

U.S. Military Forces in FY 2020

Air Force

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Part of U.S. Military Forces in FY2020: The Struggle to Align Forces with Strategy

The Air Force continues procurement and development of fifth generation aircraft to meet the demands of great power conflict while a high operational tempo has forced it to invest in readiness and aging legacy platforms. Thus, the Air Force is in effect driven to a high-low mix of capabilities.

KEY TAKEAWAYS

- Like the other services, the Air Force faces a high operational tempo while at the same time preparing to meet the demands of great power conflict. These pressures, when combined with delays and high costs in modernization programs, are driving the Air Force to a high-low mix, including procurement of F-15EXs and A-10s on the low end and procurement of F-35's and development of the B-21 on the high end.
- The Air Force is slowly addressing its aging aircraft problem as the fleet size stabilizes and new aircraft are delivered. However, the Air Force will experience historically high costs to maintain this inventory level in the future.
- Air Force procures only 12 MQ-9 Reapers in FY 2020, so the unmanned element of its aircraft inventory has plateaued at six percent of the force. This is driven partially by questions about how to adapt unmanned platforms for non-permissive environments of great power conflicts.
- The Air Force reaffirmed its 25 percent expansion goal to reach 386 operational squadrons but takes no steps to reach this goal in FY 2020.
- Nuclear forces require a greater share of the Air Force budget as Reagan era systems reach the end of their service lives and, as a result, nuclear modernization generates some opposition.
- Driven by concerns about space as a new warfighting domain, Congress has put forward bills for an independent Space Force (Senate) or a Space Corps (House). Either way, ripping this new organization out of existing institutions will be a traumatic experience for the Air Force.

Force Structure in FY 2020

Table 1: Air Force End Strength – Active and Civilians

	Air Force Active		Civilian Full-time Equivalents
	Combat Coded Squadrons	Authorized End Strength	
FY 2019 Planned	41	329,100	172,100
FY 2020 Request	41	332,800	174,600
Change	0	+3,700	+2,500

Note: Combat coded squadrons = fighter and bomber squadrons with a wartime mission; Air Force is moving toward a new sizing metric—operational squadrons—which includes fighters, bombers, airlift, intelligence/surveillance/reconnaissance, command and control, special operations, space, cyber, missile, and personnel recovery squadrons. By that metric, there are currently 312 squadrons.

Source: Department of Defense, *United States Air Force Budget Overview Fiscal Year 2020* (Washington, DC, March 2019), p. 5, <https://www.saffm.hq.af.mil/Portals/84/documents/FY20/FY2020%20Air%20Force%20Budget%20Overview%20Book%20Final%20v3.pdf?ver=2019-03-13-082653-843>; Squadron and civilian data from Office of the Under Secretary of Defense (Comptroller), *Defense Budget Overview* (Washington, DC: March 2019), p. 2-9, A-3, https://comptroller.defense.gov/Portals/45/Documents/defbudget/fy2020/fy2020_Budget_Request_Overview_Book.pdf.

Table 2: Air Force End Strength – Reserve and Air National Guard

	Air Force Reserve		Air National Guard	
	Combat Coded Squadrons	Authorized End Strength	Combat Coded Squadrons	Authorized End Strength
FY 2019 Planned	3	70,000	20	107,100
FY 2020 Request	3	70,100	21	107,700
Change	0	+100	+1	+600

Source: Department of Defense, *United States Air Force Budget Overview Fiscal Year 2020*, p. 5. Squadron data from Office of the Under Secretary of Defense (Comptroller), *Defense Budget Overview*, A-3.

The active force remains at 41 combat coded squadrons—fighter and bomber squadrons with a wartime mission. The Air National Guard adds one squadron to get back to the 21 it had in FY 2018.

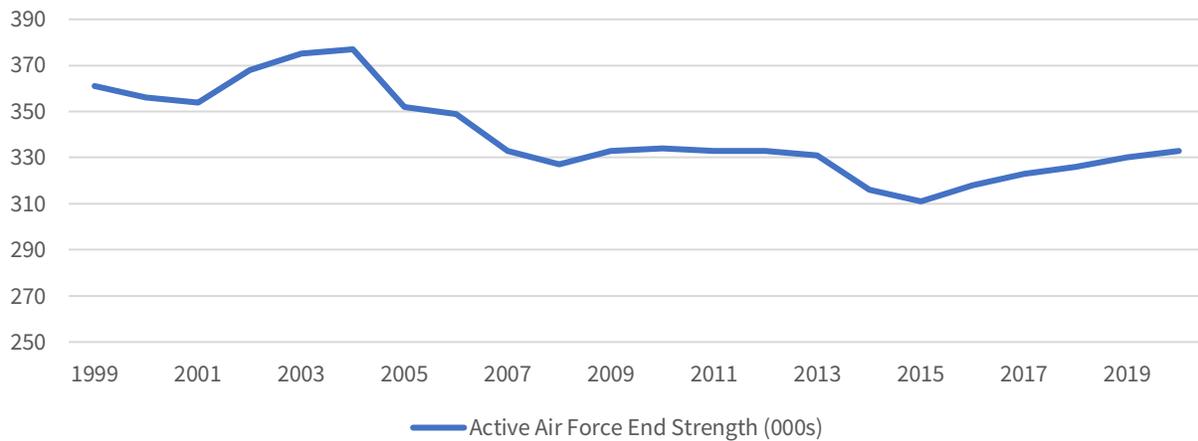
The budget increases end strength for all three components above the FY 2018 level. The active-duty force has the largest increase, primarily for additional equipment maintainers to improve readiness, but also to increase nuclear, special warfare, cyber, and intelligence personnel. The Air Force plans to fix a serious pilot shortfall by adding 1,480 new pilots in its FY 2020 budget, although it is still not expected to fully resolve the shortage this year. The increase in the Air Force reserve components is small, but it is the only service reserve component that gets larger in FY 2020.¹

A bright spot is active/reserve relations. By working closely with its reserve components, and giving them at least a small end strength increase, the Air Force avoided the internal conflicts that had marred earlier budgets and required a 2014 force structure commission to make peace.²

1. Stephen Losey, “Air Force budget calls for 510K airmen; 1,480 new pilots in 2020,” *Air Force Times*, March 12, 2019, <https://www.airforcetimes.com/news/your-air-force/2019/03/12/air-force-budget-calls-for-510k-airmen-1480-new-pilots-in-2020/>.

2. National Commission on the Structure of the Air Force, *Report to the President and Congress of the United States* (Washington, DC: January 2014), <https://policy.defense.gov/Portals/11/Documents/hdasa/AFForceStructureCommissionReport01302014.pdf>.

