

## Excalibur XM982 Precision Engagement Projectiles

### Executive Summary

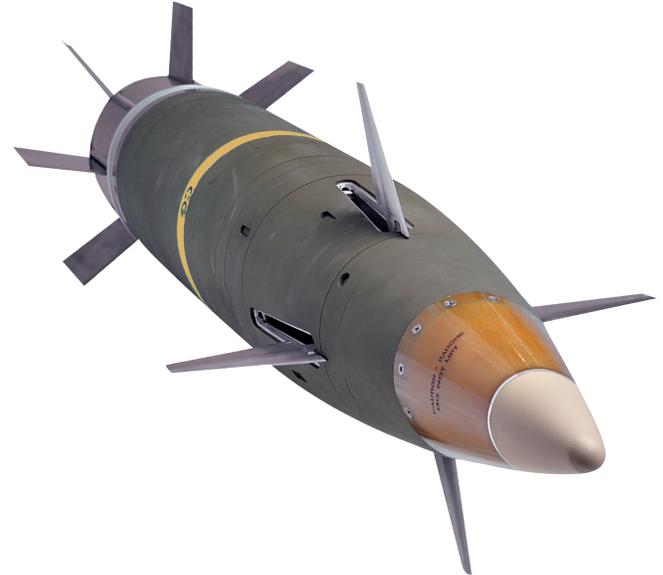
- Paladin-equipped units in Operation Iraqi Freedom have been using Excalibur since May 2007 to engage targets. As of July 2008, Field Artillery units have fired over 66 rounds with reported accuracy better than 10 meters and 80 percent effects on target.
- M777A2 Lightweight 155 mm Howitzer-equipped artillery units have been using Excalibur in Operation Enduring Freedom and Operation Iraqi Freedom since February 2008.
- The Army awarded design and maturation contracts for full and open competition for Excalibur Increment Ib to reduce unit cost and improve reliability.

### System

- Excalibur is a family of precision-guided, 155 mm artillery projectiles.
- The Army plans to develop three Excalibur variants:
  - High Explosive, Unitary (Increment I)
  - Smart (Increment II)
  - Discriminating (Increment III)
- The Army is developing the High Explosive, Unitary Projectile (Increment I) in three spirals of increasing capability (Ia-1, Ia-2, and Ib).
- All variants use GPS and an Inertial Measurement Unit to attack point targets with an accuracy of less than 20 meters from the desired aim point.
- The projectiles are fin-stabilized and glide to their target. The Ia-1 projectiles use aerodynamic lift generated by canards to extend range out to 24 km. The Ia-2 projectiles add base bleed technology to further increase range to 30 km.

### Mission

Artillery units will use Excalibur to provide fire support to combat maneuver units in all weather and terrain, including urban areas.



Artillery units will use:

- The High Explosive, Unitary Projectile (Increment I) to attack stationary targets in complex and urban terrain and minimize collateral damage
- The Smart Projectile (Increment II) to engage moving and time sensitive targets
- The Discriminating Projectile (Increment III) to search, detect, and selectively engage individual vehicles by distinguishing specific target characteristics

### Prime Contractors

- Bofors
- Raytheon

### Activity

#### Increment Ia-1

- Paladin-equipped units in Operation Iraqi Freedom have been using Excalibur since May 2007 to engage targets. As of July 2008, Field Artillery units have fired over 66 rounds with reported accuracy better than 10 meter and 80 percent reliability.
- Following the February 2008 extension of the Excalibur material release to the M777A2 Lightweight 155 mm Howitzer, artillery units in Operation Enduring Freedom and Operation Iraqi Freedom have also been using Excalibur projectiles.

#### Increment Ia-2

- In the first half of FY08, the program manager conducted a series of Sequential Environmental Tests for Safety and Performance for the Excalibur Increment Ia-2 projectile. The tests evaluated the projectile's base bleed technology against the requirements identified in the Capability Production Document. The projectile demonstrated 80 percent reliability during the performance tests, which included test firings with the maximum charge. These tests also integrated live fire testing to collect data for lethality analysis by using an array of realistic targets as aim-points.

- In January 2008, the Army fired six Excalibur Increment Ia-2 projectiles at the Cold Regions Test Center, Alaska, in minus 35 degree Fahrenheit weather. Three rounds hit the target with better than 10-meter accuracy. The other three rounds were reliability failures. Two rounds experienced Inertial Measurement Unit (IMU) built-in-test failures that caused them to fly to the ballistic impact point. A software problem with the fuze setter sent incorrect GPS data to the third round that failed.
- The contractor redesigned the base with stronger threads following separation of a projectile base in testing with a foreign cannon and non-standard charges. The program manager continues base qualification testing to demonstrate improved reliability.
- The contractor has selected a new IMU vendor to improve projectile reliability when used with the maximum propellant charge. The Army will conduct further testing to qualify the new IMU and demonstrate that the projectile meets reliability and performance requirements with all propellant charges.
- The contractor has redesigned the GPS antennas and software to improve performance in GPS jamming environments. Additional testing in 2QFY09 should demonstrate the projectile's capabilities in jamming environments.
- The Army postponed the Initial Operational Test by seven months to allow more time to grow reliability to the required 85 percent and align Excalibur testing with development of the Advance Field Artillery Tactical Data System (AFATDS) software version needed to support Excalibur fielding.

## **Increment Ib**

- In September 2008, the Army awarded design and maturation contracts through full and open competition for Excalibur Increment Ib to reduce unit cost and improve reliability. The companies will evolve their proposed concepts and then demonstrate them in a side-by-side live firing event. The Army will then select a single contractor to move forward with the qualification and initial production of the Increment Ib projectile.

## **Assessment**

- The Excalibur Increment Ia-1 projectile achieved the desired lethal effects against personnel and structure targets during the February 2007 Limited User Test. The projectile met reliability, safety, and suitability goals for early release to combat forces. Fielding to artillery units in Operation Iraqi Freedom in 2007 has enhanced their ability to precisely strike targets requiring minimal collateral damage.
- The Excalibur Increment Ia-2 projectile demonstrated effectiveness against personnel and structure targets in an unjammed environment. The Army expects the projectile will meet reliability, lethality, and safety requirements before the Initial Operational Test scheduled for 2QFY09.
- There is significant risk to achieving performance requirements in a GPS jamming environment for all Excalibur projectiles. The contractor and program manager have developed a plan for the Ia-2 projectile to address projectile susceptibility from accredited GPS jamming threats to overcome this. The projectile will have adequate opportunity in the remaining test events to demonstrate performance in a jamming environment.
- The Smart (Increment II) and Discriminating (Increment III) projectiles have been proposed to document the Army's intent to pursue incremental improvements as technology matures. These projectiles will incorporate target discrimination capabilities. The previous efforts to field projectiles with target discrimination capabilities were successful against fully exposed benign targets, but consistently not successful against targets that employed active and passive countermeasures. Successfully demonstrating target discrimination capabilities in the future is a concern.

## **Recommendations**

- Status of Previous Recommendations. The Army is making progress on DOT&E's previous recommendations.
- FY08 Recommendation.
  1. The Army should closely monitor AFATDS Version 6.6 development for indications of further delays.