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KEEPING A COMPETITIVE U.S. MILITARY AIRCRAFT INDUSTRY ALOFT

Findings from an Analysis of the Industrial Base

JOHN **BIRKLER** | PAUL **BRACKEN**
GORDON T. **LEE** | MARK A. **LORELL**
SOUMEN **SAHA** | SHANE **TIERNEY**

Prepared for the Office of the Secretary of Defense

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Summary

A handful of prime contractors dominate the United States' military aircraft industry today. Whereas during the first several decades after World War II, more than a dozen firms competed to develop and produce U.S. military aircraft, now only three domestic contractors develop, produce, and sustain complex fixed-wing military manned aircraft. One major firm supplies unmanned aircraft, three major firms supply avionics, and three contractors produce large turbofan engines.

For at least two decades, policymakers have expressed concerns that further consolidation could erode the competitive environment for military aircraft and degrade the industry's abilities to develop, manufacture, and support innovative designs. In 2001, at the request of the U.S. Senate, the Department of Defense (DoD) asked RAND's National Defense Research Institute to study the implications of having little or no competition in the fixed-wing military aircraft industry. RAND performed that evaluation and published its results in 2003.[4]

Policymakers' concerns have persisted in the years since publication of that study, and in 2009 the Committee on Armed Services of the House of Representatives requested that RAND's 2003 analysis be updated. This project responds to that request. Carried out for the Under Secretary of Defense for Acquisition, Technology, and Logistics, the project reviewed RAND's earlier evaluation of the risks and costs of the United States' having little or no competition among companies involved with designing, developing, and producing fixed-wing military aircraft and related systems; examined changes in industrial-base

[4] See Birkler et al., 2003, and Lorell, 2003.

structure and capabilities that have taken hold since that analysis was performed; and determined how these and future changes will affect the industrial base.

To conduct the study, we interviewed and collected data from three major prime fixed-wing aircraft contractors—the Boeing Company, Lockheed Martin Corporation, and Northrop Grumman Corporation—and from General Atomics, the main manufacturer of unmanned aerial systems (UAS). We also communicated with EADS (European Aeronautic Defence and Space Company N.V.) North America. In addition, we held discussions with and collected data from various DoD offices and numerous other organizations.[5] The data we collected allowed us to update the database that we used in the 2003 study,[6] which we then used to populate models from which we projected the impact that combinations of new aircraft programs that are not in DoD's current procurement pipeline would have on the industrial base.

Current Status of the Fixed-Wing Military Aircraft Industrial Base

Three major prime manufacturers—Boeing, Lockheed Martin, and Northrop Grumman—dominate the domestic fixed-wing industry

[5] We interviewed individuals at Boeing, Lockheed Martin, Northrop Grumman, EADS North America, and U.S. government offices. We used proprietary data from all those companies except EADS North America. We also obtained other data from the Aerospace Industries Association, previous RAND work, the Commission on the Future of the United States Aerospace Industry, the National Science Foundation, the Institute for Defense Analyses, the Office of the Deputy Assistant Secretary of Defense for Industrial Policy, the Office of the Under Secretary of Defense (Comptroller), service acquisition commands and laboratories, and company annual reports.

[6] The database drew from program budget exhibits—R-1 documentation for RDT&E data and P-1 documentation for procurement data. It also included Selected Acquisition Reports, Budget Item Justification exhibits, and other budget and planning documents. However, one difference from our 2003 report was that we were not able to break out by funding between prime and major subcontractors. We were able to do that in 2003, but because these numbers change frequently, such refinements were not part of the current study's database.

in the United States today. Another company, General Atomics, has arisen in the past decade as the main prime in the UAS field.

However, the industry continues to evolve. Thirty years ago, companies focused on manufacturing airframes and platforms; 20 years ago they concentrated on providing integrated systems. Today, however, they largely provide system integration capabilities. Primes now outsource much of what they once did in house. They do, however, maintain sufficient core skills to oversee and support their second-tier vendors. At the same time, the aerospace industry appears to be morphing toward commercial enterprise models that rely on networks of agile, smaller teams that have autonomy, budgets, and delayered authority structures and processes. This means that with primes increasingly focused on integrating complex systems, significant innovations are now expected to occur in second-tier firms as well as at the prime contractor level.

