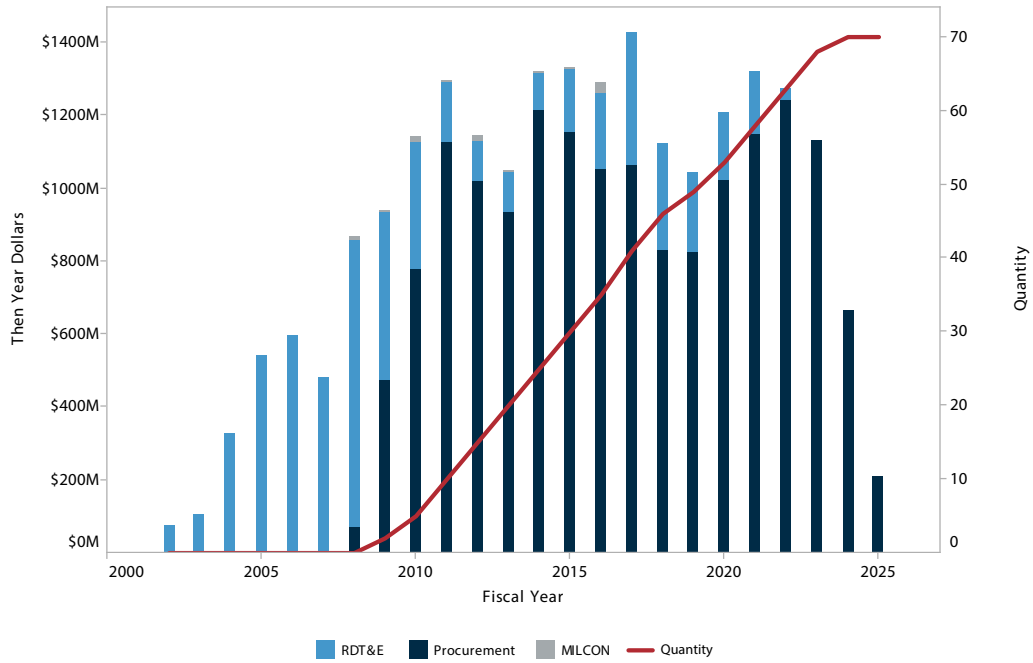


16 GAO, *Defense Acquisitions of Selected Weapon Programs,* pp. 131–132.

17 2015 SARs.

E-2D Advanced Hawkeye Aircraft (E-2D AHE)

The E-2D replaces the E-2C as the carrier-based multi-mission aircraft for command and control (C2) and surveillance. The radar on the E-2D is designed to detect advanced threat aircraft and cruise missiles in the overland, littoral, and open ocean environments. The E-2D began full-rate production in FY 2013[18] and was declared operational on October 10, 2014. The Navy plans to replace all legacy E-2C aircraft by 2027.[19] A total of $12.5 billion has been appropriated through FY 2016 for the development and procurement of the first forty aircraft. An additional $6.12 billion was requested over the FY 2017 FYDP for twenty-three aircraft, and $3.28 billion is planned for twelve aircraft procurements beyond the FYDP.[20]



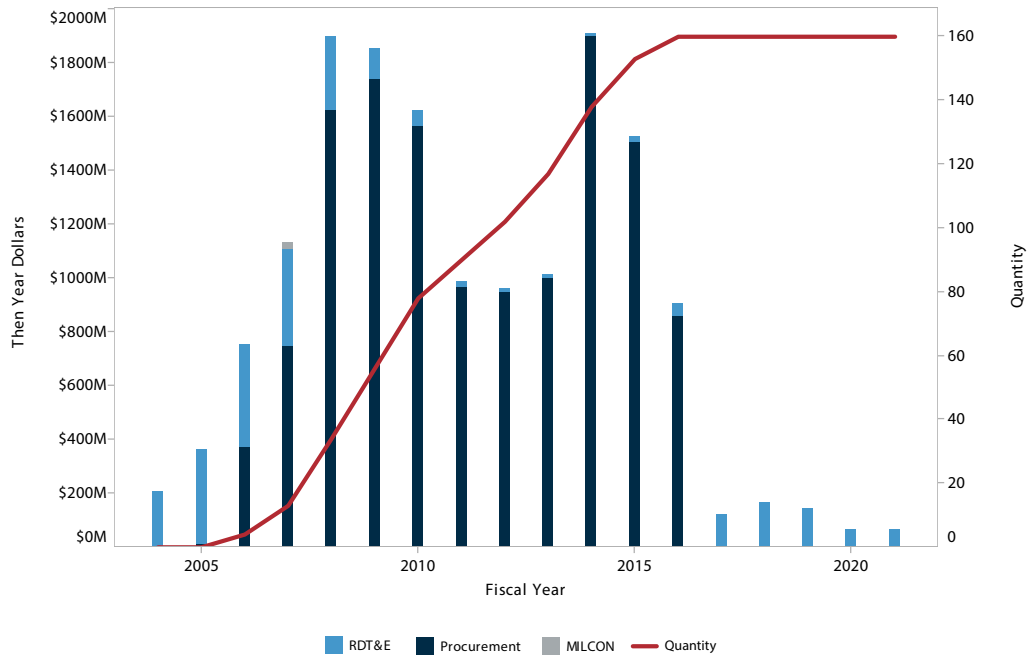
18 2015 SARs.

19 Dave Majumdar, "Navy Declares IOC for E-2D Hawkeye," *USNI News*, October 16, 2014.

20 Five E-2D aircraft were procured with RDT&E funding and are not reflected in the quantity line.

EA-18G Growler Aircraft (EA-18G)

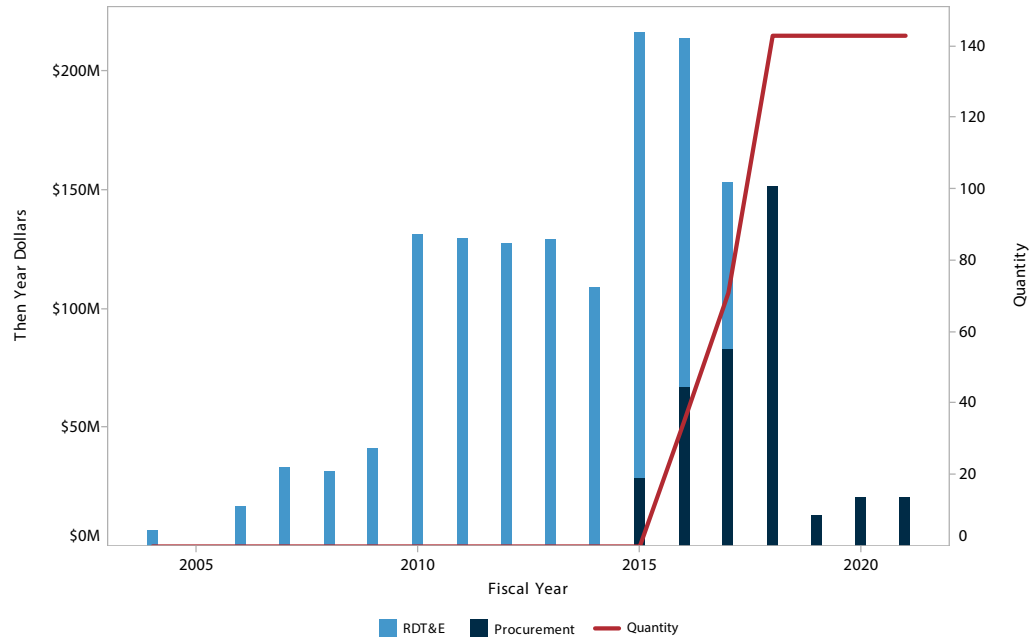
The Growler variant of the F/A-18 aircraft replaces the EA-6B and provides the Navy with the ability to detect, identify, locate, and suppress enemy air defenses and communications. Program costs grew by almost 9 percent primarily due to increasing the planned procurement by seven to reach a total program procurement of 160 aircraft. The Navy also received three additional aircraft from Boeing in FY 2014 as part of the settlement of unrelated litigation stemming from the cancellation of the A-12 program more than two decades ago. A total of $15.11 billion has been appropriated through FY 2016, and $557.6 million was requested over the FY 2017 FYDP for the balance of the program.[21]



21 2015 SARs.

F-22 Increment 3.2B (F-22 Mods)

The F-22 is a stealthy, short-range air-to-air and air-to-ground aircraft. The F-22 modernization program, established in 2003, is intended to upgrade the air-to-ground, information warfare, and reconnaissance capabilities of the aircraft as well as improve overall performance, reliability, and maintenance.[22] The current increment, 3.2B, enhances electronic protection, geolocation, and intra-flight data link capabilities. It also enables the aircraft to use the AIM-9X and AIM-120D missiles. Full hardware qualification was completed in October 2014, software development is in progress, and the first five test aircraft have been modified.[23] A total of $1.18 billion has been appropriated through FY 2016, and an additional $358.7 million was requested over the FY 2017 FYDP to complete the program.

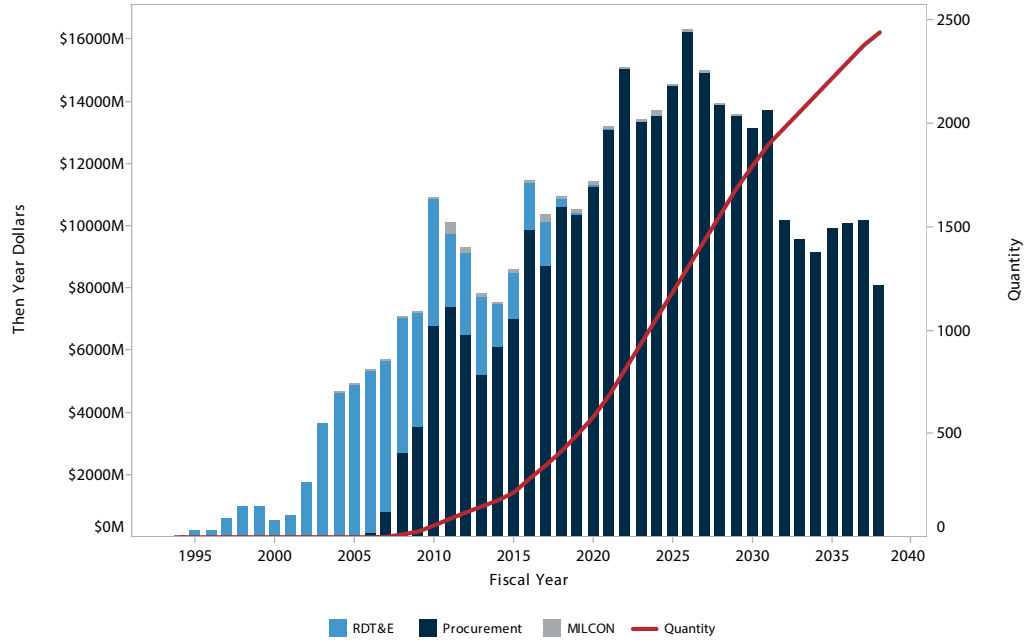


22 GAO, *Defense Acquisitions of Selected Weapon Programs*, pp.137–138.

23 2015 SARs.

F-35 Joint Strike Fighter (JSF)

The F-35 is a joint program to develop a family of fifth-generation strike fighter aircraft for the Air Force, Navy, and Marine Corps. It is the single largest acquisition program in DoD. The F-35 is intended to replace the A-10, F-16, AV-8B, and F/A-18C/D while complementing the F/A-18/E/F and the F-22A. The F-35's Autonomic Logistics Information System (ALIS) and Mission Systems Software are still under development and pose potential technical risks to the program.[24] The primary schedule risk factors involve standing up four separate reprogramming labs, completing weapons envelope testing for the Block 3F software and starting operational testing. The F-35B achieved IOC in July 2015, the F-35A is scheduled to achieve IOC in August 2016, and the F-35C is expected to achieve IOC in August 2018.[25] A total of $11.04 billion has been appropriated through FY 2016, which includes procurement funding for 285 aircraft. An additional $56.48 billion was requested over the FY 2017 FYDP for continued development and testing and the procurement of 404 aircraft. Beyond the FYDP, DoD projects it will need $209.51 billion to procure the remaining 1,754 aircraft currently planned.[26]



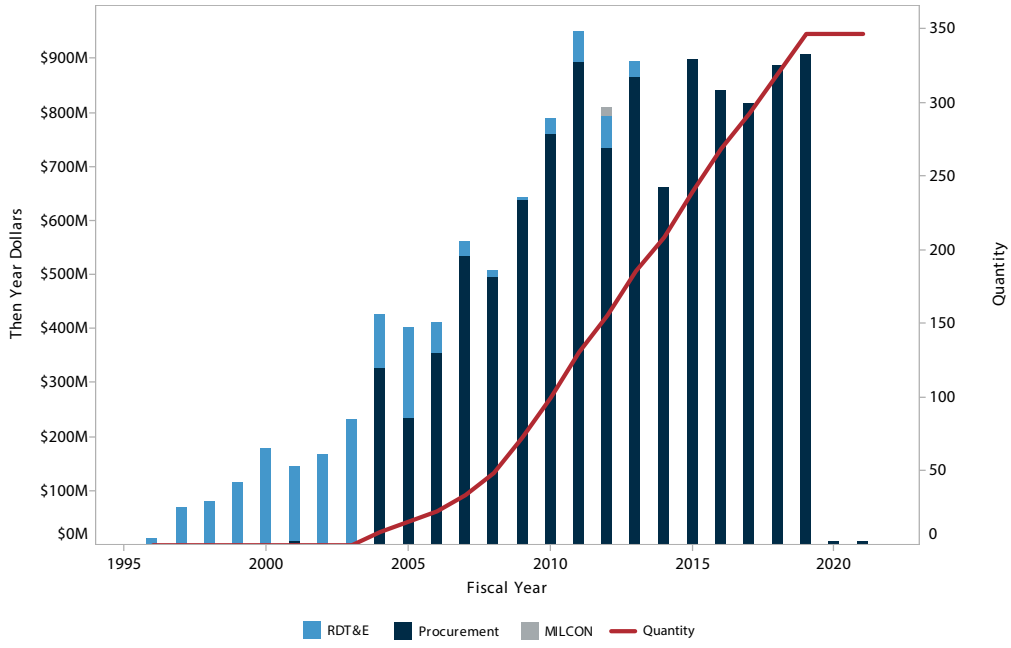
24 2015 SARs.

25 2015 SARs.

26 Fourteen F-35 aircraft were procured with RDT&E funding but are not included in the quantity line. Foreign partners contributed $5.21 billion to RDT&E efforts through FY 2016, and they will contribute an additional $49.5 million over the FYDP. The foreign contributions are included in the chart and figures above.

H-1 Upgrades (4BW/4BN)

The H-1 upgrade program provides increased maneuverability, speed, and payload capability to the AH-1Z attack helicopter and the UH-1Y utility helicopter. 269 helicopters have been procured or remanufactured through FY 2016, and a further seventy-eight new-build helicopters will be procured through the end of the program. The H-1 program is also pursuing foreign military sales opportunities. Pakistan has signed a letter of offer and acceptance to acquire twelve AH-1Z helicopters valued at $681 million.[27] A total of $9.8 billion has been appropriated through FY 2016. $2.63 billion was requested over the FY 2017 FYDP.[28]

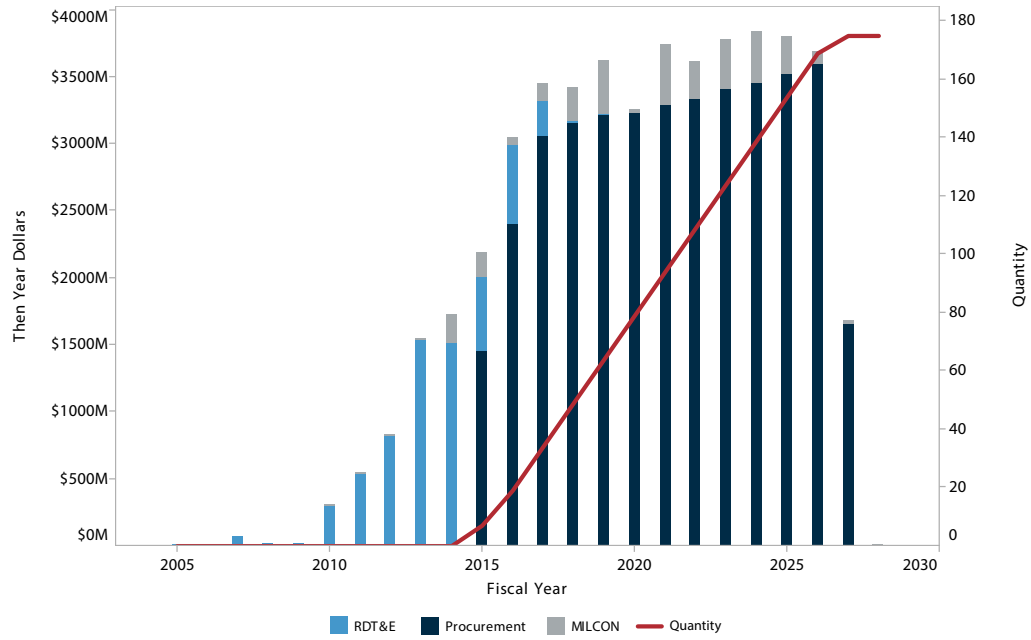


27 2015 SARs.

28 Four H-1 helicopters were upgraded through RDT&E funding but are not included in the quantity line.

KC-46 Tanker Modernization Program (KC-46A)

The Air Force's KC-46A is a Boeing 767 modified for use as an aerial refueling tanker to support U.S. and allied aircraft. This program is the first of three planned phases to replace the Air Force's existing KC-135 tankers, replacing roughly one-third of the KC-135s in service. The KC-46 will provide increased refueling capacity and efficiency as well as improved cargo, aeromedical evacuation, and defensive capabilities.[29] Two developmental aircraft are flying, and the final two developmental aircraft are nearing completion. A total of 179 aircraft are planned. The KC-46 will miss the required assets available milestone of eighteen delivered tankers by fourteen months due to a failure to certify the wing aerial refueling pods; the revised estimate is October 2018. A low-rate production decision is expected in August, delayed from the previous June estimate.[30] The Air Force is only liable for up to $4.9 billion on the engineering and manufacturing development contract, with Boeing required to absorb any cost overruns.[31] Boeing could try and recoup this investment in future production contracts. A total of $10.31 billion has been appropriated through FY 2016. The Air Force requested $17.5 billion over the FY 2017 FYDP for seventy-five aircraft, and $20.41 billion is planned for beyond the FYDP to procure an additional eighty-one aircraft.[32]



29 Joakim Kasper Oestergaard Balle, "Boeing KC-46 Pegasus," *AeroWeb*, Barr Group Aerospace, October 23, 2015.

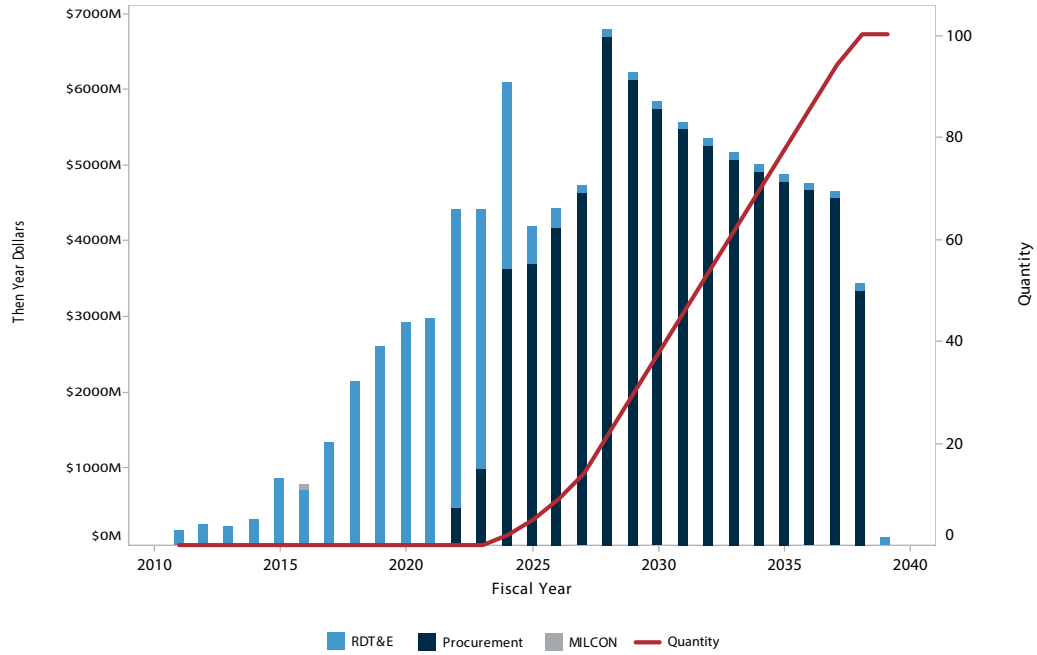
30 Courtney Albon, "KC-46 RAA milestone slips by one year, LRIP expected in August," *Inside Defense*, May 27, 2016.

31 2015 SARs.

32 Four KC-46A aircraft were procured with RDT&E funding and are not included in the quantity line.

Long Range Strike-Bomber (LRS-B)/B-21 Program

The LRS-B program, designated the B-21 in February 2016, is intended to be a long-range stealth aircraft that is nuclear-capable and may be optionally manned in the future. The B-21 is a special access program and thus does not report detailed program information in unclassified documents. While a formal cost estimate has not been released and the program is not included in DoD's most recent public SARs, DoD has revealed some information. It has stated that the average procurement unit cost will be $511 million per aircraft in FY 2010 dollars, beating Secretary Gates' target of $550 million in FY 2010 dollars.[33] The FY 2017 budget also shows annual RDT&E funding ramping up from $1.36 billion in FY 2017 to $3.02 billion in FY 2021.[34] Assuming RDT&E costs begin to level off in FY 2022 and gradually decline in subsequent years, the development cost could be roughly $25 billion in then-year dollars. Assuming procurement begins in the early 2020s and grows gradually to an estimated eight aircraft per year in the late 2020s, a buy of a hundred aircraft would be completed in the mid-to-late-2030s at a procurement cost of roughly $75 billion in then-year dollars (representing the equivalent of an average procurement unit cost of $511 million in FY 2010 dollars).[35] Based on the information released by DoD, as reflected in the graph below, this sums to roughly $100 billion in then-year dollars, or $81 billion in FY 2017 dollars.



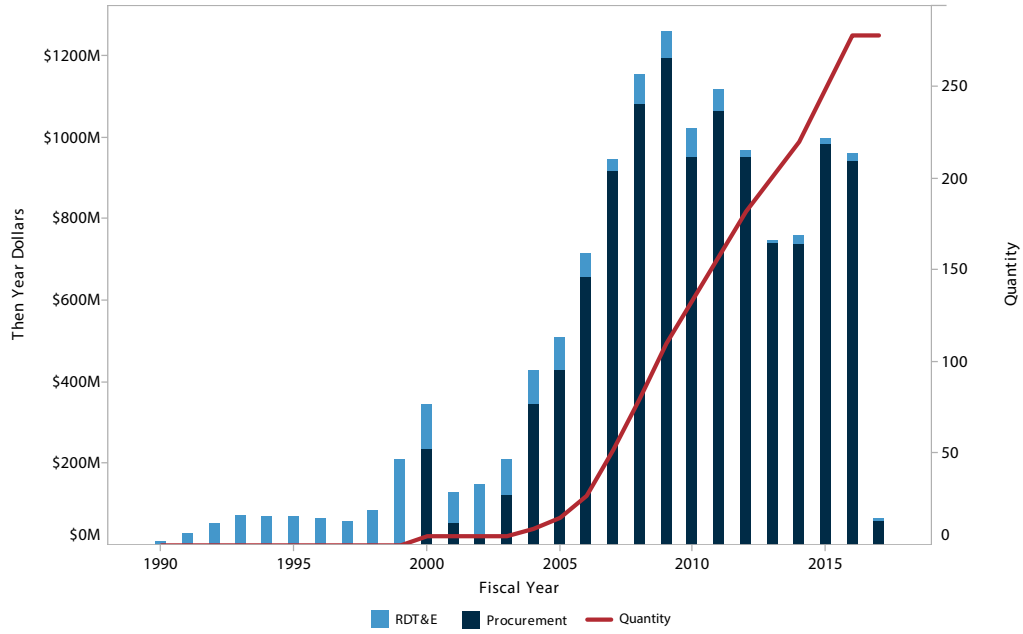
33 John Tirpak, "Launching the New Bomber," *Air Force Magazine*, January 2016.

34 DoD, *FY 2017 PB Submission*, Air Force Justification Book Volume 2, *Research, Development, Test & Evaluation*, Vol-II.

35 Tirpak, "Launching the New Bomber."

MH-60R

The MH-60R is a Navy variant of the Army's UH-60 Blackhawk helicopter used for anti-submarine and surface warfare, search and rescue, logistics, transportation, and medical evacuation. The MH-60R replaces the SH-60B and SH-60F helicopters and provides improved avionics, sonar, radar, and defensive capabilities. FY 2017 is the final year of MH-60R procurement.[36] A total of $13.14 billion has been appropriated through FY 2016, and $66.5 million was requested over the FY 2017 FYDP to complete procurement of 280 helicopters.[37]

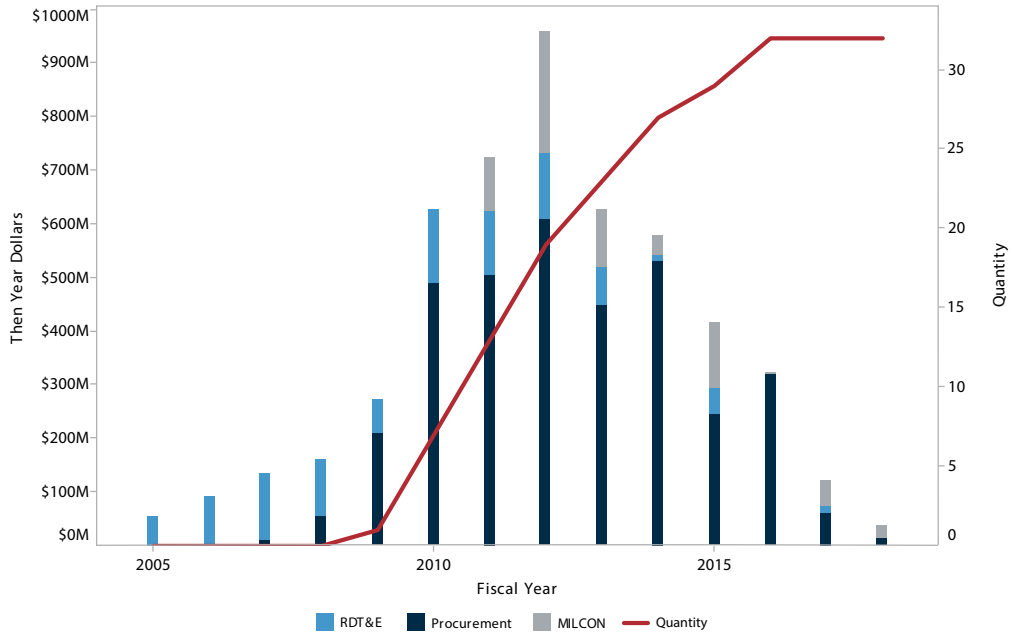


36 Two MH-60R helicopters were procured with RDT&E funding but are not included in the quantity line.

37 2015 SARs.

