NOVEMBER 2021

U.S. Military Forces in FY 2022

Air Force

Mark F. Cancian

This paper is part of *U.S. Military Forces in FY 2022*. The Air Force continues developing and procuring next-generation aircraft to meet the demands of great power conflict. Fielding of new aircraft has slowed the increase in fleet age, but the Air Force is not buying enough new aircraft to sustain its force structure at its current size. Deep cuts are likely in the future.

KEY TAKEAWAYS

- Air Force active and reserve military personnel levels are essentially unchanged in FY 2022. Force structure is also essentially unchanged.
- Air Force official documents have ceased describing operational demands and have downplayed stress associated with current operations. This may reflect a reduction in operations as the Middle East conflicts wind down but may also reflect a strategic decision to shift emphasis to great power conflict.
- Aircraft inventories have stabilized in the near term. However, the Air Force is not buying enough new aircraft to maintain the inventory over the long term. Increasing procurement to the levels needed to sustain the inventory would require historically high costs.
- Fleet aging has slowed but not stopped. The average age of some fleets is high, at 45 years for bombers, 49 years for tankers, and 29 years for fighter/attack aircraft.
- Under the "divest to invest" concept, the Air Force will likely close this gap by retiring older aircraft and shrinking the force, possibly substantially. However, Congress has been reluctant to do this in the past.
- Unresolved is how the Air Force will meet operational demands with a shrinking fleet if these demands continue at the high level of recent years.
- The FY 2022 budget procures 91 manned aircraft but no remotely piloted aircraft, so the unmanned fleet has plateaued at 6 to 7 percent of the force.
- Nuclear forces require a greater share of the Air Force budget as Reagan-era systems reach the end of their service lives. Nevertheless, the Biden administration, despite rhetorical support for arms control, provides strong budget support for nuclear modernization.

CSIS | CENTER FOR STRATEGIC & INTERNATIONAL STUDIES

End Strength in FY 2022

Table 1: Air Force End Strength – Active and Civilian

	Air Force Active		Civilian Full-Time Equivalents[1]	
	Combat Coded Squadrons	*End Strength*	*Air Force ("Blue")*	*Non-Air Force*
FY 2021 Enacted	40	327,000	139,300	32,500
FY 2022 Request	40	328,300	140,600	35,300
Change	0	+1,300	+1,300	+2,800

Note: Figures rounded to the nearest hundred.

Source: USAF Financial Management & Comptroller, *United States Air Force Budget Overview Fiscal Year 2022* (Washington, DC: May 2021), 12, https://www.saffm.hq.af.mil/Portals/84/documents/FY22/SUPPORT_/FY22%20Budget%20Overview%20Book.pdf?ver=Reck2JzBUzoZmGByl9Zm-Q%3d%3d. Squadron and total civilian data from Office of the Under Secretary of Defense (Comptroller), *Defense Budget Overview* (Washington, DC: May 2021), 2–8, A-3, https://comptroller.defense.gov/Portals/45/Documents/defbudget/FY2022/FY2022_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	*End Strength*	*Combat Coded Squadrons*	*End Strength*
FY 2021 Planned	3	70,300	21	108,100
FY 2022 Request	3	70,300	20	108,300
Change	0	0	-1	+200

Source: USAF Financial Management & Comptroller, *United States Air Force Budget Overview Fiscal Year 2022*, 12. Squadron data from Office of the Under Secretary of Defense (Comptroller), *Defense Budget Overview*, A-3.

Changes in personnel levels are small. The active-duty Air Force has a net increase in personnel even as it loses some personnel to the Space Force. Budget documents attribute this increase to the retention of medical personnel to cope with the pandemic.[2] Active-duty personnel and the Air Force Reserve maintain the major elements of force structure. The Air National Guard loses one squadron.

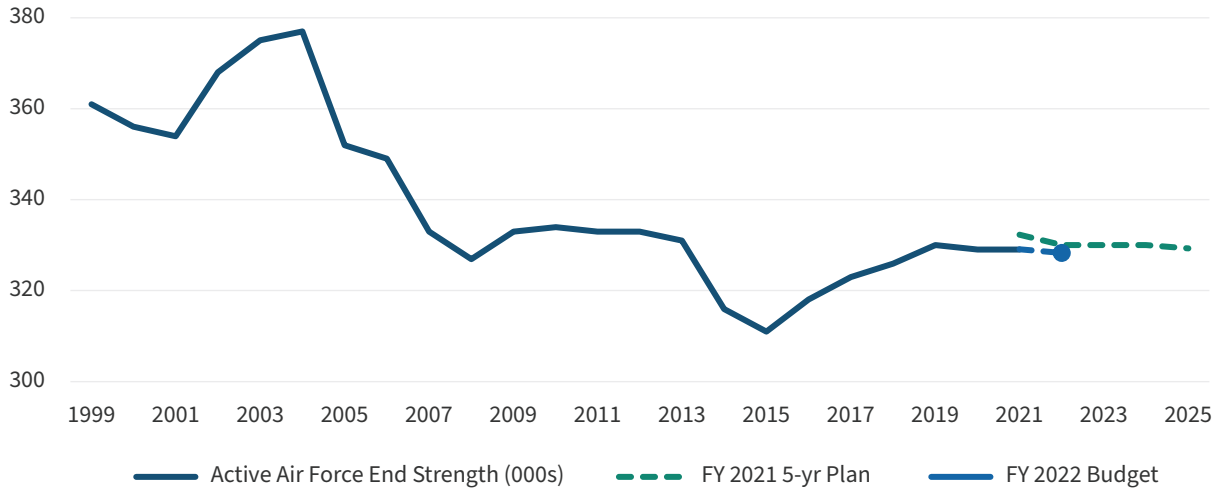
Air Force civilian personnel increase, with budget documents citing training, network protection, and diversity and inclusion initiatives. Non-Air Force civilians increase substantially, by 8.6 percent, but the budget documents give no explanation.

1. The Air Force budget distinguishes between "blue" and "non-blue" activities. "Blue" activities are those that pertain to the Air Force. "Non-blue" activities are those that relate to other organizations that are funded in the Air Force budget but not related to the Air Force, such as intelligence organizations.
2. USAF Financial Management & Comptroller, *United States Air Force Budget Overview Fiscal Year 2022* (Washington, DC: May 2021), 12, https://www.saffm.hq.af.mil/Portals/84/documents/FY22/SUPPORT_/FY22%20Budget%20Overview%20Book.pdf?ver=Reck2JzBUzoZmGByl9Zm-Q%3d%3d. Squadron data from Office of the Under Secretary of Defense (Comptroller), *Defense Budget Overview* (Washington, DC: May 2021), 11, https://comptroller.defense.gov/Portals/45/Documents/defbudget/FY2022/FY2022_Budget_Request_Overview_Book.pdf.

A continuing bright spot is active/reserve relations. By working closely with its reserve components and maintaining their end strength, the Air Force has avoided the internal conflicts that had marred earlier budgets and required a 2014 force structure commission to make peace.[3]

Another bright spot is that the pandemic eased the pressure from the Air Force's long-standing and, until recently, severe pilot shortage. Neither the budget documents nor the posture statement reference the pilot shortage. With the commercial travel industry still in recession, the airlines have stopped hiring, at least in the near term, so pilots are staying in the service.[4]

Figure 1: Air Force – Active End Strength, 1999–2022



Source: Office of the Under Secretary of Defense (Comptroller), *National Defense Budget Estimates for FY2022* (Washington, DC: Department of Defense, August 2021), Table 7-5: Department of Defense Manpower, 258–260, https://comptroller.defense.gov/Portals/45/Documents/defbudget/FY2022/FY2022_Budget_Request_Overview_Book.pdf.

As Figure 1 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. That decrease harmed readiness and reduced the pilot inventory.[5] Thus, the Air Force began increasing end strength in FY 2016.