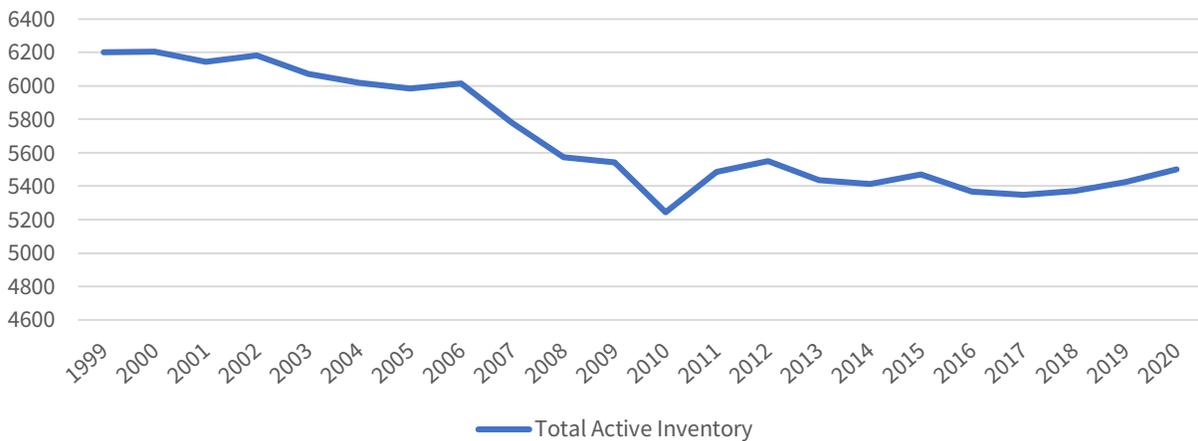
Figure 1: Air Force – Active End Strength 1999-2020



Source: Office of the Under Secretary of Defense (Comptroller), *National Defense Budget Estimates for FY2020* (Washington, DC: May 2019), Table 7-5: Department of Defense Manpower, p. 260-262, https://comptroller.defense.gov/Portals/45/Documents/defbudget/fy2020/FY20_Green_Book.pdf.

As the chart above shows, end strength rose in the wake of the invasions of Afghanistan and Iraq. After 2004, however, the Air Force adopted a strategy of retiring older aircraft and reducing personnel to shift funds to modernization. Active-duty end strength fell from a high of 377,000 to a low of 316,000. Critics argued that this decrease had harmed readiness and gutted the pilot inventory, causing the problems that the Air Force is now trying to fix.³ Thus, the Air Force began increasing end strength in FY 2016.

Figure 2: Air Force – Aircraft Inventory



Source: Department of Defense, *United States Air Force Budget Overview Fiscal Year 2020*, p. 5.

The Air Force struggles with the long-term challenge of maintaining its force structure with increasingly capable, but increasingly expensive, aircraft. As the chart above indicates, total aircraft numbers have declined since 2000 despite increasing budgets. Even as inventories decreased, average aircraft age has increased (to 29.2 years).⁴

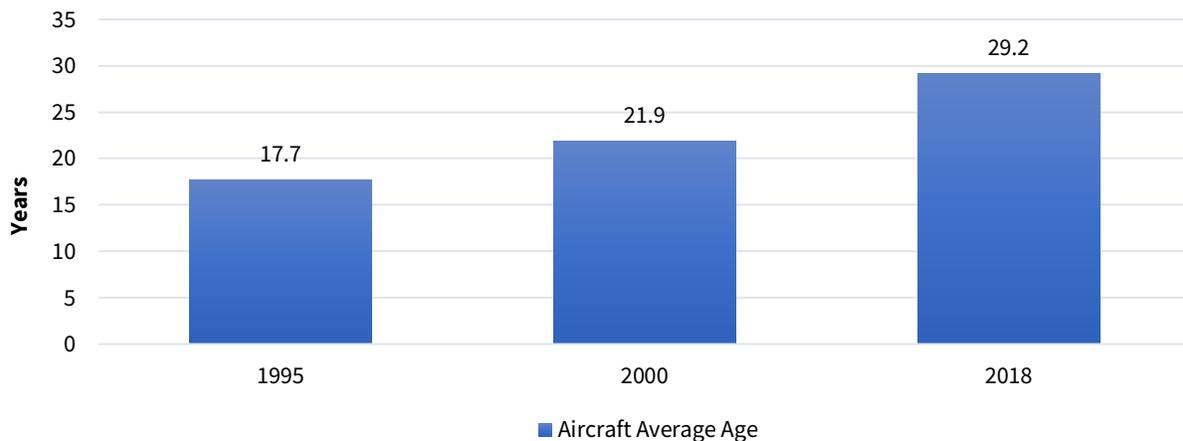
3. Mike Benitez, "Air Force in Crisis, Part II: How Did We Get Here?" War on the Rocks, March 8, 2018, <https://warontherocks.com/2018/03/air-force-in-crisis-part-ii-how-did-we-get-here/>.

4. Numbers measured by Total Active Inventory (TAI), that is, aircraft assigned to operating forces, as well as for test and maintenance. It includes primary, backup, and attrition reserve aircraft.

This happened because the Air Force plan to move rapidly to an all fifth-generation fighter/attack fleet collapsed in the early-2000s when the F-22 buy was curtailed at 187 aircraft and the F-35 program was delayed many years because of development problems. Further, the B-2 program procured only 21 aircraft instead of the planned 132, and other modernization programs were delayed as budgets shrank in the 1990s and the strategic focus shifted to the lower threat air environments of regional conflicts. As a result, the Air Force purchased few aircraft for almost two decades.

The good news is that fleet size has stabilized and aging overall has stopped as new aircraft enter the force. The bad news is that the procurement cost of just maintaining the current inventory will rise far above historical aircraft procurement budget levels through the 2030s.⁵

Figure 3: Air Force – Aircraft Average Age



Source: “USAF Almanac 2019,” *Air Force Magazine* 102, no. 6 (June 2019): p. 56, http://www.airforcemag.com/MagazineArchive/Magazine%20Documents/2019/June%202019/AFM_June2019%20Full%20Issue.pdf; “USAF Almanac 2001,” *Air Force Magazine* 84, no. 5 (May 2001): 55-58, http://www.airforcemag.com/MagazineArchive/Magazine%20Documents/2001/May%202001/0501facts_figs.pdf; “USAF Almanac 1996,” *Air Force Magazine*, 79, no. 5 (May 1996): 56-60, http://www.airforcemag.com/MagazineArchive/Magazine%20Documents/1996/May%201996/0596facts_figures.pdf. 2000 and 1995 years calculated by averaging the average age of the active, reserve, and air national guard fleet aircraft.

Some fleets are in relatively good shape: the transport fleet (21 years) because of acquiring C-17s, the special operations fleet (14 years) because of the C-130Js, and the UAVs/RPVs (8 years) because of large wartime purchases. Other fleets are old: fighter/attack (27 years old, on average), bomber (43 years), tanker (52 years), helicopter (29 years), and trainers (31 years).⁶ All the older fleets (except for some specialty aircraft) have programs in place for modernization, but the programs have been delayed, are expensive, and may take years to fully implement.