MQ-1C Gray Eagle Unmanned Aircraft System

The Army's MQ-1C Gray Eagle is an upgraded version of the Air Force's MQ-1 Predator unmanned aircraft.[38] It is used for reconnaissance, surveillance, target acquisition, and attack missions. A Gray Eagle platoon typically consists of four MQ-1C unmanned aircraft and associated ground support systems. In FY 2015 the Army was authorized to procure thirty-six extended-range Improved Gray Eagle aircraft out of the total authorized procurement of 167 aircraft. The program has completed follow-on test and evaluation.[39] A total of $4.96 billion has been appropriated through FY 2016, and an additional $158.9 million was requested over the FY 2017 FYDP.[40]



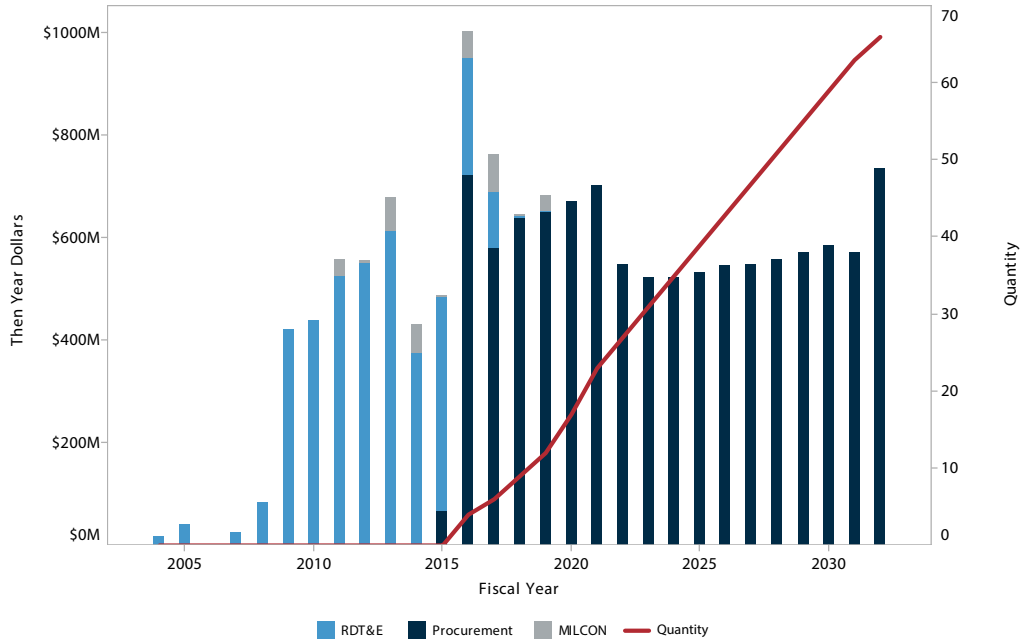
38 General Atomics Aeronautical, "Gray Eagle™ UAS," 2014, http://www.ga-asi.com/products/aircraft/gray_eagle.php.

39 2015 SARs.

40 Two Gray Eagle units were procured with RDT&E funding but are not included in the quantity line.

MQ-4C Triton Unmanned Aircraft System

The Navy's MQ-4C Triton, formerly known as the Broad Area Maritime Surveillance (BAMS) program, is designed to provide persistent maritime intelligence, surveillance, and reconnaissance. It is based on the Air Force's RQ-4B Global Hawk and will operate from five land-based sites. Future planned improvements include a signals intelligence collection capability and an upgraded systems communication relay. The Navy has completed the operational assessment of the MQ-4C.[41] The program is expected to reach Milestone C in 2016 and achieve IOC in late 2018. The MQ-4C FMS team is executing technical services planning cases with Australia and Germany. Canada, Japan, Germany, Norway, and the United Kingdom have also expressed interest in the system.[42] A total of $4.74 billion has been appropriated through FY 2016, $3.46 billion was requested over the FY 2017 FYDP, and $6.23 billion is planned for beyond the FYDP to procure a total quantity of seventy MQ-4Cs.[43]



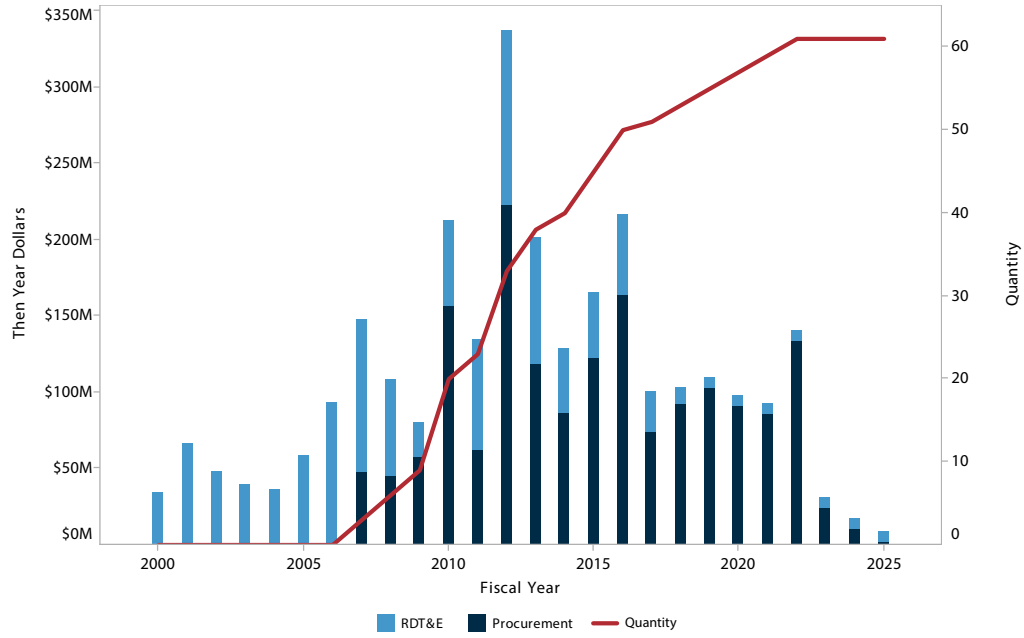
41 Lee Hudson, "Triton completes operational assessment," *Inside Defense*, February 16, 2016.

42 2015 SARs.

43 Four Triton aircraft were procured with RDT&E funding but are not in the quantity line.

MQ-8 Fire Scout

The MQ-8 Fire Scout is designed to provide surveillance and targeting information for ground, air, and sea forces. Among other uses, it is intended to support the Littoral Combat Ship surface warfare, mine countermeasures, and anti-submarine warfare mission packages.[44] The MQ-8B model is smaller and has a maximum endurance of 5.5 hours. The MQ-8C model is larger and has a maximum endurance of twelve hours.[45] The Fire Scout has had a Nunn-McCurdy breach, RDT&E breach, and schedule breach. As such, the program is developing a new baseline, which should be completed by the end of 2016.[46] A total of $2.11 billion has been appropriated through FY 2016 for development and procurement of fifty-nine MQ-8s, $501.8 million was requested over the FY 2017 FYDP to procure nine aircraft, and $196.4 million is requested after the conclusion of the FYDP for the final two aircraft.[47]



44 2015 SARs.

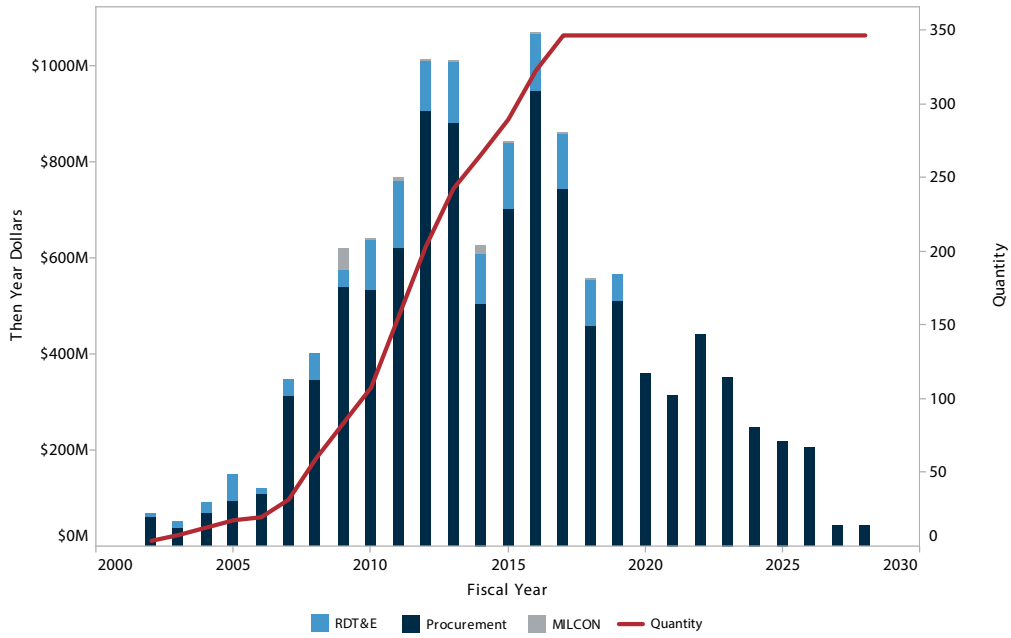
45 Naval Air Systems Command, "MQ-8 Fire Scout," http://www.navair.navy.mil/index.cfm?fuseaction=home.display&key=8250AFBA-DF2B-4999-9EF3-0B0E46144D03.

46 2015 SARs.

47 Nine MQ-8s were procured with RDT&E funding but are not reflected in the quantity line.

MQ-9 Reaper Unmanned Aircraft System

The Air Force's MQ-9 Reaper, based on the Service's MQ-1 Predator, is a multirole, medium-altitude, unmanned aircraft for surveillance and strike missions in permissive airspace. It can carry laser and GPS-guided bombs and Hellfire missiles.[48] Production lines transitioned to the Block 5 design in mid-2015 despite ongoing thermal management problems that, when operating in hot weather, can result in batteries overheating and missions being aborted. This problem was resolved in late 2015. Currently, the program is trying to determine the root cause of starter-generator failures, which have resulted in the loss of thirteen aircraft. The program is mitigating the risk through the installation of a backup alternator and considering a second source for an alternate starter-generator. Follow-on testing and evaluation for Increment I Block 5 should be complete in late 2016, roughly two years after the program baseline timeline. A total of $7.81 billion has been appropriated through FY 2016 for 326 aircraft, and an additional $2.65 billion was requested over the FY16 FYDP for twenty-four aircraft.[49] No additional procurements are projected beyond the FYDP, but an additional $1.55 billion is planned for continued upgrades.[50]



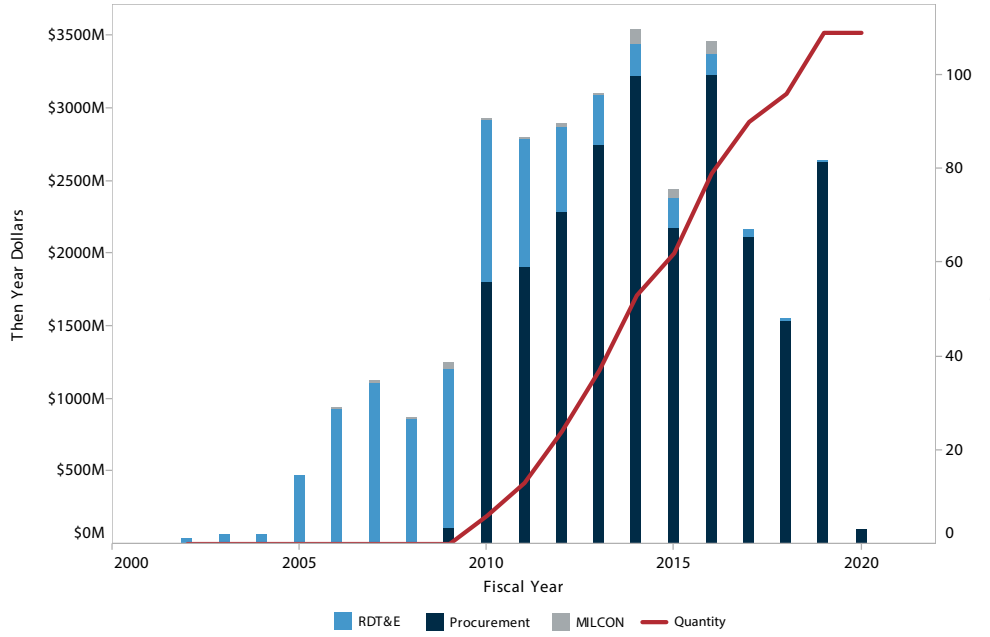
48 2015 SARs.

49 Three Reaper aircraft were procured with RDT&E funding but are not included in the quantity line. The quantity line includes numbers of aircraft procured only and not number of systems; the ground control stations are not counted.

50 2015 SARs.

P-8A Poseidon Multi-Mission Maritime Aircraft

The Navy's P-8A Poseidon is being procured to replace the P-3C Orion for anti-submarine warfare; anti-surface warfare; and intelligence, surveillance, and reconnaissance missions. The P-8A is based on the Boeing 737 airframe and is produced in the same production line as commercial 737s. The program is designed to field incremental upgrades to pace the anti-submarine warfare (ASW) mission. The first upgrade added a broad-area, multi-static acoustic ASW capability that significantly increased the P-8s search rate in littoral environments. A high altitude ASW sensor and a high altitude ASW weapon are under development and are the next incremental upgrades that will be integrated onto the P-8.[51] A total of $25.95 billion has been appropriated through FY 2016 for the development and procurement of eighty-four aircraft, and $6.45 billion was requested over the FY 2017 FYDP for thirty aircraft. No additional funding is planned after the FYDP.[52]

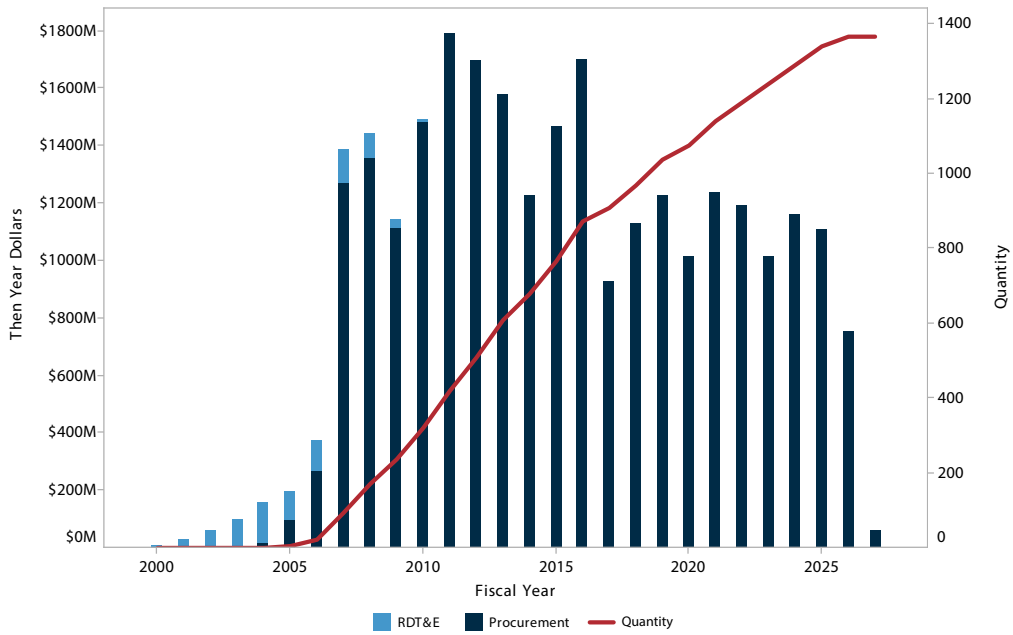


51 2015 SARs.

52 Five P-8A aircraft were procured with RDT&E funding, but are not included in the quantity line.

UH-60M Black Hawk Helicopter (UH-60M)

The UH-60 Black Hawk is the Army's utility helicopter for air assault, aeromedical evacuation, and general transportation needs. Variants of the UH-60 are also used by the Air Force and the Navy. The M-variant includes upgraded engines, rotor blades, and instrumentation. Full-rate production began in 2007, and DoD plans to buy a total of 1,375 helicopters.[53] A total of $15.8 billion has been appropriated through FY 2016 for 881 helicopters, $5.53 billion was requested for 268 helicopters over the FY 2017 FYDP, and $5.28 billion is planned for 226 helicopters beyond the FYDP.[54]

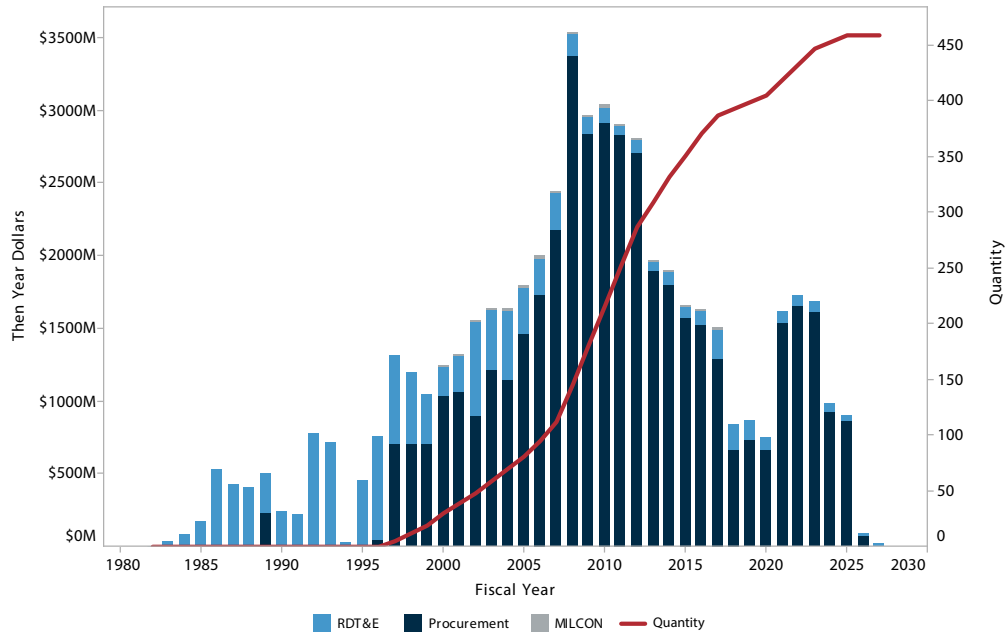


53 2015 SARs.

54 Eight UH-60M helicopters were procured with RDT&E funding but are not in the quantity line.

V-22 Osprey Joint Services Advanced Vertical Lift Aircraft (V-22)

The V-22 is a tilt-rotor helicopter capable of vertical takeoff and landing as well as long-range cruise like that of a turboprop fixed-wing aircraft. The V-22 can fly up to 2,100 nautical miles with one in-flight refueling. The MV-22 variant replaces the Marine Corps' CH-46E and CH-53D for transport of troops, equipment, and supplies. The Air Force's CV-22 variant replaces the MH-53J/M for long-range special operations missions. The Navy's CMV-22 will replace the C-2A and provide carrier-onboard-delivery and will begin development in FY 2016 with production scheduled to begin in FY 2018. In May 2016, the Navy selected Bell Boing to develop and integrate an aerial refueling system that can be retrofitted onto the MV-22.[55] As of February 2016, a total of 329 V-22s have been delivered out of a projected buy of 461.[56] A total of $44.89 billion has been appropriated through FY 2016, and $5.57 billion is requested over the FY 2017 FYDP for the procurement of forty-eight aircraft. An additional $5.4 billion is planned for beyond the FYDP to complete the program and procure the final forty aircraft.[57]



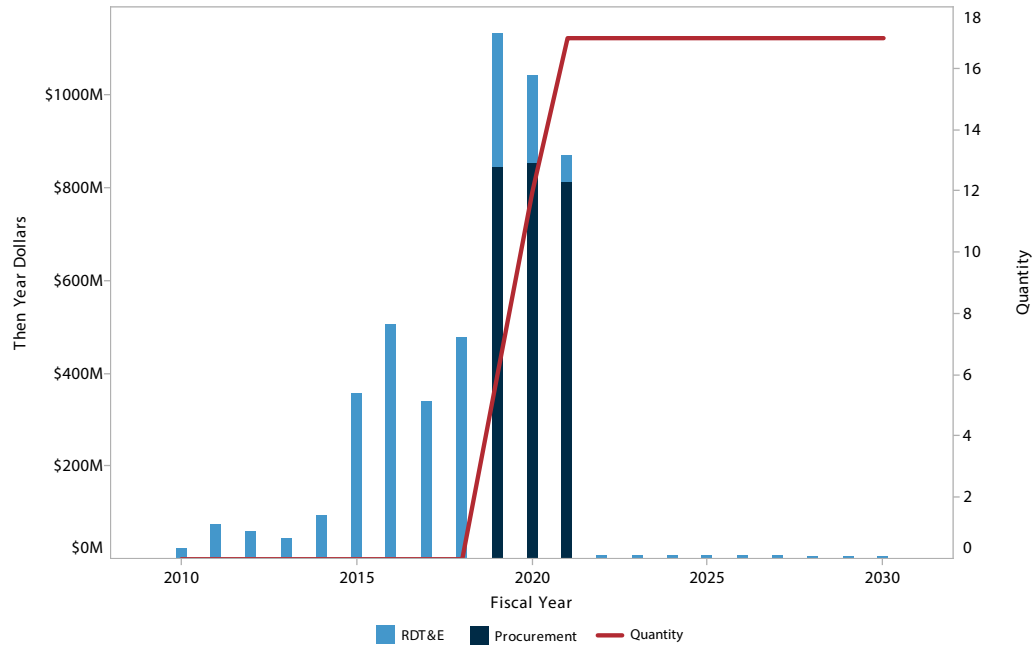
55 Justin Doubleday, "Bell-Boeing awarded deal for V-22 aerial refueling system development," *Inside Defense*, June 7, 2016.

56 2015 SARs.

57 Two V-22 aircraft were procured with RDT&E funding but are not included in the quantity line.

VH-92A Presidential Helicopter (VH-92A)

The VH-92 Presidential Helicopter is designed to provide safe transport to the President and other senior U.S. leaders. The VH-92 is intended to replace the VH-3D and VH-60N currently flown by Marine Helicopter Squadron One (HMX-1). It will be a heavily modified variant of Sikorsky's S/H-92 civilian and military medium-lift helicopter. The VH-92A is expected to achieve initial operating capability in 2020. The program is a successor to the VH-71 helicopter replacement program that was cancelled in 2009 after falling six years behind schedule and doubling in cost.[58] A total of $1.16 billion has been appropriated through FY 2016, and $3.87 billion is requested over the FY 2017 FYDP for the procurement of seventeen aircraft.[59] An additional $63.9 million is planned for beyond the FYDP to complete the program. Four of the six test aircraft will convert to operational status at the conclusion of the test phase.[60]



58 Richard Whittle, "Marine One, Take 2: No Bright Ideas!" *Breaking Defense*, May 5, 2015.

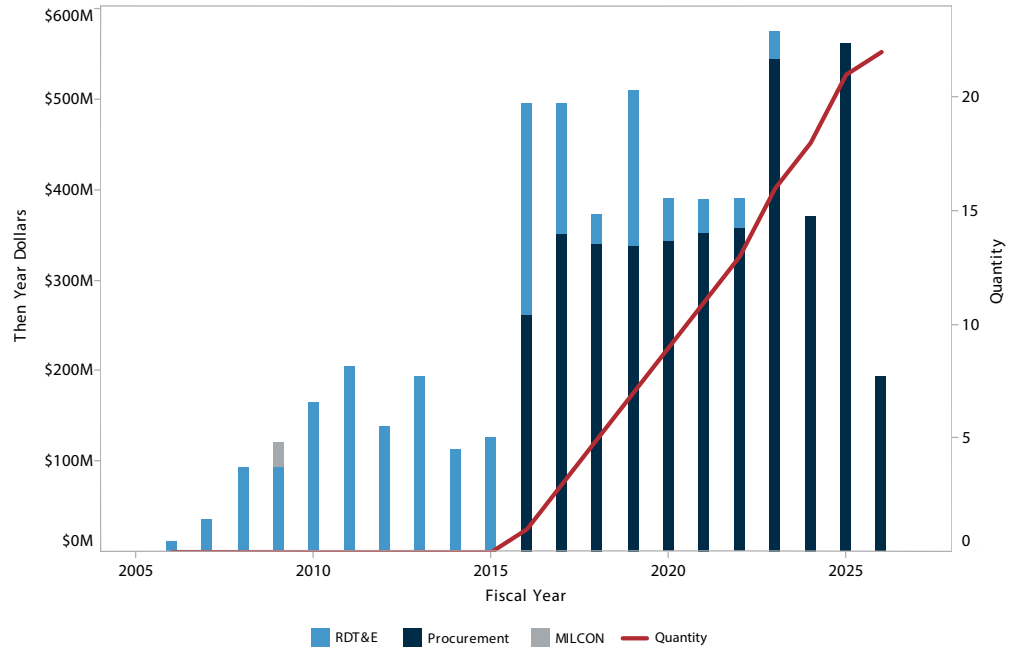
59 2015 SARs.

60 Six aircraft were procured with RDT&E funding but are not included in the quantity line.

Air and Missile Defense

Air and Missile Defense Radar (AMDR)

The Navy's AMDR is a next-generation radar for ballistic missile and air defense. The Navy is planning to install a 14-foot variant of the AMDR on the DDG-51 Flight III, which is the maximum size this ship can accommodate. The AMDR is designed to be scalable, and a 20-foot or greater radar would be necessary to meet the Navy's desired performance for integrated air and missile defense. Two of four planned software builds are complete and the remaining two should be completed by September 2016.[61] Low-rate initial production is expected to begin in 2017. A total of $1.7 billion has been appropriated through FY 2016 for AMDR. An additional $2.16 billion was requested over the FY 2017 FYDP, and $2.09 billion is planned for beyond the FYDP.[62]

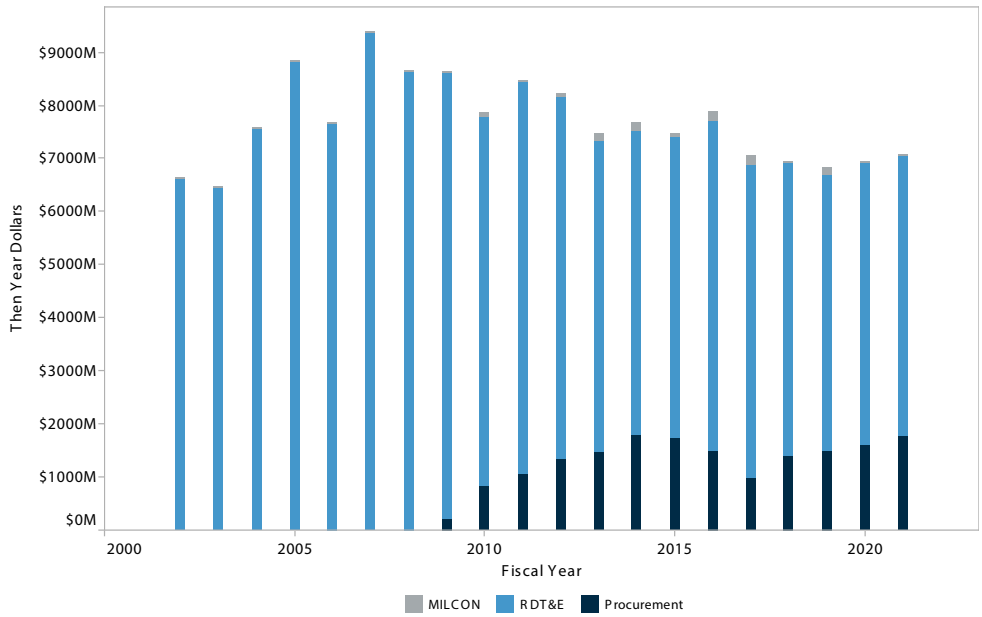


61 GAO, *Defense Acquisitions of Selected Weapon Programs*, pp. 89–90.

62 2015 SARs.

Ballistic Missile Defense System (BMDS)

BMDS is a defense-wide program to develop and deploy a layered BMDS to defend the United States and its allies and partners from ballistic missile attacks. The program currently supports ground-based interceptors (GBI) for homeland defense, forward-based Army-Navy Transportable Radar Surveillance & Control-Series 2 (AN/TPY-2) radars to track missile launches, Terminal High Altitude Area Defense (THAAD) batteries to protect deployed forces, and Aegis Ballistic Missile Defense equipped ships.[63] The program supports the European Phased Adaptive Approach (EPAA) to protect NATO allies and deployed troops. In 2015, Phase II added an Aegis Ashore system in Romania.[64] Phase III is scheduled for 2018, which will include an Aegis Ashore site in Poland and the SM-3 Block IIA missiles,[65] co-developed with Japan. The program also includes funding for cooperation with Middle Eastern and Asian countries including the United Arab Emirates and Japan. In summer 2016 construction will begin on the Long Range Discrimination Radar (LRDR) at Clear Air Force Station, Alaska. Additionally, a Multi-Object Kill Vehicle (MOKV) is being developed to enable multiple kills from a single GBI. A total of $119 billion has been appropriated through FY 2016 and $34.87 billion was requested over the FY 2017 FYDP. The SAR does not project any funding beyond the FYDP, but spending will likely continue at roughly the current rate for the foreseeable future.[66]



63 The Aegis Weapon System is a centralized and automated C2 system designed to detect and destroy enemy missiles and aircraft. Based on the AN-SPY-1 radar, it can perform search, track, and missile guidance functions for more than a hundred targets simultaneously. U.S. Navy, "Aegis Weapon System," http://www.navy.mil/navydata/fact_display.asp?cid=2100&tid=200&ct=2.