Assessment Criterion

We stayed close to the intent of Congress in choosing the criterion to gauge the adequacy of the U.S. military fixed-wing aircraft industrial base. We used the legislative language "that the United States must ensure, among other things, that more than one aircraft company can design, engineer, produce and support military aircraft in the future."[7] We interpreted that language to mean that the U.S. industrial base would be adequate if it was able to sustain at least two full-service prime contractors, each possessing approximately equal shares of *both* research, development, test, and evaluation (RDT&E) funding and procurement funding.[8]

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[7] U.S. House of Representatives, 2009, p. 380.

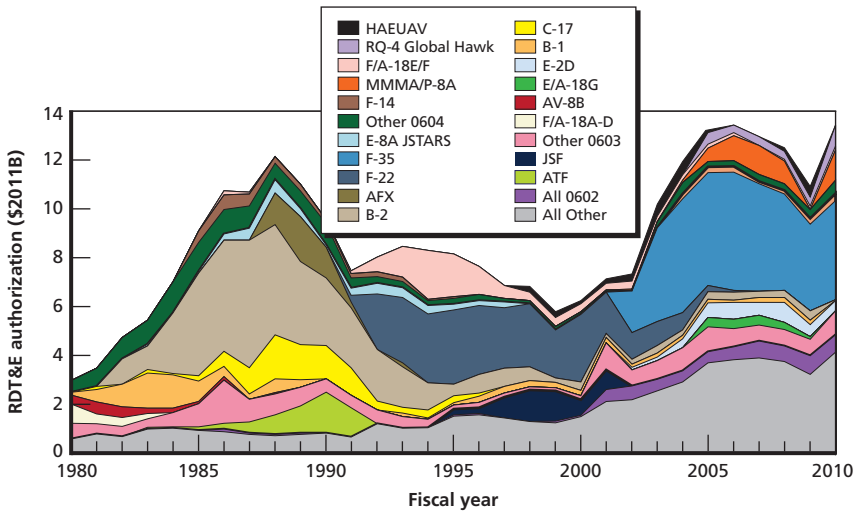
[8] This equal split is supported by the Herfindahl-Hirschman Index, a commonly accepted measure of market concentration. The index takes into account the relative market shares and distribution of the firms in a market and approaches zero when a market has a large number of firms possessing relatively equal shares of the market. The index increases as the number of firms in the market decreases and as the disparity in the market shares between those firms increases. The index is at minimum when firms have equal shares of the market. For further explanation, see U.S. Department of Justice, "The Herfindahl-Hirschman Index," n.d.

Current Research and Procurement Funding Is High

In 2010, the industrial base operated in an environment in which annual funding for RDT&E was at a 30-year high, hitting $13.45 billion, and funding for procurement was at $32.23 billion, twice the level of a decade earlier.[9]

Figures S.1 and S.2[10] display RDT&E and procurement outlays (in billions of fiscal year [FY] 2011 dollars) for programs funded from FY 1980 through FY 2010.[11]

