Small Diameter Bomb Increment II (SDB II)

The Small Diameter Bomb Increment II (SDB II) program continued integration efforts on the F-35 and limited supplemental testing on the F/A-18E/F before resumption of the Navy F/A-18E/F Quick Reaction Assessment planned for 1QFY23. In FY22, the Navy conducted 8 out of 10 planned SDB II releases required for declaration of an Early Operational Capability (EOC) for F-35B with software blocks 30R07 and 30R08: 5 successful releases of the SDB II from F-35B 30R07 test aircraft and 3 successful releases from F-35B 30R08 test aircraft. In September 2022, the Air Force declared Initial Operational Capability (IOC) for F-15E.

SYSTEM DESCRIPTION

The SDB II, also known as the GBU-53/B StormBreaker, is an air-to-ground glide weapon capable of destroying moving targets in adverse weather by using a multi-mode seeker. SDB II is a 250-pound weapon that uses deployable wings to increase standoff range. It is the first Air Force network-enabled weapon to use weapon datalink (WDL), allowing post-launch tracking and control of the weapon via in-flight target updates. The seeker uses multiple sensors to operate in adverse weather. Once launched, SDB II guides to a designated target cue which is updated inflight via the WDL until the seeker provides terminal guidance to the target. SDB II is fielded on the F-15E, and integration efforts continue on the F/A-18E/F and F-35B/C.

MISSION

Combatant Commanders will use units equipped with the SDB II to attack stationary and moving ground and littoral targets in adverse weather conditions at standoff ranges.

PROGRAM

SDB II is a joint Air Force and Navy Acquisition Category IC program intended to deliver capabilities deferred from SDB I. DOT&E approved the SDB II Milestone C Test and Evaluation Master Plan (TEMP) in April 2015. The TEMP update, including a cybersecurity strategy for Multiservice Operational Test and Evaluation (MOT&E) Phase II, was originally planned for FY22 but now is expected in FY23.

The Air Force fielded SDB II on the F-15E following completion of MOT&E Phase I with an early fielding report in July 2020 and declared IOC in September 2022.

The Navy is integrating the SDB II on the F/A-18E/F as part of a Quick Reaction Assessment approved by the Commander, Operational Test and Evaluation in June 2020. Integration is expected to be completed as early as 1QFY23.

Completion of MOT&E Phase II on the F-35 is expected in FY25. The F-35B 30R07 is progressing towards a limited envelope EOC declaration 1QFY23. In parallel, testing of the SDB II on the F-35B/C 30R08 started in FY22 with developmental environmental and loads testing, and is expected to complete in FY23 for the F-35B, leading to a second full envelope EOC declaration by the Marine Corps. Testing on the F-35C 30R08 is expected to complete in FY24 leading to an EOC declaration by the Navy. Testing on the F-35B/C 41R01 is scheduled for FY23 to FY25 supporting an IOC declaration by the Navy and informing the Full-Rate Production decision for the SDB II in FY25.

» MAJOR CONTRACTOR

- Raytheon Missiles & Defense – Tucson, Arizona

TEST ADEQUACY

The Navy conducted MOT&E testing in accordance with the DOT&E-approved Milestone C TEMP. Certain test limitations including cryptographic modernization delays, F-35B operational flight program limitations, and range safety restrictions have limited the findings. However, in the eight releases from the F-35B, the aircraft showed the capability to condition the weapon for laser, coordinate, and normal attack modes. Additionally, current range safety restrictions do not allow for operationally relevant employment of all-up-round SDB IIs, resulting in missed training and testing opportunities while putting a strain on a limited supply of costly guided test vehicles.

MOT&E Phase I cybersecurity testing conducted by the Air Force was inadequate to support an independent evaluation. The test shortfalls from Phase I need to be addressed during MOT&E Phase II testing.

PERFORMANCE

» EFFECTIVENESS

F-35B limited envelope integration and F/A-18E/F integration issues will need to be resolved for the SDB II to be operationally effective in all mission contexts. The F-35B EOC configuration, allowing only a single weapon release and no WDL post-launch control (consistent with the release conditions

observed during the seven SDB II releases in FY22), will heavily restrict tactical employment of the bomb when initially fielded on the F-35B.

F/A-18E/F integration testing in early FY22 showed multiple integration issues stemming from various software faults found in the aircraft, weapon, and mission planning systems, as well as a bomb rack hardware issue related to SDB II employment. These issues, combined with the expiration of legacy encryption keys, resulted in a broad effort to upgrade all major software types (i.e., aircraft, weapon, WDL, and mission planning) in a well-coordinated and integrated manner. The Navy is implementing cryptographic modernization of the encryption keys to allow resumption of the testing. Additionally, the Navy is addressing the bomb rack hardware issue to lessen the likelihood of it inducing a failure or degrading weapon performance when ejecting the SDB II.

The Navy flew two F/A-18E/F envelope expansion missions with one successful and the other suffering a release abort. The software issue causing the abort was quickly identified and a fix incorporated in the next weapon software release.

The SDB II continues to be operationally effective as employed by the F-15E. The range safety restrictions mentioned above and real-world contingencies have delayed SDB II Operational Test and Weapon System Evaluation Program drops during FY22. Despite these delays, the Air Force declared IOC in September 2022.

» SUITABILITY

Ongoing MOT&E testing is required to inform a suitability assessment, but the SDB II appears to be on track to be operationally suitable when employed from the F-35B and the F/A-18E/F. The complexity of cryptographic information delivery, loading, and mission planning (e.g., the exclusion zone creation processes), continues to be a problem with only modest mission planning improvements incorporated into the Joint Mission Planning System to date.

The SDB II continues to be operationally suitable as employed by the F-15E.

» SURVIVABILITY

The survivability of the SDB II in a cyber-contested environment is currently unknown due to the lack of adequate test assets provided by the vendor, which resulted in inadequate cybersecurity testing during MOT&E Phase I.

RECOMMENDATIONS

The DOD should:

1. Work with the candidate open-air-ranges for SDB II integration trials on the F-35 to address and mitigate self-lasing restrictions. Additionally, the DOD should work with the ranges to reassess restrictions on all-up-rounds and release profiles, to allow operationally representative employment by all platforms.
2. Continue to advocate for operationally suitable initiatives to streamline the cryptographic information delivery, loading, and verification process.

The Navy should:

1. Develop and fund an adequate MOT&E Phase II cybersecurity T&E strategy to support an evaluation of SDB II survivability in a cyber-contested environment. The SDB II Program Office should also update the Milestone C TEMP to reflect this commitment.

The SDB II Program Office should:

1. Continue efforts to streamline the mission planning process to decrease the time required and increase reliability, particularly with regard to cryptographic data entry.