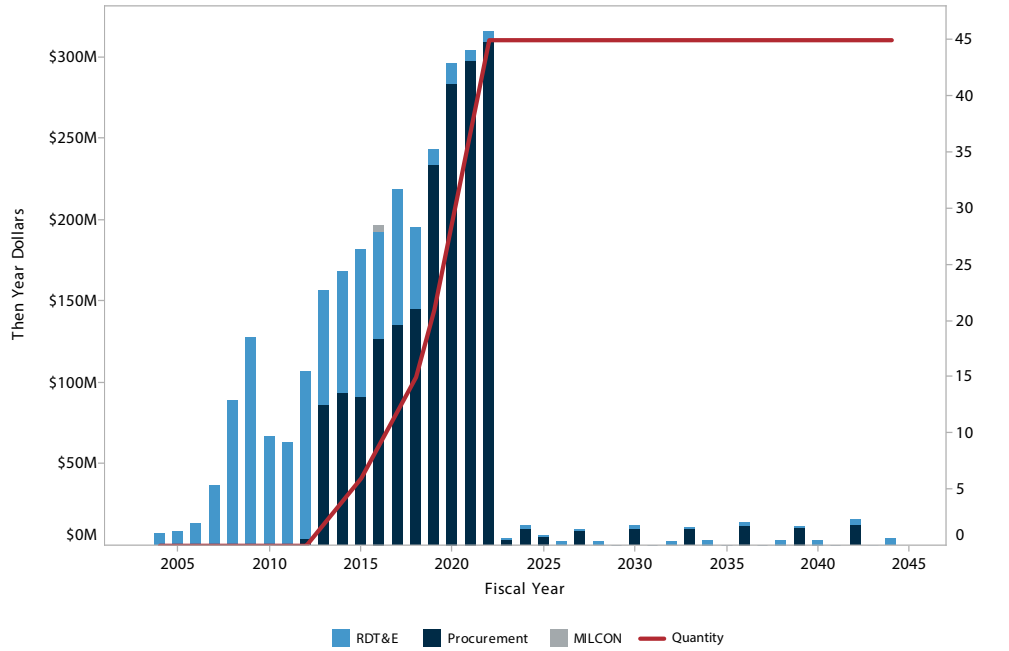
64 Ryan Maass, "Aegis Ashore Missile Defense System Goes Online in Romania," *UPI*, December 18, 2015.

65 Missile Defense Agency, "Aegis Ashore Fact Sheet," March 31, 2016.

66 2015 SARs.

Ground/Air Task Oriented Radar (G/ATOR)

The Marine Corps' G/ATOR program is a short-range, three-dimensional, multi-role radar designed to detect unmanned aerial systems, cruise missiles, air-breathing targets, rockets, mortars, and artillery. G/ATOR will replace five legacy radar systems and is a block acquisition program with the follow-on blocks primarily providing software upgrades. A low-rate initial production (LRIP) contract was awarded in March 2014, and a second was awarded in March 2015. The second LRIP was authorized to address the challenges involved with the decision to use a different type of gas in the system's semiconductors by increasing initial production to fourteen radars.[67] The first six will use the old modules, and the later eight will use the new ones.[68] A total of $1.22 billion has been appropriated through FY 2016, and $1.26 billion was requested over the FY 2017 FYDP. The SAR projects that an additional $0.43 billion will be needed beyond the FYDP.

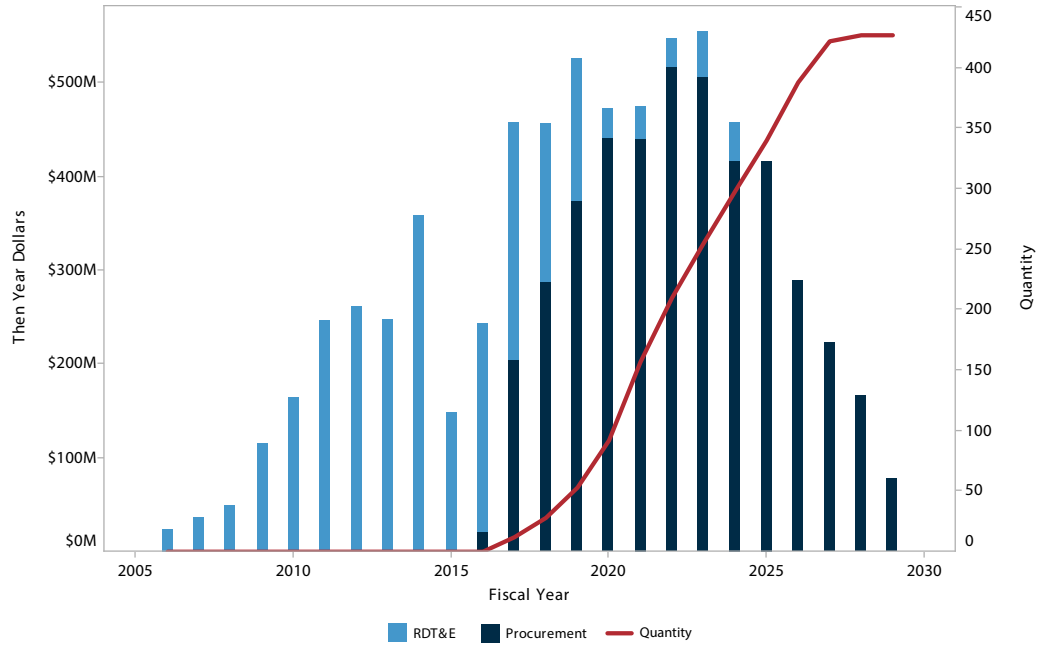


67 2015 SARs.

68 GAO, *Defense Acquisitions of Selected Weapon Programs*, pp. 99–100.

Integrated Air and Missile Defense (IAMD)

The Army's IAMD program will network sensors, weapons, and a common command system to protect against air and missile threats. It will transform air and missile defense efforts to a "plug and fight" architecture that integrates sensors, weapons, and C2. A Patriot radar, connected to the IAMD system, conducted the first successful target track of an airborne target in November 2014. The IAMD system also completed its first successful intercept test against a tactical ballistic missile in May 2015. Since the IAMD program is designed to integrate the capabilities of several other acquisition programs, its progress is dependent on the success of those programs. To mitigate this risk, the IAMD program has focused on simplifying program software and adopting an incremental delivery schedule.[69] The LRIP decision is scheduled for August 2016. A total of $1.89 billion has been appropriated through FY 2016, $2.39 billion was requested over the FY16 FYDP, and $2.73 billion is planned for beyond the FYDP.[70]

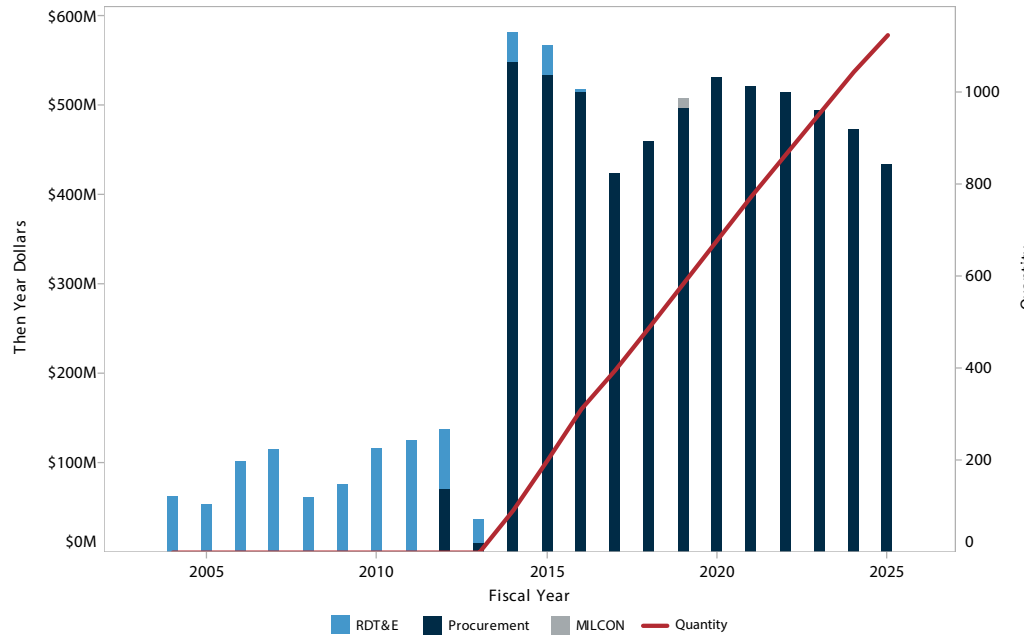


69 GAO, *Defense Acquisitions of Selected Weapon Programs*, pp. 71–72.

70 2015 SARs.

Patriot Advanced Capability-3 Missile Segment Enhancement (PAC-3 MSE)

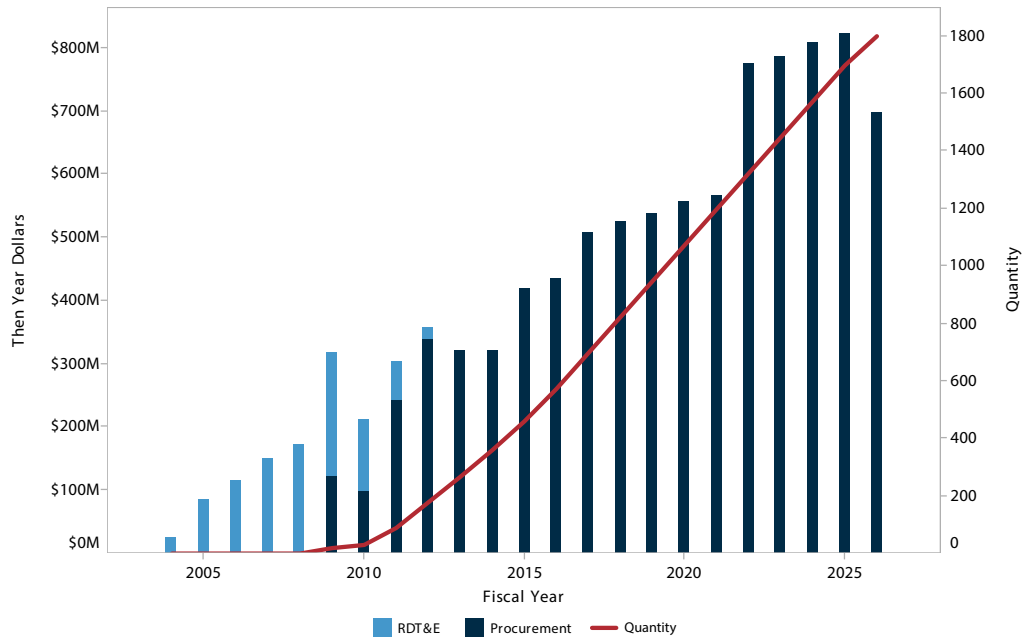
The PAC-3 missile is a high velocity hit-to-kill surface-to-air missile designed to intercept and destroy theater ballistic missiles, cruise missiles, and aircraft. The PAC-3 MSE is a follow-on to the PAC-3 missile. The PAC-3 MSE's improved performance is due to an improved solid rocket motor, more responsive control surfaces, and upgraded guidance software. The PAC-3 MSE is being integrated into existing Patriot systems, requiring only minor modifications to the existing hardware and utilizing the existing software. The system is on track to achieve initial operational capability in late 2016. A total of $2.55 billion has been appropriated through FY 2016, $2.44 billion was requested over the FY 2017 FDYP, and an additional $1.91 billion is planned for beyond the FYDP.[71]



71 2015 SARs.

Standard Missile-6 (SM-6)

The SM-6 Extended Range Active Missile (ERAM) is a sea-based surface-to-air missile designed to intercept aircraft and cruise missiles. The DoD recently revealed that the SM-6 can also be fired in an anti-surface warfare mode, providing Navy warships with an advanced anti-ship missile.[72] It is deployable from AEGIS cruisers and destroyers. The SM-6 ERAM is a multi-block program intended to keep pace with evolving threats through block upgrades. The SM-6 ERAM Block I achieved initial operating capability in November 2013. A total of $3.22 billion has been appropriated through FY 2016 to support the purchase of 573 missiles, $2.69 billion is requested for the FYDP for 625 missiles, and $3.89 billion is planned for beyond the FYDP to complete the total buy of 1800 missiles.[73]



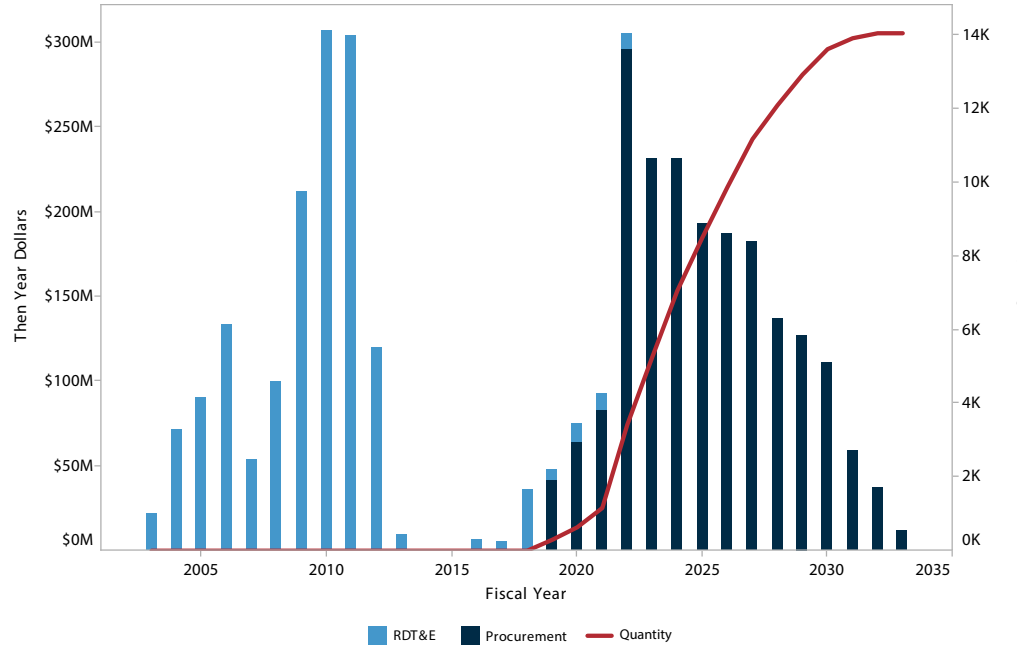
72 Sam LaGrone, "SECDEF Carter Confirms Navy Developing Supersonic Anti-Ship Missiles For Cruisers, Destroyers," *USNI News*, February 4, 2016.

73 2015 SARs.

Communications and Electronics

Airborne and Maritime/Fixed Station Joint Tactical Radio System (AMF JTRS)

The AMF JTRS program plans to streamline and standardize airborne radio systems by acquiring non-developmental, software-defined radios. In August 2015 the Army directed the program to close out the Small Airborne Link 16 Terminal (SALT) subprogram. As a result, SALT funding will be moved to the Small Airborne Networking Radio (SANR), which will connect commanders to Army aviation assets. The SANR subprogram expects to award a production contract in October 2017. The Capability Production Document (CPD) associated with the SALT subprogram is being revised, which will cause it to experience schedule breaches.[74] A total of $1.43 billion has been appropriated through FY 2016, and $256 million was requested over the FY 2017 FYDP. An additional $1.81 billion is planned for beyond the FDYP to complete the planned procurement of more than 14,000 radios.[75]

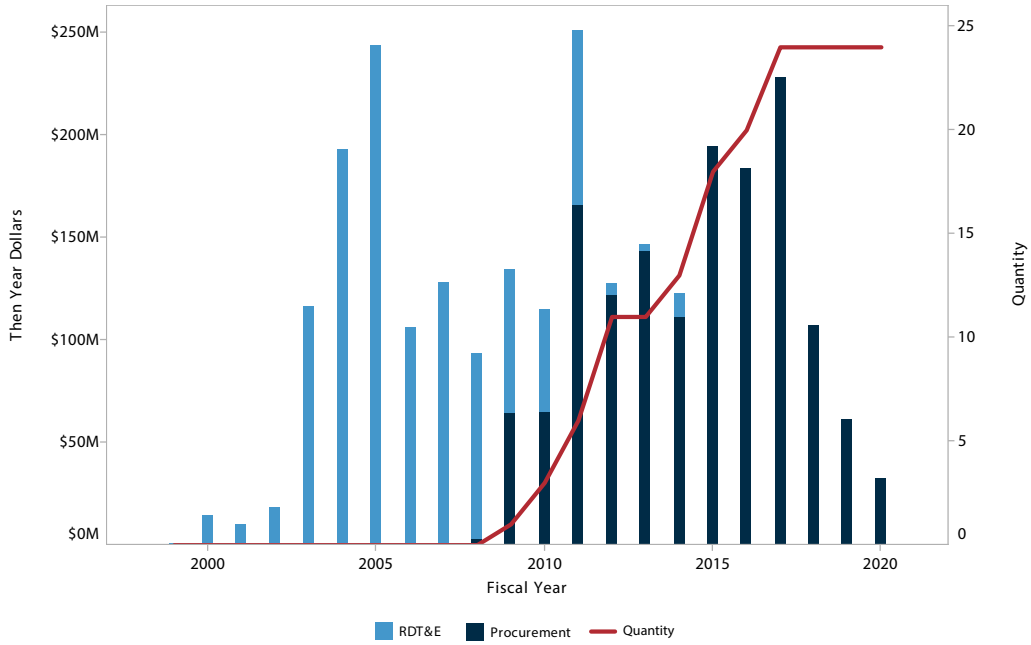


74 2015 SARs.

75 An additional 212 units were procured with RDT&E funding but are not included in the quantity line.

Airborne Warning and Control System Block 40/45 Upgrade

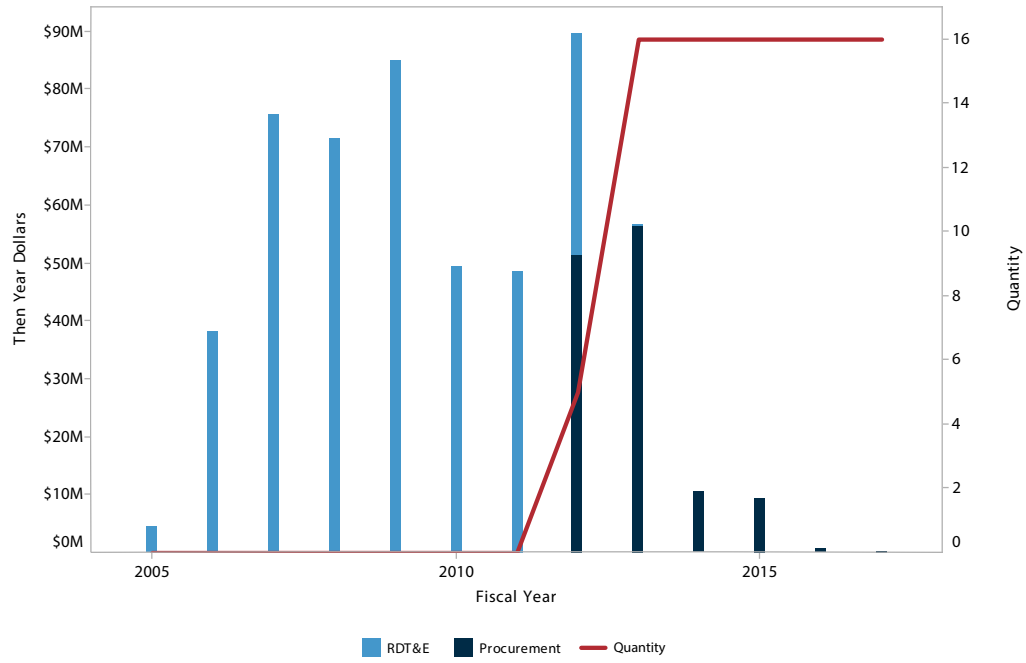
AWACS aircraft provide a mobile battle management, wide area surveillance, and C2 capability. The AWACS Block 40/45 upgrade program will improve target tracking capabilities and the radar's ability to distinguish friend from foe. It includes updated data processing, data link, and battle management tools. In FY 2013, the Block 40/45 upgrade program reported a significant Nunn-McCurdy breach primarily due to reducing the quantity of aircraft being upgraded from thirty-one to twenty-four. Ten of the planned upgraded aircraft, now designated the E-3G, were delivered as of December 2015, allowing the Air Force to declare initial operating capability. A total of $2.2 billion has been appropriated through FY 2016, and an additional $428.5 million was requested over the FY 2017 FYDP.[76]



76 2015 SARs.

B-2 Extremely High Frequency (EHF) SATCOM and Computer Increment 1

The B-2 EHF program will upgrade the B-2 to make it compatible with the future Advanced Extremely High Frequency (AEHF) satellite constellation. Increment 1 installs an upgraded protected satellite communications terminal compatible with both the AEHF constellation and the legacy MILSTAR constellation. It also provides the necessary fiber optic structure and processing power to support future B-2 upgrades.[77] A total of $540.2 million has been appropriated through FY 2016, and an additional $2 million was requested in the FY 2017 FYDP through program completion in FY 2017.[78]

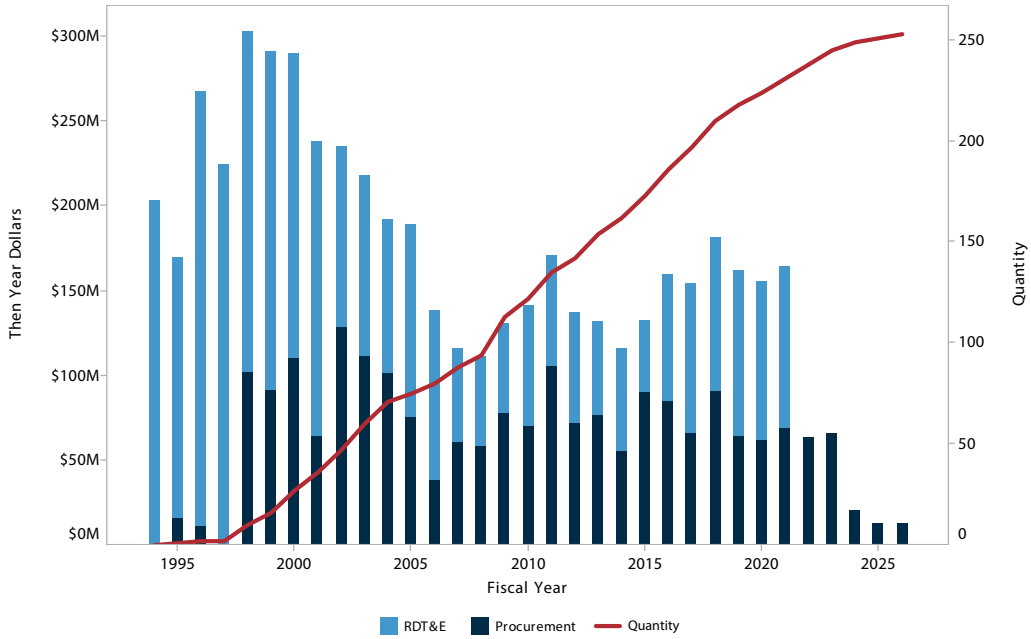


77 2015 SARs.

78 Funding for four of the twenty planned upgrades were paid for through RDT&E funding. That expenditure is reflected in the graph, but the quantity is not.

Cooperative Engagement Capability (CEC)

The CEC is a Navy-led program to increase overall naval air defense capabilities by integrating sensors and weapons into a single data distribution network offering improved situational awareness and increased intercept ranges. The CEC program is developing shipboard, airborne, Marine Corps ground mobile, Army JLENS, and foreign military sales variants. Both the shipboard and airborne variants are in full-rate production. The foreign military sales variants were deemed sensitive by the participating countries (United Kingdom, Australia, and Canada) and are not included in this SAR.[79] The Marine Corps variant has been fully procured.[80] A total of $4.31 billion has been appropriated through FY 2016 for 184 units, $817.1 million was requested over the FY 2017 FYDP for forty-five units, and $175.1 million is planned for beyond the FYDP to complete production at 253 units.[81]



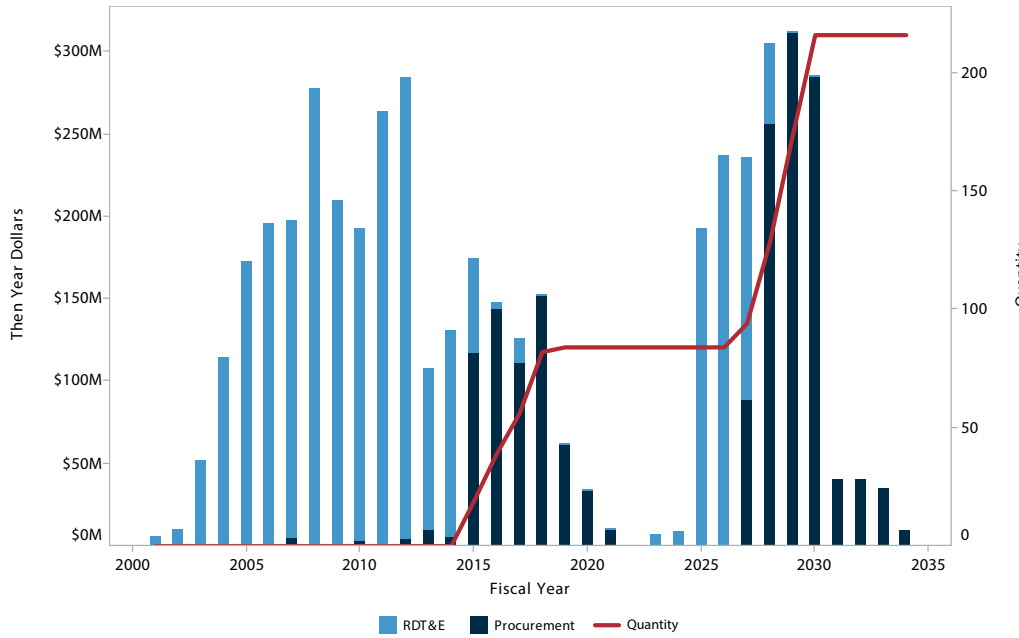
79 2015 SARs.

80 U.S. Marine Corps, "Composite Tracking Network (CTN)," *Concepts & Programs*, May 18, 2015.

81 Thirty units were procured with RDT&E funding, but are not included in the quantity line.

Family of Beyond Line-of-Sight Terminals (FAB-T)

The Air Force's FAB-T program is developing protected satellite communications terminals for airborne and ground-based users to replace legacy nuclear attack survivable terminals. FAB-T provides voice and data communications for conventional and nuclear forces using the new capabilities, improved data rates, and protection provided by the AEHF constellation of satellites.[82] In July 2015 Congress was notified that the FAB-T program will be restructured into the command post terminals (CPT) and Future and Emerging Technologies (FET) sub-programs. Currently the FET remains unfunded. The Air Force expects to complete a cost-capability analysis for the FET in 2017.[83] In mid-2014, the Air Force awarded the contract to produce the CPT to Raytheon.[84] The CPT is expected to reach initial operating capacity in December 2019.[85] A total of $2.54 billion has been appropriated through FY 2016 for the program, $385.2 million was requested over the FY 2017 FYDP, and $1.71 billion is planned for beyond the FYDP for the procurement of a total of 216 terminals over the life of the program.[86]



82 2015 SARs.

83 Courtney Albon, "Air Force expects FAB-T airborne terminal cost capability analysis in 2017," *Inside Defense*, June 3, 2016.