Figure S.1
Fixed-Wing Military Aircraft RTD&E Funding, FY 1980–2010



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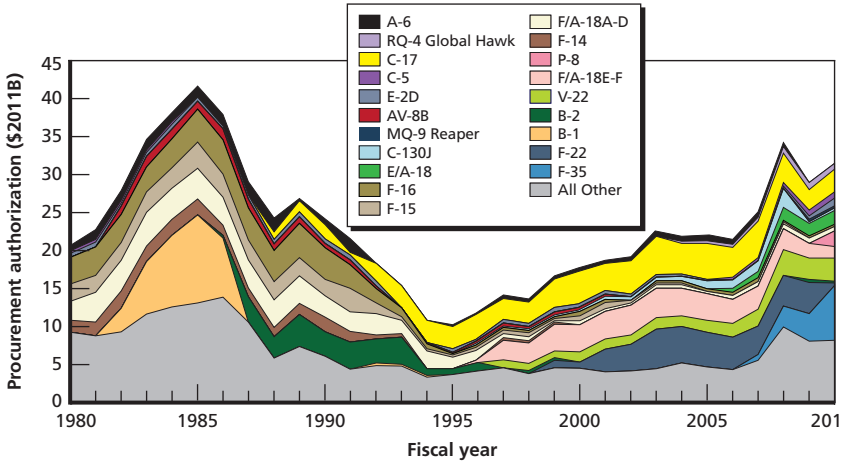
[9] Amounts are in fiscal year (FY) 2011 dollars. Two elements make up procurement funding: aircraft production ($22.75 billion in 2010) and aircraft modifications ($9.51 billion in 2010). Much of the increase in RDT&E has been due to the F-35 program, which is developing three versions of the Joint Strike Fighter.

[10] For these and subsequent RDT&E and procurement funding figures, we used data from program budget exhibits—R-1 documentation for RDT&E data and P-1 documentation for procurement data. We also used Selected Acquisition Reports, Budget Item Justification exhibits, and other budget documents.

[11] The "All Other" category in Figures S.2 and S.3 contains a multitude of smaller programs.

Figure S.2
Fixed-Wing Military Aircraft Procurement Funding, FY 1980–2010



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The four primes received only a portion of the funding depicted in Figure S.1 and Figure S.2. Moreover, while the distribution of RDT&E funding has been uneven, procurement funding has been more evenly balanced in recent years (See Figures S.3 and S.4).[12]

When these figures are viewed in the light of the assessment criterion discussed above, current programs of record (as of 2010) do not adequately appear to sustain two or more primes, each receiving

[12] Readers should note that the RDT&E funding data that we received did not break out the funds that primes allocate to subcontracts. Thus, Lockheed Martin's subcontracts to Northrop Grumman on the F-35, for example, were not broken out in our data set. As a result, the data we display may overrepresent Lockheed Martin's RDT&E share and underrepresent Northrop Grumman's share. Similarly, in terms of procurement, the amounts shown are for the contracted prime only and do not separately identify subcontracted work, such as Northrop Grumman's participation in the F/A-18 and F-35 programs.