Stephen Kosiak, a long-time budget commentator, argues that these trends arise from deliberate choices: “[H]istorical trends in the US military’s force structure and modernization plans are largely the result of policy and programmatic choices made by DOD and service leadership. Contrary to widely held belief . . . the size and shape of today’s forces are not simply a byproduct of budgetary or other pressures beyond DOD’s control.”⁷

5. Edward Keating, David Arthur, and Adebayo Adejeji, *The Cost of Replacing Today’s Air Force’s Fleet* (Washington, DC: Congressional Budget Office, December 2018), <https://www.cbo.gov/system/files/2018-12/54657-AirForceAviationFunding.pdf>.

6. Fleet age numbers current as of September 30, 2018, from “USAF Almanac 2019,” p. 59.

7. Steven M. Kosiak, *Is the US Military Getting Smaller and Older? And How Much Should We Care?* (Washington, DC: Center for a New American Strategy, June 2017), <https://s3.amazonaws.com/files.cnas.org/documents/CNASReport-SmallerOlderMilitary-Final.pdf?mtime=20170310154527>.

Operational Tempo—and the Tension with Warfare at the High End

Like the other services, the Air Force notes how busy it is. In her budget testimony, Secretary Wilson noted that the Air Force had 21,000 airmen deployed in over 179 locations around the globe, conducting over 50,000 sorties and 3,400 precision strikes last year in the campaigns against ISIS and 44,000 more sorties in Afghanistan. These are in addition to 60 sorties conducted by Air Force bombers in the Indo-Pacific and increased efforts at NATO interoperability and readiness through the European Deterrence Initiative (EDI). The Air Force is effectively conducting an air war in the Middle East while still meeting its other global commitments.⁸

RAND noted that “since the 1990s, the US military has operated at a tempo more akin to war than peace” and found that “prolonged operations are driving contemporary [Air Force] capacity shortfalls” and that these would continue in the four notional futures that RAND analyzed.⁹

Despite this high operational tempo, the National Defense Strategy (NDS) calls on the Air Force to give priority to the demands of great power competition. While recognizing the need to meet threats from terrorist groups and regional adversaries, the NDS focuses on challenges from China and Russia: “Long-term strategic competitions with China and Russia are the principal priorities for the Department, and require both increased and sustained investment, because of the magnitude of the threats they pose to U.S. security and prosperity today, and the potential for those threats to increase in the future.”¹⁰

General David Goldfein, Air Force Chief of Staff, described the Air Force’s dichotomy: “to defeat a peer threat while being able to deter a near-peer threat . . . and simultaneously being able to maintain campaign momentum against violent extremism . . . at a moderate level of risk.” The Air Force Future Operating Concept also noted this dichotomy: “The future Air Force will retain tailored numbers of high-end assets to operate against adversaries that pose advanced threats. . . . To conduct follow-on sustained operations, or a sustained irregular warfare effort in a permissive or semi-permissive environment, the Air Force forces will primarily use lower-cost/lower-capability assets.”¹¹ This drives the Air Force to procure a variety of capabilities.

The F-15EX, A-10, OA-X, and the Purpose of Airpower

Until the FY 2020 budget, the Air Force had purchased its last fourth-generation aircraft in FY 2001, unlike the Navy, which had continued to buy fourth-generation F-18s. Now the Air Force is pursuing several programs that produce capacity rather than high capability. Collectively, these decisions—coupled with the F-35 procurement plateau, described below—indicate a new leaning toward a high-low mix, a substantial change from the Air Force’s previous focus on capability and the high-end conflicts that drove it.

- **F-15EX:** A major change in the FY 2020 budget is that the Air Force proposes buying a new version of the F-15E dual-role aircraft, the F-15EX. Although the procurement cost is only about 10 percent lower than the F-35’s currently (in part a result of the F-35s higher production rate), the sustainment cost of

8. U.S. Air Force, *USAF Posture Statement Fiscal Year 2020* (Washington, DC: March 2019), https://www.af.mil/Portals/1/images/posture-statement/FY20_POSTURE_STATEMENT_OMB_Cleared_12MAR_1310L.pdf. Last year, Secretary Wilson stated the Air Force conducted 172,000 sorties and 98,000 precision strikes against ISIS. U.S. Air Force, *USAF Posture Statement Fiscal Year 2019* (Washington, DC: March 2018), https://www.af.mil/Portals/1/documents/1/FY19_AF_POSTURE_STATEMENT_HIGH_RES.PDF, p. 1.

9. Alan Vick, Paul Dreyer, and John Speed Myers, *Is the Air Force Flying Force Large Enough? Assessing Capacity Demands in for Alternative Futures* (Santa Monica, CA: RAND Corporation, 2018), https://www.rand.org/pubs/research_reports/RR2500.html.

10. DOD, *A Summary of the 2018 National Defense Strategy: Sharpening the American Military’s Competitive Edge*, January 2018 (Washington, DC: 2018), p. 2, <https://dod.defense.gov/Portals/1/Documents/pubs/2018-National-Defense-Strategy-Summary.pdf>.

11. Department of the Air Force, *Future Operating Concept: A View of the Air Force in 2035* (Washington, DC: September 2015), p. 10, <https://www.ang.af.mil/Portals/77/documents/AFD-151207-019.pdf>.

an F-15EX is projected to be about 40 percent lower, and therefore the fleet will be more sustainable. Further, the time needed for units to transition from legacy aircraft to the F-15EX is much shorter than the two years needed for the more complicated transition to the F-35A. Thus, the Air Force will have more squadrons available for operations.

The proposal has been controversial, with the Air Force having been pushed into the procurement by the Office of the Secretary of Defense and many airpower advocates criticizing any procurement of fourth-generation aircraft as a step backward. However, Congress seems inclined to go along with the plan.¹²

Numerically, this is a minor shift since the Air Force proposes to buy only eight F-15EXs in FY 2020 and 80 through the FYDP. During this period, the Air Force will buy 3.5 times as many F-35s. Nevertheless, it is a major shift in acquisition strategy and opens the possibility for a larger shift in the future.

- **A-10s:** The Air Force has surrendered to the will of the Congress (and to real world operations) by re-winging the A-10 fleet and extending fleet life into the late-2030s rather than retiring the fleet in the near term.¹³
- **Legacy aircraft:** Buying F-15 EXs will allow the Air Force to retire the oldest legacy aircraft more quickly. The Air Force will also upgrade and extend the lives of F-16C aircraft and F-15C/D/Es; thus, the FY 2020 budget allocates \$850 million to modify A-10s, F-15s, and F-16s.
- **OA-X:** The Air Force continues dithering with off-the-shelf light attack aircraft (called “OA-X”). The concept is that such an aircraft would be better for missions in low-threat environments because it would be less expensive to operate, reduce wear on high-end aircraft, and have more focused training. The Air Force suspended the program last year, then put \$35 million in the FY 2020 budget for testing and some procurement funds in future budgets, FY 2022-FY 2024, skipping FY 2021.¹⁴ However, the Air Force has not established a formal acquisition program, so the OA-X’s future is uncertain. SOCOM expressed its disappointment, arguing to field this capability. The Congress has supported the program, appropriating \$100 million to the program for procurement in FY 2019.¹⁵

This shift from an all high-end fleet to an implicit high-low mix arose from three strategic questions, the first two of which have bedeviled the Air Force from its earliest days:

- *What kinds of conflicts should the Air Force prepare for: those with anti-access/area denial (A2/AD) environments or a spectrum of air environments, including those with less-demanding environments?* For 18 years in Afghanistan and even longer in Iraq, the Air Force has operated intensively but in relatively permissive environments. That allowed unchallenged power projection, forward bases to be used as sanctuaries, low combat attrition, and assured communications. In these lower threat air environments, the Air Force can use legacy aircraft extensively and therefore keep them in the inventory longer. For conflicts against great powers like China and Russia, with their A2/AD

12. John Tirpak, “F-15EX: Careful What You Don’t Ask for,” *Air Force Magazine*, April 2019, <http://www.airforcemag.com/MagazineArchive/Pages/2019/April%202019/F-15EX-Careful-What-You-Dont-Ask-For.aspx>.

