



Improved Turbine Engine Program (ITEP)

The Army's ITEP is developing a next generation turbo-shaft engine for the Black Hawk, Apache, and Future Attack Reconnaissance Aircraft (FARA) fleets. The new engine is required to fit inside the existing engine compartments of Black Hawk and Apache helicopters and to integrate with FARA. ITEP is also expected to provide an increase in power, improve fuel efficiency, enhance reliability, and lower sustainment costs. The Army plans to field the improved turbine engine for all platforms in fiscal year 2027.

Source: U.S. Army | GAO-22-105230

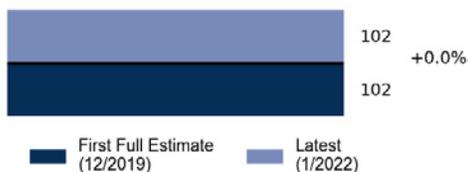


Program Essentials

Milestone decision authority: Army
Program office: Redstone Arsenal, AL
Prime contractor: General Electric Aviation
Contract type: CPIF

Acquisition Cycle Time

(in months)

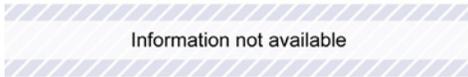


Software Development

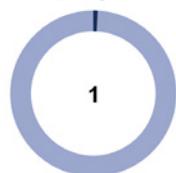
(as of January 2022)

Approach: Agile and Incremental

Average time of software deliveries (months)



Software percentage of total program cost



Software type

- 1 percent Off-the-shelf
- 0 percent Modified off-the-shelf
- 99 percent Custom software

ITEP uses a combination of software development approaches with different delivery time frames.

Program Performance (fiscal year 2022 dollars in millions)

	First full estimate (12/2019)	Latest (8/2020)	Percentage change
Development	\$2,080	\$2,008	-3.4%
Procurement	\$10,520	\$10,522	+0.0%
Unit cost	\$2	\$2	-0.6%
Total quantities	6,258	6,258	+0.0%

Total quantities comprise 69 development quantities and 6,189 procurement quantities. Current cost and quantity data were not available because out-year funding estimates were not updated during the fiscal year 2022 budget cycle.

Attainment of Product Knowledge (as of January 2022)

	Status at Development Start	Current Status
Resources and requirements match		
Demonstrate all critical technologies are very close to final form, fit, and function within a relevant environment	●	●
Demonstrate all critical technologies in form, fit, and function within a realistic environment	○	○
Complete a system-level preliminary design review	●	●
Product design is stable		
Release at least 90 percent of design drawings	●	●
Test a system-level integrated prototype	○	○
Manufacturing processes are mature		
Demonstrate Manufacturing Readiness Level of at least 9, or critical processes are in statistical control	NA	NA
Demonstrate critical processes on a pilot production line	NA	NA
Test a production-representative prototype in its intended environment	NA	NA

- Knowledge attained ... Information not available
- Knowledge not attained NA Not applicable

We did not assess ITEP's manufacturing maturity because the program has yet to reach production.

ITEP

Technology Maturity and Design Stability

ITEP reported its critical technologies as approaching maturity, a change from last year when the program reported them as fully mature. Program officials told us that this year's levels are based on a more realistic assessment of prototype testing than the assessment supplied last year by the prime contractor. That assessment rated three technologies as mature based on their use in other commercial products. We updated our Attainment of Product Knowledge graphic to reflect the testing-informed assessment.

Program officials plan to verify technology maturity during ITEP's first system-level engine test beginning in the second quarter of fiscal year 2022. The test was initially scheduled for January 2021 but manufacturing was delayed due to COVID-19. Leading acquisition practices call for this testing to be completed prior to design review, but it is now scheduled to begin more than a year and a half after the design review. This could increase the risk of costly, time-intensive rework of the prototype if testing reveals issues. The delay also intensifies existing manufacturing risks discussed below, and delayed delivery of the first ITEP engines for FARA from the first quarter of fiscal year 2022 to the first quarter of fiscal year 2023.

ITEP released over 90 percent of its design drawings for its critical design review in July 2020. Moreover, according to the program, ITEP successfully completed the first incremental critical design review with the Apache program in December 2020 and the FARA system requirements review in February 2021. Blackhawk critical design reviews are scheduled for fiscal years 2022 and 2023. These reviews are critical to ITEP's technology maturation and reduction of integration risk with each aircraft. Without fully mature technologies, however, ITEP risks issues emerging in testing that could require re-designs that disrupt integration with these aircraft.

Production Readiness

Over the past year, engine production start was delayed by several months due to COVID-19 manufacturing impacts and funding cuts in fiscal years 2020 and 2021.

ITEP continues to track two manufacturing risks identified in last year's report, which could affect engine delivery and flight test schedules. The first is a failure of a production instrument to demonstrate expected performance in a production representative environment prior to design review. The program is using new tooling and leveraging parts from other programs to resolve the issue, which could result in rework and delays. The second risk is delayed delivery of the engine's front frame and oil tank due to a 2020 delivery delay of two additive manufacturing machines required for their production. For FARA's first ITEP

engines, this issue resulted in a roughly 9-month delivery delay. While traditional manufacturing techniques could be utilized as alternatives, their use would likely result in increased weight, further contributing to the existing weight risk tracked by the program. The program is working to recover schedule delays through multiple engineering efforts to reduce cycle time and improve production.

Software and Cybersecurity

Program officials identified ITEP's software development as a risk due to hardware design changes that required additional software development, but have been unable to provide information about how they plan to mitigate this risk. They did note that contractors completed two of the five developmental software releases planned between September 2020 and the second quarter of fiscal year 2024. The first release was completed in July 2021, a delay of roughly 10 months, and the second in August 2021.

ITEP's software and hardware are not currently mature enough to support developmental and operational cybersecurity testing, according to program officials. They delayed cybersecurity vulnerability and adversarial assessments, tentatively scheduled for July 2021, to the third quarter of fiscal year 2023 and the third quarter of fiscal year 2025, as a result. Our prior work found that focusing on cybersecurity late in the development cycle or after a system is deployed is more difficult and costly than when handled early in the cycle.

Program Office Comments

We provided a draft of this assessment to the Army for review and comment. The Army provided technical comments, which we incorporated where appropriate. The program noted that during fiscal year 2021, it accomplished several key program events, including the Apache incremental critical design review, Black Hawk integrated baseline review, and FARA software preliminary design review. The program added that it is working toward its next major milestone—testing the first engine—currently planned for the second quarter of fiscal year 2022. In addition, the Army reiterated ITEP's commitment to cybersecurity and noted that the decision to delay formal test events is a demonstration of the program's commitment to deliver a secure product and preserve test resources.