Figure S.3
RDT&E Funding for Prime Contractors, FY 2000–2010

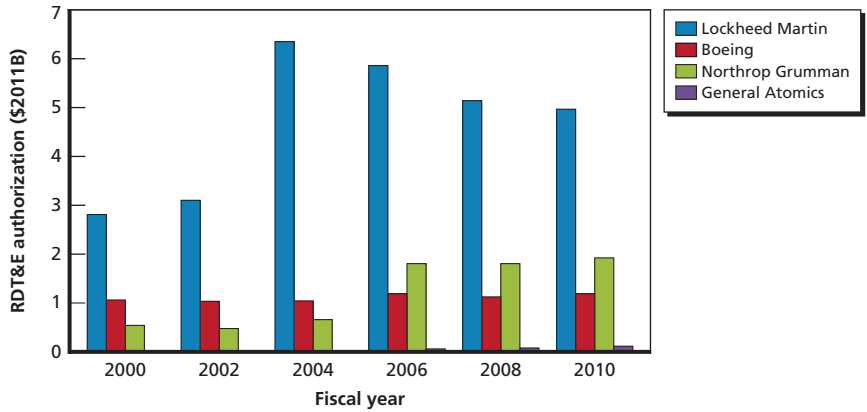

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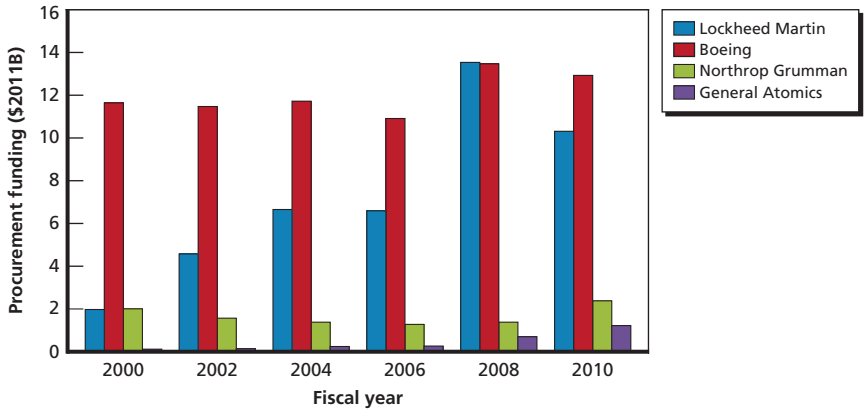
Figure S.4
Procurement Funding for Prime Contractors, FY 2000–2010



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approximately equal shares[13] of both RDT&E funding and procurement funding.[14]

What If DoD Were to Pursue Additional Programs?

We identified six new programs that DoD might consider pursuing: the T-X trainer, the KC-X tanker, the unmanned carrier-launched surveillance and strike aircraft (UCLASS), the F-22 fighter sold as foreign military sales (termed F-22 FMS), a next-generation bomber, and a sixth-generation fighter.[15]

Using the 2011 Future Years Defense Plan as our funding base case, we modeled the degree to which these six programs might foster innovative, competitive conditions in the future. We found that if DoD were to award three new programs—T-X, KC-X, and UCLASS—to the contractor most needing the work to maintain its viable competitive status as a designer and producer of military aircraft (in this case, Boeing), the industry still would cease to be competitive after 2015.[16] That also would be the outcome if, in addition to those three programs, DoD were to pursue foreign military sales of the F-22.

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[13] Although the congressional language motivated us to split RDT&E and procurement funding equally between two primes, it is not clear exactly what the shares should be. Depending on the circumstances, unequal divisions of funding—say 60:40, 70:30, or even 80:20—may be sufficient to sustain multiple primes for a period of time. Additionally, there also may be circumstances where funding could be split among three primes, either equally or unequally. However, if sustained over the long term, such unequal divisions may put lesser-funded primes at a disadvantage.

[14] Readers who compare the current report and the 2003 document should be aware of a fundamental difference between the two studies. The previous study used Selected Acquisition Reports (SARs), contract data, and available contractor reporting data to estimate the allocation of total obligation authority among prime contractors when two (or more) were involved in specific programs (e.g., F/A-18, F-22, JSF/F-35, etc.). Because these numbers change frequently, such estimates were not done for the current study. Consequently, charts depicting contractor funding levels/shares are not comparable between the two studies.

[15] In this monograph, we use the acronym *FMS* to denote both foreign military sales and other export sales to non-U.S. customers.

[16] Boeing generates $64 billion in total revenues, of which only 22 percent comes from unclassified military aircraft contracts.

However, by involving two primes equally in performing RDT&E and procurement on a next-generation bomber, DoD could sustain two firms through 2020 with RDT&E funding and through 2025 with procurement funding (see Figures S.5–S.8). Note that the KC-X does not appear in Figures S.5 and S.6 but does appear in Figures S.7 and S.8. The reason is that funding for the new tanker's RDT&E is already in the authorized budget, whereas funding for procurement has yet to be decided.

Adding a sixth-generation fighter to the previous industrial base cases would have funding impacts similar to the next-generation bomber. Assuming the program is shared between Lockheed Martin and Northrop Grumman, the RDT&E base would be sustained through 2025 with two primes having almost equal shares in the latter years. In terms of procurement, the fighter would not have much of an impact until the middle of the next decade, with three primes having almost equal shares (see Figures S.9 and S.10).