13. Stephen Losey, “A-10 re-winging completed, will keep Warthog in the air until late 2030s,” *Air Force Times*, August 13, 2019, <https://www.airforcetimes.com/news/your-air-force/2019/08/13/a-10-re-winging-completed-will-keep-warthog-in-the-air-until-late-2030s/>.

14. Rachel Cohen, “OA-X Projected to Cost More Than \$1 Billion Through 2024,” *Air Force Magazine*, March 18, 2019, <http://www.airforcemag.com/Features/Pages/2019/March%202019/OA-X-Projected-to-Cost-More-Than-1-Billion-Through-2024.aspx>.

15. Heather Venable, “The Little Airplane That Couldn’t? The Air Force’s Light Attack Message,” *War on the Rocks*, March 4, 2019, <https://warontherocks.com/2019/03/the-little-airplane-that-couldnt-the-air-forces-light-attack-message/>; Courtney Albom, “Air Force Programs \$400 Million in FY DP to Buy Light Attack Aircraft,” *Inside Defense*, March 13, 2019, <https://insidedefense.com/daily-news/air-force-programs-400m-fydp-buy-light-attack-aircraft>.

capabilities, the Air Force would need to develop and field advanced capabilities. The NDS emphasizes the latter. A high-low mix is a compromise to meet either eventuality.

- *How can airpower achieve the greatest effects?* Will the greatest effects come from attacks close to friendly front lines—that is, through close air support and battlefield interdiction? The ground forces are strong advocates here, arguing that these effects are immediate and tangible.¹⁶ Specifically designed aircraft like the A-10 are both cheaper and more effective for these missions than multirole stealth aircraft like the F-35.¹⁷ Airpower advocates argue that the greatest effect comes from the deep attack of strategic targets, but flying these missions requires extensive self-protection capabilities. The Air Force has historically leaned toward the latter for a variety of organizational and doctrinal reasons.¹⁸ The debate goes far beyond this monograph.
- *What is the value of stealth in modern air warfare?* Stealth—needed to penetrate heavily defended airspaces—is expensive to develop, procure, and then sustain.¹⁹ Further, there is an operational penalty. Because stealthy aircraft must fly “clean” to remain stealthy, they cannot carry external munitions or fuel tanks. Proponents argue that the cost and performance tradeoffs are worthwhile because of rising air threats.²⁰ The Center for Strategic and Budgetary Assessments (CSBA) built an entire Air Force structure around the need to increase stealth capabilities (as well as long-range capabilities) in its congressionally-directed force structure study.²¹ Opponents argue that only a small part of the fleet needs to be stealthy, while the rest can be non-stealthy. This has been the prevailing perspective since the end of the Cold War, when the United States faced only regional adversaries.²²

Even with the Trump administration’s higher budgets, the Air Force does not have enough money to buy a pure fifth-generation force that can fill out its entire force structure. On the other hand, it does have enough money to buy some fifth-generation aircraft, maintain a viable legacy force, and perhaps buy some new capabilities like a light attack aircraft. The FY 2020 budget heads down this path. However, if budgets go down, even this high-low mix may not be viable.

The Curse of Short Range

A new concern about the Air Force tactical aviation fleet is that it is too short ranged. The F-35, for example, has a combat range of about 680 miles, more than the F-16 but less than the F-15E and much less

16. Scott Beauchamp, “An Infantryman’s Defense of the A-10,” Task and Purpose, February 29, 2016, <http://taskandpurpose.com/infantrymans-defense-10>.

17. Mandy Smithberger, “Congress Questions Air Force’s Commitment to Close Air Support,” Project on Government Oversight, March 26, 2016, <http://www.pogo.org/strauss/issues/weapons/2016/congress-questions-air.html>.

18. The literature on close air support versus strategic attack is extensive. For a recent example, see Phil Haun and Colin Johnson, “Breaker of Armies: Airpower in the Easter Offensive and the Myth of Linebacker One and Two in the Vietnam War,” *International Security* 40, no. 3 (Winter 2015/16): 139–78, https://www.mitpressjournals.org/doi/abs/10.1162/ISEC_a_00226?journalCode=isec.

19. Technically not “stealth” but “low observability” since nothing is actually invisible. The additional cost of stealth is difficult to estimate since aircraft are bought in different quantities, have different characteristics beyond stealth, and costs can include different elements (like development). One data point is from the Navy, which is buying both fourth generation F-18E/Fs and fifth generation F-35s. The average recurring procurement cost of F-35B/Cs over the life of the program is about 30 percent more than an F-18 in FY 2020. Adding non-recurring costs for manufacturing and development would greatly increase the cost differential.

20. Jeff Harrigan and Max Morosko, “Fifth Generation Air Combat: Maintaining the Joint Force Edge,” Mitchell Institute for Aerospace Studies, The Mitchell Forum, no. 6, July 2016, http://docs.wixstatic.com/ugd/a2dd91_bd906e69631146079c4d082d0eda1d68.pdf; Loren Thompson, “Trump Defense Team inherits Bad Ideas About Air Power from The Obama Years,” *Forbes*, February 2, 2017, <https://www.forbes.com/sites/lorenthompson/2017/02/01/trump-defense-team-inherits-bad-ideas-about-air-power-from-the-obama-years>.

21. Mark Gunzinger et al., *An Air Force for An Era of Great Power Competition* (Washington, DC: Center for Strategic and Budgetary Assessments, 2019), <https://csbaonline.org/research/publications/an-air-force-for-an-era-of-great-power-competition>.

22. Mike Pietrucha, “The U.S. Air Force and Stealth: Stuck on Denial Part I,” *War on the Rocks*, March 24, 2016, <http://warontherocks.com/2016/03/stuck-on-denial-part-i-the-u-s-air-force-and-stealth>; Mike Benitez, “Stealth Is King, the World Is Flat,” *War on the Rocks*, May 19, 2016, <https://warontherocks.com/2016/05/stealth-is-king-the-world-is-flat/>.

than the old F-111, which had twice the combat range (1330 miles). During the Cold War, short range was not a problem because the forward fighter bases in NATO were close to the front line. It was not a problem after the Cold War because adversaries did not have strong antiair capabilities, and as a result, U.S. tactical aircraft could refuel as often as they needed.