The FY 2021 budget projected that personnel levels would stay constant through FY 2025.[6] This was likely a hedge against an uncertain budget future. The Air Force was reluctant to add personnel that it could not sustain but was not at the point of major cuts either.

---

3. National Commission on the Structure of the Air Force, *Report to the President and Congress of the United States* (Arlington, VA: January 2014), https://policy.defense.gov/Portals/11/Documents/hdasa/AFForceStructureCommissionReport01302014.pdf.
4. This respite in the pilot shortage may be temporary, as some analysts argue. See Brian Kruchkow and Tobias Switzer, "The USAF's Bad Bets on Pilot Retention Show It Needs outside Help," Defense One, April 19, 2021, https://www.defenseone.com/ideas/2021/04/usafs-bad-bets-pilot-retention-show-it-needs-outside-help/173431/.
5. 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/.
6. Office of the Under Secretary of Defense (Comptroller), *National Defense Budget Estimates for FY2022* (Washington, DC: August 2021), Table 7-5: Department of Defense Manpower, 258–260, https://comptroller.defense.gov/Portals/45/Documents/defbudget/FY2022/FY2022_Budget_Request_Overview_Book.pdf.

The FY 2022 budget has no out-year projections, pending publication of the Biden administration's National Defense Strategy (see the previously published "strategy and budget overview section of this series for more detail). The FY 2022 level is slightly below the FY 2021 projection (-1,700), but that likely reflects the vagaries of recruiting, retention, and minor organizational reshuffles. The bottom line is that the future structure of the Air Force is still undetermined.

> *The FY 2022 level [for active-duty military personnel] is slightly below the FY 2021 projection (-1,700), but that likely reflects the vagaries of recruiting, retention, and minor organizational reshuffles. The bottom line is that the future structure of the Air Force is still undetermined.*

For many years, including FY 2021, the Air Force described how many missions it flew, weapons it dropped, and personnel it deployed. In a dramatic change from past practice, neither the posture statement nor the budget documents for FY 2022 contain this information. The posture statement does have a brief note that, "The core missions of the Air Force continue to be in constant demand around the world. And because the many capabilities we provide are exclusive to our Service, our forces have been under strain for two decades. The strain negatively impacts readiness and our ability to modernize."[7] The budget documents do not contain a similar concern.

This may reflect a reduction in operational tempo from the height of the bombing campaigns against the Islamic State in Syria and Iraq and against the Taliban in Afghanistan. It also may reflect a desire to focus on great power competition and downplay day-to-day operations. Nevertheless, the problem has not gone away.

Many commentators have noted the tension between operational tempo and inventory. Mark Gunzinger and Carl Rehberg of the Mitchell Institute observed that "retiring aircraft doesn't retire real-world demand for them."[8] Mackenzie Eaglen noted that the "bias toward getting smaller and older—but no less busy—without sufficient replacements will exacerbate the Air Force's readiness challenges."[9] A RAND study concluded that "since the 1990s, the U.S. military has operated at a tempo more akin to war than peace," that "prolonged operations are driving contemporary [Air Force] capacity shortfalls," and that these would continue in the four notional futures that RAND analyzed.[10]

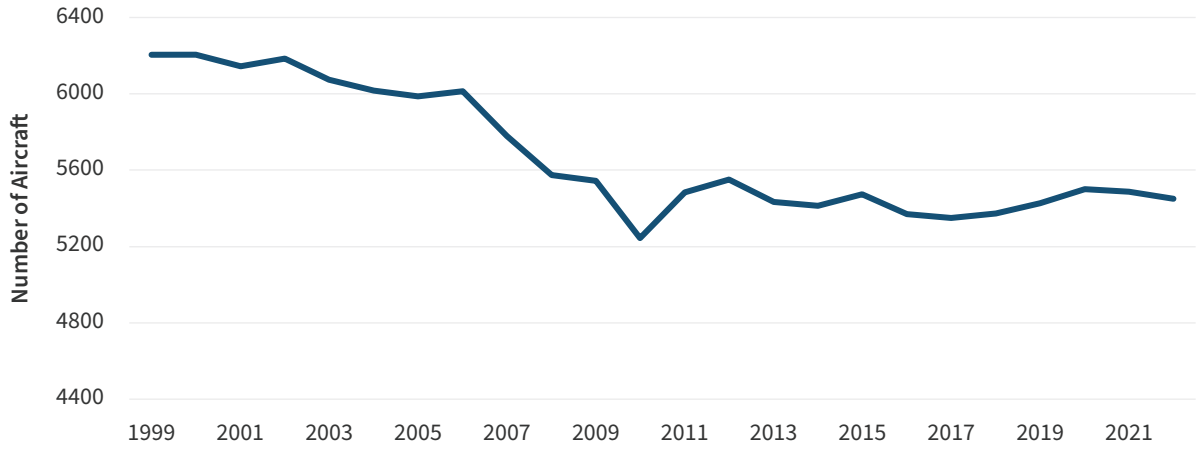
In short, the operational demands and the stress they create may reappear in the future.

---

7. John P. Roth, Charles Q. Brown, Jr., and John W. Raymond, *Posture of the Department of the Air Force in review of the Defense Authorization Request for Fiscal Year 2022 and the Future Years Defense Program, Before the Senate Armed Services Committee*, 117th Cong., 1st sess., 2021, https://www.armed-services.senate.gov/imo/media/doc/FY22%20DAF%20Posture%20Statement%20-%20Final%20(v23.1)1.pdf. This is often referred to as the "Posture Statement."
8. Mark Gunzinger and Carl Rehberg, *Moving toward the Air Force We Need? Assessing Air Force Budget Trends* (Arlington, VA: Mitchell Institute, 2019), 17, http://mitchellaerospacepower.org/wp-content/uploads/2019/12/Moving-Toward-the-Air-Force-We-Need.pdf.
9. Mackenzie Eaglen, "The Smaller, Older—But Busier—U.S. Air Force," 1945, July 15, 2021, https://www.19fortyfive.com/2021/07/the-smaller-older-but-busier-u-s-air-force/.
10. 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.

Force Structure in FY 2022 and Beyond

Figure 2: Air Force – Aircraft Inventory



Source: Department of Defense, *United States Air Force Budget Overview Fiscal Year 2022*, 12.

The Air Force has stabilized its force structure at about 5,500 aircraft after a sharp decline from 2002 to 2009. The Air Force has maintained its inventories by allowing the average aircraft age to increase (to 30.6 years).[11]

This happened because the Air Force took a procurement holiday in the late 1990s and, for its large fighter/attack fleet, planned to move directly to an all fifth-generation force fleet. This plan collapsed in the early 2000s when DOD curtailed the F–22 buy at 187 aircraft, and the F–35 program was delayed many years because of development problems.