Figure S.5
RDT&E Funding: Base Case Plus T-X, F-22 FMS, UCLASS, and Next-Generation Bomber Programs, FY 2000–2025

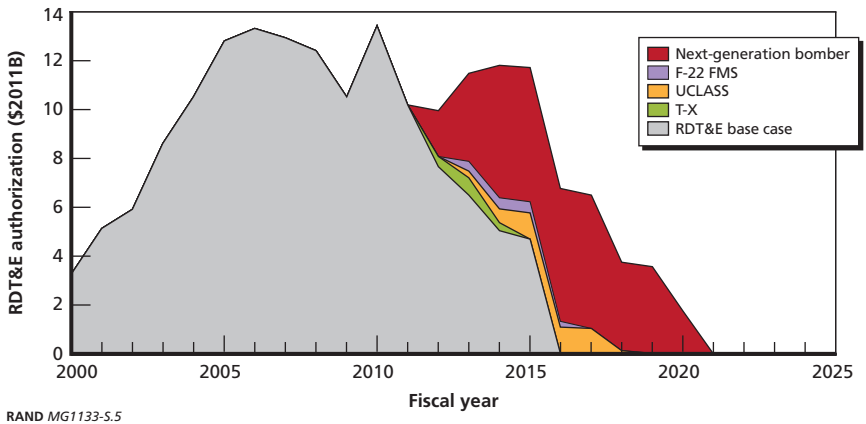

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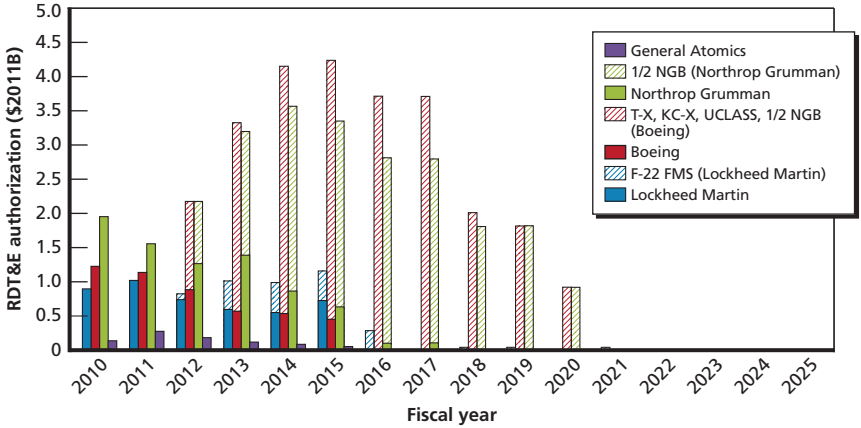
Figure S.6
Potential Prime Contractor Shares of RDT&E Funding: Base Case Plus T-X, F-22 FMS, UCLASS, and Next-Generation Bomber Programs, FY 2010–2025



NOTES: NGB = Next-generation bomber.

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Figure S.7
Procurement Funding: Base Case Plus T-X, F-22 FMS, UCLASS, and Next-Generation Bomber Programs, FY 2000–2025

