B-52 Commercial Engine Replacement Program (CERP)

Executive Summary

- The Air Force is conducting a government-led engine source selection process with final engine selection planned for June 2021. Primary engine competitors include General Electric, Rolls Royce, and Pratt & Whitney. Competing contractors delivered side-by-side engine virtual Power Pod Prototype (vPPP) digital designs in November 2019. The vPPPs are being used to develop a complete aircraft digital design model, known as the Virtual System Prototype (vSP), which is expected to be complete in October 2021. The vPPP and vSP digital design models will provide detailed information to support physical modification of two B-52 prototype aircraft.
- DOT&E approved the initial B-52 Commercial Engine Replacement Program (CERP) Test and Evaluation Master Plan (TEMP) in March 2020. The Air Force approved a B-52 CERP Capabilities Development Document (CDD) in May 2020 to establish formal operational requirements. These documents fulfilled specified National Defense Authorization Act (NDAA) 2020 requirements.
- The B-52 CERP middle tier of acquisition (MTA) rapid prototyping development program is built around a five-phase integrated test strategy designed to maximize operational test data collection during the prototyping phase. It includes a limited operational demonstration using prototype aircraft followed by a comprehensive IOT&E using low-rate initial production (LRIP) aircraft prior to a Full-Rate Production (FRP) decision.

System

- The B-52H is a long-range, all-weather bomber with a crew of two pilots, two weapon system officers, and an electronic warfare officer.
- Mission systems include a GPS-aided precision navigation system, strategic radar targeting systems, electronic combat systems, and worldwide communications and data transfer systems.
- The B-52H can carry up to 80,000 pounds of precision-guided or unguided conventional and nuclear stores in an internal bomb bay and/or external wing pylons.

- The B-52H CERP replaces the legacy TF33 engines with fuel-efficient, commercial-derivative engines, increases electrical power generation capacity, and integrates digital engine controls and displays.

Mission

- Theater Commanders use units equipped with the B-52H to conduct long-range, all-weather conventional and nuclear strike operations that employ a wide range of munitions against ground and maritime targets in low-to-medium adversary threat environments.
- B-52 theater mission tasks include strategic attack, time-sensitive targeting, air interdiction, close air support, suppression/destruction of enemy air defenses, maritime mining, and nuclear deterrence. Key B-52H mission capabilities include:
  - Large and versatile internal and external weapons payload
  - All-weather targeting sensors and systems
  - Unrefueled intercontinental range extended by air refueling capability
  - Rapid nuclear alert start and launch capabilities
  - Nuclear-hardened and certified avionics and communication systems

Major Contractor
Boeing Defense, Space, and Security – St. Louis, Missouri

Activity

- The Air Force formally designated B-52 CERP as a rapid prototyping MTA program in September 2018, leading to acquisition of approximately 650 engines to modify and support the 76-aircraft B-52 fleet. The Air Force implemented a government-led engine source selection strategy coupled with a prime contractor-led integration program. Primary engine competitors include General Electric, Rolls

Royce, and Pratt & Whitney with final selection planned in June 2021.
- The engine competitors delivered their vPPP digital models of the side-by-side engine configurations in November 2019. The individual engine vPPPs are being used to develop a complete aircraft digital model, known as the vSP planned for

completion in October 2021. These digital design models will provide detailed information to support physical modification of two B-52 prototype aircraft.

- The Air Force developed a traditional production and fleet modification strategy for the remaining 74 B-52 aircraft. This strategy includes production of 11 LRIP aircraft to support the final phase of system development testing and IOT&E. The remaining 63 aircraft would be modified in 6 FRP lots. The Air Force continues to evaluate options to accelerate production and fielding, including the potential use of the MTA rapid fielding pathway.

- The B-52 Program Office initiated a B-52 modernization program integration working group to review options for aligning the B-52 CERP development and modification program with other major B-52 modernization programs. The effort is intended to identify potential test resource and fleet modification program efficiencies to minimize impact on B-52 operational availability.

- DOT&E approved the initial B-52 CERP TEMP in March 2020. The B-52 CERP Integrated Test Team initiated sub-working groups to begin development of detailed test plans, requirements, resources, and data collection systems. The Air Force approved a B-52 CERP CDD in May 2020 to comply with NDAA 2020 direction to establish formal operational requirements for this program.

- The B-52 Program Office continued the development of a comprehensive, enterprise-level cybersecurity test strategy that will progressively conduct incremental cybersecurity assessments across multiple B-52 modernization programs, including B-52 CERP. This approach is intended to maximize cyber test efficiency while supporting cyber test requirements for multiple B-52 upgrade programs.

Assessment

- The B-52 CERP TEMP defines an initial integrated test strategy designed to maximize collection of operationally relevant test data during the prototyping phase and a limited operational demonstration of the two prototype aircraft. The TEMP also defines the test requirements and resources necessary to complete an adequate IOT&E using production-representative LRIP aircraft prior to an FRP/fleet modification decision. The Air Force should update the TEMP following the B-52 Program Office modernization program alignment review, if test resources, schedules, or test configurations change significantly.

- The Air Force Operational Test and Evaluation Center (AFOTEC) operational test strategy provides an adaptive framework to support progressive evaluation of system capabilities during prototype development. The AFOTEC operational test design, early data collection strategy, and cumulative reporting approach provide an adequate basis for tailored integration of operational testing with the B-52 rapid prototyping program. Prototype testing will culminate in an AFOTEC-led operational demonstration to assess residual conventional and nuclear mission capabilities. AFOTEC intends to leverage operationally representative prototype test data to support a final evaluation of production system operational effectiveness, suitability, and survivability across the full spectrum of nuclear, conventional, and training missions.

Recommendations

The Air Force should:
1. Continue to develop B-52 CERP detailed test plans to integrate developmental and operational test objectives during the rapid prototyping test phases.
2. Complete development of a comprehensive, enterprise-level B-52 cybersecurity strategy to establish a system cybersecurity baseline and progressively evaluate planned system upgrades while leveraging previous test results to reduce redundant testing. This strategy should integrate B-52 CERP and all other planned B-52 modernization programs with cybersecurity test requirements.
3. Review pending B-52 modernization program alignment study recommendations and modify B-52 CERP test strategy, schedules, and resources, if required.