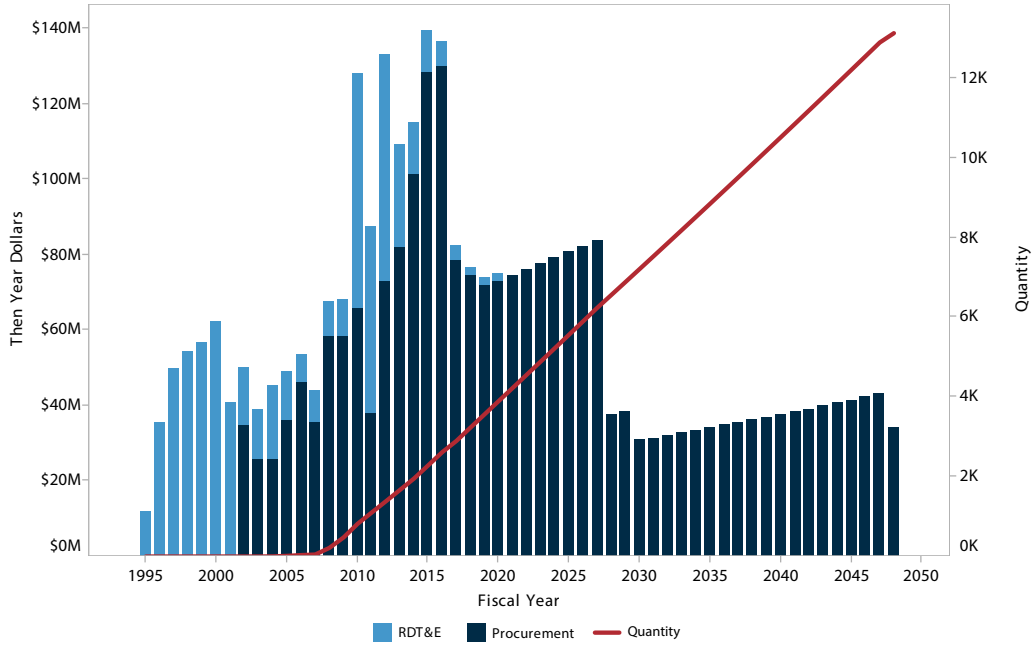
84 Joey Cheng, "Air Force switches contractors with $298M award for FAB-T satellite terminals," *Defense Systems*, June 4, 2014.

85 GAO, *Defense Acquisitions of Selected Weapon Programs*, pp. 139–140.

86 Fifty-one units (twenty-five CPTs and twenty-six FETs) were procured with RDT&E funding but are not included in the quantity line.

Integrated Defensive Electronic Countermeasures (IDECM)

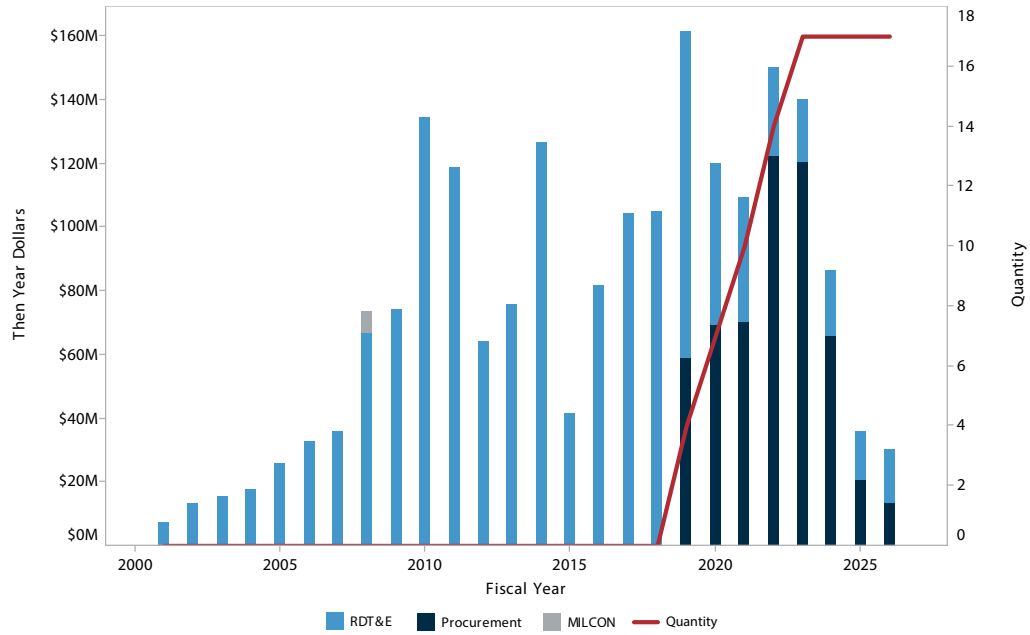
IDECM is a Navy program to design a radio frequency electronic countermeasure suite for the F/A-18 aircraft. The system is designed to receive and process signals from enemy radars and disrupt these signals using on-board and off-board jammers. Four IDECM variants are being developed with slightly different capabilities. The first three are only compatible with F/A-18E/F aircraft and the fourth variant is compatible with F/A-18C/D/E/F aircraft.[87] A total of $1.56 billion has been appropriated through FY 2016, $382.5million was requested over the FY 2017 FYDP, and $1.25 billion is planned for beyond the FYDP.



87 2015 SARs.

Joint Precision Approach and Landing System (JPALS)

JPALS is a Navy program to develop a GPS-based aircraft landing system for ships and airfields to replace the current radar-based systems. Increment 1A is the ship-based system and increment 1B will integrate JPALS onto sea-based aircraft. In 2013, the program reported a critical Nunn-McCurdy breach due in part to the elimination of ten training systems.[88] The program has been restructured and a Milestone B decision is expected in 2016.[89] A total of $938.2million has been appropriated through FY 2016, $599.6 million was requested over the FY 2017 FYDP, and $442.4million is planned for beyond the FYDP.[90]



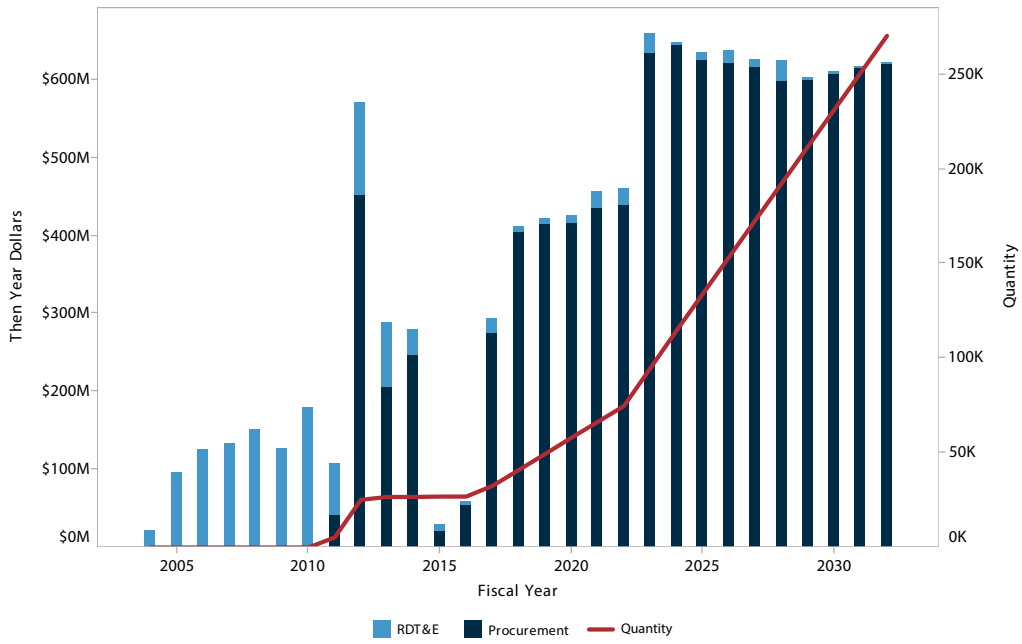
88 2015 SARs.

89 GAO, *Defense Acquisitions of Selected Weapon Programs*, pp. 101–102.

90 Ten systems were procured with RDT&E funding but are not included in the quantity line.

Joint Tactical Radio System Handheld, Manpack, and Small Form Fit Radios (JTRS HMS)

The JTRS HMS is an Army program to procure a family of software-defined radios that can create secure, self-forming, ad hoc voice and data networks. The program will procure multi-channel Manpack, single-channel Rifleman, and Small Form Fit radios.[91] The Army is considering altering the program to also acquire two-channel Rifleman radios, which would require a separate competition, but the Army believes it would not significantly delay the program.[92] The Army awarded contracts to General Dynamics, Harris Corp., and Rockwell Collins in February 2016 for thirty test radios each as the Army moves towards a full-rate production decision in FY 2018. The Army will downselect to, at most, two vendors.[93] The Pentagon's top weapons tester has identified cybersecurity vulnerabilities in both radio variants, although the Army states that it is fixing these vulnerabilities.[94] A total of $2.16 billion has been appropriated through FY 2016, $2.01 billion was requested over the FY 2017 FYDP, and $6.74 billion is planned for beyond the FYDP for a total procurement of more than 270,000 radios.[95]



91 2015 SARs.

92 Ellen Mitchell, "Army Mulling Over Option of Two-Channel Handheld Rifleman Radio," *Inside Defense*, February 1, 2016.

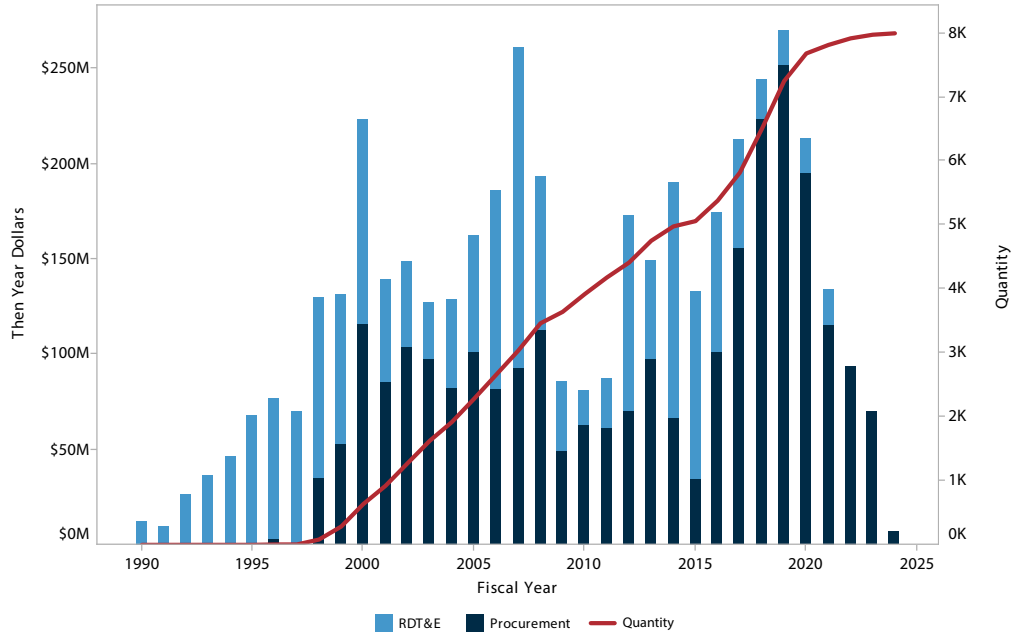
93 Courtney McBride, "Army taps three vendors for Manpack radio testing phase," *Inside Defense*, February 29, 2016.

94 Ellen Mitchell, "Pentagon Finds Cyber Vulnerabilities in Army Vehicular, Handheld Radios," *Inside Defense*, February 8, 2016.

95 Some 833 radios were procured with RDT&E funding but are not included in the quantity line.

Multifunctional Information Distribution System (MIDS)

The MIDS program is a multinational (United States, France, Germany, Italy, and Spain) program to develop lightweight tactical radios for U.S. and allied aircraft, ships, and ground sites. The Navy is leading the U.S. portion of the program. The MIDS Joint Tactical Radio System (MIDS-JTRS) is intended for U.S. military use and provides additional capabilities over the MIDS variant developed by international partners. Both terminals are in production, and the MIDS-JTRS has been approved for sale to many foreign countries, including Belgium, Canada, Poland, South Korea, and Japan.[96] A total of $3.25 billion has been appropriated through FY 2016, $1.07 billion was requested over the FY 2017 FYDP, and $170 million is planned for beyond the FYDP for a total procurement of 8,000 radios.[97]

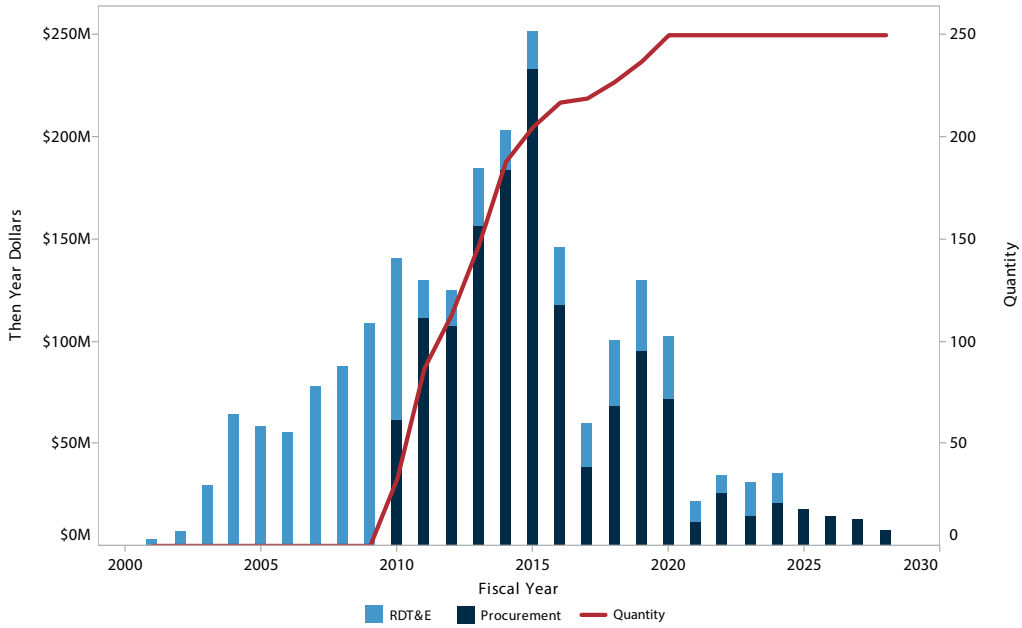


96 2015 SARs.

97 604 MIDS radios were procured with RDT&E funding, but are not included in the quantity line.

Navy Multiband Terminal (NMT)

The NMT is a multiband SATCOM terminal for naval forces. The NMT will be capable of communicating using the DSCS, WGS, MILSTAR, and AEHF satellite constellations. The program is in full-rate production, having completed 101 of 250 terminals, and preparing for follow-on operational testing and evaluation in the third quarter of FY 2016.[98] A total of $1.67 billion has been appropriated through FY 2016, $413.1 million was requested over the FY 2017 FYDP, and $152.8 million is planned for beyond the FYDP.[99]

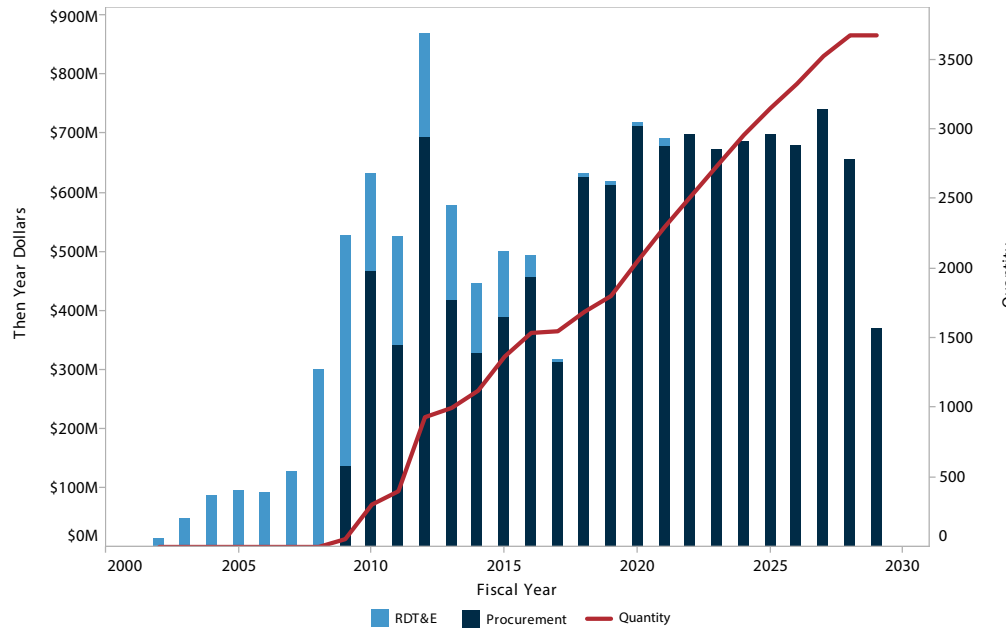


98 2015 SARs.

99 Twenty-eight NMT terminals were procured with RDT&E funding but are not reflected in the quantity line.

Warfighter Information Network-Tactical (WIN-T)

WIN-T is a multi-increment program that provides mobile self-forming high-speed and high-capacity networking to units at the company level. Increment 2 was approved for full-rate production in June 2015.[100] In part due to space and power constraints, the Army is struggling to integrate the WIN-T system onto its tracked vehicles.[101] The Increment 3 subprogram was restructured in 2014, turning the program into a software development program only. The restructured Increment 3 subprogram will focus on developing network operations software and two new waveforms that can be inserted into Increment 2 equipped units. Increment 2 quantities and capabilities have been adjusted to cover the fielding requirements of the Increment 3 subprogram.[102] The reduction of the Increment 3 subprogram and the associated expansion of the Increment 2 subprogram caused the Increment 2 subprogram to report a significant Nunn-McCurdy breach in 2014.[103] A total of $5.33 billion has been appropriated through FY 2016, $2.98 billion was requested for the FY 2017 FYDP, and $5.2 billion is planned for beyond the FYDP.[104]



100 "General Dynamics' WIN-T Increment 2 Cleared for $8.3B Production Run," *Inside Defense,* June 8, 2015.

101 Ellen Mitchell, "Pentagon's Chief Weapons Tester Worried Over Win-T Aboard Army Vehicles," *Inside Defense*, February 1, 2016.

102 2015 SARs.

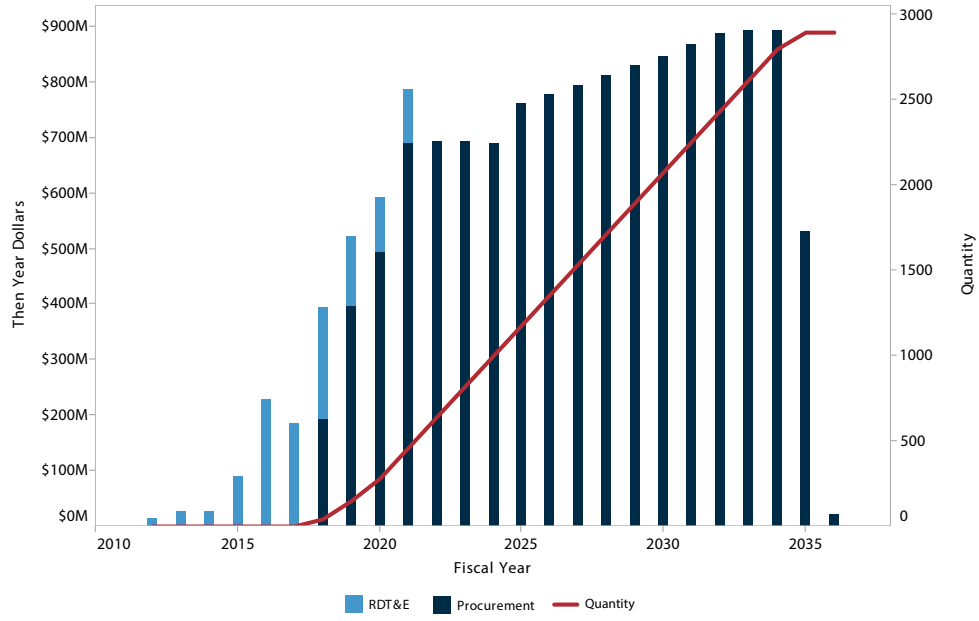
103 DoD, "Department of Defense Selected Acquisition Reports (SARs) (as of December 31, 2014)," Press Operations Release NR-090-15, March 19, 2015.

104 Fifty-six WIN-T Increment 2 units were procured with RDT&E funding but are not included in the quantity line.

Ground Systems

Armored Multi-Purpose Vehicle (AMPV)

The AMPV program will replace the M113 family of vehicles and fulfill medical treatment/evacuation, mission command, general purpose, and mortar carrier roles with 2,897 new vehicles at the armored brigade combat team level and below. In December 2014, BAE was awarded a cost plus incentive fee engineering and manufacturing development contract. The program completed its preliminary design review in June 2015. The AMPV, however, will use some software that is in development for another program, so any delays in that program could impact the AMPV software delivery schedule.[105] The program acquisition strategy is based on utilizing derivatives of existing military vehicles and not requiring the development of new technology in order to manage overall program risk. In June 2016, the program passed its critical design review suggesting that the vehicle design is stable, meets its performance requirements, and can be executed within the program's current budget.[106] A total of $381.4 million has been appropriated through FY 2016, $2.48 billion was requested over the FY 2017 FYDP, and $10.98 billion is planned for beyond the FYDP.[107]



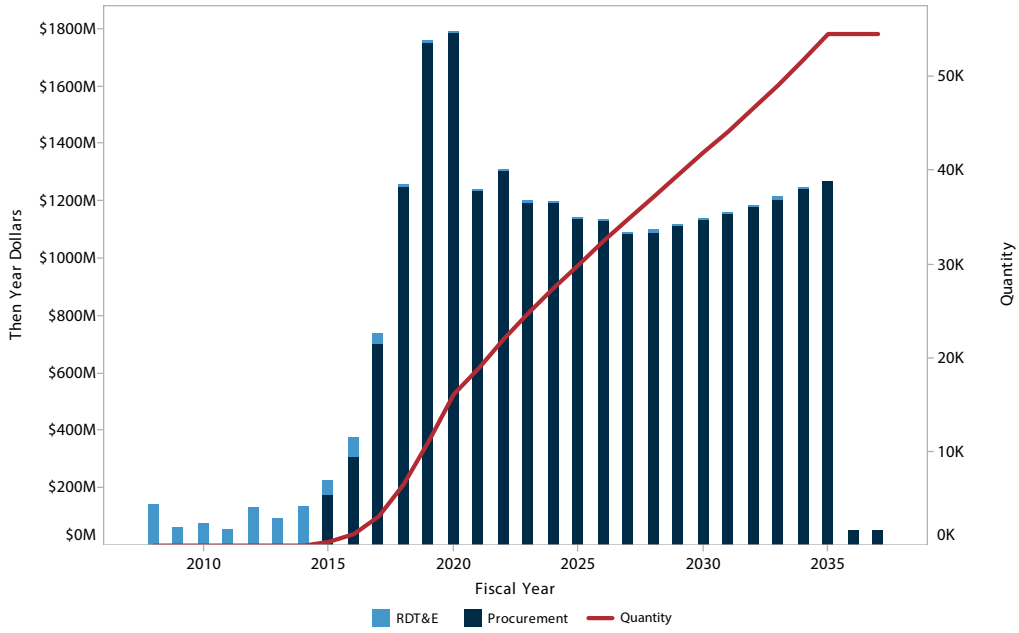
105 GAO, *Defense Acquisitions of Selected Weapon Programs*, pp. 65–66.

106 Jason Sherman, "Armored Multi-Purpose Vehicle program clears key EMD milestone," *Inside Defense*, July 1, 2016.

107 Thirty-nine AMPV vehicles will be procured with RDT&E funding but are not included in the quantity line.

Joint Light Tactical Vehicle (JLTV)

This Army-led program is intended to replace part of the fleet of High Mobility Multipurpose Wheeled Vehicles (HMMWVs) used by the Army and Marine Corps. The JLTV will provide better protection for passengers and has greater payload capacity than the up-armored HMMWV. It will be produced in a two-seat and four-seat variant with the two-seat variant supporting a higher payload capacity of 5,100 pounds versus 3,500 pounds for the four-seat variant.[108] In August 2015, Oshkosh Corporation was awarded a firm fixed-price production contract. The Army and Marine Corps expect the JLTV to achieve initial operational capability in 2019.[109] A total of $1.29 billion has been appropriated through FY 2016, $6.78 billion was requested over the FY 2017 FYDP, and $16.6 billion is planned for beyond the FYDP for a total projected buy of 54,599 vehicles through FY 2037.[110]



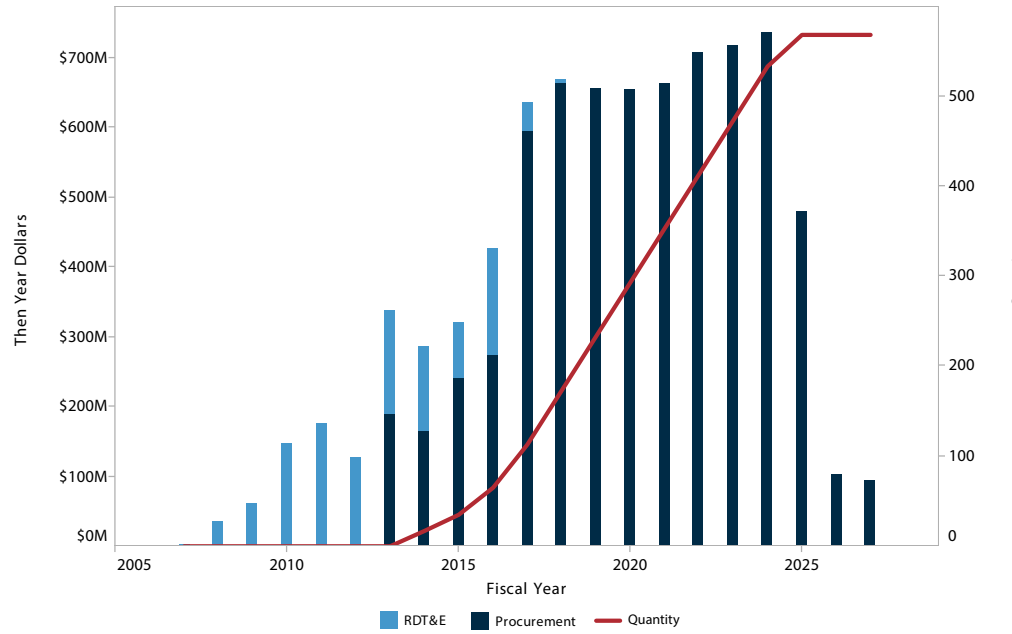
108 2015 SARs.

109 U.S. Army, "JLTV Enters Low Rate Production," August 25, 2016, http://www.army.mil/article/154425/JLTV_enters_low_rate_production/.

110 115 vehicles were procured with RDT&E funding but are not included in the quantity line.

Paladin Integrated Management (PIM)

The Army's PIM program is producing two new ground vehicles: a self-propelled 155mm howitzer and a tracked ammunition carrier to replace the current M109A6 Paladin and the M992A2 Field Artillery Ammunition Supply Vehicle. The previous upgrade to the M109A6 variant rebuilt the turret. This program will rebuild the hull, effectively resulting in procuring a new howitzer in two phases. The upgraded vehicles will provide improved protection and sustainability over the current variant by including a new hull and modernized electrical system, as well as by incorporating modified versions of the power train, suspension, and tracks from the Bradley Infantry Fighting Vehicle. The systems developed for the PIM program will support future upgrades to the Bradley and the AMPV program, resulting in significant commonality amongst Army vehicle programs. The first production vehicles were delivered in 2015 with operational testing scheduled for 2016.[111] The full-rate production decision is scheduled for the second quarter of FY 2017. The first units should be equipped with the upgraded howitzers in 2017.[112] A total of $1.92 billion has been appropriated through FY 2016. An additional $3.28 billion was requested over the FY 2017 FYDP, and $2.84 billion is planned for beyond the FYDP.[113]



111 Sydney Freedberg, "Paladin PIM: The Little Cannon That Could & The Future Of The Armored Brigade," *Breaking Defense*, April 6, 2015.