Thus, Stephen Kosiak, a long-time budget commentator, has argued that these trends—shrinking inventories and aging fleets—arise from deliberate choices: "Historical trends in the U.S. military's force structure and modernization plans are largely the result of policy and programmatic choices made by Department of Defense (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."[12]

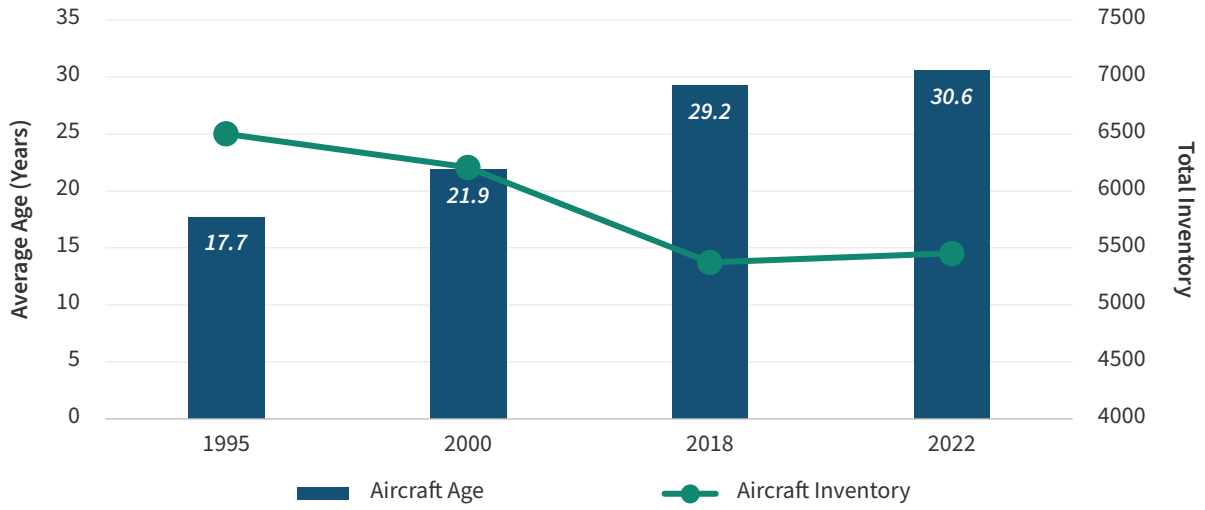
The good news is that fleet aging overall has slowed as new aircraft enter the force and old aircraft retire. The bad news is that the Air Force cannot maintain its current inventories and stabilize aging at recent procurement levels. It can achieve only two out of the three goals: inventory, aging, or procurement level. In recent years, the Air Force has chosen to maintain its inventory and procurement level while letting age increase. General Charles Q. Brown, Jr., chief of staff of the Air Force, would cut inventory to reduce age.[13]

---

11. Numbers measured by Total Active Inventory (TAI), that is, aircraft assigned to operating forces, including for test and maintenance. It includes primary, backup, and attrition reserve aircraft. "2021 USAF & USSF Almanac: Equipment," *Air Force Magazine*, June 30, 2021, https://www.airforcemag.com/article/2021-usaf-ussf-almanac-equipment/.
12. 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), 1, https://s3.amazonaws.com/files.cnas.org/documents/CNASReport-SmallerOlderMilitary-Final.pdf?mtime=20170310154527.
13. Amy McCullough, "Making the Air Force's Case for Big Fighter Cuts," *Air Force Magazine*, May 14, 2021, https://www.airforcemag.com/making-the-air-forces-case-for-big-fighter-cuts/. General Brown makes similar points in his FY 2022 posture statement and War on the Rocks article.

Although the Navy and Army also face challenges with aircraft aging and maintaining their aircraft fleets, the Air Force is in far worse shape regarding aging and the slow acquisition of replacements.[14] (See the Navy and Army chapters of this series for detailed discussion.)

Figure 3: Air Force – Aircraft Average Age and Inventory



Note: 2000 and 1995 years calculated by averaging the average age of the active, reserve, and air national guard fleet aircraft.

Source: "USAF Almanac 2021," *Air Force Magazine* 102, no. 6 (June 2021): https://www.airforcemag.com/article/2021-usaf-ussf-almanac-equipment/; and "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.

Some fleets are in relatively good shape: the transport fleet (21 years, on average) because of acquiring C-17s and C-130s; the special operations fleet (12 years) because of its high priority; and the unmanned aerial vehicles/remotely piloted vehicles (UAVs/RPVs) (6 years) because of large wartime purchases. Other fleets are old: fighter/attack (29 years old), bomber (45 years), tanker (49 years), helicopter (32 years), and trainers (32 years).[15] 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 implement fully.

Unfortunately, the FY 2022 procurement level is far too low to sustain the Air Force's current inventory.

14. Edward Keating, *The Cost of Replacing the Department of Defense's Current Aviation Fleet* (Washington, DC: Congressional Budget Office, January 2020), https://www.cbo.gov/system/files/2020-01/55950-CBO-DoD-aviation.pdf. For analysis of the Air Force fleet specifically, see Edward Keating, David Arthur, and Adebayo Adejeji, *The Cost of Replacing Today's Air Forces Fleet* (Washington, DC: Congressional Budget Office, December 2018), https://www.cbo.gov/system/files/2018-12/54657-AirForceAviationFunding.pdf.
15. Fleet age numbers current as of June 30, 2021, from "Equipment," in Amanda Miller, Arie Church, and Air Force Magazine Staff, "USAF and USSF Almanac 2021," *Air Force Magazine*, June 1, 2020, https://www.airforcemag.com/article/air-force-space-force-almanac-2020/. Some fleet averages recalculated from figures shown in the almanac using weighted averages for individual model/series.

Table 3: Air Force Aircraft Acquisition in FY 2022

	FY 2021 Request	FY 2021 Enacted	FY 2022 Request
F-35A	48	60	48
MC-130J	4	12	3
HH-60W	19	19	14
KC-46A	18	18	14
F-15EX	12	12	12
MH-139	8	8	0
CV-22	2	2	0
Total	**106**	**128**	**91**

Source: USAF Financial Management & Comptroller, *United States Air Force Budget Overview Fiscal Year 2022* (Washington, DC: May 2021), 50, https://www.saffm.hq.af.mil/Portals/84/documents/FY22/SUPPORT_/FY22%20Budget%20Overview%20Book.pdf?ver=Reck2JzBUzoZmGByl9Zm-Q%3d%3d; USAF Financial Management & Comptroller, *United States Air Force Budget Overview Fiscal Year 2021* (Washington, DC: February 2020), 42, https://www.saffm.hq.af.mil/Portals/84/documents/FY21/SUPPORT_/FY21%20Budget%20Overview_1.pdf?ver=2020-02-10-152806-743; and U.S. Congress, House, *William M. (Mac) Thornberry National Defense Authorization Act for Fiscal Year 2021*, HR 6395, 116th Cong., 2nd Sess., January 1, 2021, https://www.congress.gov/bill/116th-congress/house-bill/6395.

Assuming a 30-year service life, aircraft procurement requested for FY 2022 will sustain an inventory of 2,730 aircraft.

91 aircraft procured in FY 2022 x 30-year service life = 2,730 total inventory

The current inventory is 5,451. To sustain that inventory requires doubling the number of aircraft acquired per year.

5,451 target inventory ÷ 30-year service life = 182 aircraft acquired per year

Even at the FY 2021-enacted level (128 aircraft), which included congressional adds, the implied service life required to maintain the fleet size is 43 years.

5,451 target inventory ÷ 128 aircraft acquired per year = 43 years average life

Fundamentally, to sustain its current inventory without excessive aging, the Air Force will have to buy many more aircraft or less expensive aircraft. Alternatively, the Air Force will need to greatly reduce its aircraft inventory and sharply cut its force structure.

Size of the Future Force: "Divest to Invest"

Not long ago, the Air Force talked about increasing its size. In 2018, then-secretary of the Air Force Heather Wilson proposed an almost 25 percent expansion of force structure, describing it as "the Air Force we need."[16] This would have increased the number of operational squadrons from 312 to 386. However, the Air Force, unlike the Navy, never made any concrete moves to implement its proposed expansion. Now, that discussion has become a historical curiosity.

16. 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 available here: https://spacepolicyonline.com/wp-content/uploads/2018/09/SECAF-AFA-Speech-FInal-Sep-17-2018-AF-We-Need.pdf.

Instead, the question today is how much the Air Force will contract. The Air Force has two reasons to reduce its aircraft inventory and associated force structure. First, as described above, is its inability to maintain the structure with the number of aircraft that it has been able to procure recently and will procure in the foreseeable future. Second is its desire to save money in order to make a wide variety of expensive investments in advanced systems, aircraft, weapons, sensors, and networks that would be suitable for conflict with a great power such as China.