However, in prospective conflicts with China and Russia, operational range matters. The Pacific is vast, and U.S. bases in Europe, even forward bases in Eastern Europe, are still far from potential battlefields in, for example, the Baltic states. Further, airbases are vulnerable as never before, so U.S. aircraft may need to be based further away from their targets, and adversary air defenses may make aerial tanking risky.

As a result, many analyses recommend actions to increase standoff range and reduce vulnerability: an emphasis on bomber forces because of their long range; the curtailment of F-35 procurements because of their short range; the dispersion of basing; and the development of long-range strike, especially unmanned systems. For example, in a congressionally-directed study, the CSBA recommended, “the Air Force should rebalance its combat forces in favor of long-range, penetrating bombers.” The CSBA also recommended developing a new, long-range fighter/attack aircraft (“penetrating counter air”) to substitute for some F-35 inventory.²³ Similarly, in another congressionally-directed study, the MITRE Corporation recommended “an increase in available long-range aircraft and bases [to] strengthen the conventional deterrence posture of U.S. forces.”²⁴

The Navy suffers from the same range limitation but has the advantage of being able to move its airfields (carriers) around, so this affects the Air Force more intensely.²⁵

*Piloted versus Unpiloted (or “Manned versus Unmanned”)*²⁶

For the Air Force, this revolution is over. Whereas the Navy’s efforts to integrate unmanned aircraft into its aviation fleet are still controversial, slow, and limited, as described in this project’s corresponding chapter on the Navy, the Air Force incorporation of unmanned aircraft into its force structure—after strong resistance during the 1990s and early-2000s—has become routine.

However, the Air Force has stalled in its effort to bring remotely piloted aircraft (RPA) into the force. The RPA proportion of the force has leveled off at 5–7 percent for 10 years and current procurement plans show no change in the future. The FY 2020 budget procures only 12 additional MQ-9 Reapers, the follow-on aircraft to MQ-1 Predators, which retired in March, and no additional RQ-4 Global Hawks. By contrast, the budget procures 88 manned aircraft.²⁷

The Air Force is experimenting with “loyal wingman” RPAs and one, “Valkyrie,” is in testing. At some point in the future, this might change the balance. However, this is not yet an official “program of record.”²⁸

23. Gunzinger et al., *An Air Force for An Era of Great Power Competition*, p. xi

24. MITRE Corporation, *US Air Force Aircraft Inventory Study: Unclassified Report*, <http://www.airforcemag.com/DocumentFile/Documents/2019/MITRE-USAF-Aircraft-Inventory-Study.pdf?>; This is the unclassified version of a longer classified report on the Air Force aircraft force structure, directed by the Congress.

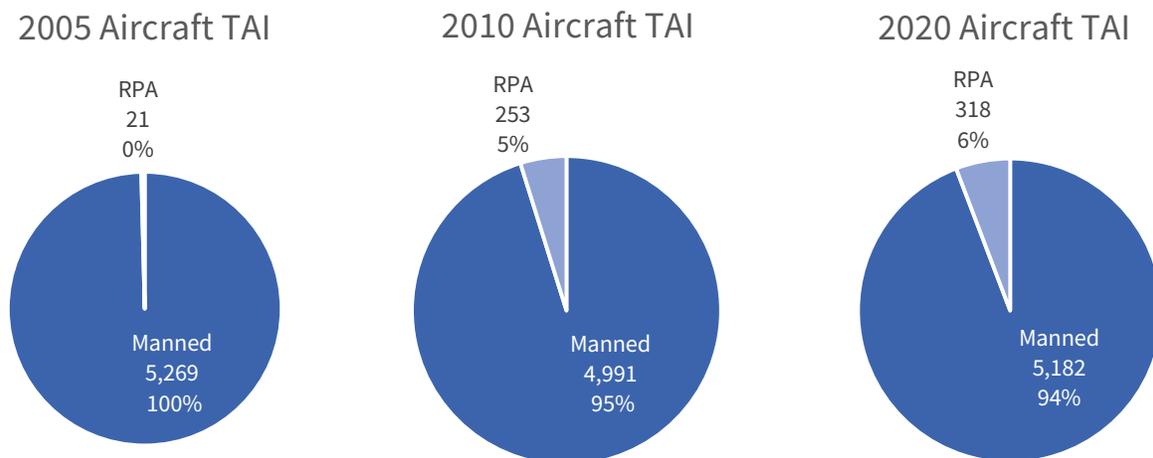
25. See Jerry Hendricks, *Retreat from Range: The Rise and Fall of Carrier Aviation* (Washington, DC: Center for a New American Security, October 2015), <https://www.cnas.org/publications/reports/retreat-from-range-the-rise-and-fall-of-carrier-aviation>.

26. The Air Force is emphatic that these are aircraft and are not “unmanned” but are instead “remotely piloted.” Hence, the Air Force uses the term “Remotely Piloted Aircraft.” There are cultural reasons for this distinction, the Air Force being run by pilots. However, there is also a substantive argument in that, although there are no humans in the aircraft itself, there is a large ground-based support structure to launch, fly, and recover the aircraft.

27. Department of the Air Force, *Air Force Justification Book Volume 1 of 2, Aircraft Procurement*, p. x-xiii.

28. Aaron Gregg, “Air Force Completes First Flight of Valkyrie Unmanned Fighter Jet,” *Washington Post*, March 6, 2019, <https://www.washingtonpost.com/business/2019/03/07/air-force-completes-first-flight-test- Valkyrie-unmanned-fighter-jet/>.

Figure 4: RPA versus Manned Aircraft, 2005, 2010, 2020



Source: Department of Defense, *United States Air Force Budget Overview Fiscal Year 2020*, p. 38; “USAF Almanac 2011,” *Air Force Magazine* 94, no. 5 (May 2011): p. 48, http://www.airforcemag.com/MagazineArchive/Magazine%20Documents/2011/May%202011/0511facts_figs.pdf; “USAF Almanac 2006,” *Air Force Magazine* 89, no. 6 (May 2006): p. 63, http://www.airforcemag.com/MagazineArchive/Magazine%20Documents/2011/May%202011/0511facts_figs.pdf; Air Force Almanac, Aircraft Total Active Inventory, 2019, 2010, 2005; 2020 numbers taken from the *Air Force FY2020 Budget Overview*, Appendix, Air Force Total Aircraft inventory.

Another major issue is whether to buy RPAs for permissive or non-permissive environments.²⁹ Reapers can only operate in permissive environments. That has been fine for the kinds of conflicts the United States has fought recently. However, in a conflict with a high-end competitor like Russia or China, these aircraft would be vulnerable because of their slow speed, high visibility, and lack of defensive systems. The issue was illustrated dramatically in July 2019 when the Iranians shot down a Navy RQ-4.