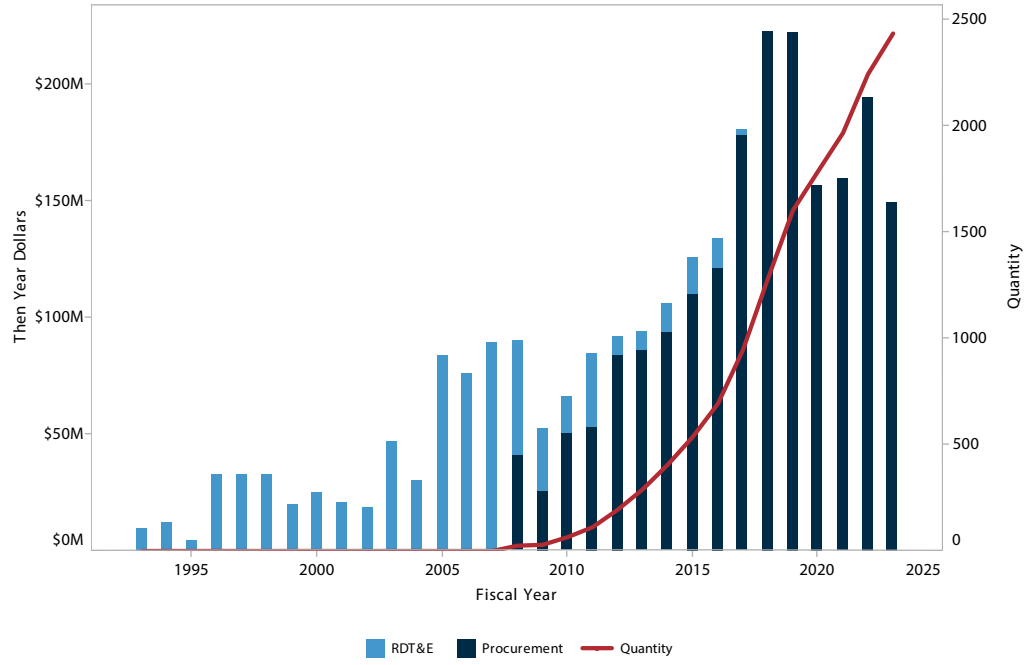
112 2015 SARs.

113 Two PIM systems were procured with RDT&E funding but are not included in the quantity line.

Missiles and Munitions

AGM-88E Advanced Anti-Radiation Guided Missile (AARGM)

The AGM-88E is an air-to-surface missile for targeting enemy air defenses. The AARGM program upgrades the guidance and control mechanisms of the existing AGM-88 High Speed Anti-Radiation Missile (HARM) propulsion and warhead sections. The AARGM can also transmit weapon impact assessment data via satellite. The AARGM will be compatible with the F/A-18C/D/E/F, EA-6B, EA-18G, F-16C/J, and F-35 (external carriage).[114] The Navy plans to procure a total of 2,435 missiles through FY 2023. A total of $1.38 billion has been appropriated through FY 2016, and $941.2 million was requested over the FY 2017 FYDP. The FY 2017 budget also includes a request for funding for development and procurement of the AARGM Extended Range (AARGM-ER) program; that funding is not included in the chart below as the program will be run separately.[115]

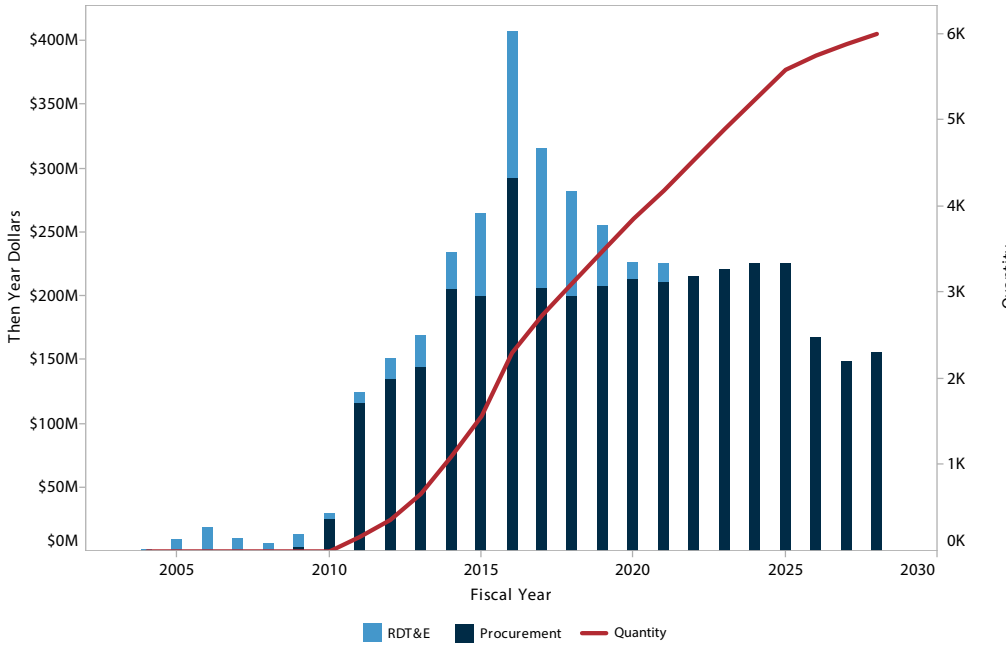


114 2015 SARs.

115 Forty AGM-88E AARGM missiles were procured with RDT&E funding but are not included in the quantity line.

AIM-9X Block II Air-to-Air Missile

The AIM-9X Block II is a Navy-led program to acquire short-range air-to-air missiles for the F-15, F-16, F-18, F-22A, and F-35 aircraft. The Block II variant includes hardware and software upgrades to improve the range from which the missile can engage and discriminate among targets. The most significant upgrade allows the Block II missiles to engage targets its seeker can't see at launch using targeting data from the launching fighter. Additionally, the range upgrades to the Block II provide some beyond-visual-range capabilities. The program entered full-rate production in September 2015.[116] A total of $1.44 billion has been appropriated through FY 2016, $1.3 billion was requested over the FY 2017 FYDP, and $1.36 billion is planned for beyond the FYDP for a total procurement quantity of 6,000 missiles.[117]

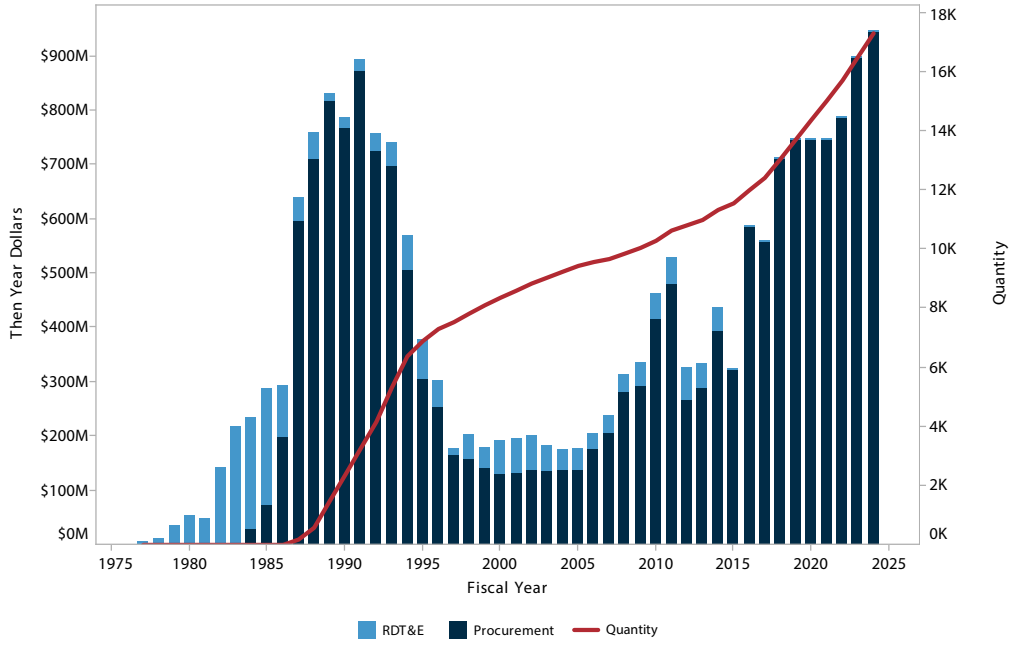


116 Richard Scott, "First Full-Rate Production Contract for AIM-9X Sidewinder Block II," *Jane's Missiles & Rockets*, September 28, 2015.

117 2015 SARs.

AIM-120 Advanced Medium Range Air-to-Air Missile (AMRAAM)

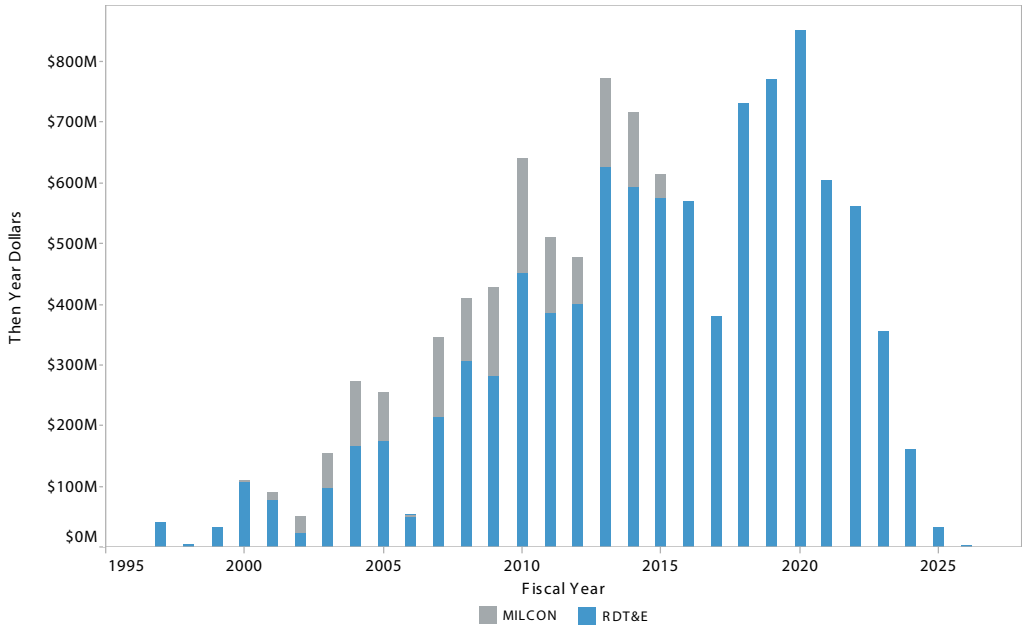
The AMRAAM is an Air Force-led program to acquire an advanced medium-range air-to-air missile. The AIM-120, designed to replace the AIM-7 Sparrow, is an active radar-guided missile with electronic protection capabilities. The AIM-120D has improved accuracy, network compatibility, and electronic protection, and it achieved IOC with the Air Force and Navy in January 2015.[118] A total of $13.75 billion has been appropriated through FY 2016, $3.52 billion was requested over the FY 2017 FYDP, and $2.63 billion is planned for beyond the FYDP for a total procurement of 17,312 missiles.



118 2015 SARs.

Chemical Demilitarization-Assembled Chemical Weapons Alternatives (Chem Demil-ACWA)

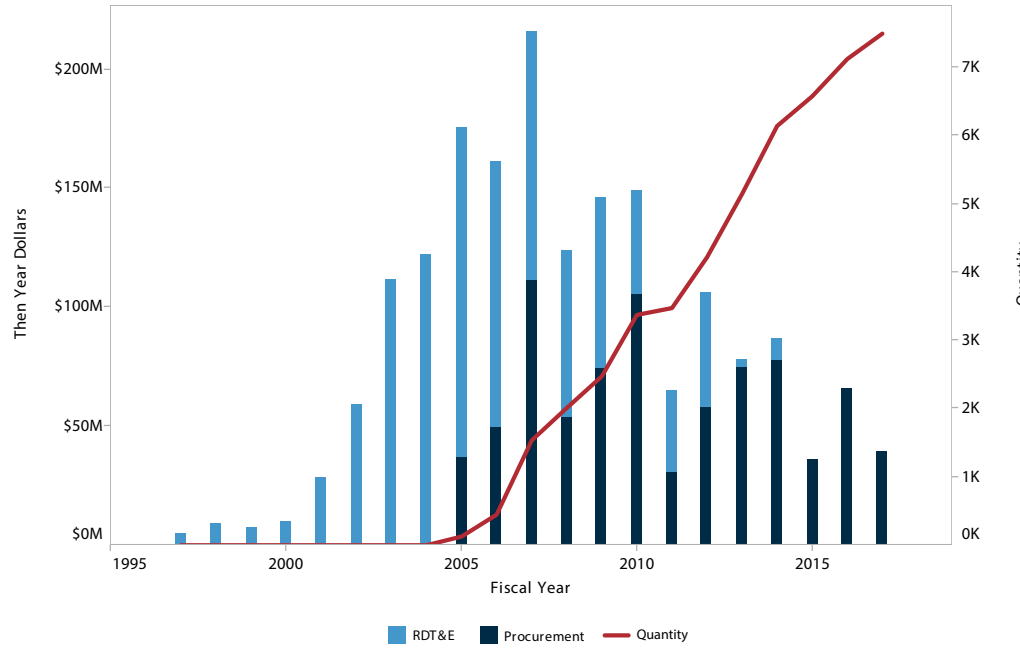
This DoD-wide program is employing two different technologies to eliminate stockpiles of chemical weapons. It is in the process of building fixed-base, single-use systems at the Pueblo Chemical Depot in Colorado and the Blue Grass Army Depot in Kentucky. The Colorado facility should complete its operations in late 2022, and the Kentucky facility should complete its operations in mid-2025. A total of $6.55 billion has been appropriated through FY 2016, $3.34 billion was requested over the FY 2017 FYDP, and $1.11 billion is planned for beyond the FYDP.[119]



119 2015 SARs.

Excalibur Precision 155mm Projectiles (Excalibur)

The Army's Excalibur projectile is a GPS-based fire-and-forget 155mm artillery munition intended to extend the range of artillery ammunition to 40.5 kilometers and improve its accuracy to within 3 meters. The Excalibur projectile can be fired by the M77A2, M109A6, M109A7, and Swedish Archer howitzers. The near vertical angle of the round's descent is supposed to minimize collateral damage and improve effectiveness in urban environments. Increments Ia-1 and Ia-2 are in use. Increment Ib is designed to increase reliability and reduce costs further.[120] After exceeding the Army's reliability, lethality, and range requirements, the Increment Ib projectile entered full-rate production in July 2014.[121] Several countries have purchased or plan to purchase Increment Ib projectiles including Jordan, Germany, Canada, and Sweden. A total of $1.76 billion has been appropriated through FY 2016, and $39.2 million was requested in the FY 2017 FYDP through the projected end of the program that year.[122]



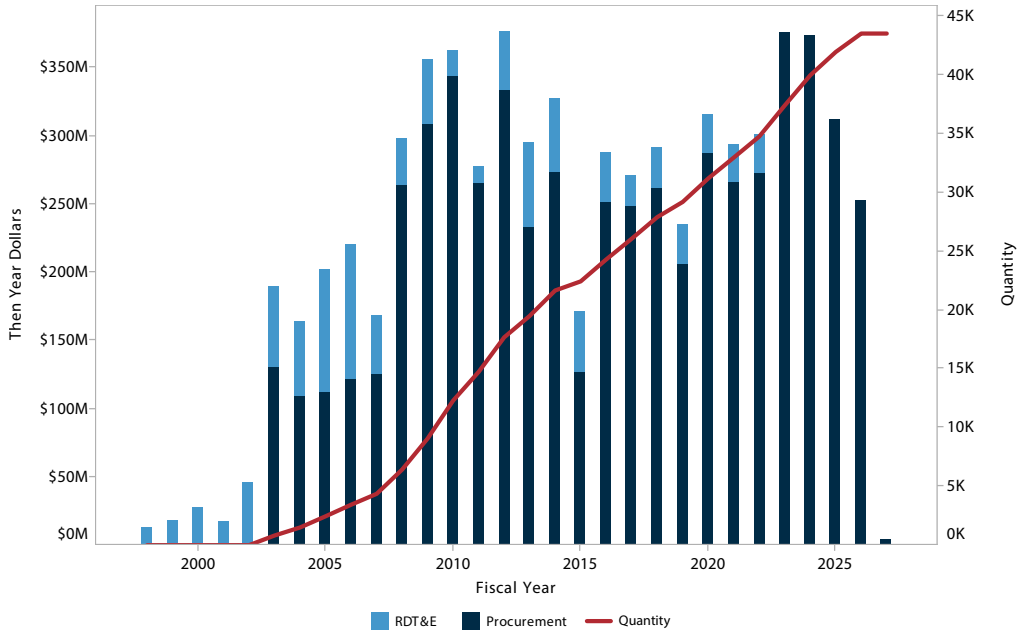
120 2015 SARs.

121 Raytheon, "Excalibur IB Enters Full Rate Production and Receives $52 Million Award," press release, July 31, 2014.

122 544 projectiles were procured with RDT&E funding but are not included in the quantity line. The $69 million contributed by the Kingdom of Sweden for system development is included in the figures and chart above.

Guided Multiple Launch Rocket System/Guided Multiple Launch Rocket System Alternative Warhead (GMLRS/GMLRS AW)

This Army-led program is developing and procuring rockets designed to attack targets using indirect and precision fires out to roughly 70 kilometers. GMLRS uses a solid propellant rocket and an inertial measurement unit with GPS assistance for guidance. It can be fired either from the M270A1 tracked vehicle or the High Mobility Artillery Rocket System (HIMARS) mobile launch vehicle. It is currently fired with either cluster munitions for personnel and thinly-armored vehicles or a 200-pound unitary warhead designed to limit collateral damage. The alternative warhead (AW) will replace the cluster munition warhead due to the impending entry into force of the Cluster Munitions Ban.[123] In 2016, Jordan and Finland purchased GMLRS AW rockets. A total of $3.81 billion has been appropriated through FY 2016, $1.4 billion was requested over the FY 2017 FYDP, and $1.62 billion is planned for beyond the FYDP.[124]

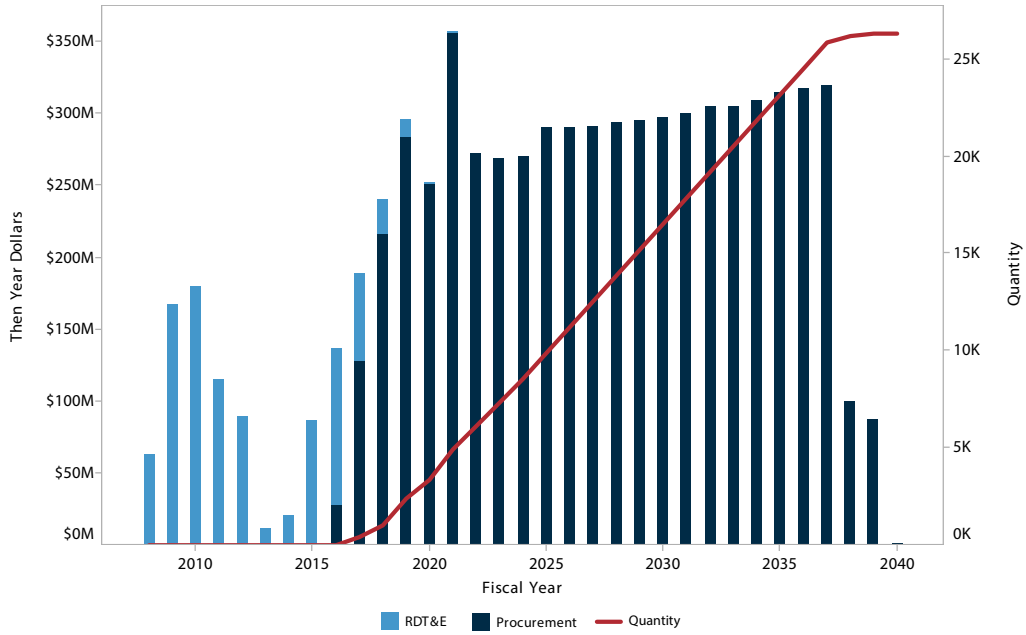


123 2015 SARs.

124 376 GMLRS rockets were procured with RDT&E funding but are not included in the quantity line.

Joint Air-to-Ground Missile (JAGM)

This Army-led program will develop the next-generation air-launched ground attack missile to replace the Hellfire and Longbow missiles. In January 2016, the program completed its critical design review. A low-rate production decision is scheduled for July 2017.[125] A total of $870.7 million has been appropriated through FY 2016, $1.3 billion was requested over the FY 2017 FYDP for the procurement of 4,931 missiles, and $4.93 billion is planned for beyond the FYDP for the procurement of 21,388 missiles.[126]

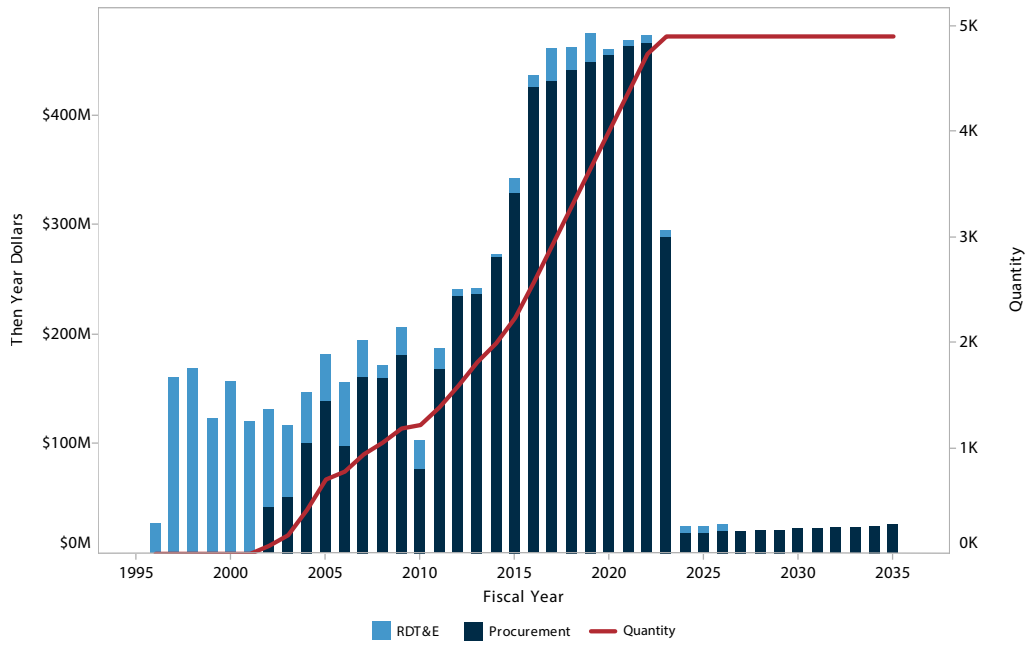


125 2015 SARs.

126 118 of the 26,437 JAGM missiles in the program were procured with RDT&E funding but are not included in the quantity line.

Joint Air-to-Surface Standoff Missile/JASSM-Extended Range (JASSM/JASSM-ER)

The Air Force-run JASSM/JASSM-ER program is developing the next generation low-observable, subsonic cruise missile. It is designed to carry a 1000-pound warhead with ranges greater than 200 nautical miles (for JASSM) or 500 nautical miles (for JASSM-ER). JASSM is accurate within 3 meters when using the imaging infrared seeker and within 13 meters when only using the GPS/INS navigation system.[127] JASSM and JASSM-ER give fighters and bombers the ability to strike heavily defended targets from greater distances than current munitions allow. The two missiles share 70 percent of the same hardware and 95 percent of the same software. The JASSM-ER entered full-rate production in December 2014.[128] A total of $3.89 billion has been appropriated through FY 2016, $2.33 billion was requested over the FY 2017 FYDP, and $1.05 billion is planned for beyond the FYDP.[129]



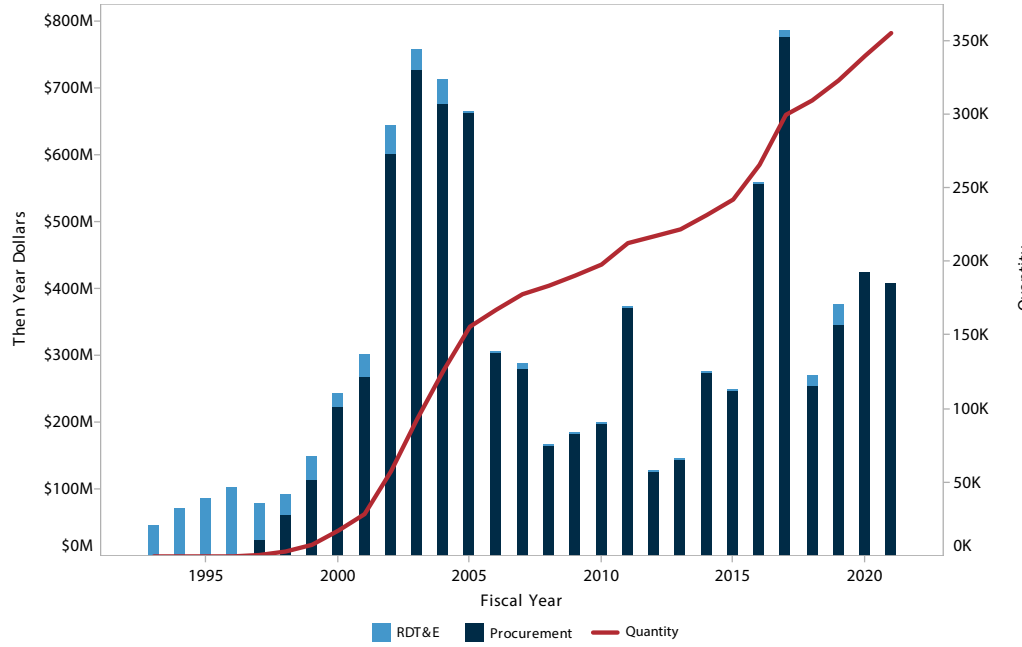
127 2015 SARs.

128 "JASSM Moves to Full-Rate Production," *Inside Defense*, December 15, 2014.

129 Eighty-seven JASSM missiles and thirty-one JASSM-ER missiles were procured with RDT&E funding but are not included in the quantity line.

Joint Direct Attack Munition (JDAM)

The JDAM program is a joint Air Force–Navy effort to upgrade the existing inventory of general-purpose bombs with GPS and inertial navigation tailkits to improve accuracy under all weather conditions. JDAM bombs can be employed on a variety of aircraft, including the B-52H, B-2A, B-1B, F-16C/D, F/A-18A+/C/D/E/F, F-15E, A-10C, AV-8B, and the F-22A.[130] Integration with the MQ-9 and F-35 is in progress. Laser sensors are also being incorporated onto some JDAMs to improve the bomb's ability to attack mobile targets while minimizing collateral damage.[131] A total of $6.83 billion has been appropriated through FY 2016, and $2.27billion was requested over the FY 2017 FYDP. No additional funding is projected beyond the FYDP.[132]



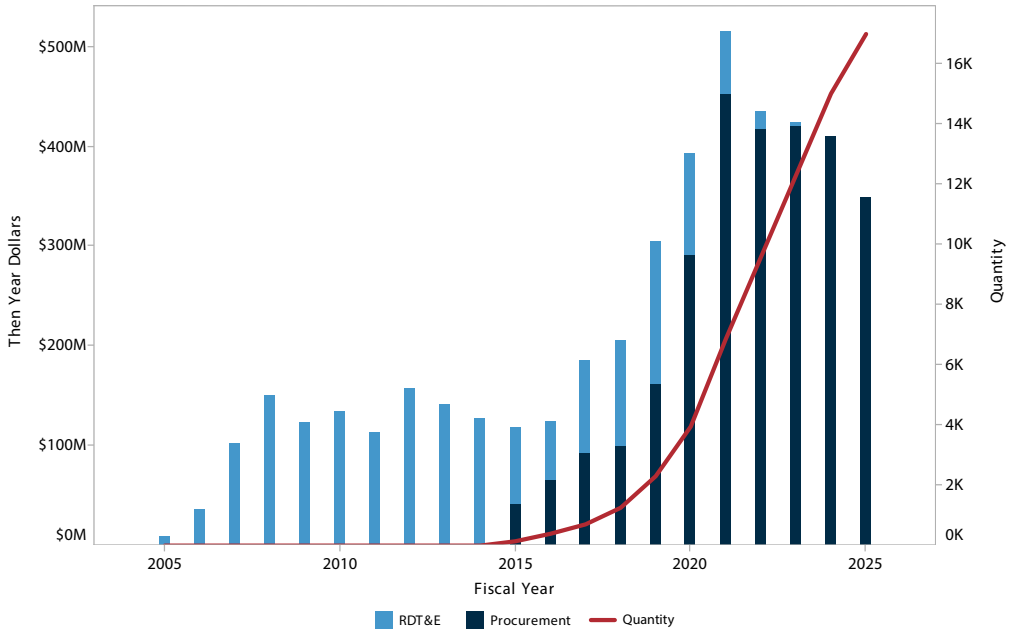
130 2015 SARs.