> *[Air Force plans for expansion have] become a historical curiosity. Instead, the question today is how much the Air Force will contract.*

General Brown has made this point repeatedly. Thus, he talks about "ruthless prioritization," implying the elimination of many older systems.[17] Air Force budget documents foreshadow a large future force structure cut: "Changes to force structure are necessary to enable the Service to pivot away from cost prohibitive platforms and continue focusing on system modernization and future capabilities required to win the high-end fight."[18] Similarly, the FY 2022 posture statement says, "we need to shift away from legacy platforms and weapons systems that are decreasing in relevance today and will be irrelevant in the future."[19]

General Brown, in a joint article with Marine Commandant General David H. Berger, made the broad argument that concepts of readiness need to include capability. In the past, arguments like this have often been a prelude to cutting the traditional measures of readiness (maintenance and training) to invest in modernization—"freeing ourselves from the tyranny of short-term operational readiness concepts."[20] However, such a trade-off does not appear in the Air Force's FY 2022 budget. The new National Defense Strategy and FY 2023 budget will indicate how the Air Force implements this new readiness concept.

This capability argument is an analog to the naval debate about ship counts. Counting platforms is easy and a convenient shorthand for force structure and military power, but it does not capture all the elements of capability. Indeed, many "non-iron futures" focus on artificial intelligence, mesh networks, cyber, space, and sensors rather than platforms.

As a result of these discussions, the Air Force has repeatedly proposed to retire aircraft. The proposed retirements for FY 2021 are substantial (Table 4). Congress, however, has often balked at retirements, noting that the Air Force says it is already too small for the tasks it has been given. When the Air Force proposed eliminating the A-10 fleet, for example, Congress forbade such an action.[21] Similar retirement restrictions appear in the House and Senate versions of the National Defense Authorization Act (NDAA) for FY 2022. (There is no enacted FY 2022 NDAA yet.[22])

---

17. Charles Q. Brown, Jr., "Accelerate Change or Lose," U.S. Air Force, August 2020, 5, https://www.airforcemag.com/app/uploads/2020/08/CSAF-22-Strategic-Approach-Accelerate-Change-or-Lose-31-Aug-2020.pdf.
18. Undersecretary of Defense (Comptroller)/Chief Financial Officer, *Defense Budget Overview*, 4–9.
19. Roth, Brown, and Raymond, *Posture of the Department of the Air Force, 2*.
20. Charles Q. Brown, Jr., and David H. Berger, "Redefine Readiness or Lose," War on the Rocks, March 15, 2021, https://warontherocks.com/2021/03/redefine-readiness-or-lose/.
21. U.S. Congress, House, *Howard P. "Buck" McKeon National Defense Authorization Act for Fiscal Year 2015,* HR4435, 113th Cong., 2nd sess., Introduced in House April 9, 2014, https://www.congress.gov/bill/113th-congress/house-bill/4435/actions.
22. U.S. Congress, House, *National Defense Authorization Act for Fiscal Year 2022,* HR 4350, 117th Cong., 1st sess., Introduced July 2, 2021, https://www.congress.gov/117/bills/hr4350/BILLS-117hr4350pcs.pdf; and U.S Congress, Senate, *National Defense Authorization*

Table 4: Proposed Air Force Aircraft Retirements in FY 2022

KC-10	-14
KC 135	-18
C-130H	-8
RQ-4	-20
A-10	-42
E-8	-4
F-15C/D	-48
F-16C/D	-47
Total	**-201**

Source: John A. Tirpak, "Air Force Asks to Retire 201 Aircraft, Buy 91 in 2022," *Air Force Magazine*, May 28, 2021, https://www.airforcemag.com/air-force-fiscal-2022-retire-buy/.

A CSIS report laid out the savings that the Air Force might achieve by retiring certain aircraft fleets.[23] The fleets most likely to be retired are the KC-10 tanker, the B-1 and B-2 bombers, the A-10 close air support aircraft, the E-8C surveillance aircraft, the U-2 spy plane, and the E-3 airborne warning and control plane. The report argued that the greatest savings arose when entire fleets were retired, thus eliminating the fixed costs of training and maintenance infrastructure.

However, the report also noted that such retirements would leave gaps in Air Force capabilities. Retiring the B-2 bombers, for example, would leave the United States without a stealthy penetrating bomber until the B-21 was fielded in strength.

A variety of outside commentators have criticized prospective cuts to the Air Force and argued for increasing resources devoted to airpower. The Heritage Foundation, for example, downgraded its assessment of the Air Force from "marginal" to "weak" because of readiness challenges caused by the pandemic as well as insufficient capacity for more than one conflict and the slow pace of modernization.[24] Similarly, retired Air Force lieutenant general Dave Deptula of the Mitchell Institute argued that "the Department of the Air Force has become the indispensable force and therefore requires immediate prioritization."[25]

Prospective force structure trade-offs drive a series of strategic choices about airpower:

- **What kinds of conflicts should the Air Force prepare for: those against great powers or a spectrum of air operations, including in less-demanding environments?** In lower-threat air environments—for example, against North Korea—the Air Force can use legacy aircraft extensively. These fleets also provide the numbers needed to cover a high level of day-to-day operational deployments. For conflicts against great powers such as China and Russia, with their sophisticated air defenses, the Air Force would need to focus on advanced capabilities, at least in the early phases of the conflict.
- **How can airpower achieve the greatest effects?** Will the greatest effects come from attacks on enemy forces—that is, through close air support and battlefield interdiction? The ground forces are strong advocates here, arguing that these effects are immediate and tangible.[26] Airpower advocates argue that the greatest effect comes from the deep attack on strategic—command and control, economic,

Act for Fiscal Year 2022, S 2792, 117th Cong., 1st sess., Introduced September 22, 2021, https://www.congress.gov/117/bills/s2792/BILLS-117s2792rs.pdf.

23. Todd Harrison, *How the Air Force Can Save $30 Billion* (Washington, DC: CSIS, 2019), https://aerospace.csis.org/wp-content/uploads/2019/11/How-the-Air-Force-Can-Save-30-Billion.pdf.

24. Dakota Wood, *An Assessment of US Military Power: US Air Force* (Washington, DC: Heritage Foundation, October 2021), https://www.heritage.org/military-strength/assessment-us-military-power/us-air-force.

25. Dave Deptula, "Reviving a 'Weak' Department of the Air Force," *Forbes*, October 25, 2021, https://www.forbes.com/sites/davedeptula/2021/10/25/reviving-a-weak-department-of-the-air-force/.

26. Scott Beauchamp, "An Infantryman's Defense of the A-10," Task and Purpose, February 29, 2016, http://taskandpurpose.com/infantrymans-defense-10.

and political—targets and the deterrent effects that such capability has. The Air Force has historically leaned toward the latter for a variety of organizational and doctrinal reasons.[27]

- **What is the value of stealth in modern air warfare?** Stealth—needed to penetrate heavily defended airspaces—is expensive to develop, procure, and sustain.[28] Further, there is an operational penalty. Proponents argue that the cost and performance trade-offs are worthwhile because of rising air threats.[29] Opponents argue that only a small part of the fleet needs to be stealthy, while the rest can be non-stealthy.[30]
- **Does the future lie with manned or unmanned aircraft?** For the foreseeable future, fleets will have a mix of manned and unmanned aircraft, just as the Air Force possesses today. However, will the future be primarily unmanned, thus allowing higher numbers because of their lower overall cost and higher-risk mission? Or will the future still be primarily manned, which offers human judgment and control? This debate parallels discussions about the definition of "legacy capabilities," discussed in the overview chapter of this series.

The answers to these questions go far beyond the scope of this report, but the questions show that there are difficult strategic decisions behind inventory numbers. There is more substance here than the caricature of future visionaries versus parochial traditionalists often portrayed by commentators.

