



The Challenges of Developing New Weapon Systems

Lessons Learned from the F/A-22 and F/A-18E/F

Since the late 1980s, the U.S. Air Force and the U.S. Navy have been acquiring two multirole fighter aircraft. The Air Force has pursued the F/A-22, the world's first supersonic stealth fighter, while the Navy has developed the F/A-18E/F, a carrier-capable fighter with air-to-air, interdiction, and close air support capability. The F/A-22 program has experienced significant cost growth and schedule delays and is still in the testing stage. The F/A-18E/F completed its development on cost and without any significant delays and has already been used in Operations Enduring Freedom and Iraqi Freedom.

The Air Force asked RAND Project AIR FORCE (PAF) to investigate the reasons behind these differences and to derive lessons for improving future acquisitions. Major conclusions about the F/A-22 and F/A-18E/F programs are as follows:

- **Each program used different methods to divide work among contractors during the development phase.** Concerns about the needed mix of technical expertise and other industrial base issues led the F/A-22 program to divide work equally between three major contractors, resulting in a lack of integration and coordination on some of the main components. The program's move from facilities in Burbank, Calif., to Marietta, Ga., may have contributed to further program instability. The F/A-18E/F program drew on preexisting relationships between the prime contractor and many of the subcontractors. Contractors' preexisting expertise minimized technological risks and cost and schedule instability.
- **Concurrent development of new technology created greater technical challenges for the F/A-22, while incremental improvements reduced technical risk in the F/A-18E/F.** The F/A-22 cost growth was mainly the result of design challenges in the airframe, the integrated avionics suite, and the new propulsion system. Some of these challenges were either assumed to be low-risk or were not accounted for in the initial program cost estimates. The F/A-18E/F incorporated incremental improvements with a minimal stealth requirement, a mostly existing avionics system, and a derivative engine design.
- **The programs allocated different portions of their budgets for management reserve.** Management reserve is used to cover unknown problems in a development program. The F/A-22 program allocated only about 2 percent of its budget for management reserve. This reserve was depleted in about the first year of development because of the technical challenges. The F/A-18E/F program maintained roughly 10 percent of the contract value as management reserve, enough to cover unforeseen problems as they arose.

The different approaches used by each program—and their outcomes—suggest important lessons for acquisition planners:

- A stable development team structure, proper team experience, clear lines of responsibility and authority, and a lead contractor responsible for overall program progress are critical to success.
- Concurrent development of new technology for the airframe, avionics, and propulsion adds significant risk to the program. Planners should be mindful of such risk in formulating budgets and schedules.
- Early, realistic cost and schedule estimates and appropriate use of management reserve can help address program problems and can mitigate cost and schedule growth.

These lessons can help the Air Force and other military services improve future acquisition projects, such as the Joint Strike Fighter, unmanned aerial vehicles, and missile programs. ■

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