131 Boeing, "Boeing Receives Additional Laser JDAM Contract from US Navy," press release, April 17, 2012.

132 804 JDAMs were procured with RDT&E funding but are not included in the quantity line.

Small Diameter Bomb Increment II (SDB II)

The Air Force's SBD II is an all-weather air-to-ground glide bomb for use against mobile targets. It uses radar, infrared, and laser sensors to track targets. As funding becomes available, the SDB II will be integrated with the F-15E, F-35, F/A-18E/F, F-16, F-22A, B-1B, B-2, B-52, A-10, MQ-9, and AC-130.[133] The SDB II program was approved for low-rate initial production in May 2015.[134] A total of $1.34 billion has been appropriated through FY 2016, $1.6 billion is requested for the FYDP, and $1.62 billion is planned for beyond the FYDP.[135]



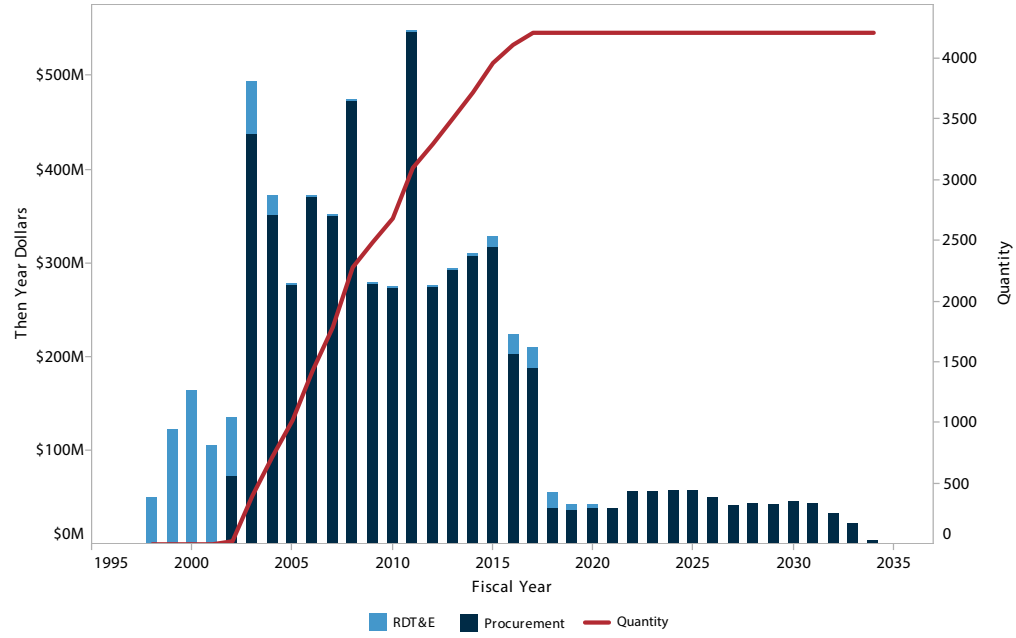
133 2015 SARs.

134 Colin Clark, "Raytheon Wins Small Contract for Huge Program: SDB II Exports by 2018," *Breaking Defense*, June 19, 2015.

135 163 SDB II bombs were procured with RDT&E funding but are not included in the quantity line.

Tactical Tomahawk (TACTOM)

Tactical Tomahawk (TACTOM) is a Navy cruise missile designed to destroy fixed and mobile targets at a range of up to 1,000 miles. The Block IV design includes improved navigation and anti-jam GPS, the ability to re-target in-flight, a loitering capability, and the ability to send a single-frame battle-damage assessment image of overflown areas.[136] The FY 2017 budget request included funding to replace Tomahawks that have been expended during combat operations. Continued procurement funding sustains the industrial base to support unplanned maintenance requirements, and additional funds may be allocated to replace expended weapons. As of February 2016, 3,636 TACTOMs have been delivered. A total of $5.45 billion has been appropriated through FY 2016, $386.8 million was requested over the FY 2017 FYDP, and $553.4 million is planned for beyond the FYDP.[137]



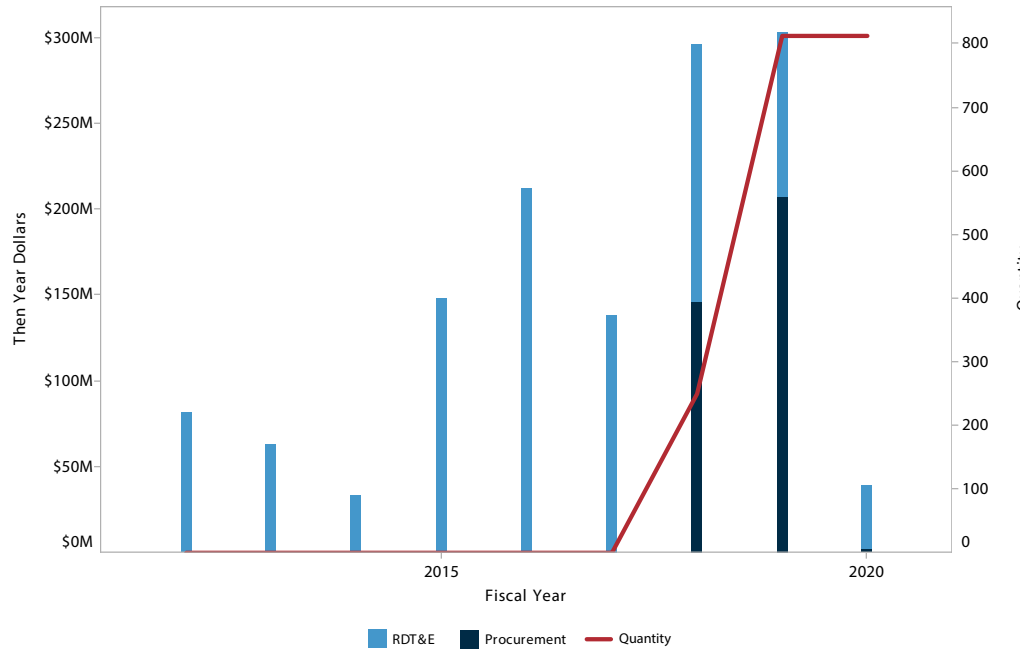
136 2015 SARs.

137 Ten TACTOM missiles were procured with RDT&E funding but are not included in the quantity line.

Nuclear Forces

B61 Mod 12 Life Extension Program Tailkit Assembly

The B61 modernization program will consolidate four variants of the existing B61 air-delivered nuclear gravity bomb—the Mod 3, Mod 4, Mod 7, and Mod 10—into one Mod 12 version with a variable yield and an extended service life.[138] It is a joint DoD–Department of Energy (DoE) program. The Air Force-led DoD portion of the modernization effort adds a tailkit to the bomb to improve its accuracy, reducing the yield required to destroy a target.[139] The program expects a low-rate initial production decision in late-2018. For DoD's share of the program, a total of $537.4 million has been appropriated through FY 2016, and $776 million was requested in the FY 2017 FYDP through program completion in 2020. These figures do not include DoE's share of the program's funding.

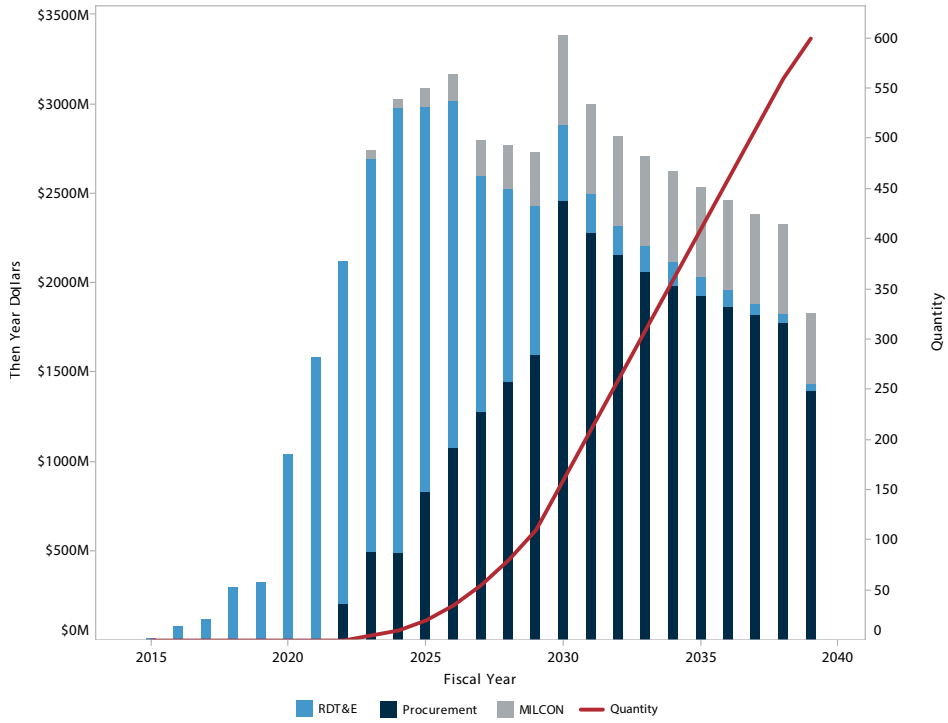


138 Jeffrey Lewis, "B61 Mod 12 LEP," *Arms Control Wonk*, blog, October 13, 2008; and "B61 nuclear bomb," *Jane's Strategic Weapons Systems*, June 18, 2014.

139 2015 SARs.

Ground Based Strategic Deterrent (GBSD)

The GBSD is designed to replace the Minuteman III ICBM. The Air Force is currently funding a development program, which is in the technology maturation and risk reduction phase. The project is structured to deliver a fully integrated system in the late 2020s.[140] The GBSD, however, does not yet have a public SAR. Using the RDT&E funding identified in the FY17 budget request and assuming that roughly $15.36 billion in additional development funding will be needed in FY 2022 and beyond, the total RDT&E cost of the program will likely total $18.78 billion in then-year dollars.[141] Assuming an average procurement unit cost of $33.66 million in FY 2017 dollars for roughly 600 missiles, the total procurement cost would be roughly $27.11 billion in then-year dollars. The total program cost will likely be roughly $51.89 billion in then-year dollars.[142]



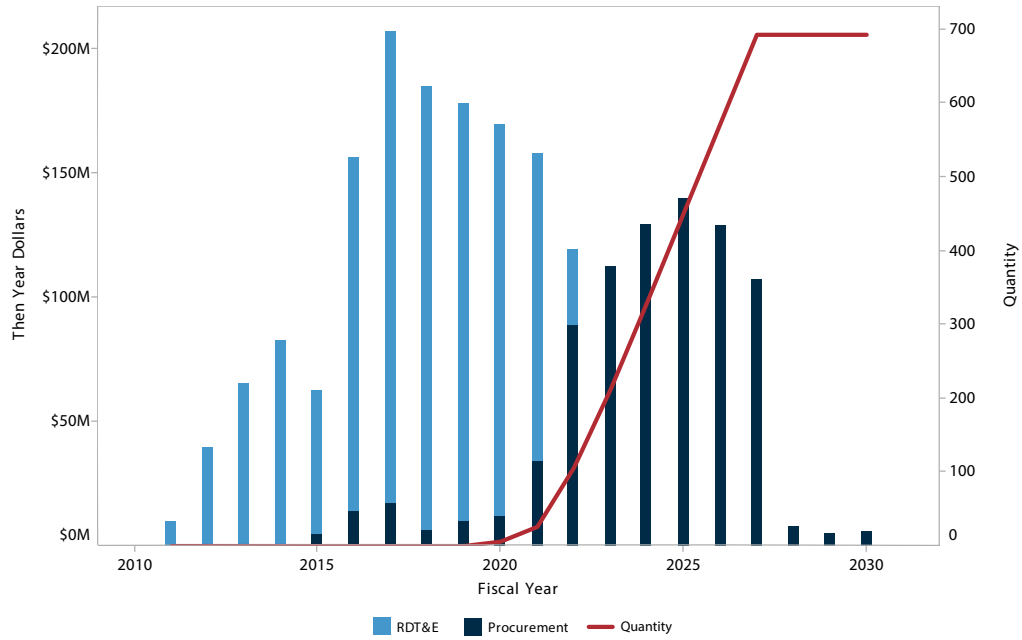
140 DoD, *Department of Defense Fiscal Year (FY) 2017 President's Budget Submission*, Air Force Justification Book Volume 2, *Research, Development, Test & Evaluation*, Vol-II (Washington, DC: DoD, February 2016).

141 RDT&E requirements were assumed to be in line with the 2006 LBSD analysis of alternatives. *The Future of the U.S. Intercontinental Ballistic Missile Force* (Santa Monica, CA: RAND, 2014).

142 This estimate is derived from Todd Harrison and Evan Montgomery, *The Cost of U.S. Nuclear Forces* (Washington, DC: Center for Strategic and Budgetary Assessments, 2015).

Intercontinental Ballistic Missile Fuze Modernization (ICBM Fuze Mod)

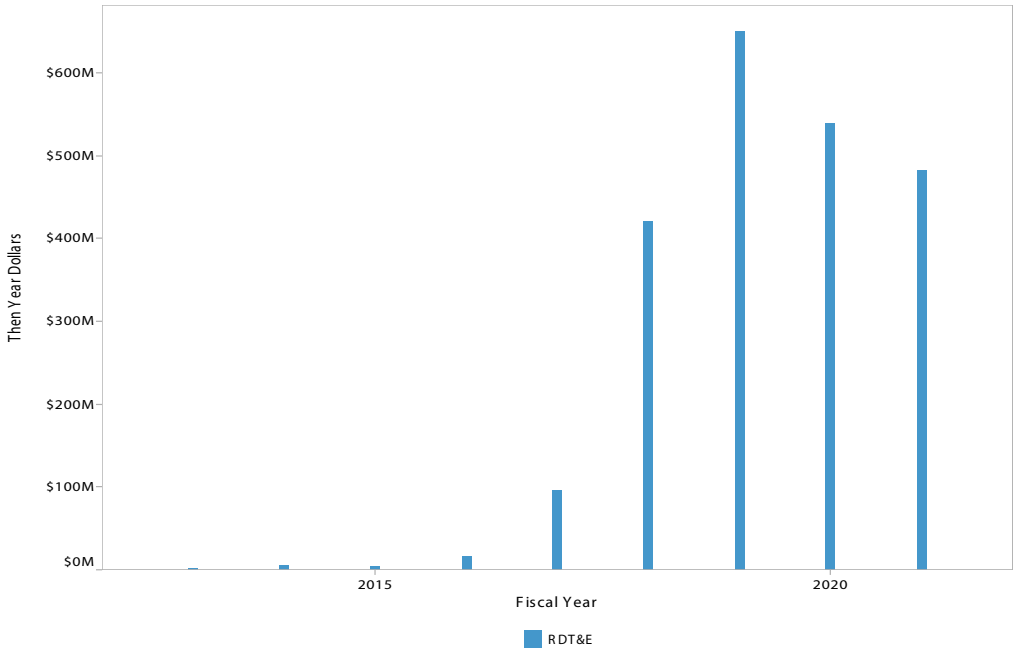
This ICBM fuze modernization program will develop and procure a replacement for the legacy Mk21 arming and fuzing assembly in the W87 warhead on the Minuteman III ICBMs. Current fuzes have been in service three times longer than their designed service life. The new fuze, with a thirty-year service life, will meet the requirements of the current generation Minuteman III missiles as well as the planned replacement missile—the Ground Based Strategic Deterrent. A total of $416.1 million has been appropriated through FY 2016, $897 million is requested through the FYDP, and an additional $756.8 million is planned for beyond the FYDP.[143]



143 2015 SARs. Eighty-eight ICBMs were procured through RDT&E funding but are not included in the quantity line.

Long Range Standoff Weapon (LRSO)

The LRSO is designed to replace the AGM-86B nuclear-capable air-launched cruise missile.[144] The Air Force released a request for proposals in July 2017, and up to two awards are expected in late 2017. The LRSO should begin entering service by 2030.[145] The LRSO, however, does not yet have a public SAR or a formal cost estimate, and there is insufficient official information to create a reliable cost estimate. The graph below only includes RDT&E funding for the program as reported in the *FY 2017 PB Submission*.[146]



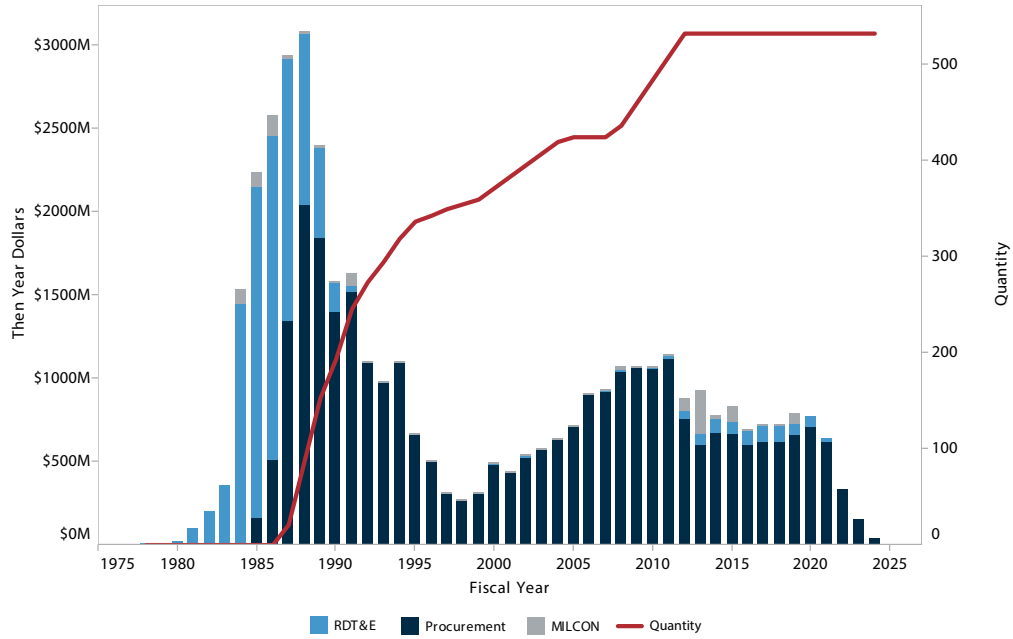
144 Kingston Reif, "Air Force Wants 1,000 New Cruise Missiles," *Arms Control Today*, May 5, 2015, updated with an official Air Force response on May 7, 2015.

145 Air Force Nuclear Weapons Center Public Affairs, "AF releases request for proposal for nuclear air-launched cruise missile replacement," *Air Force*, July 29, 2016.

146 DoD, *FY 2017 PB Submission*, Air Force Justification Book Volume 2, *Research, Development, Test & Evaluation*, Vol-II.

Trident II (D-5) Sea-Launched Ballistic Missile UGM 133A

The Trident II is a submarine-launched nuclear ballistic missile fielded on the Ohio-class SSBN. The current program modernizes and extends the service life of existing Trident II missiles. Due to the high rate of Trident II production early in the program, a significant portion of the inventory will be due for modernization in the coming years. Overall program costs for the Trident II modernization could increase if NASA chooses a liquid fuel rocket motor for its next generation launch vehicle in 2016, as the industrial base for solid fuel rocket motors would be diminished.[147] The program remains on track for initial fleet introduction of the D5 Life Extension missile in FY 2017. A total of $37.56 billion has been appropriated through FY 2016, $3.64 billion was requested over the FY 2017 FYDP, and $521.3 million is planned for beyond the FYDP.[148]



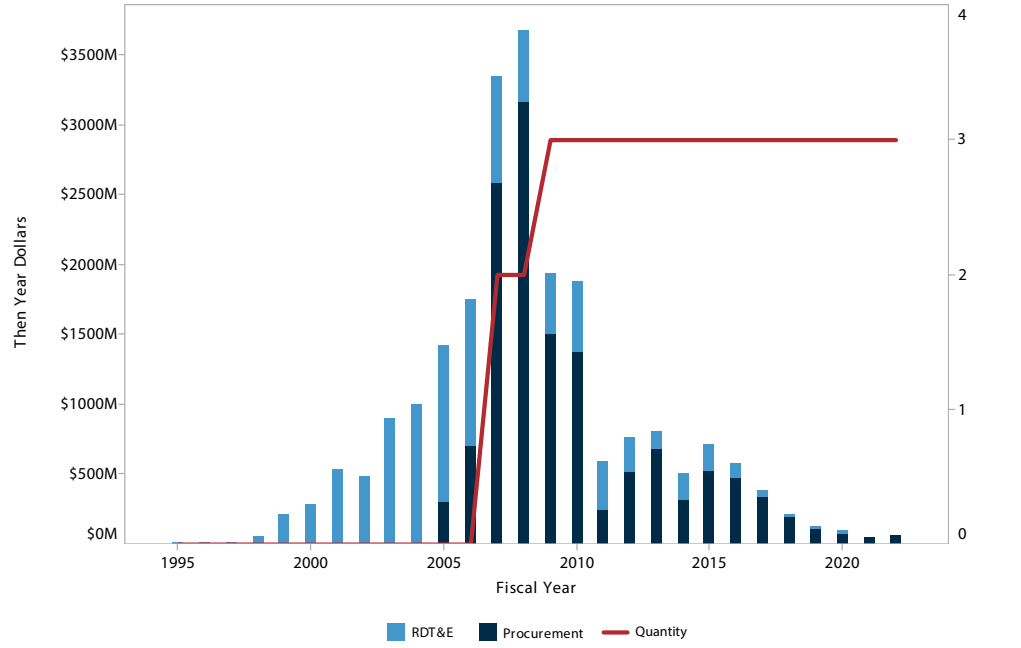
147 2015 SARs.

148 Twenty-eight Trident II missiles were procured with RDT&E funding but are not included in the quantity line.

Shipbuilding

DDG-1000 Zumwalt-Class Destroyer

The Navy's DDG-1000 is a destroyer designed for littoral and land-attack operations. The DDG-1000 incorporates several features to reduce its radar signature, and it includes an advanced gun system and greater power generation capabilities for future weapons systems. The lead ship was delivered in May 2016, and fabrication is in process on the remaining two ships in the class.[149] The program was originally intended to produce ten ships but was scaled back to three ships due to the growing cost of the program. As a result, production of the Arleigh Burke-class DDG-51 destroyer was restarted.[150] A total of $21.47 billion has been appropriated through FY 2016, $868.9 million was requested over the FY 2017 FYDP, and $60.8 million is planned for beyond the FYDP.[151]



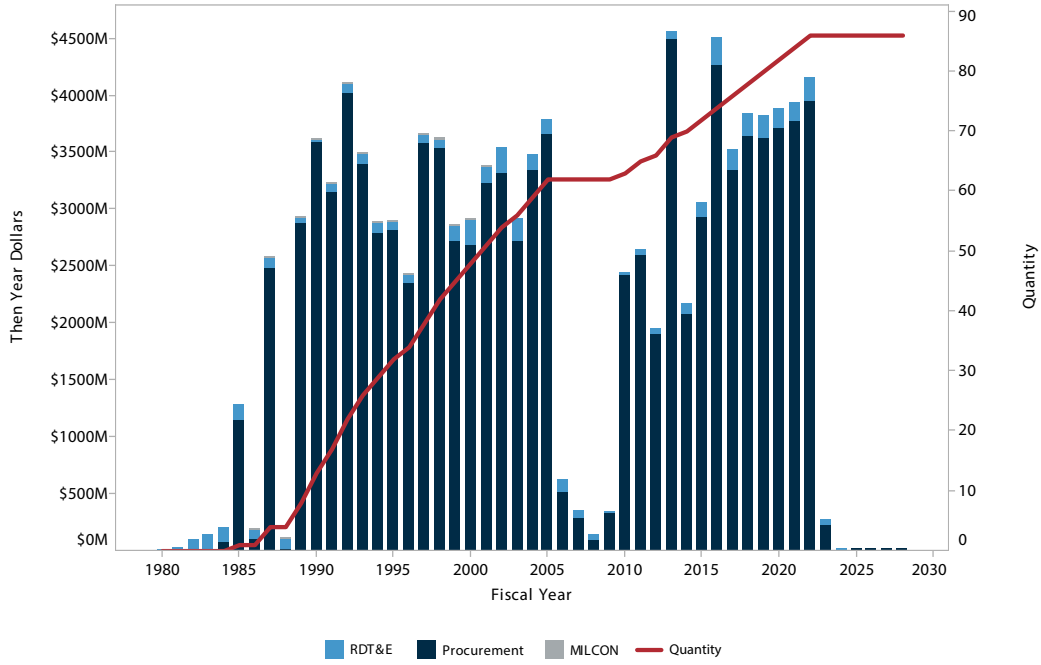
149 James Downey, "World's Greatest Navy Takes Ownership of the World's Greatest Ship, DDG-1000," *Navy Live,* May 20,2016.

150 "Gates Lays out Key FY 2010 Budget Recommendations," *Defense Industry Daily,* April 6, 2009.

151 2015 SARs.

DDG-51 Arleigh Burke-Class Guided Missile Destroyer

The DDG-51 destroyer is designed to operate against air, surface, and subsurface threats. The destroyer has been in procurement since the 1980s, making it one of the oldest programs in DoD's current portfolio. The Navy restarted the program in 2008 after a four-year break in production.[152] Program costs increased by 1.25 percent between the December 2014 and December 2015 SARs due to the procurement of an additional four ships, bringing the total program quantity up to eighty-six. The latest version of this ship, the Flight III, will likely have an increased focus on missile defense and will include the new Air and Missile Defense Radar (AMDR). The entirety of the Navy's planned Flight III purchase is not included in the December 2015 SAR, so the total spending on the DDG-51 will likely exceed that reported below.[153] A total of $83.3 billion has been appropriated through FY 2016, $19.01 billion was requested over the FY 2017 FYDP, and $4.53 billion is planned for beyond the FYDP.[154]



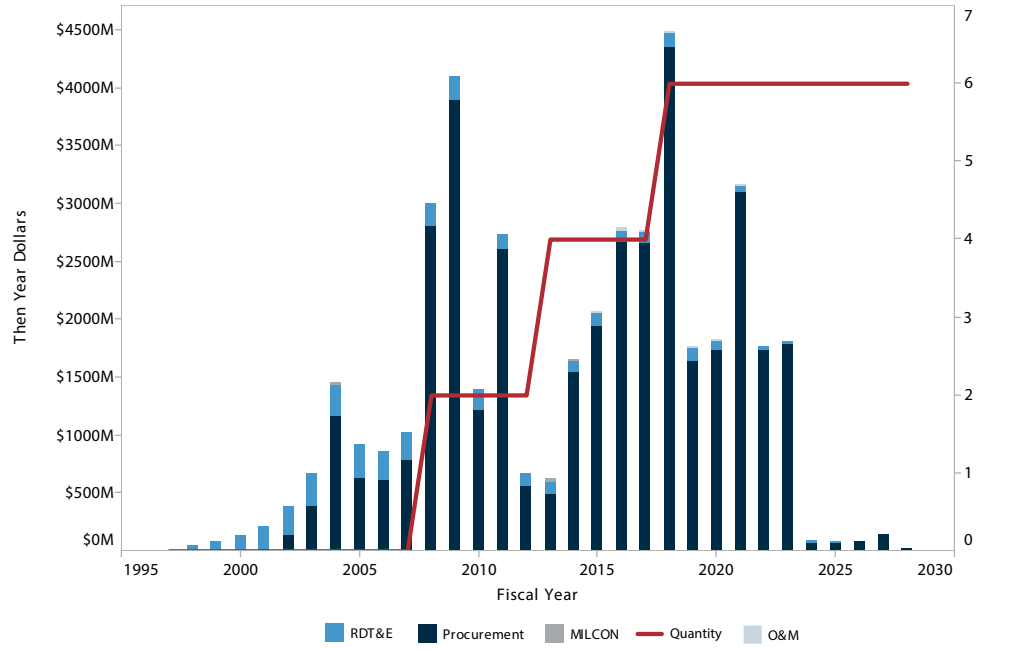
152 Megan Eckstein, "Ingalls Shipbuilding Launches First Ship Since Destroyer Program Restart," *USNI News*, March 30, 2015.

