

## B61 Mod 12 Life Extension Program Tail Kit Assembly

### Executive Summary

- The B61 Mod 12 (B61-12) Life Extension Program (LEP) Tail Kit Assembly (TKA) program began operational flight testing in September 2019, and continued Department of Energy (DOE) system qualification testing. Ongoing operational flight testing thus far included seven weapons dropped from B-2s and eight weapons dropped from F-15Es.
- When hardware is available, side-by-side comparison testing of the respun Bomb Assembly (BA) Weapon Control Unit (WCU), with replacement capacitors, will be required for DOT&E to determine if the weapons deployed during operational testing (OT) completed to date are production representative and are valid for IOT&E. The capacitors in the original design did not meet long-life reliability requirements.
- The TKA demonstrated high degrees of accuracy and reliability throughout developmental testing (DT) and in OT to date with no reliability failures. The Air Force Operational Test and Evaluation Center (AFOTEC) analysis of OT flight tests conducted in September and October 2019 is expected to be available in December 2019.

### System

- The Nuclear Weapons Council (NWC) directed the B61-12 LEP as part of the Nuclear Modernization effort. The B61-12 LEP extends the life of the gravity-released ballistic bomb while adding a guidance capability.
- The B61-12 LEP consolidates four legacy B61 variants (Mods 3, 4, 7, and 10) into a single variant.
- The B61-12 All-Up-Round (AUR) is comprised of an updated BA integrated with a new TKA. The DOE National Nuclear Security Administration (NNSA) supplies the BA and the U.S. Air Force supplies the TKA. The NNSA is updating the BA to address all age-related deficiencies.
- The TKA is mechanically mated and electrically connected to the nuclear BA. The TKA and BA communicate with each other and with the aircraft to provide the AUR guide-to-target capability (System 2), while retaining the legacy ballistic flight capability (System 1).



TKA - Tail Kit Assembly

- The TKA design does not include a GPS receiver. It receives pre-programmed target location data and updates from the aircraft prior to release.
- The Air Force is testing the TKA in accordance with DOD Instruction 5000.02 requirements. The NNSA leads B61-12 BA activities, and the BA will be tested and qualified per the NWC Phase 6.X Process. When mated, the BA and TKA constitute an AUR, which will be qualified in accordance with the B61-12 System Qualification Plan.

### Mission

A unit equipped with the air-delivered B61-12 nuclear weapon plays a critical role in supporting the airborne leg of the nuclear triad for the United States and allies. The B61 thermonuclear bomb family is a key component of the current U.S. nuclear deterrence posture.

### Major Contractor

Boeing Defense, Space & Security – St. Louis, Missouri

### Activity

- After delivery of OT weapons, the Air Force initiated the OT phase in August 2019, and began flight testing on September 10, 2019. OT flight testing to date includes: B-2 seven munitions and F-15E eight munitions.
- Reliability testing included the 22 DT releases, 13 additional DOE/NNSA system qualification flight tests, and 15 OT releases with no reliability failures to date.
- The Air Force conducted an Operational Test Readiness Review on February 13, 2019, intending to start flight testing in April and complete testing in September. Ongoing NNSA production delays impeded the delivery of test articles and resulted in postponing the start of flight testing until September 2019.

# FY19 AIR FORCE PROGRAMS

- In FY18, Sandia National Lab conducted comparison testing between two different versions of the WCU to determine if there were any performance differences between BAs equipped with WCUs containing Field Programmable Gate Array (FPGA) chips and those containing Application-Specific Integrated Circuit chips. DOT&E required this comparison testing to determine if FPGA-equipped BAs were production representative for use in IOT&E.
- In FY19, the NNSA identified new problems with the long-life reliability of commercial off-the-shelf capacitors used in non-nuclear components, including the WCU, of the BA. Production-representative WCUs, with the new capacitors, will not be available until early CY21.
- AFOTEC Detachment 2, with support from Sandia National Lab, conducted a Cooperative Vulnerability and Penetration Assessment and an Adversarial Assessment in May and June 2018, respectively, to assess the cyber resilience of the B61-12 LEP TKA.

## Assessment

- Air Force DT of B61-12 LEP TKA is complete and OT is ongoing. DOE/NNSA system qualification testing is also ongoing. Preliminary results to date indicate:
  - The TKA demonstrates high reliability, availability, and accuracy. There have been no reliability failures during

flight test, and AFOTEC analysis of OT flight tests conducted in September and October 2019 is expected to be available in December 2019.

- One system component presents a cybersecurity vulnerability, but mitigation or elimination of the vulnerability appears feasible without a major investment of time or money.
- WCU comparison test data allowed DOT&E to determine that current flight test articles with FPGA chips in the WCU are production representative for the purpose of IOT&E.
- Additional comparison testing using respun WCUs with replacement capacitors, will be required to allow DOT&E to determine if the WCUs in the flight test articles are production representative for the purpose of IOT&E.

## Recommendations

1. The Air Force should resolve the outstanding cybersecurity problems discovered during cybersecurity testing.
2. The DOD should identify requirements of side-by-side comparison testing between WCUs used in IOT&E flight test articles and new WCUs with production capacitors to verify the articles used in IOT&E were production representative. Observation of adequate DOE/NNSA comparison testing is an exit condition of IOT&E.