> *There are difficult strategic decisions behind inventory numbers. . . . [and] more substance here than the caricature of future visionaries versus parochial traditionalists often portrayed by commentators.*

27. The literature on ground attack/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, doi:10.1162/ISEC_a_00226?journalCode=isec. To be fair to the Air Force, some analysts argue that the Air Force is becoming more nuanced in its approach to airpower. See Heather Venerable and Sebastian Lukasik, "'Bombing to Win' at 25," War on the Rocks, June 15, 2021, https://warontherocks.com/2021/06/bombing-to-win-at-25/.
28. 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 (e.g., development). One data point is from the Navy, which has bought both fourth-generation F-18E/Fs and fifth-generation F-35s in quantity. 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 2021. Adding non-recurring costs for manufacturing and development would greatly increase the cost differential.
29. For example, Jeff Harrigian 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; and 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.
30. For example, 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; and 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/.

The State of the Fleets

In general, the Air Force has programs in place to modernize the individual fleets, but this modernization has been delayed and will take time. As a result, today's aging fleets will be around for a long while. Nevertheless, each fleet faces its own circumstances and therefore deserves individual consideration.[31]

THE BOMBER FORCE

The bomber force consists of B-52s, B-1s, and B-2s. The long-range plan is for the B-21 Raider to replace the B-1s and B-2s. The B-52Hs, which the Air Force flies today, originally entered service in 1961 and will continue in service at least into the 2040s.[32] The last B-52 pilot has probably not yet been born.

Bombers are central to an Air Force roles-and-missions argument that aircraft are better at providing long-range strike than Army ground-based missiles.[33] The debate is taking place behind closed doors in the Pentagon, but the results will likely emerge in the next National Defense Strategy and FY 2023 budget.

Since no new aircraft are being procured, the bomber force continues to age (currently 45 years on average), though various 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. The Air Force has retired some B-1s, so that fleet is down to 44 aircraft.

The B-21 Raider program continues in development but edges toward procurement. The FY 2022 requests $2.981 billion, of which $108 million is for advance procurement. The relatively low amount of advance procurement indicates that the first production is still a few years away. Nevertheless, five test articles were funded in the research, development, test, and evaluation (RDT&E) account and should be flying soon. The program seems to be progressing smoothly, but its classified nature makes such judgments uncertain.[34]

Because the B-21 has a mid-2020s fielding date ("Initial Operating Capability"), the legacy B-52s, B-1s, and B-2s will comprise the bomber force for many years to come.

THE FIGHTER/ATTACK FORCE

The fighter/attack force (A-10s, F-15s, F-16s, F-22s, and F-35s) has been the central element of the Air Force since the end of the bomber era in the early 1960s. Therefore, it requires detailed examination. The bottom line is that the fighter/attack force's total inventory, age, and procurement rate do not produce a stable force. Only two of these characteristics are achievable. One must change. Under the "divest to invest" strategy, inventory will likely decline.

The average age of the fighter/attack force has increased from 8 years at the end of the Cold War in 1991 to 29 years today. Because this is the average age, about half the fleet is older, with some aircraft approaching 50 years of age. Fleet size has decreased from 4,000 in 1991 to 2,094 today. Kosiak's observation is applicable here. Both fleet aging and reduced numbers result from an Air Force decision to cease

---

31. Aircraft numbers and age come from "Aircraft Total Active Inventory," in "Air Force & Space Force Almanac 2021," *Air Force Magazine*, June 1, 2021, https://www.airforcemag.com/article/air-force-space-force-almanac-2021/. Fleet numbers are supplemented by USAF Financial Management and Comptroller, *FY 22 Budget Overview*, 50. Fleet age recalculated using weighted averages by aircraft model.
32. "B-52H Stratofortress," U.S. Air Force, June 2019, https://www.af.mil/About-Us/Fact-Sheets/Display/Article/104465/b-52h-stratofortress/.
33. For one description of this argument, see Mark Gunzinger, Lukas Autenried, and Brian Clark, "Understanding the Long-Range Strike Debate," Mitchell Institute, April 2021, https://mitchellaerospacepower.org/understanding-the-long-range-strike-debate/.
34. Barry Rosenberg, "The B – 21 Raider: Infused with the Stealthy Lessons Learned for Maintenance and Support," Breaking Defense, October 20, 2021, https://breakingdefense.com/2021/10/the-b-21-raider-infused-with-stealthy-lessons-learned-for-maintenance-and-support/.

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 to continue production of the F-18. 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.

Table 5 lays out the long-term trade-offs of the fighter/attack fleet. The Air Force cannot sustain the current fleet size and attain the desired average age without a large increase in procurement quantities. With production of the F-15EX, however, the Air Force gets close to or attains the 72 aircraft procured per year needed to maintain the current average age and fleet size.

Source: US Air National Guard photo by Tsgt William A Keele

F-35s: The Air Force again requests 48 F-35 aircraft in FY 2022, about the same as for the last four years, although Congress routinely increases the buy (to 60 in FY 2021) out of a concern that the aircraft are being fielded too slowly. According to the procurement budget documents, 48 will be the long-term procurement level, rather than the 60 aircraft per year that the Air Force had intended.[35]

After several years of making good progress in maturing technologies, the aircraft are operational, but the program has still not achieved the planned levels of reliability and capability. Problems with simulators have delayed completion of operational testing.[36]

35. USAF Financial Management & Comptroller, *FY 2021 Budget Justification Book: Aircraft Procurement, Air Force* (Washington, DC: February 2020), 1-1, https://www.saffm.hq.af.mil/Portals/84/documents/FY21/PROCUREMENT_/FY21%20Air%20Force%20Aircraft%20Procurement%20Vol%20I_1.pdf?ver=2020-02-10-145310-973.
36. Jon Ludwigson, *F – 35 Joint Strike Fighter: Cost and Schedule Risks in Modernization Program Echo Long-Standing Challenges*, Testimony before the Subcommittee on Tactical Air and Land Forces, House Committee on Armed Services, 117th Cong., 1st sess.,

Table 5: Fighter/Attack Fleet Trade-Offs

	Fleet Size	Average Age	Annual Procurement Quantity
Today's fleet	2,094	29	60
Long-term fleet size at annual procurement quantity and current age	1,740	29	60
Long-term fleet size at target fleet age and current procurement quantity	1,200	20	60
Long-term average age at current fleet size and annual procurement quantity	2,094	35	60
Long-term procurement quantity needed to maintain current average age and fleet size	2,094	29	72
Long-term procurement quantity needed to achieve target average age (20 years) and current fleet size	2,094	20	105

Source: "2021 USAF & USSF Almanac: Equipment," *Air Force Magazine*, June 30, 2021, https://www.airforcemag.com/article/2021-usaf-ussf-almanac-equipment/.

Fielding of F-35s is beginning to ease the aging of the fighter/attack fleet (as will production of F-15EXs). Nevertheless, at 48 aircraft per year, it would take another 27 years to reach the F-35 inventory objective of 1,763—FY 2049. Even at the Air Force's goal of 60 aircraft per year, it would take 21 years—FY 2043. The average age of the fighter/attack fleet will, therefore, remain high for a long time, perhaps indefinitely.

The future of the F-35 program was thrown into doubt by the announcement of a tactical aviation study that was connected to the Biden administration's broader defense strategy review. Some reports hinted at reduced numbers in the program.[37] The House Armed Services Committee complained vigorously about the program's high sustainment cost. Nevertheless, there are few alternatives immediately available. Current UAVs cannot fulfill this mission, and the Next Generation Air Dominance (NGAD) program, described below, is not ready for procurement.

> *The Air Force cannot sustain the current fleet size and attain the desired average age without a large increase in procurement quantities.*

F-15EX: In a major change of acquisition strategy, the Air Force proposed buying a new version of the F-15E dual-role aircraft in the FY 2020 budget, the F-15EX, because of its 40 percent lower sustainment cost than the F-35. Although the proposal was initially controversial, Congress has gone along with the plan.[38] Numerically, this is a minor shift since the Air Force proposes to buy only 12 F-15EXs in FY 2022

July 13, 2021, https://www.gao.gov/assets/gao-21-105282.pdf.

