

Small Diameter Bomb (SDB) II

Executive Summary

- The Small Diameter Bomb (SDB) II developmental testing is ongoing. Government Confidence Testing (GCT) began in October 2016. The Air Force awarded the Low-Rate Initial Production Lot 2 contract for 250 weapons in September 2016.
- SDB II is progressing towards meeting its effectiveness, reliability, and lethality requirements in the Normal Attack (NA) mode, which is the primary employment method for SDB II. The Air Force also successfully demonstrated Laser Illuminated Attack (LIA) and Coordinate Attack (CA) in 2016.
- The program has implemented corrective actions and fixes for all failure modes discovered in test. The weapon failed one environmental test related to the shipboard environment. The program implemented corrective action and successfully qualified design changes in corrosion, temperature, altitude and humidity, and vibration environments.
- IOT&E is scheduled to begin 4QFY17 with an adequately resourced test program.

System

- The SDB II is a 250-pound, air-launched, precision-glide weapon that uses deployable wings to achieve stand-off range. F-15E aircraft employ SDB IIs from the BRU-61/A four weapon carriage assembly.
- SDB II is designed to provide the capabilities deferred from SDB I. It includes a weapon datalink allowing for post-launch tracking and control of the weapon, as well as a tri-mode seeker to provide the ability to strike mobile targets in all weather.
- SDB II combines Millimeter-Wave radar, imaging infrared, and laser-guidance sensors in a terminal seeker, in addition to a GPS and an Inertial Navigation System to achieve precise guidance accuracy in adverse weather.
- The SDB II incorporates a multi-function warhead (blast, fragmentation, and shaped charge jet) designed to defeat armored and non-armored targets. The weapon can be set to initiate on impact, at a preset height above the intended target, or in a delayed mode.

Activity

- As of 2016, the Air Force has successfully completed 16 NA Guided Test Vehicle (GTV) and 10 Live Fire (LF) developmental tests against moving and stationary targets. Four GTV and 6 LF tests were conducted with Ultra High Frequency updates; 12 GTV and 4 LF test shots were conducted with Link 16 updates. NA is the primary employment method for SDB II. Also, in 2016, the Air Force completed three CA and four LIA GTV tests.



- SDB II provides increased weapons load per aircraft compared to legacy air-to-ground munitions used against offensive counter-air, strategic attack, interdiction, and close air support targets in adverse weather.
- SDB II is intended to provide reduced collateral damage while achieving kills across a broad range of target sets by precise accuracy, small warhead design, and focused warhead effects.
- There are three principal attack modes: NA, LIA, and CA. SDB II can be used against moving or stationary targets using its NA (radar/ infrared sensors) or LIA modes, and fixed targets with its CA mode.

Mission

- Combatant Commanders will use units equipped with SDB II to attack stationary and moving ground targets in degraded weather conditions at stand-off ranges.
- An SDB II-equipped unit or Joint Terminal Attack Controller will engage targets in dynamic situations and use a weapon datalink network to provide in-flight target updates, in-flight retargeting, weapon in-flight tracking, and, if required, weapon abort.

Major Contractor

Raytheon Missile Systems – Tucson, Arizona

- The Program Office completed 15 rounds of seeker Captive Flight Tests, resulting in over 2,260 target runs in a wide variety of terrain and environmental conditions. These tests provided terabytes of seeker performance data and logged over 483 hours of seeker operation without a single failure.
- The program has augmented and refined the Integrated Flight System (IFS) model by incorporating the results of over 2,260 Captive Flight Test runs as well as weapon flight

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- tests. IFS model verification and validation is expected to be complete by the end of March 2017, and the Air Force Operational Test and Evaluation Center is expected to accredit it prior to the start of operational testing.
- The Program Office completed over 2,000 hours of ground reliability testing and nearly 200 hours of in-flight reliability testing.
 - The program began a 28-shot NA mode GCT program in October 2016, which will test the weapon in more operationally realistic environments with operationally representative hardware and software. GCT will test the weapon versus maritime targets, countermeasures, and GPS-degraded environments.
 - The Air Force awarded the \$49 Million Low-Rate Initial Production Lot 2 contract on September 8, 2016, for 250 weapons.
 - The Air Force conducted all testing in accordance with the DOT&E-approved Test and Evaluation Master Plan.

Assessment

- SDB II is progressing towards meeting its effectiveness, reliability, and lethality requirements in the NA mode, which is the primary employment method for SDB II. SDB II successfully engaged both moving and stationary targets, including proper classification of target type (wheeled versus track) on 15 of 19 GTV flight tests; 1 GTV struck the secondary target and 3 events had failures. The program has aggressively and thoroughly implemented corrective actions and fixes for all failure modes discovered in test.
- The SDB II Program Office is preparing for IOT&E with an adequately resourced test program and no unresolved major programmatic testing problems. IOT&E is scheduled to begin in 4QFY17.
- Three GTV missions and one LF mission required additional attempts and were successfully repeated after completion of the failure investigation and implementation of corrective actions. All corrective actions to date have been successful in preventing repeats of the observed failure modes. LF-5, which the Air Force conducted on September 14, 2015, did not detonate. The investigation was completed and corrective actions implemented. The test was successfully repeated along with two other remaining LF shots September 17, 2016, to assess the lethality of the SDB II.

- LF-10, which was attempted on October 3, 2016, detonated but failed to guide to the target. LF-10 was the first LF mission using LIA. The failure investigation is ongoing.
- The Air Force successfully completed two LIA tests and two CA attacks in 2016. A third CA test, CA-3, was conducted on May 19, 2016. The weapon successfully guided to the target, but the height-of-burst fuze functioned prematurely. The SDB II Program Office determined the likely root cause of the anomaly and implemented corrective action, which was successfully demonstrated on CA-2 in September 2016. The program has met the requirements to award Lot 2 of the contract.
- The Air Force successfully conducted the first GCT of SDB II on October 18, 2016, using NA versus a static target and demonstrated in-flight retargeting of the weapon.
- The weapon failed one environmental test related to the shipboard environment. The program implemented corrective action and successfully qualified design changes in corrosion, temperature, altitude and humidity, and vibration environments.
- Continued comparisons of the IFS model pre- and post-flight predictions indicate the model is adequate for the kinematics flown in-flight test to date. Raytheon Missile Systems will continue to develop and update the IFS model, which will be essential to the assessment of the results of live fire and operational testing. IFS, in combination with lethality data, will produce single shot kill probability values needed to assess end-to-end weapon effectiveness against a range of operationally relevant targets.
- The weapon is progressing towards demonstrating the required reliability by the start of IOT&E. Further testing in GCT, LF, and the Captive Carry Reliability Test program is expected to increase confidence in weapon reliability.

Recommendations

- Status of Previous Recommendations. The Air Force completed all previous recommendations.
- FY16 Recommendation.
 1. The Air Force should continue to use the results of GCT to further refine the IOT&E test plan.