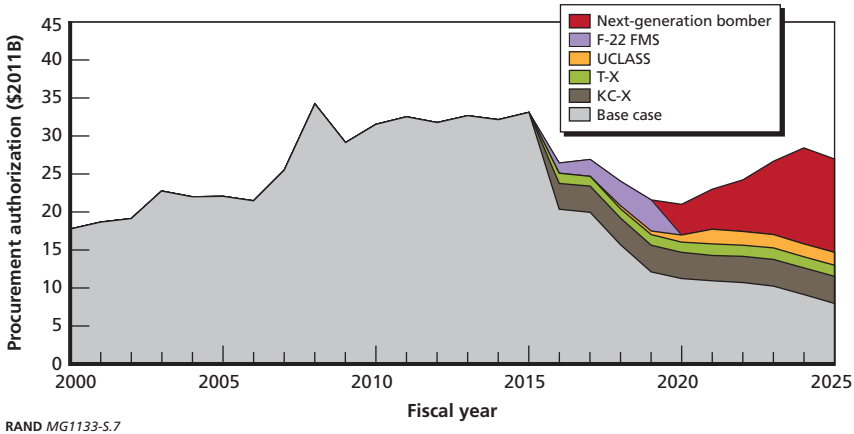

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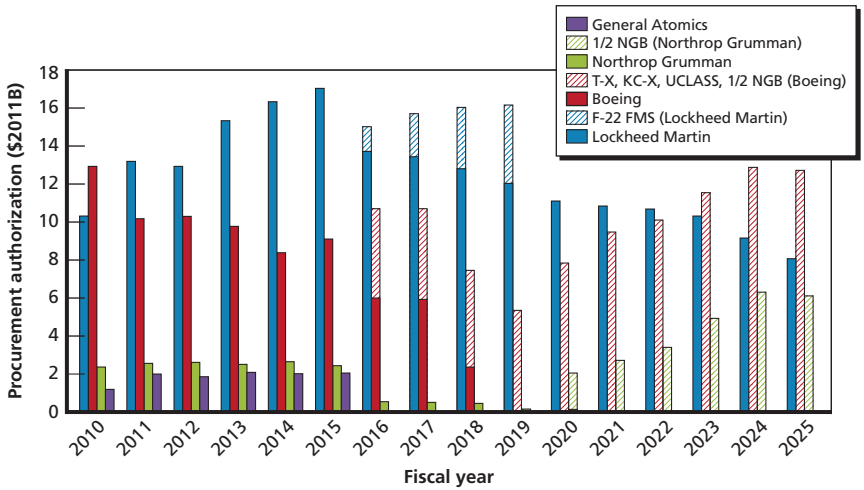
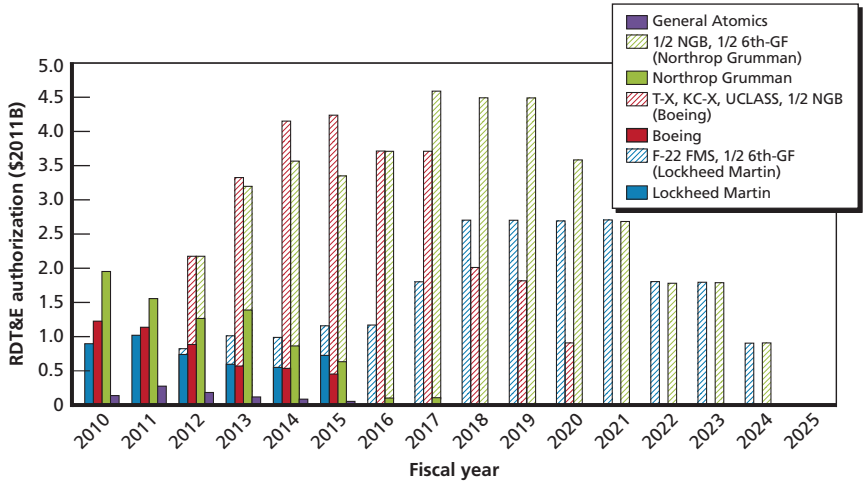
Figure S.8
Potential Prime Contractor Shares of Procurement Funding: Base Case Plus T-X, F-22 FMS, UCLASS, and Next-Generation Bomber Programs, FY 2010–2025



NOTE: NGB = Next-generation bomber.

RAND *MG1133-S.8*

Figure S.9
Potential Prime Contractor Shares of RDT&E Funding: Base Case Plus T-X, F-22 FMS, UCLASS, Next-Generation Bomber, and Sixth-Generation Fighter, FY 2010–2025



NOTES: NGB = Next-generation bomber. 6th-GF = 6th-generation fighter.