The question, then, is twofold. First, are there concepts of operation that would enable current UAVs to contribute to a high-end warfighting campaign? Second, should the Air Force develop and procure stealthy and likely largely autonomous UAVs to operate inside these challenging air defense environments? One stealthy unmanned aircraft, the RQ-170 Sentinel, an Air Force/CIA collaboration is known to exist because one was shot down over Iran in 2011 and exhibited to the public. A possible SR-72, an optionally manned successor to the SR-71, is also rumored to be in development.³⁰

One insight into possible aviation futures came from the Air Force’s decision to cancel the recapitalization program for JSTARS (E-8C), the airborne platform that uses radars to discern movement on the ground. The Air Force judged that the aircraft, slow and with predictable flight paths, would not be survivable in great power conflicts and so decided to replace it with a battle management system that leveraged distributed networks. Such a change to one program is interesting but limited. However, if this kind of reasoning were applied across the board—for example, to tankers and airborne command and control—then many of the Air Force’s large aircraft would potentially be replaced by other approaches.

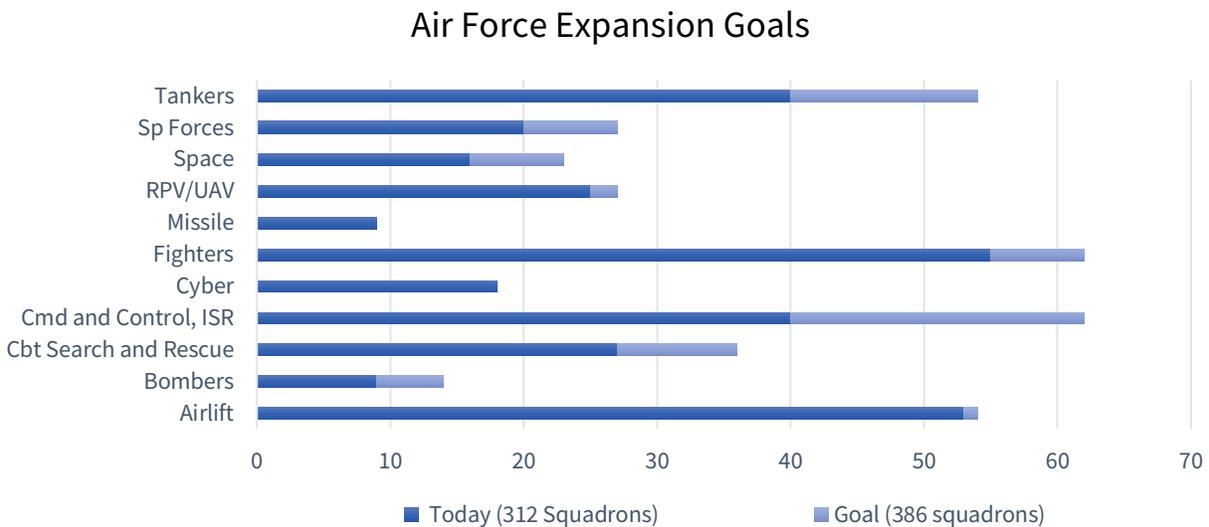
29. Mark Pomerleau, “Can the MQ-9 Reaper operate in contested environments?” C4ISRnet, October 4, 2016, <http://www.c4isrnet.com/unmanned/uas/2016/10/04/can-the-mq-9-reaper-operate-in-contested-environments>.

30. Guy Morris, “Pictures: Lockheed Martin RQ-170 Sentinel Sighting in California,” *Aviation Week*, March 5, 2018, <http://aviationweek.com/defense/pictures-lockheed-martin-rq-170-sentinel-sighting-california>; James Clark, “The SR 71 Blackbird’s Ultrasecret Successor May Scream across the Sky Sooner Than Expected,” *Task and Purpose*, September 29, 2017, <https://taskandpurpose.com/sr-71-blackbird-successor-demonstrator>.

Air Force Expansion Proposal

Last year, then-Secretary of the Air Force Heather Wilson proposed a 25 percent increase in force structure, describing it as “the Air Force we need” (see chart below).³¹ This would increase the Air Force from 312 operational squadrons to 386. Much of the growth is in enabling capabilities like tankers, special forces, space, and especially command-and-control, intelligence, surveillance, and reconnaissance, which provide the precision targeting that long-range munitions require.

Figure 5: Air Force Expansion by Mission Category



Source: Air Force, *Restoring Readiness: FY2020 Posture* (Washington, DC: April 2019), https://www.af.mil/Portals/1/documents/5/FY20_Posture_Statement.pdf?ver=2019-04-04-092535-083×tamp=1554384341518.

In FY 2020, the Air Force reaffirmed this goal.³² General Goldfein’s posture statement declared, “our analysis [has] produced an unmistakable conclusion: The Air Force is too small for what our nation needs. We currently have 312 operational squadrons . . . To implement the National Defense Strategy and prevail over our highest priority competitors, we determined that the Air Force must grow to 386 operational squadrons.” The statement went on to note that the National Defense Strategy Commission also found that the Air Force needs “greater capacity in an era of great power competition” and that the present Air Force, which had evolved from 20 years of counterinsurgency and counterterrorism operations, could not meet these new demands.³³

Details about how the calculation was done and the operational concepts behind the larger force requirement are not publicly available. The unclassified Air Force report to Congress references “combatant commander requirements, wargames, and joint force simulations” but provides no numbers or details. Interestingly, the report does note that “the maximum of the two stacked demands (competition or war) determined the peak demand for each operational squadron category.” That means that for some fleets the day-to-day operational demands set the fleet size and not the wartime demands.³⁴

31. Chuck Broadway, “SecAF Wilson provides Air Force update,” U.S. Air Force, September 17, 2018, <https://www.af.mil/News/Article-Display/Article/1635645/secaf-wilson-provides-air-force-update/>; Full speech linked here: <https://spacepolicyonline.com/wp-content/uploads/2018/09/SECAF-AFA-Speech-Final-Sep-17-2018-AF-We-Need.pdf>.

32. U.S. Air Force, *USAF Posture Statement Fiscal Year 2020*.

33. *Ibid.*

34. *Fiscal Year 2018 National Defense Authorization Act Section 1064 Study: Aircraft Inventories for the Air Force*, March 2019, <http://www.air->

CSIS estimated that the additional annual cost of this expanded force would be about \$37 billion, and up to 94,000 additional personnel, active and reserve, when all the indirect and overhead impacts are included.³⁵ However, as noted earlier, the Air Force takes no steps in FY 2020 to reach this expansion goal, unlike the Navy and its 355-ship goal.

Aircraft Modernization: The Future Force

The Air Force has programs in place to modernize the individual fleets, but this modernization has been delayed and will take time, and as a result, today's aging fleets will be around for a long while.

B-21 AND THE BOMBER FORCE

The B-21 Raider program continues in development with budget demands rising from \$2.3 billion in FY 2019 to \$3 billion in FY 2020. Because the B-21 has a mid-2020s fielding date ("IOC"), the legacy B-52s, B-1s, and B-2s will comprise the bomber force for many years to come. That force continues to age (currently 43 years on average), though a variety of upgrade programs keep the aircraft flying and operationally relevant, for example, new engines for the B-52s and a new defensive system for the B-2s.