153 Office of the Chief of Naval Operations (CNO), *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels for FY2017* (Washington, DC: DoD, 2016).

154 2015 SARs.

Gerald R. Ford-Class Nuclear Aircraft Carrier (CVN 78)

The Ford-class carrier is the Navy's latest generation of super-carrier, designed for higher sortie rates and reduced manpower through the use of new technologies, such as an electromagnetic catapult to replace the traditional steam catapult. The lead ship's procurement costs have increased by 23 percent and construction has been delayed by critical technology development delays, material shortages, and engineering problems. The advanced arresting gear is particularly troubled, and the Senate Armed Services Committee is calling for a Nunn-McCurdy review of the program.[155] Delivery of the lead ship has been pushed back to at least November after the failure of a shipboard electrical system during recent testing.[156] A total of $24.84 billion has been appropriated through FY 2016, $14.03 billion was requested over the FY 2017 FYDP, and $3.99 billion is planned for beyond the FYDP.[157] The program SAR only includes funding for the first three carriers in the class. It does not include estimates for the procurement of additional aircraft carriers at five-year intervals from FY 2023 forward as projected in the Navy's FY 2016 thirty-year shipbuilding plan.[158]



155 Justin Doubleday, "Senate Authorizers Pass Bill that Directs Nunn-McCurdy Review of Carrier Advanced Arresting Gear," *Inside Defense*, May 13, 2016.

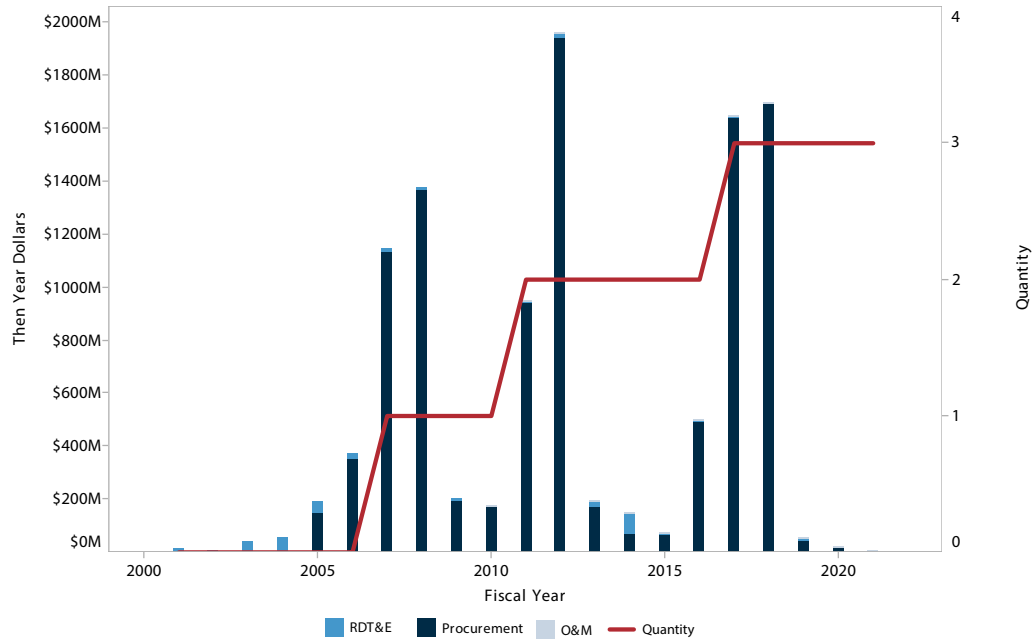
156 Justin Doubleday, "Electrical system 'fault' behind latest CVN-78 delay," *Inside Defense*, July 13, 2016.

157 2015 SARs.

158 CNO, *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels for FY2016*.

LHA 6 America-Class Amphibious Assault Ship

The LHA 6 America-class amphibious assault ship is a small deck aircraft carrier capable of supporting helicopters and short takeoff/vertical landing fixed-wing aircraft, such as the F-35B. The lead ship in the class was delivered twenty months behind schedule in April 2014,[159] the second ship is under construction, and the contract for the third was awarded to Ingalls Shipbuilding in June 2016.[160] LHA 6 and 7 do not have a well deck to move people and equipment rapidly from ship to shore, but LHA 8 will be redesigned to include a well deck. This will decrease aviation fuel capacity from 1.5 million pounds to 680,000 pounds. The flight deck of LHA 6 also has to be reconfigured to withstand the exhaust and downwash from the F-35B.[161] The LHA 6 class can transport up to 1,800 troops and their equipment as well as nine F-35B fighters, four AH-1Z attack helicopters, four CH-53E helicopters, twelve MV-22 Osprey's, and two MH-60S search and rescue helicopters.[162] A total of $7.4 billion has been appropriated through FY 2016, and $3.43 billion was requested over the FY 2017 FYDP to complete the procurement of three LHAs.[163] No additional funding or procurements are projected beyond the FYDP.



159 U.S. Navy, "Navy Accepts Delivery of the Future USS America (LHA 6)," April 28, 2014, http://www.navy.mil/submit/display.asp?story_id=80279.

160 Megan Eckstein, "Ingalls Wins LHA-8 Contract, NASSCO to Build 6 Fleet Oilers," *USNI News*, June 30, 2016.

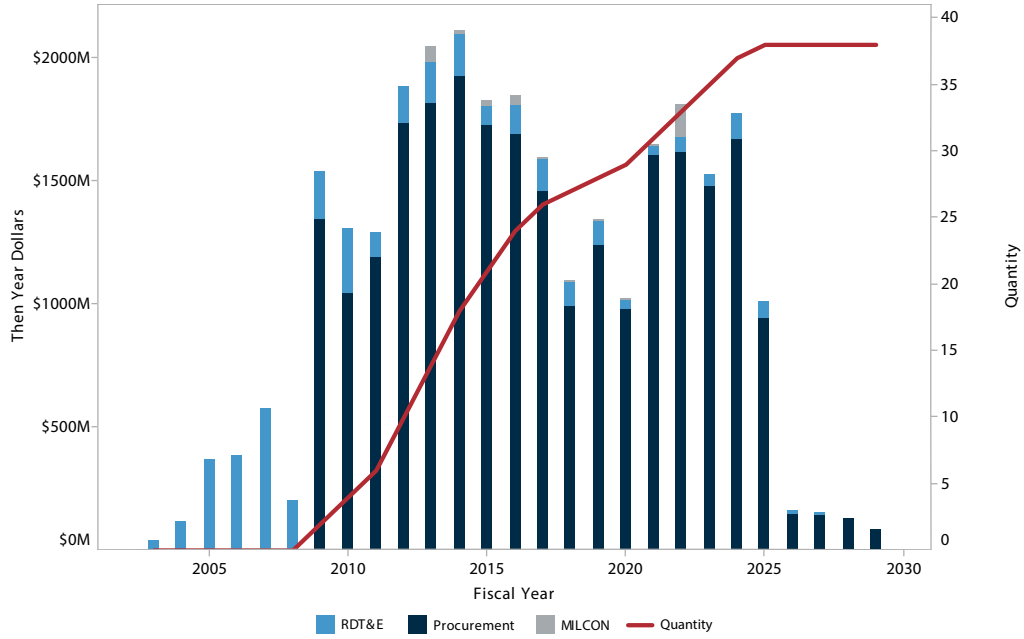
161 GAO, *Defense Acquisitions of Selected Weapon Programs*, pp. 103–104.

162 Ingalls Huntington, "The LHA 6 America-class of Amphibious Assault Ships," http://ingalls.huntingtoningalls.com/products/lha/class.

163 2015 SARs.

Littoral Combat Ship (LCS)

The LCS consists of the ship and separate mission modules (mine countermeasures, anti-submarine warfare, and surface warfare). There are two versions of the LCS: the steel mono-hull (*Freedom* variant) and the aluminum trimaran hull (*Independence* variant). The Navy had planned to downselect to a single design after the first four ships, but instead opted to split the award between the two contractors. The program, however, will likely stop at forty ships (twenty-nine LCSs and eleven frigates) with a downselect to one variant in FY 2019.[164] Retrofitting frigate enhancements onto the original LCSs and procuring eleven new-build frigates will increase total program costs by almost $2 billion. A total of $15.54 billion has been appropriated through FY 2016 for development and procurement of twenty-six ships.[165] An additional $6.71 billion was requested over the FY 2017 FYDP for seven ships, and $6.65 billion is planned for beyond the FYDP for the final seven ships.[166]



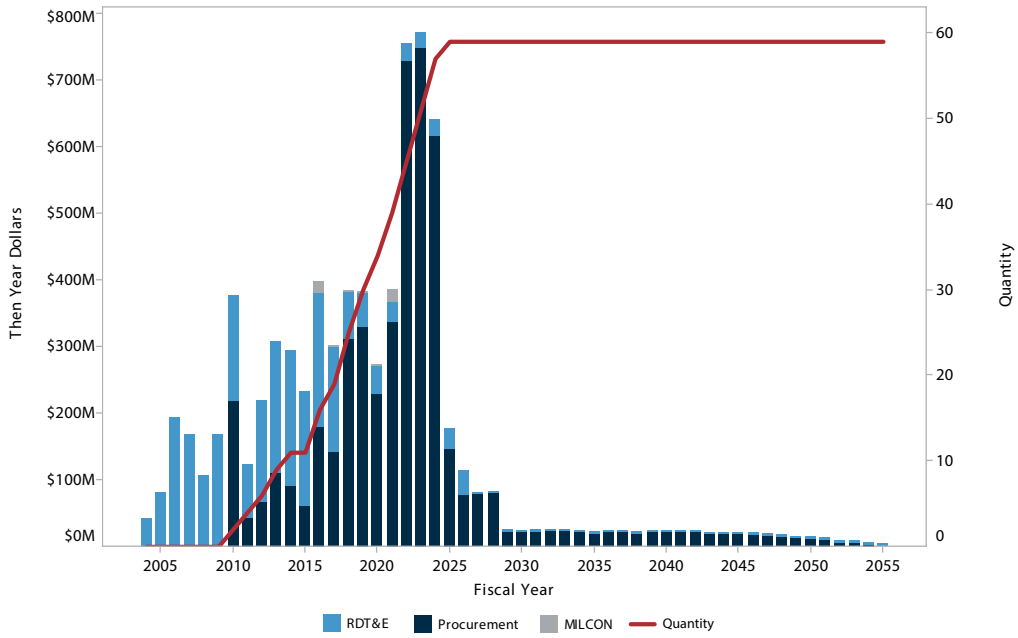
164 Justin Doubleday, "Navy Pushes Back on LCS Cut, Gets One More Ship in FY-17 Request," *Inside Defense*, February 16, 2016.

165 2015 SARs.

166 Two of the planned forty seaframes were procured with RDT&E funds but are not included in the quantity line.

Littoral Combat Ship (LCS MM)

The LCS consists of the ship and separate mission modules (mine countermeasures, anti-submarine warfare, and surface warfare). Mission modules combine systems such as vehicles, sensors, and weapons with support equipment and can be installed in the ships via standard interfaces. The modules are designed to be rapidly interchangeable, increasing the operational flexibility of the LCS. Additionally, the modules can be used separately from the LCS. However, the anti-submarine warfare module would be the most difficult to use on a different platform due to the processing requirements of the module. The mine countermeasures module has experienced performance problems, the surface warfare module is still under development, and development on the anti-submarine warfare module has been delayed for one year, as funding for the ASW module was shifted to compensate for insufficient funding allocated to the mine-countermeasure and surface warfare modules.[167] A total of $2.71 billion has been appropriated through FY 2016 for development and procurement of twenty-one mission modules.[168] An additional $1.73 billion was requested over the FY17 FYDP for the procurement of twenty-three mission modules, and $3.14 billion is planned for beyond the FYDP and the procurement of twenty mission modules.[169]



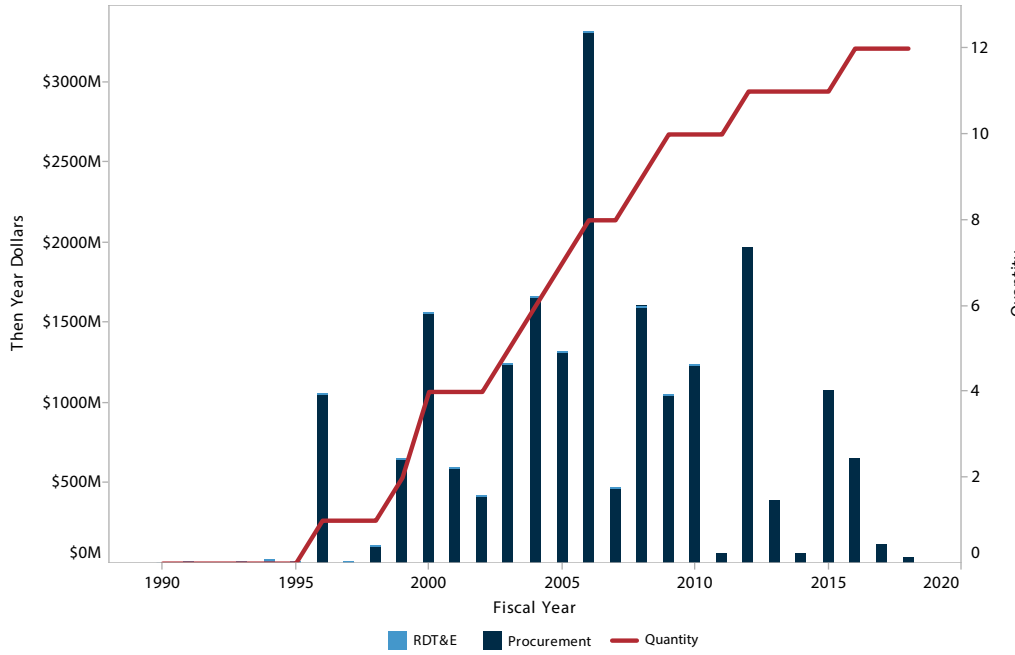
167 GAO, *Defense Acquisitions of Selected Weapon Programs*, pp. 107–108.

168 2015 SARs.

169 Five of the planned mission modules were procured with RDT&E funds but are not included in the quantity line.

LPD 17 San Antonio-Class Amphibious Transport Dock

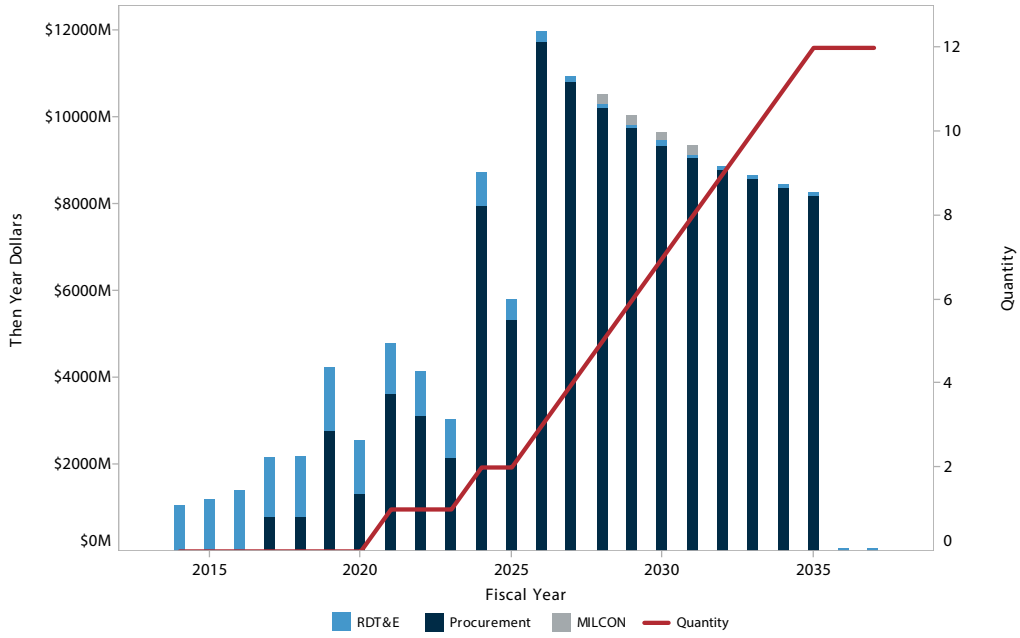
The San Antonio-class landing platform dock (LPD) is designed to transport and land elements of a Marine landing force by helicopter, landing craft, and amphibious vehicles. An LPD 17 can carry up to 800 personnel (surge) and two MV-22 tilt rotors. A total of $20.57 billion has been appropriated through FY 2016 for development and procurement of twelve ships, and $144.9million is requested to complete the program over the FYDP.[170]



170 2015 SARs.

Ohio-Class Replacement SSBN

The Navy's current fleet of 14 Ohio-class ballistic missile submarines is widely seen as the most survivable leg of the nuclear triad. The Navy has already extended the life of the Ohio-class boats beyond their original design life and plans to begin retiring them in the late 2020s. The Navy has begun a program to design and build a fleet of twelve replacement boats for the Ohio-class, but this program does not have a public SAR. While the Navy has not yet released a formal cost estimate, some cost information can be derived from RDT&E funding included in the budget request, the Navy's report to Congress on the Ohio-class replacement cost tracking information, and the Navy's thirty-year shipbuilding plan.[171] Using the RDT&E funding identified for the program in the FY 2017 budget request and assuming that roughly $4.41 billion in additional development funding will be needed in FY 2022 and beyond, the total RDT&E cost of the program is likely to total some $14.7 billion in then-year dollars. Navy plans indicate that procurement of the first sub will begin in FY 2021, followed by the second in FY 2024, and one sub per year from FY 2026 to FY 2035.[172] Assuming an average procurement unit cost of $9.8 billion (in FY 2017 dollars), the total procurement costs would be roughly $122 billion (in then-year dollars).[173] The total program cost would be $138 billion in then-year, or $112.6 billion in FY 2017 dollars, making it second to only the F-35 program in terms of future funding requirements.



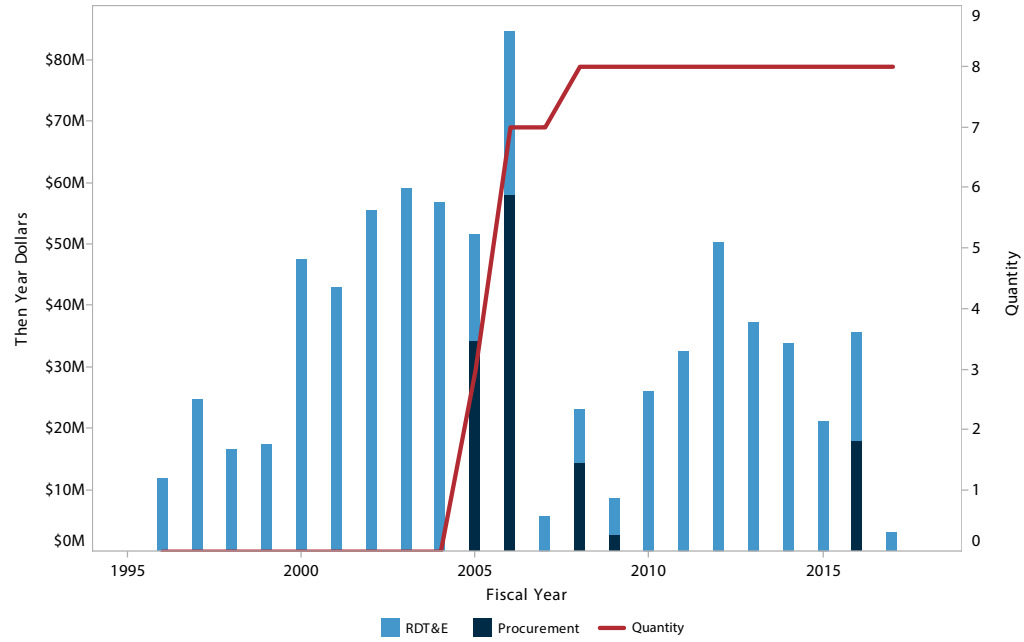
171 Ohio Class Replacement Submarine Program, *Ohio Class Replacement Submarine Cost Tracking Information*, report to Congress (Washington, DC: DoD, February 2016). This report was prepared in compliance with P.L. 114-92, or the FY16 NDAA, and obtained by *Inside Defense*.

172 CNO, *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels for FY2016*.

173 This estimate is derived from Harrison and Montgomery, *The Cost of U.S. Nuclear Forces*.

Remote Minehunting System (RMS)

This Navy program was designed to develop and procure a semi-autonomous system to detect, classify, and localize bottom and moored mines in shallow and deep water. It would deploy from an LCS as part of the mine countermeasure mission package and would allow the Navy to conduct mine countermeasure operations while keeping sailors and ships safely away from minefields.[174] The Navy, however, canceled the RMS program in March 2016.[175] The Navy is exploring alternative vehicles to tow sonar as part of the LCS mine countermeasures package.[176] A total of $741.6 million has been appropriated through FY 2016, and $3 million is requested for the FYDP. No additional funding or procurements are projected beyond the FYDP.[177]



174 2015 SARs.

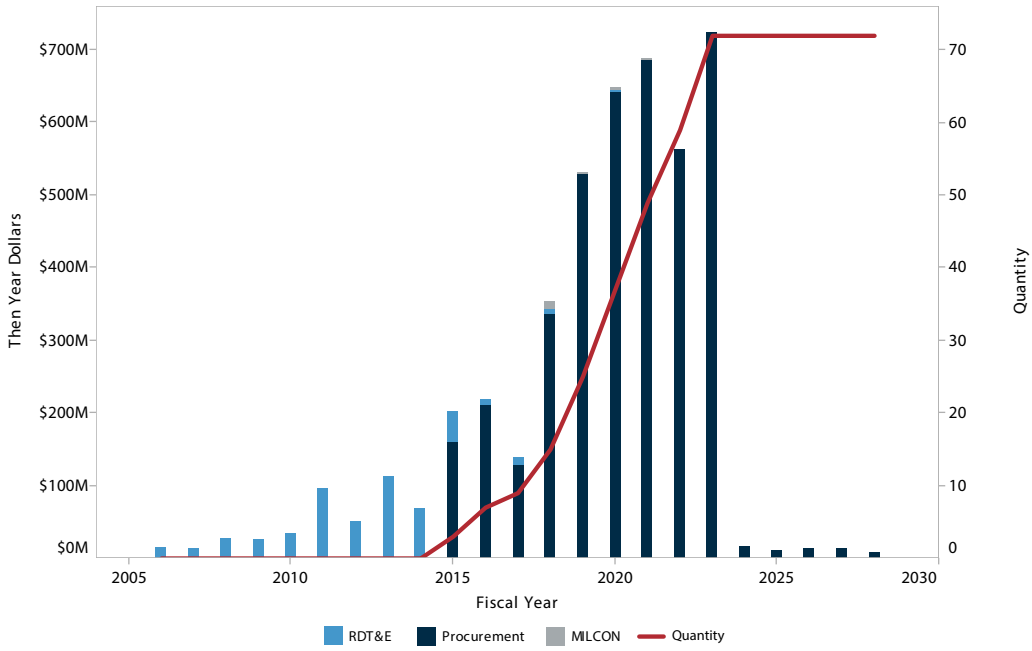
175 Megan Eckstein, "Navy's Remote Minehunting System Officially Canceled, Sonar May Live On," *USNI News*, March 24, 2016.

176 Justin Doubleday, "Textron, Navy discussing additional orders for unmanned surface vehicle," *Inside Defense*, May 19, 2016.

177 Two RMS units were procured with RDT&E funding but are not include in the quantity line.

Ship to Shore Connector Amphibious Craft (SSC)

The Navy's SSC is an air cushioned landing craft designed to transport personnel, equipment, and supplies from amphibious vessels to shore. It will be lighter and more environmentally friendly than the system it replaces, the Landing Craft, Air Cushion (LCAC). The SSC will deploy from the well deck of amphibious ships, such as the LPD-17.[178] The SSC program is scheduled for a full-rate production decision in late 2018.[179] The Navy plans to procure seventy-two landing craft. A total of $859.5 million has been appropriated through FY 2016, $2.36 billion was requested over the FY 2017 FYDP, and $1.34 billion is planned for beyond the FYDP.[180]



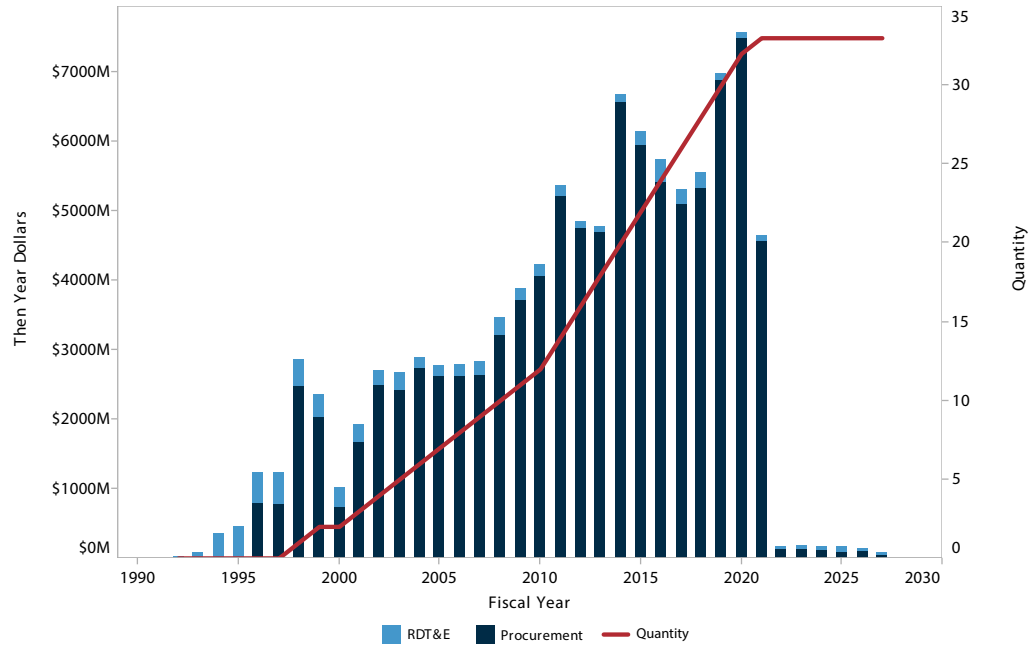
178 GAO, *Defense Acquisitions of Selected Weapon Programs*, pp. 117–118.

179 2015 SARs.

180 One landing craft was procured with RDT&E funding but is not reflected in the quantity line.

SSN 774 Virginia-Class Submarine

The Virginia-class SSN is the replacement for the Los Angeles-class attack submarine. In addition to performing traditional submarine missions, the Virginia class also supports special operations forces and maintains a cruise missile vertical launch capability.[181] The current SAR only includes procurements of two Virginia-class submarines per year through FY 2020 and does not reflect the Navy's current shipbuilding plan.[182] The Navy is also continuing to plan for the Virginia Payload Module (VPM), which will add additional vertical launch tubes to the hull design for future ships—adding four large payload tubes, which can carry seven cruise missiles each. The VPM addition will help mitigate the loss of strike capacity as existing SSGNs are decommissioned.[183] The FY 2017 budget requests funding for an additional submarine, bringing the total purchase reflected in the December 2015 SAR to thirty-three. A total of $73.29 billion has been appropriated through FY 2016 for the development and procurement of the initial twenty-four SSNs, and $30.08 billion was requested over the FY 2017 FYDP for the nine remaining SSNs. The SAR projects an additional $891.3 million beyond the FYDP.