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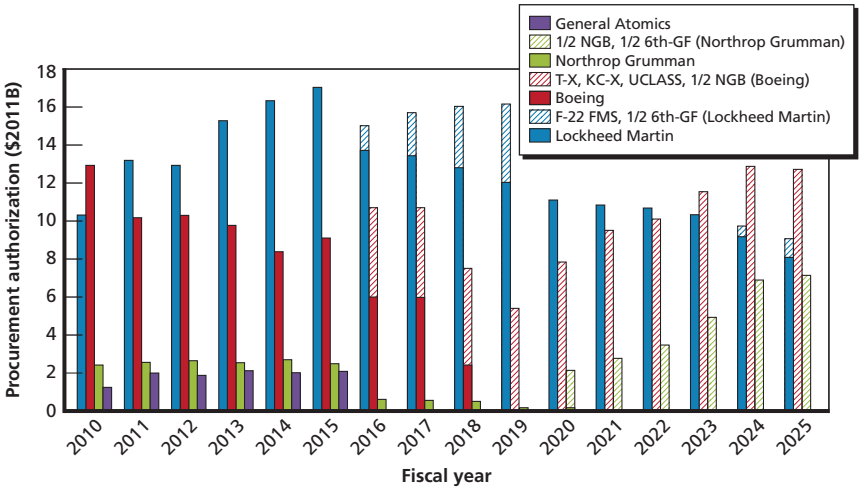
Figure S.10
Potential Prime Contractor Shares of Procurement Funding: Base Case Plus T-X, F-22 FMS, UCLASS, Next-Generation Bomber and Sixth-Generation Fighter, FY 2010–2025



NOTES: NGB = Next-generation bomber. 6th-GF = 6th-generation fighter.
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Which Program Combinations Would Best Sustain Competition?

Our evaluations suggest that small programs likely will not sustain the industrial base, in terms of either RDT&E or procurement.[17] The T-X, KC-X, and UCLASS programs would, in combination, sustain only Boeing as a viable competitor in the fixed-wing military market if it were the winner. Selling the F-22 to foreign militaries would boost Lockheed Martin's fortunes for only four years or so (FY 2016–2019).

To keep two primes healthy and competitive through 2025, a next-generation bomber program, or a program of similar size, is needed. This could sustain Boeing and Northrop Grumman if each

[17] However, as noted in RAND's 2003 study, a series of relatively small demonstration programs could sustain the advanced design teams that are precursors to new major systems.

company were to share 50 percent of funding for RDT&E and procurement. After 2025, an additional program on the scale of a sixth-generation fighter would need to be pursued. Table S.1 displays how the primes fare under each of these strategies, with cells in gray and yellow denoting combinations that would significantly or modestly sustain the primes, respectively.[18]

Table S.1 suggests that it may be possible to maintain a competitive and innovative fixed-wing military aircraft industrial base into the immediate future, even with a reduced number of prime contractors and with new program starts during a period of growing pressure on the federal budget. This is mainly because of three new trends that have

Table S.1
Program Combinations That Would Sustain Primes in 2011–2025 Period and Post-2025 Period

Time period	Strategy	Boeing	Lockheed Martin	Northrop Grumman
2011–2025	T-X + KC-X + UCLASS			
	+ F-22 foreign military sales			
	+ next-generation bomber			
Post-2025	+ sixth-generation fighter			

NOTE: Gray = significantly sustained; yellow = modestly sustained.

[18] While it was outside the scope of this study, we recognize that attention must be paid to the distribution of activities among contractors. Simply dividing funding equally between two contractors does not guarantee that all the activities that companies need to remain robust across the design-support spectrum will be nurtured. Under conditions in which few programs are under way and their schedules do not overlap, the opportunities for such nurturing may not easily arise, inasmuch as long gaps may separate opportunities presented to specific skill groups in companies. With more programs, keeping an advanced design group or a field support activity going becomes easier because groups of personnel can be moved from one project to the next.

emerged over the past ten years: the dramatic upsurge in RDT&E and procurement funding following the attacks of September 11, 2001; the large increase in the development and procurement of UAS, accompanied by the entry of new contractors and regeneration of traditional firms; and the continuing movement toward greater competitive outsourcing of research, development, and production tasks to lower-tier contractors, both foreign and domestic.

The future composition and capabilities of the military aircraft industry depend largely on the amount of business that the industry receives from DoD and how that business is distributed among development of technology, development of new designs, and production of completed designs. In Table S.1, we show the case in which firms that most need the work will win the award.

Competition may not produce the outcome displayed, however, and the industry may become further concentrated. Directed shares may be necessary to sustain multiple primes into the foreseeable future. Unless very purposeful and structured program decisions are made soon, the congressional objective—maintaining two or more companies capable of designing, engineering, producing, and supporting military aircraft—may not be achieved.