F-35 AND THE FIGHTER FORCE

The Air Force requests 48 aircraft in FY 2020, about the same as for the last four years, although Congress routinely increases the buy (to 56 in FY 2019) out of a concern that the aircraft are being fielded too slowly. Forty-eight may be the long-term procurement level, rather than the 60 aircraft per year that the Air Force has planned.

After several years of making good progress in maturing technologies, the program has still not achieved the planned levels of reliability and capability. The annual report of the director of Operational Test and Evaluation (DOT&E) highlighted that many of the criticisms from its 2017 report remained unaddressed. For example, the report noted that "The operational suitability of the F-35 fleet remains at a level below Service expectations. Similar to the 2017 DOT&E report, most suitability metrics remained nearly the same throughout 2018 or moved only within narrow bands." Moreover, cybersecurity testing revealed that "vulnerabilities identified during earlier testing periods still had not been remedied." The DOT&E also found that fleet-wide average availability "is below the program target value of 60 percent and well below planned 80 percent needed for efficient conduct." Other issues, such as "unacceptable" gun accuracy for the F-35A and durability of the F-35B, which was well under 8,000 flight hours and expected to begin reaching service life limit in 2026, were also noted.³⁶

Age of the fighter/attack force has increased from 8 years at the end of the Cold War in 1991 to 26 years today, while numbers have decreased from 4,000 in 1991 to 1,981 (total) today. Kosiak's observation is applicable here. Both fleet aging and reduced numbers result from an Air Force decision to cease

forcemag.com/DocumentFile/Documents/2019/Air%20Force%20FY18%20NDA%20Section%201064%20Study.pdf; Air Force Chief of Staff General Dave Goldfein noted that the war-gaming that went into the 386 number would be elaborated in closed hearings with Congress, and that apart from the fact that some 3,000 iterations were conducted, more could not be revealed in an unclassified setting. Kyle Rempfer, "The 386-squadron goal is still lean compared to Desert Storm days, Air Force chief says," *Air Force Times*, February 19, 2019, <https://www.airforcetimes.com/news/your-air-force/2019/02/20/the-386-squadron-goal-is-still-lean-compared-to-desert-storm-days-air-force-chief-says/>; The absence of detailed studies on how 386 was determined and how exactly it will be reached has been repeatedly noted, John Lehman, "386! Go On Air Force. Say it Loud. Now!" *Breaking Defense*, March 19, 2019, <https://breakingdefense.com/2019/03/386-go-on-air-force-say-it-loud-now/>.

35. Mark Cancian, "Air Force 386 Squadron Plan: Hallucination Or Negotiating Tactic?" *Breaking Defense*, September 26, 2018, <https://breakingdefense.com/2018/09/air-force-386-squadron-plan-hallucination-or-negotiating-tactic/>.

36. Director of Operational Test and Evaluation, *FY 2018 Annual Report* (Washington, DC: Department of Defense, December 2018), p. 23-36, <https://www.dote.osd.mil/pub/reports/FY2018/pdf/dod/2018f35jsf.pdf>.

production of fourth generation aircraft (F-15s and F-16s) in the 1990s and instead wait for production of the fifth generation (F-22s and F-35s). This was the opposite of the Navy's decision. Unfortunately, production of the F-22 was curtailed at 187 aircraft during the budget drawdown in the late-2000s, and the F-35 was delayed many years from its original schedule.

Fielding of new F-35s is beginning to ease the aging of the fleet (as will production of F-15EXs). Nevertheless, at 48 aircraft per year, it would take another 29 years to reach the F-35 inventory objective of 1,763—FY 2049. Even at 60 aircraft per year, the Air Force goal, it would take 23 years—FY 2043. The average age of the fighter/attack fleet will, therefore, remain high for a long time, perhaps indefinitely.

NEXT GENERATION AIR DOMINANCE (NGAD)

Coming up over the horizon is NGAD, the next-generation fighter/attack program for both the Navy and Air Force (known in the Navy as FA-XX). Sometimes seen as a sixth-generation fighter, the program is not yet well defined, including perhaps manned and unmanned systems, as well as sensors and munitions. Funding in the FY 2020 budget reaches \$1 billion. How this program shakes out will have a profound effect on the shape of the future Air Force and, indeed, may determine whether manned aircraft are a dying capability or whether they have decades of continuing relevance.

KC-46 AND THE TANKER FORCE

The KC-46 will replace the Air Force's aging tanker force, the current KC-135 tankers having an average age of 57 years and the KC-10s 34 years. The program was thought to be low risk since the airframe is a variant of Boeing's widely used 767.

However, the program has been troubled from the beginning, with first delivery not occurring until January 2019, three years late. Production deficiencies and problems with the refueling boom caused the Air Force to withhold \$360 million of payments recently until the deficiencies were corrected.³⁷ Boeing, the contractor, continues to execute the fixed price contract that it greatly underbid and on which the company is taking large losses (\$3.6 billion so far).³⁸ That underbidding strategy appears to have paid off, however, as the Air Force announced that it would not recompet the contract after the current buy but would procure more KC-46s.

The bottom line is that the KC-46 program is still not quite ready, and the current tanker fleet of KC-10s and KC-135s will be around for a lot longer.

Strategic Mobility

The NDS focus on great power conflict appeared to raise the possibility of wartime attrition being a concern for sizing the strategic airlift and sealift fleets. Russia and China can threaten sea and air lines of communication in a way that regional threats, like Iran or North Korea, cannot. Many outside analyses had pointed to this new threat.³⁹ That would drive inventory requirements higher.

37. Colin Clark, "Air Force Gets Tough with Boeing, Withholds \$360 Million," Breaking Defense, July 24, 2019, <https://breakingdefense.com/2019/07/air-force-gets-tough-with-boeing-withholds-360-million-from-kc-46/>; "KC-46 Tanker Modernization: Aircraft Delivery Has Begun, but Deficiencies Could Affect Operations and Will Take Time to Correct," Government Accountability Office, June 12, 2019, <https://www.gao.gov/products/GAO-19-480>.

38. Garrett Reim, "Boeing losses in KC-46A Programme Continue to Rise," Flight Global, February 12, 2019, <https://www.flightglobal.com/news/articles/boeing-losses-in-kc-46a-programme-continue-to-rise-455679/>.

39. Sydney Freedberg, Jr., "U.S. Needs More Tankers, Transports Since Russia and China Can Shoot Them Down," Breaking Defense, September 21, 2017, <https://breakingdefense.com/2017/09/more-tankers-transport-needed-since-russia-china-can-shoot-them-down-everhart>.

However, the most recent strategic mobility study, *Mobility Capabilities and Requirements Study 2018*, completed in February 2019, did not address this potential challenge and found that the fleets were sized adequately. The major concerns were recapitalization of the aging tanker and sealift fleets.⁴⁰ DOD appeared to be ignoring this potential problem.