37. Teresa Hitchens, "F – 35 in Crosshairs As Joint Staff Assess Tech Air Buys for Biden Budget," Breaking Defense, February 25, 2021, https://breakingdefense.com/2021/02/f-35-in-crosshairs-as-joint-staff-assess-tacair-buys-for-biden-budget/.

38. John Tirpak, "F-15EX: Careful What You Don't Ask for," *Air Force Magazine*, April 2019, http://www.airforcemag.com/

and 144 in total.[39] The Air Force is buying four to five times as many F-35s. Nevertheless, the step will ease fleet aging.

A-10s: The Air Force has surrendered to the will of 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. Nevertheless, Congress and the Air Force continue to spar over how large the fleet should be, the Air Force wanting to shrink it to about 240 while Congress pushes to retain all current 281 A-10s.

F-15s and F-16s: Although the Air Force plans to retire large numbers of older F-15s and F-16s, the slow rate of acquiring new aircraft requires sustaining some of these aircraft for many years. F-16s still provide 40 percent of the Air Force fighter fleet. In FY 2022, the Air Force proposes $617 million for F-16 modifications and upgrades, particularly for advanced radars. For the F-15, it proposes to spend $234 million for a variety of upgrades, particularly for an improved radar.

F-16 Replacement?: As part of the fighter/attack reviews described above, General Brown announced "a clean sheet assessment of a new F-16 follow-on, that he characterized as a four and a half generation or fifth generation minus aircraft." He also noted that, "a revamped mix of high, medium, and low-end fighters could take the pressure off the service to over-deploy the F-35 and help defray its huge operations and maintenance costs."[40]

That approach makes a lot of sense given the high cost of F-35 operations (currently $36,000 per flight hour) and the mismatch between fighter/attack inventories, age, and procurement rate.[41] A spectrum of capabilities also makes sense given the many demands on the fighter/attack force, not all of which will require the highest level of capability, as described in the overview chapter of this series. However, the Air Force terminated its participation in the light attack aircraft program. Its only other aircraft program, NGAD, described below, is shaping up to be at least as expensive as the F-35. Whether something tangible comes out of the Air Force reviews will be seen when the Biden administration unveils its National Defense Strategy.

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. Funding in the FY 2022 budget reaches $1.5 billion.[42] Because the program is classified, its exact nature is unclear. The Air Force talks about the program as an aircraft—a sixth generation and a follow-on to the F-35—plus associated technologies and enablers. Indeed, the program received a lot of attention last year when the Air Force reported that a "full-scale flight demonstrator" flew.[43] At other times, the services talk about the program as a collection of technologies. The Air Force budget overview states that NGAD "is focused on fielding capabilities to mitigate identified gaps, not on creating a 'next generation' aircraft."[44]

MagazineArchive/Pages/2019/April%202019/F-15EX-Careful-What-You-Dont-Ask-For.aspx.

39. USAF Financial Management & Comptroller, *FY 2021 Budget Justification Book: Aircraft Procurement*, 1-17.

40. Theresa Hitchens, "F-35 In Crosshairs As Joint Staff Assess TacAir Buys For Biden Budget," Breaking Defense, February 25, 2021, https://breakingdefense.com/2021/02/f-35-in-crosshairs-as-joint-staff-assess-tacair-buys-for-biden-budget/.

41. F-35 flying hour costs widely reported as $36,000 per hour, for example, Joe Gould and Valerie Insinna, "Ripping F – 35 Costs, House Armed Services Chairman Looks to Cut Our Losses," Defense News, March 5, 2021, https://www.defensenews.com/congress/2021/03/05/ripping-f-35-costs-house-armed-services-chairman-looking-to-cut-our-losses/.

42. Office of the Under Secretary of Defense (Comptroller), *Defense Budget Overview* (Washington, DC: August 2021), 2–7, https://comptroller.defense.gov/Portals/45/Documents/defbudget/FY2022/FY2022_Budget_Request_Overview_Book.pdf.

43. Jeremiah Gertler, "Air Force Next-Generation Air Dominance Program: An Introduction," Congressional Research Service, IF11659, October 5, 2020, https://sgp.fas.org/crs/weapons/IF11659.pdf.

44. USAF Financial Management & Comptroller, *United States Air Force Budget Overview Fiscal Year 2022*, 3.

The Air Force's FY 2021 budget justification books show RDT&E rising to $2.7 billion in FY 2025 but no procurement in the five-year plan (at least in the published documents).[45]

NGAD will raise the key question, what does "legacy" mean when talking about weapon systems? As discussed in the overview chapter of this military forces report, the military services define legacy as old systems in the inventory. They, especially the Air Force, would see NGAD as a new aircraft to replace old aircraft. Strategists, on the other hand, see legacy platforms as those that use old technologies and outdated operational concepts. They will likely question NGAD, arguing that developing another expensive manned aircraft is looking toward the past and not the future. Instead, these strategists would see NGAD as a collection of innovative technologies, including unmanned aircraft.

> *[Strategists] will likely question NGAD, arguing that developing another expensive manned aircraft is looking toward the past and not the future.*

Perhaps for this reason, the Navy has indicated that it may be headed in a different direction. The Navy's head of air warfare stated that the two services will have different airframes, though the systems inside the platforms will be similar.[46]

THE TANKER FORCE: STILL STRUGGLING WITH THE KC-46

The KC-46 is replacing the Air Force's aging tanker force; the current KC-135 tankers having an average age of 59 years and the KC-10s 36 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, and with years of technical problems and production delays.[47] Boeing, the contractor, continues to execute the fixed price contract that it greatly underbid on and on which the company is taking large losses (over $5.1 billion so far).[48]

For many years, that underbidding strategy appeared to have paid off, as the Air Force planned to continue acquisition. However, the Air Force has recently announced that, because of increasing air threats, it will conduct a new tanker competition after procuring the initial 179 aircraft.[49]

---

45. Valerie Insinna, "The U.S. Air Force Has Built and Flown a Mysterious Full-Scale Prototype of Its Future Fighter Jet," Defense News, September 15, 2020, https://www.defensenews.com/breaking-news/2020/09/15/the-us-air-force-has-built-and-flown-a-mysterious-full-scale-prototype-of-its-future-fighter-jet/.
46. Mallory Shelbourne, "Navy: NGAD Will Be a Family of Systems, Super Hornet Replacement Likely Unmanned Fighter," USNI News, March 30, 2021, https://news.usni.org/2021/03/30/navy-ngad-will-be-family-of-systems-super-hornet-replacement-likely-a-manned-fighter.
47. Valerie Insinna, "The Air Force's KC 46 Tanker Has Another Serious Technical Deficiency, and Boeing Is Stuck Paying for It," Defense News, March 30, 2020, https://www.defensenews.com/air/2020/03/31/the-air-forces-kc-46-tanker-has-another-serious-technical-deficiency-and-boeing-is-stuck-paying-for-it/.
48. Garrett Reim, "After $5 Billion in Losses, Can the KC 46A Become Profitable?," Flight Global, February 14, 2021, https://www.flightglobal.com/fixed-wing/after-more-than-5bn-in-losses-can-kc-46a-become-profitable/142419.article#toggle.
49. Teresa Hitchens, "Beyond KC – 46: Air Force Exploring 'Advanced' Tech on Next Tanker," Breaking Defense, July 21, 2021, https://breakingdefense.com/2021/07/beyond-kc-46-air-force-exploring-advanced-tech-on-next-tanker/.

The KC-46 program is gradually overcoming its difficulties, with deliveries of new aircraft being made and clearance having been obtained to refuel most types of Air Force aircraft. Nevertheless, given the slow pace of acquisition, the current tanker fleet, particularly the KC-135s, will be around for a lot longer.