181 2015 SARs.

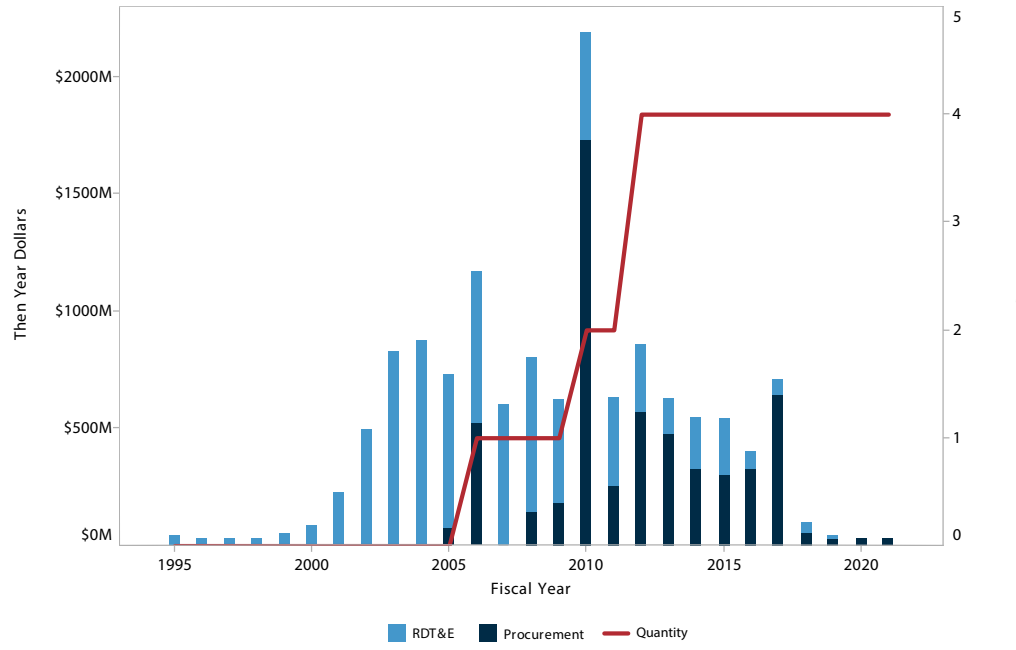
182 CNO, *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels for FY2016*.

183 Four Ohio-class ballistic missile submarines were converted to guided missile submarines (SSGN) to provide the Navy with increased strike and special operations capabilities from a clandestine platform. See U.S. Navy, "Guided Missile Submarines: SSGN," 2013, http://www.navy.mil/navydata/fact_display.asp?cid=4100&tid=300&ct=4.

Space Systems

Advanced Extremely High Frequency Satellite (AEHF)

AEHF is constellation of satellites that provide global, survivable, secure, and jam-resistant communications for tactical and strategic users. The program currently plans to field six satellites in geosynchronous orbit. The program was funded in part by Canada, the Netherlands, and the United Kingdom, which in exchange will be able to use a portion of the constellation's capacity.[184] Three AEHF satellites are currently on orbit, and the fourth is scheduled for launch in 2017. The fifth and sixth satellites are scheduled for launch in 2018 and 2019, respectively. Once the fourth satellite is operational, the system will have achieved full operational capability.[185] A total of $12.45 billion has been appropriated through FY 2016, $914.1million was requested over the FY 2017 FYDP, and there is no funding planned for beyond the FYDP.

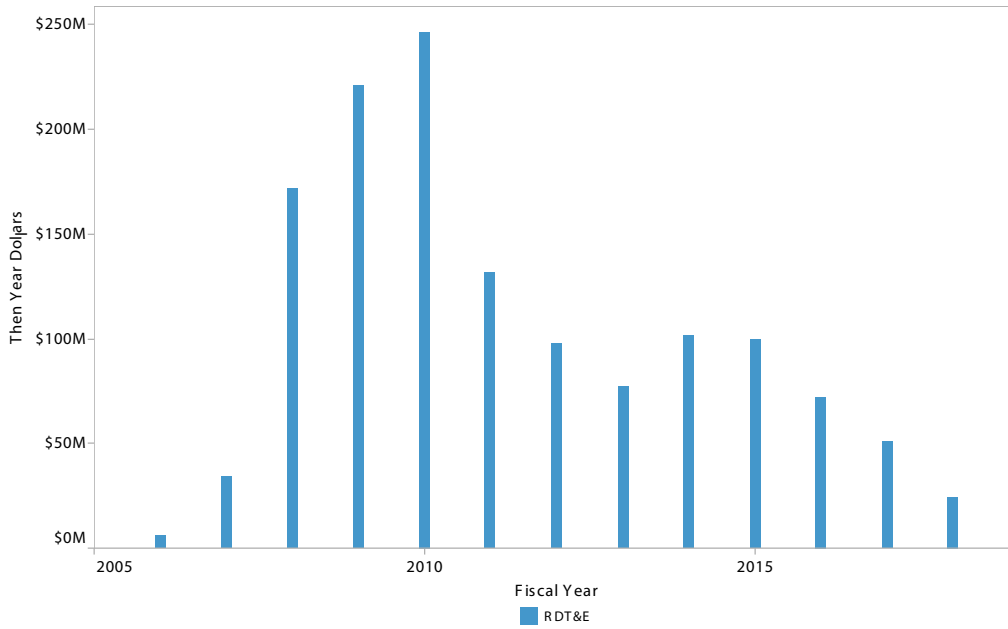


184 2015 SARs.

185 Lockheed Martin, "Fourth AEHF Protected Communications Satellite Begins Integration Months Ahead of Schedule," press release, April 2014.

Enhanced Polar System (EPS)

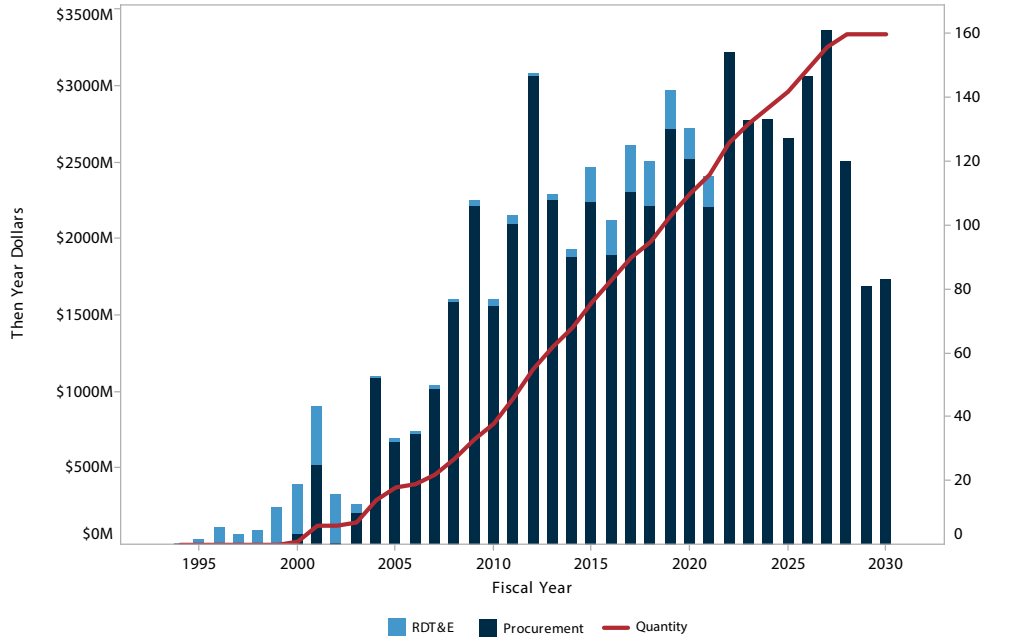
The Enhanced Polar System provides low probability of interception and detection and extremely high frequency (EHF) communications over the north polar region via two hosted payloads in Molniya orbits. The program has four segments: two hosted payloads, user terminals, a fixed gateway connecting users in the north polar region to users in middle latitudes, and a fixed C2 center. The two payloads are complete with one ready for launch and the second being integrated into the host satellite. The entire system should be operationally available in mid-2018. A total of $1.26 billion has been appropriated through FY 2016, and $75.3 million was requested over the FY 2017 FYDP for the completion of the program.[186]



186 2015 SARs.

Evolved Expendable Launch Vehicle (EELV)

The Air Force's EELV provides launch services to support the Department of Defense and other government missions. The United Launch Alliance is currently the sole provider of launch vehicles for the U.S. military and intelligence community, providing multiple configurations of the Atlas V and Delta IV launch vehicles. The Atlas V uses the Russian-made RD-180 rocket motor, however, and efforts are underway to develop a domestically produced alternative. The Air Force certified SpaceX as a launch provider in May of 2015.[187] Other new entrants are working through the certification process and expect to be certified by the end of 2016. Future EELV awards will be done on a competitive basis.[188] A total of $25.48 billion has been appropriated through FY 2016, and $13.2 billion was requested over the FY 2017 FYDP for thirty-three launch vehicles.[189] An additional $23.76 billion is planned for beyond the FYDP for an additional forty-four launch vehicles through FY 2028.[190]



187 Stephen Clark, "Air Force Stays the Course with SpaceX Rocket Certification," *Spaceflight Now*, July 2, 2015.

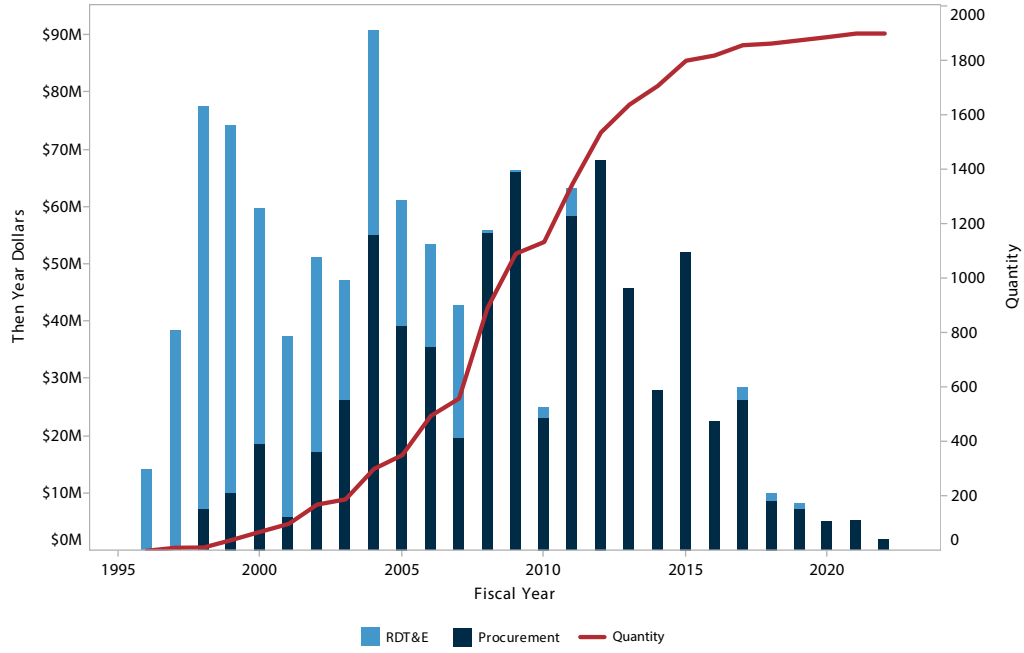
188 GAO, *Defense Acquisitions of Selected Weapon Programs*, pp. 135–136.

189 2015 SARs.

190 One EELV was procured with RDT&E funding, but is not included in the quantity line.

Global Broadcast Service (GBS)

This Air Force program provides global, high-capacity, one-way transmission of video, imagery, and geospatial intelligence products supporting command centers and joint-combat forces. It utilizes available commercial technologies and can broadcast over GBS-payloads hosted on two Ultra-High Frequency Follow-On satellites, commercially leased transponders, and the Wideband Global SATCOM constellation to connect data sources (e.g., UAVs) to commanders via 2,039 receiver suites procured and maintained by the GBS program.[191] A total of $1.07 billion has been appropriated through FY 2016, $56.8 million was requested over the FY 2017 FYDP, and $1.9 million was requested for beyond the FYDP.[192]

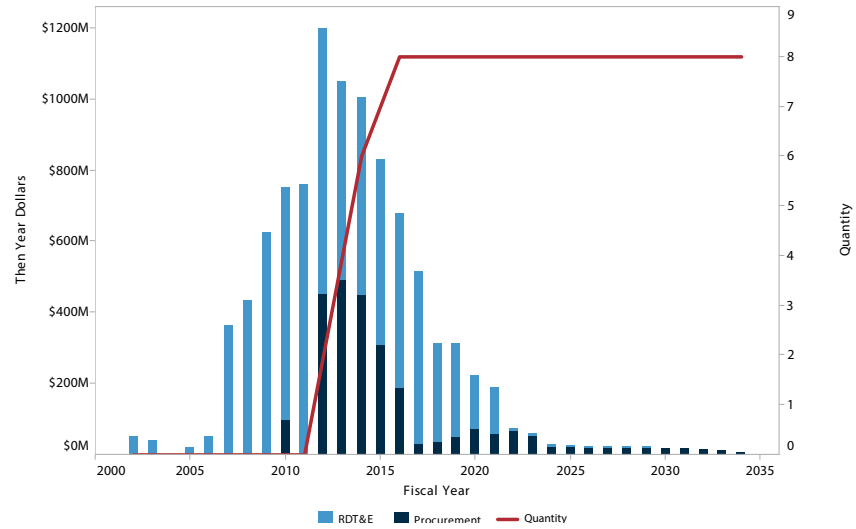


191 136 of the 2,039 receivers were procured with RDT&E funding. That funding is captured in the graph, but the quantity is not.

192 2015 SARs.

Global Positioning System III (GPS III) and Next Generation Operational Control System (GPS OCX)

The GPS III program will replace the existing GPS constellation. GPS III provides a high-gain antenna for the military signal that increases the signal strength and makes it more resistant to jamming. It also provides a new civilian signal for improved accuracy. The OCX subprogram is developing a new C2 ground system to support the constellation and enable many new features.[193] Initial operations of the OCX program have been delayed until July 2021, which will push the availability of its Block 0 capability to September 2017 (necessary for launch and checkout of the GPS III satellites).[194] The first GPS III satellite should be available before Block 0 is online, so existing ground stations will need to be modified to perform launch and checkout functions for the new satellites.[195] As a result of these delays, the Senate Appropriations Committee is attempting to cancel parts of the OCX program and delay the launches of some GPS III satellites.[196] The OCX program declared a Nunn-McCurdy breach in June 2016.[197] The costs reported in the SAR only cover the first eight satellites and the OCX ground segment.[198] A total of $7.85 billion has been appropriated through FY 2016, $1.55 billion was requested over the FY 2017 FYDP, and $337.4 million is planned for beyond the FYDP.[199]



193 2015 SARs.

194 Courtney Albon, "Air Force to Measure Impact of OCX Delay on Early GPS III Launch Plans," *Inside Defense,* January 29, 2016.

195 Courtney Albon, "Lockheed Awarded GPS Upgrade Contract," *Inside Defense,* February 5, 2016.

196 Courtney Albon, "Senate appropriators call for termination of GPS OCX blocks 1 and 2," *Inside Defense*, May 27, 2016.

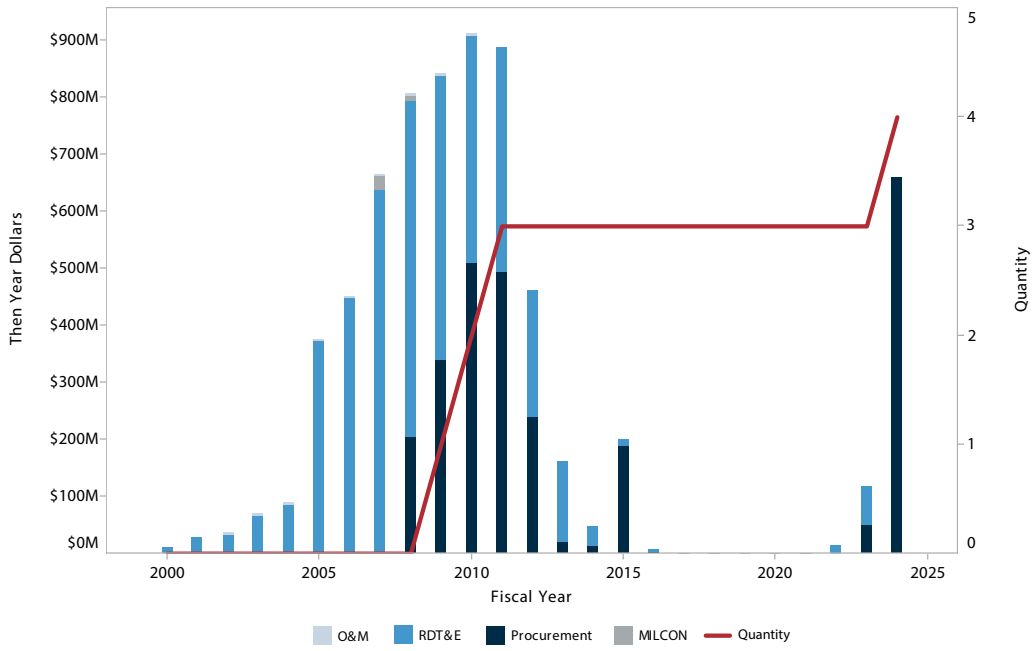
197 Courtney Albon, "Air Force declares Nunn-McCurdy Breach on GPS OCX," *Inside Defense*, July 1, 2016.

198 The U.S. has committed to maintaining at least twenty-four operational GPS satellites with 95 percent availability, so the program will likely expand as additional legacy satellites have to be replaced. See "Space Segment," GPS.gov, August 2, 2014, http://www.gps.gov/systems/gps/space/.

199 The OCX program expects to receive $23 million from the Department of Transportation to support this program. These funds are not included in the graph. Two systems were procured with RDT&E funding. That funding is captured in the graph, but the quantity is not.

Mobile User Objective System (MUOS)

The Navy's MUOS satellite constellation is designed to provide increased narrowband SATCOM capacity for mobile and fixed-site users. It will replace the Ultra High Frequency Follow-On (UFO) satellite system currently in use. The MUOS program includes funding for both the space and ground control segments. The space segment includes four satellites plus a fifth on-orbit spare. Advanced MUOS capabilities are currently not available to users due to delays in developing the MUOS-compatible radios through the JTRS program. Moreover, the system is suffering from frequent problems with call reliability. Lockheed Martin is currently investigating the root cause of this problem. The first two MUOS satellites are on orbit and functional. MUOS 3 was launched in January 2015, MUOS 4 was launched in September 2015, and MUOS 5 was launched in June 2016 but is stuck between its rocket deployment orbit and geosynchronous orbit due to an unidentified anomaly.[200] The entire system is scheduled to reach full operational capability in 2017. A total of $6.05 billion has been appropriated through FY 2016, nothing was requested over the FY 2017 FYDP, and $791.1 million is planned for beyond the FYDP.[201]

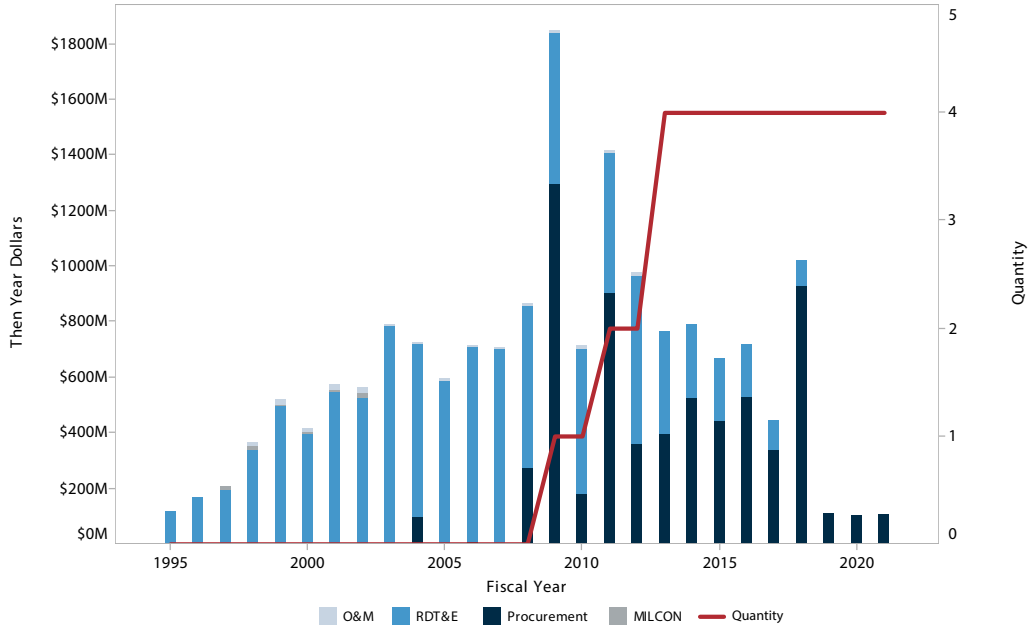


200 ULA, "United Launch Alliance Successfully Launches the U.S. Navy's Mobile User Objective System-4," press release, September 2, 2015; ULA, "United Launch Alliance Successfully Launches MUOS-5 Satellite for the U.S. Air Force and U.S. Navy," press release, June 24, 2016; and Justin Ray, "Navy's new MUOS5 Communications Satellite Experiences Snag in Space," *Spaceflight Now*, July 8, 2016.

201 2015 SARs. Two systems were procured with RDT&E funding. That funding is captured in the graph, but the quantity is not.

Space Based Infrared System High (SBIRS High)

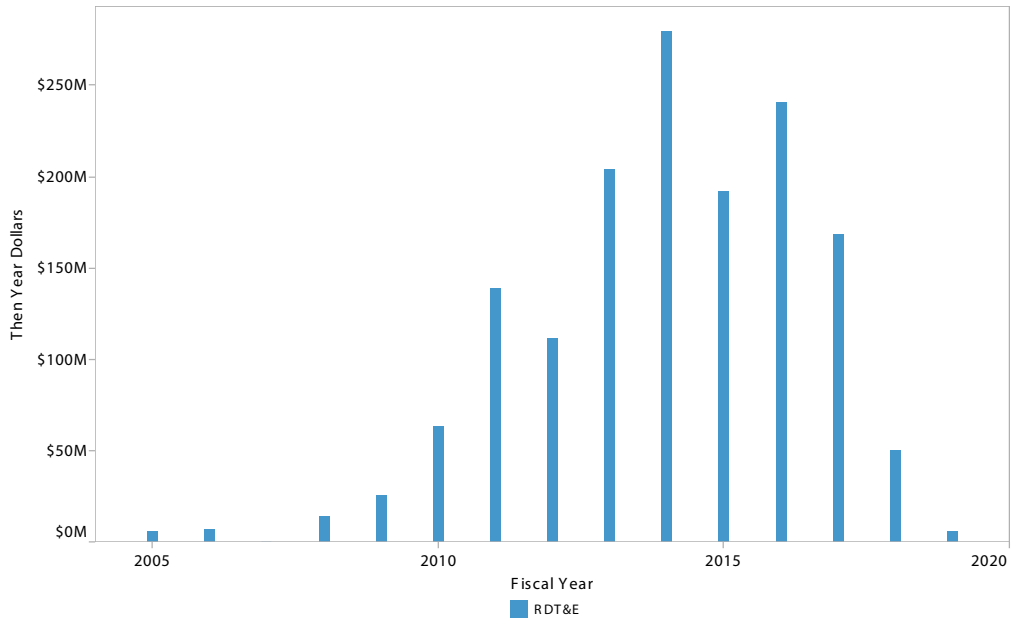
SBIRS is designed to replace the Defense Support Program to provide missile warning, technical intelligence, and battlespace awareness. The program includes four geostationary SBIRS satellites, two SBIRS hosted payloads on satellites in a highly elliptical orbit, two replenishment satellites and sensors, and fixed and mobile ground stations. The program is on track to have both hosted HEO payloads and four GEO satellites on orbit by 2017. The two GEO spares should be available by 2021. A total of $15.21 billion has been appropriated through FY 2016 for the program, $1.78 billion is requested for the FYDP.[202]



202 2015 SARs.

Space Fence Ground-Based Radar System Increment 1

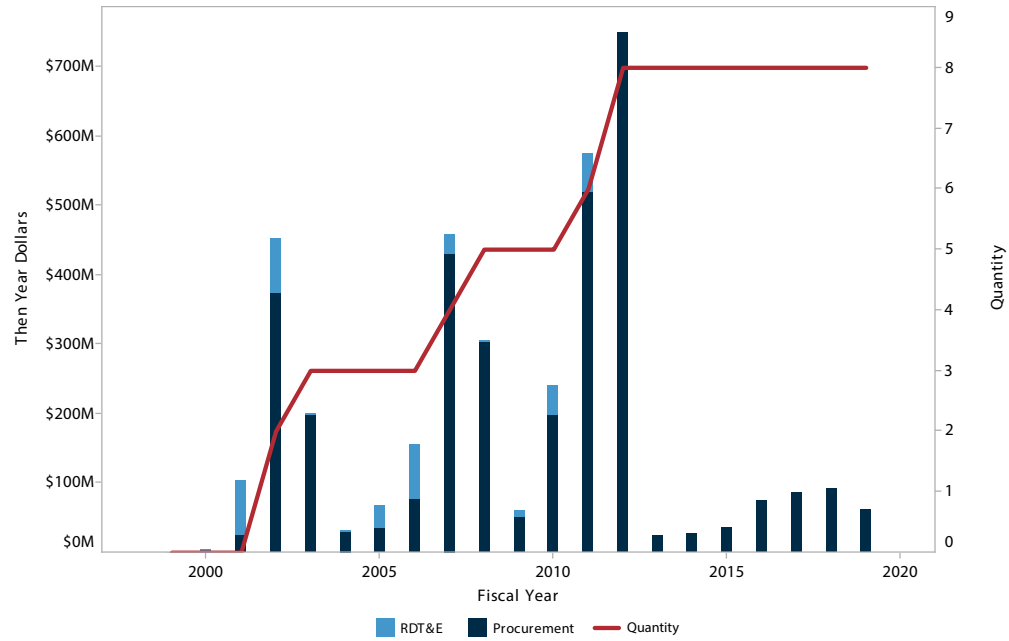
The Space Fence Ground-Based Radar system is designed to detect orbiting objects in Low-Earth/Medium-Earth Orbit (LEO/MEO), replacing the Air Force Space Surveillance System Very High Frequency radar. When complete, the system will include one ground station and two S-band radar stations. Increment 1 funds one radar site at Kwajalein Atoll and the ground station in Huntsville, Alabama. The system is projected to be operationally available in October 2018. A total of $1.28 billion has been appropriated through FY 2016 for the program, and $223.9 million is requested for the FYDP.[203]



203 2015 SARs.

Wideband Global SATCOM (WGS)

This Air Force-led program, previously known as the Wideband Gapfiller System, provides DoD with its highest capacity communications satellites. Seven WGS satellites are on orbit with three additional satellites in production. The system reached full operational capability in May 2014 once the sixth satellite arrived on station. The satellites are based on Boeing's commercial 702 satellite design.[204] Australia, Canada, Denmark, Luxembourg, the Netherlands, and New Zealand are providing funding to the United States in exchange for the right to use some of the WGS constellation's global capacity, which has enabled the Air Force to expand the constellation. A total of $3.56 billion has been appropriated through FY 2016, and $239.1 million was requested over the FY 2017 FYDP.[205]



204 Boeing, "Transformational Wideband Communication Capabilities for the Warfighter," factsheet, 2014, http://www.boeing.com/boeing/defense-space/space/bss/factsheets/702/wgs/wgs_factsheet.page.

205 2015 SARs.

CSBA
Center for Strategic and Budgetary Assessments

1667 K Street, NW, Suite 900
Washington, DC 20006
Tel. 202-331-7990 • Fax 202-331-8019
www.csbaonline.org