However, Congress was not ignoring the problem and raised a number of questions about the analysis. In response, the United States Transportation Command, or TRANSCOM, is doing an unprecedented follow-on study that broadens the analysis by tying it to “campaigning and combat analysis” and extending the time horizon beyond 2023. Interim results will be ready by June 2020, in time for CSIS’s military forces analysis next year, and final results will be available in January 2021.⁴¹

Nuclear Enterprise

The ICBM force has declined from 450 to the New START limit of 400. The bomber force holds steady at 157 total (TAI). The direction of the nuclear enterprise was laid out in the DOD’s Nuclear Posture Review (NPR), published in February 2018. The NPR affirmed the need for the nuclear triad to deter nuclear and non-nuclear aggression and assure allies and partners.

Further, the NPR highlighted the “the increasing need for this diversity and flexibility” as “one of the primary reasons why sustaining and replacing the nuclear triad and non-strategic nuclear capabilities, and modernizing NC3, is necessary now.”⁴²

However, after nearly three decades of low public visibility and relatively low cost, the nuclear enterprise is getting more attention because the systems acquired during the Reagan buildup of the 1980s are now reaching the end of their service lives and must be replaced. That brings opposition from arms-control advocates. Table 3 shows the most controversial nuclear modernization programs.

These programs—with the B-21 bomber and the *Columbia*-class submarine—contribute to the nuclear modernization bow wave that DOD faces in the 2020s and 2030s and which will require DOD to either trim programs or increase the proportion of the budget allocated to nuclear forces.⁴³

One piece of good news: In response to scandals several years back and several outside reviews, the Air Force (and the Navy) are continuing their efforts to improve the standards and quality of their nuclear enterprise, both personnel and operations. The absence of any recent incidents may indicate some success.

A “Space Force?”

The great issue about space this year, like last year, is whether, and how, to create a “space force” separate from the Air Force. The concept is to give space, now one of the five domains of warfighting (with land, sea, air, and cyber), increased attention. The issue appeared to have subsided last year when Congress declined to create such an organization in the face of determined opposition from the Air Force and DOD. However, the issue resurfaced over the summer of 2018 when President Trump expressed his intention to create a

40. “Mobility Capabilities and Requirements Study (MCRS) 2018,” United States Transportation Command, February 2019, <http://www.airforcemag.com/DocumentFile/Documents/2019/MobilityCapabilitiesRequirementsStudy2018.pdf>.

41. Courtney Albon, “TRANSCOM Crafting Follow-On Capability Study with a Broader Scope,” Inside the Pentagon, October 2, 2019, <https://insidedefense.com/daily-news/transcom-crafting-follow-capability-study-broader-scope>.

42. DOD, *Nuclear Posture Review* (Washington, DC: Department of Defense, February 2018), <https://media.defense.gov/2018/Feb/02/2001872886/-1/-1/1/2018-NUCLEAR-POSTURE-REVIEW-FINAL-REPORT.PDF>.

43. Todd Harrison and Evan Montgomery, *The Cost of U.S. Nuclear Forces: From BCA to Bow Wave and Beyond*, (Washington, DC: Center for Strategic and Budgetary Assessments, 2015), <http://csbaonline.org/search/?x=0&y=0&q=harrison>.

“space corps” of some sort. Now, the department has fallen into line and proposed creating a “space force” as an independent service initially under the Department of the Air Force but eventually under its own military department.

Table 3: Nuclear Modernization Programs (\$ millions)

Program	FY 2019 enacted	FY 2020 proposed	Comment
<i>Ground-Based Strategic Deterrent (GBSD)</i>	414.4	570.4	GBSD has been controversial among arms-control advocates and some budget hawks who see it as unnecessary and would reduce the nuclear forces to a “dyad” or even a “monad.”
<i>Long-Range Standoff (LRSO) weapon</i>	664.9	712.5	LRSO, a nuclear-armed cruise missile, has been controversial because bombers already have one nuclear munition, the B61 bomb.
<i>B61 tail kit program</i>	233.8	108.4	Designed to increase the accuracy of the B61 nuclear bomb, the program faces some opposition because of concerns that it makes nuclear warfighting more viable.

Note: Additional funding for an Analysis of Alternative is provided in the DOE NNSA budget for the development of a low yield SLCM called for in the 2018 NPR.

Source: Office of the Under Secretary of Defense (Comptroller), *Program Acquisition Cost by Weapon System* (Washington, DC: Department of Defense, March 2019), https://comptroller.defense.gov/Portals/45/Documents/defbudget/fy2020/fy2020_Weapons.pdf; Department of Energy, *FY 2020 Congressional Budget Request: National Nuclear Security Administration, Vol. 1* (Washington, DC: March 2019), p. 73; National Nuclear Security Administration, *FY 2020 Congressional Budget Request* (Washington, DC: Department of Energy, March 2019), <https://www.energy.gov/sites/prod/files/2019/04/f62/doe-fy2020-budget-volume-1.pdf>.

Congress seems inclined to go along in some way. The Senate authorization act essentially follows the DOD proposal but makes the unrealistic provision that all additional billets come out of the Air Force. The House authorization act creates a “space corps” that does not quite rise to the level of an independent service but does have representation on the joint chiefs of staff. Some compromise will be developed in the fall of 2019 for the final NDAA.

If a separate service were created, it would have profound effects on DOD’s internal organization, especially the Air Force, which would give up many organizations and personnel to create the new military service. A “space force” would also redefine the nature of military service since its personnel would be essentially noncombatants whose mission was to develop, launch, and control satellites from the continental United States.

Munitions as an Element of Strategy: Volume for the Long War

All the services are buying more munitions. Many analyses show that U.S. forces would expend large amounts of munitions in a great power conflict. Thus, the Air Force budget procures a lot of munitions, especially air-to-ground munitions.

Procurement of munitions may not hold up if budgets decline. The downside of munitions acquisition is that they are sterile; that is, once procured, they go on the shelf to be used in case of conflict. If there is no conflict that requires their use, then the services must pay to dispose of the munitions at the end of their useful life. Munitions are not visible and, therefore, may not contribute significantly to deterrence. For this reason, many U.S. allies and partners do not have large munitions stocks despite the wartime requirement.

Program	FY 2020 request (#)
JDAM	37,000
Small Diameter Bombs (SDB-I and II)	7,078/ 1,175
Joint Air-to-Surface Standoff Missile (JASSM)	430
AIM-9X Sidewinder	355
AIM120D Advanced Medium-Range Air-to-Air Missiles (AMRAAM).	220
Hellfire Missile	3,859
Advanced Precision Kill Weapon System (APKWS)	5,400

Source: Air Force, “Defense-Wide Justification Book Volume 1, Procurement of Ammunition,” JDAM, p. 71, 80; APKWS, p. 3, 7; Air Force, “Defense-Wide Justification Book Volume 1, Procurement of Missiles,” SDB I and II, p. 85, 95, 97, 105; JASSM, p. 23, 37; AIM-9X Sidewinder, p. 49, 62 (*MAX production rate is 1,400 [per Manufacturer location] missiles of any mix required); AMRAAM, p. 63, 73; Predator Hellfire Missile, p. xi.

By contrast, aircraft, ships, and vehicles get used every day; their visibility creates a perception of U.S. capability in potential adversaries and thus adds to deterrence. As a result, there is always pressure to buy platforms rather than munitions.

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