TACTICAL MOBILITY

This large fleet consists mainly of C-130s, initially fielded in 1956 and now on the "J" model. ("Tactical mobility" also includes some specialty aircraft, mainly small VIP passenger aircraft, which are not discussed here.) The C-130 production line operates smoothly, producing aircraft every year for the Air Force, Navy, and Marine Corps. The Air Force inventory is large: about 200 C-130s for tactical mobility and another hundred or so aircraft in specialty roles.

The most recent mobility requirements study affirmed a fleet requirement of 300, about where the fleet is now.[50] The problem is that the Air Force is not buying enough new aircraft to maintain its large inventory. The FY 2022 budget requests only three aircraft. The intention is likely to retire many of the older C-130H models and reduce the size of the fleet, despite the recent requirements study.

The challenge in cutting the fleet is that large numbers of these aircraft reside in the reserve components, and members of Congress are loath to lose flying squadrons in their districts.

Source: United States Air Force photo by SrA Kristine Gruwell

50. United States Transportation Command, *Mobility Capabilities and Requirements Study (MCRS) 2018* (Belleville, IL: 2019), http://www.airforcemag.com/DocumentFile/Documents/2019/MobilityCapabilitiesRequirementsStudy2018.pdf.

STRATEGIC MOBILITY

This fleet consists of C-17s, upgraded C-5s (which were originally built in the 1970s and 1980s), and KC-10s (also classed as refuelers because they have dual missions). No production lines are currently operating, the last C-17 having been delivered in 2013. However, the fleet is relatively healthy because of the large investments made in the 2000s.

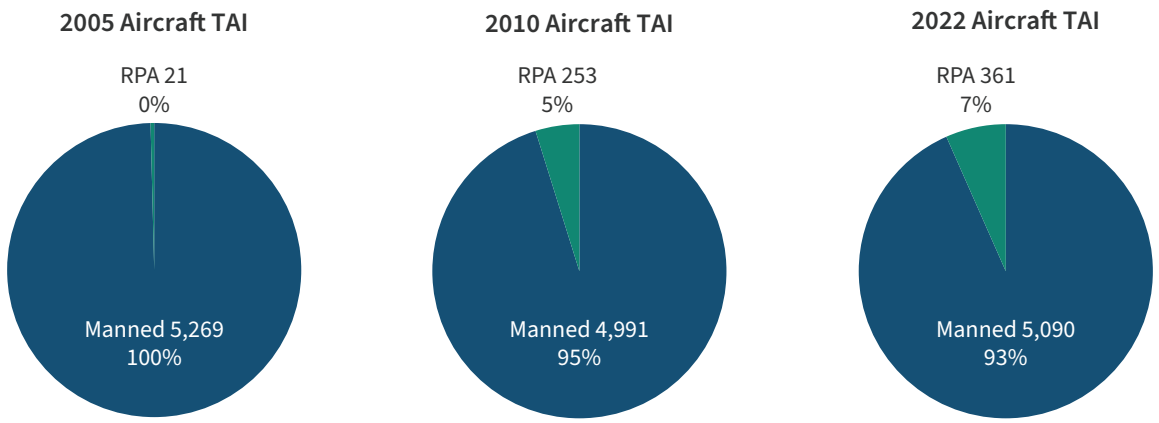
The most recent strategic mobility study, *Mobility Capabilities and Requirements Study 2018*, completed in February 2019, found that the fleets were sized adequately.[51] A relatively young fleet that is properly sized would seemingly indicate a lot of stability.

However, the National Defense Strategy's focus on great power conflict raised the possibility of wartime attrition being a consideration for sizing the strategic airlift and sealift fleets, something that earlier studies had not considered. The Government Accountability Office (GAO) reports 11 recent studies that considered contested mobility. The collective insights may push this mobility fleet toward smaller and more numerous platforms, though current acquisition plans do not yet reflect such a shift. [52]

In September 2021, the U.S. Transportation Command completed the *Mobility Capabilities and Requirements Study 2020*. These periodic studies have specified strategic mobility requirements, including airlift, sealift, and pre-positioning. However, the Department of Defense (DOD) has released no details of the study findings.[53]

REMOTELY PILOTED AIRCRAFT (RPA)

Figure 4: Remotely Piloted Aircraft versus Manned Aircraft, 2005, 2010, 2022



Source: Department of Defense, *United States Air Force Budget Overview Fiscal Year 2022*, 38; "USAF Almanac 2011," *Air Force Magazine* 94, no. 5 (May 2011): 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): 63, http://www.airforcemag.com/MagazineArchive/Magazine%20Documents/2011/May%202011/0511facts_figs.pdf; 2022 numbers taken from the *Air Force FY2022 Budget Overview*, Appendix, Air Force Total Aircraft inventory.

For the Air Force, this revolution is over. Whereas the Navy's efforts to integrate unmanned systems into its aviation fleet are still controversial, slow, and limited, as described in this project's corresponding

51. Ibid.
52. Government Accountability Office, *Defense Transportation: DOD Can Better Leverage Existing Contested Mobility Studies and Improve Training* (Washington, DC: February 2021), https://www.gao.gov/assets/gao-21-125.pdf.
53. "Statement on the Completion of Mobility Capabilities and Requirements Study 2020," United States Transportation Command, June 30, 2021, https://www.ustranscom.mil/cmd/panewsreader.cfm?ID=AE9B584E-9B91-7D14-AAC653E5F6341145.

chapter on the Navy, the Air Force's incorporation of unmanned aircraft into its force structure—after strong resistance during the 1990s and early 2000s—has become routine.[54]

> *The Air Force's incorporation of unmanned aircraft into its force structure . . . has become routine. However, the Air Force has stalled in its effort to bring more RPAs into the force.*

However, the Air Force has stalled in its effort to bring more RPAs into the force. The RPA proportion of the force has leveled off at 5 to 7 percent for 10 years, and current procurement plans show no change in the future. The FY 2022 budget procures no RPAs and retires the block 30 RQ-4 Global Hawk fleet in favor of the manned E-11. By contrast, the Air Force's FY 2022 budget procures 91 manned aircraft.[55]

The Air Force is experimenting with "loyal wingman" RPAs under the umbrella of "Skyborg." The program has produced the XQ-58A Valkyrie as a demonstrator aircraft. The Low-Cost Attritable Aircraft Technology program explores low-cost, autonomous, and attritable systems, thus allowing the Air Force to operate within an adversary's defensive zone. The Air Force is emphatic that these complement, rather than replace, manned aircraft. A study by the Air Force Association's Mitchell Institute reinforced this point: "[drones] are complementary, force multiplying capabilities, not replacements for fifth-generation stealth aircraft."[56]

General Brown has stated that the Air Force is seriously considering building a fighter fleet with more drones than piloted aircraft.[57] Existing RPA initiatives, plus any new programs that might come out of the ongoing aircraft reviews, might change the inventory balance in the future. However, none of these RPA programs are yet an official "program of record."

A major issue is whether to buy RPAs for permissive or non-permissive environments. MQ-9 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 adversary such as Russia or China, these aircraft would be vulnerable because of their slow speed, high visibility, and lack of defensive systems. That vulnerability was illustrated dramatically in July 2019 when the Iranians shot down a Navy RQ-4.

Will the Air Force develop and procure stealthy and largely autonomous UAVs to operate inside these challenging air defense environments? That may already be occurring. 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 larger RQ-180, a high-altitude, unmanned long-range reconnaissance system, is also reported to be flying and likely operating.[58] However, both appear to be for reconnaissance, not attack.

---

54. The Air Force is emphatic that these are aircraft and not "unmanned" but 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.
55. USAF Financial Management and Comptroller, *FY 2021 Budget Justification Book: Aircraft Procurement*, x–xiii.
56. Mark Gunzinger and Lucas Autenreid, "Understanding the Promise of Skyborg and Low Cost Attritable Unmanned Aerial Vehicles," Mitchell Institute, October 1, 2020, https://www.mitchellaerospacepower.org/single-post/understanding-the-promise-of-skyborg-and-low-cost-attritable-unmanned-aerial-vehicles.
57. Teresa Hitchens, "Air Force Meet Tilt to Drones: CS AF Brown," Breaking Defense, May 12, 2021, https://breakingdefense.com/2021/05/air-force-may-tilt-to-drones-csaf-brown/.
58. Many stories report on the RQ-170 and RQ-180. For example, David Axe, "America's New Stealthy Drone Appears to Operational near China," *Forbes*, September 7, 2021, https://www.forbes.com/sites/davidaxe/2021/09/07/americas-new-stealth-drone-appears-to-

The Curse of Short Range

A recent concern is that the Air Force tactical aviation fleet is too short ranged for great power conflicts. Combat ranges of current aircraft run from 550 to 750 miles. NGAD might have a range of up to 1,000 miles, but the program is mostly conceptual at this point.

The problem is that demands on the fleet have changed. 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 anti-air capabilities that could reach much beyond their own borders. As a result, U.S. tactical aircraft could refuel as often as they needed.

However, in potential conflicts with China and Russia, operational range matters. The Pacific is vast. Although Kadena Air Force base on Okinawa is close enough to Taiwan (400 miles), it is 1,400 miles from the South China Sea, where conflict is also possible. Anderson Air Force Base on Guam is 1,400 miles from the South China Sea and 1,700 miles from Taiwan.

U.S. bases in Europe, even forward bases in Eastern Europe, are still far from potential battlefields. RAF Lakenheath, for example, is nearly 1,000 miles from the Baltic states and Spangdahlem Air Force Base in Germany is 850 miles. Further, airbases are again vulnerable, 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 bombers 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 Center for Strategic and Budgetary Assessments (CSBA) recommended, "the Air Force should rebalance its combat forces in favor of long-range, penetrating bombers." CSBA also recommended developing a new, long-range fighter/attack aircraft ("penetrating counter-air") to substitute for some F-35 inventory.[59] 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."[60]

The Air Force argues that long-range munitions such as the Joint Air-to-Surface Standoff Missile (JASSM) can compensate for short-ranged aircraft. Such munitions do allow standoff, which is helpful, but they are also expensive. JASSM XR has a range of 1,200 miles but costs $1.25 million.[61]

The Air Force has also instituted a new deployment concept, Agile Combat Employment, which spreads aircraft out from large and vulnerable fixed bases. That helps greatly with the vulnerability problem and may help with the range problem, though the shorter the aircraft range, the deeper it must be based inside an adversary's defensive bubble.

---

be-operational-near-china/?sh=76743a0c1621.

59. Mark Gunzinger et al., *An Air Force for An Era of Great Power Competition* (Washington, DC: Center for Strategic and Budgetary Assessments, 2019), xi, https://csbaonline.org/research/publications/an-air-force-for-an-era-of-great-power-competition/publication/1.

60. MITRE Corporation, *US Air Force Aircraft Inventory Study: Unclassified Report* (McLean, VA: 2020), 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. See also Rebecca Grant, "Air Force, Don't Cut a Single Bomber," Breaking Defense, April 30, 2020, https://breakingdefense.com/author/rebeccagrant/.

61. "JASSM/JASSM ER," *Missile Threat*, CSIS, last updated July 30, 2021, https://missilethreat.csis.org/missile/jassm/. In FY 2021, Office of the Undersecretary of Defense (Comptroller)/Chief Financial Officer, *Program Acquisition Cost By Weapon System* (Washington, DC: Department of Defense, May 2021), 5–6, https://comptroller.defense.gov/Portals/45/Documents/defbudget/FY2022/FY2022_Weapons.pdf.

The Navy suffers from the same range limitation but has the advantage of being able to move its airfields (aircraft carriers) around, so this affects the Air Force more intensely.[62]

DOD's ongoing reviews of aircraft programs in capabilities may pick up on this point and recommend a change in direction.

Nuclear Enterprise

After decades of stability and low visibility, the nuclear force is getting attention again as the cost of modernization programs makes them more visible and controversial.

In 2018, the intercontinental ballistic missile (ICBM) force leveled off at the New START limit of 400, where it remains. The nuclear bomber force (B-2s and B-52s) holds steady at 96 (Total Active Inventory). The Trump administration's Nuclear Posture Review (NPR), published in February 2018, affirmed the need for the nuclear triad to deter nuclear and non-nuclear aggression and assure allies and partners.[63]

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. The Biden administration's Interim National Security Strategy Guidance endorses arms control, citing "the need to reduce the role of nuclear weapons" and pledging "to head off costly arms races and re-establish our credibility as a leader in arms control."[64]

The Biden administration is conducting a nuclear posture review, which will lay out its direction for nuclear forces. That review will be published at the end of calendar year 2021 or the beginning of 2022.

Table 6 shows FY 2022 budget plans for DOD's two most controversial nuclear modernization programs. Especially striking, when combined with the Biden administration's support for the B-21 bomber and the Columbia-class ballistic missile submarine, is the strong budget support for nuclear programs despite rhetoric about arms control. It may be that the Biden administration is supporting nuclear programs pending a new round of arms-control negotiations.[65]

One piece of good news is that in response to scandals several years back and several outside reviews, the Air Force (and the Navy) implemented a wide variety of actions to improve the standards and quality of their nuclear enterprise, both personnel and operations. The absence of any recent incidents indicates success. Here, no news is good news.

---

62. 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.
63. Office of the Secretary of Defense, *2018 Nuclear Poster 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.
64. Joseph R. Biden, Jr., *Interim National Security Strategic Guidance* (Washington, DC: The White House, March 2021), 13, https://www.whitehouse.gov/wp-content/uploads/2021/03/NSC-1v2.pdf.
65. The Biden administration FY 2022 budget also supported two smaller Navy nuclear modernization programs despite criticism by arms control advocates: the Sea Launched Cruise Missile – Nuclear and the W76-2 small yield warhead.

Table 6: Nuclear Modernization Programs

Program	FY 2021 enacted ($, millions)	FY 2022 proposed ($, millions)	Comment
Ground-Based Strategic Deterrent (GBSD)	1,447	2,564	ICBM replacement, in development. DOD has strongly endorsed maintenance of the nuclear triad. However, 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."
Long-Range Standoff (LRSO) weapon	385	609	In development. LRSO, a nuclear-armed cruise missile, provides standoff for nuclear attack. It has been controversial because bombers already have one nuclear munition, the B61 bomb.

Source: Office of the Under Secretary of Defense (Comptroller), *Program Acquisition Cost by Weapon System* (Washington, DC: Department of Defense, May 2021), 5–21, https://comptroller.defense.gov/Portals/45/Documents/defbudget/FY2022/FY2022_Weapons.pdf.

Creation of the Space Force

The Space Force is now a reality as the fifth DOD military service (the sixth U.S. military service, including the Coast Guard). By the end of FY 2022, the Space Force will have 8,400 military personnel, most transferred from the Air Force. This includes the transfer of 23 units. A later chapter will describe these actions in more detail.

So far, the split has been amicable. The Air Force has supported the establishment of the new service and facilitated its stand-up. Nevertheless, some elements of the division of personnel, facilities, and organizations remain. The split has been facilitated by the increase in personnel. Originally, the Space Force was not going to increase the number of billets in the DOD. That goal has been abandoned, with both the Air Force and Space Force increasing in size. ■

Mark F. Cancian *(Colonel, USMCR, ret.) is a senior adviser with the International Security Program at the Center for Strategic and International Studies in Washington, D.C.*

This report is made possible by general support to CSIS. No direct sponsorship contributed to this report.