

JAVELIN ANTITANK MISSILE



Army ACAT IC Program

Total Number of Systems	
CLUs:	4,510 (4,092 Army; 418 USMC)
Missiles:	22,358 (19,805 Army; 2,553 USMC)
Total Program Cost (TY\$):	\$3,821.2M (\$765.7M RDT&E; \$2,748.8M Army; \$306.7M USMC)
Average Unit Costs	
CLU (TY\$):	\$162K
Missile (TY\$):	\$78K

Prime Contractor

Lockheed Martin/Raytheon
Joint Venture

SYSTEM DESCRIPTION & CONTRIBUTION TO JOINT VISION 2020

The Javelin is a man-portable, fire-and-forget, medium anti-tank missile employed by dismounted troops to defeat current and future threat armored combat vehicles out to 2,500 meters. Javelin attacks most targets from the top to defeat explosive reactive armor; it also has the capability, in the direct fire mode, to attack targets under cover or those that would be unreachable by top attack. The program is in the process of replacing the Dragon system in both the Army and Marine Corps, including Reserves and National Guard. Javelin provides a medium anti-tank capability for dismounted (including light) forces while the TOW Fire and Forget and LOSAT systems will provide heavy anti-tank capabilities for all light forces.

The Javelin consists of a missile in a disposable launch tube and a re-usable Command Launch Unit (CLU), with a trigger mechanism and day/night sighting device for surveillance, target acquisition, and built-in test capabilities. The missile locks onto the target before launch using an infrared focal

plane array and on-board processing, which also maintains target track and guides the missile to the target after launch. A full-up system weighs less than 50 pounds.

The Javelin Training System consists of three devices, each fulfilling a specific role. The Missile Simulation Round is a form, fit, and weight, but not functional, representation of the missile in its launch tube and is used to familiarize the gunner with the physical characteristics of the Javelin. The Basic Skills Trainer (BST) is used in classrooms to develop the basic tactical and technical gunnery skills to operate the Javelin. The Field Tactical Trainer (FTT) refines the gunner's abilities and enables the gunner to participate in both range training and force-on-force exercises. There are two FTT configurations used in the field: (1) a fixed-site version supporting instructor-guided range training; and (2) a mobile version for tactical field training and exercises.

The Javelin contributes to *Joint Vision 2020* as a tactical *precision engagement* system that enhances the Army's *dominant maneuver* capabilities in the ground battle. Its strong capability against threat-armored vehicles contributes to *full dimensional protection* for dismounted forces.

BACKGROUND INFORMATION

The January 1978 Anti-armor Mission Need Statement identified the deficiencies of the Army's current man-portable anti-armor weapon—the Dragon. The Joint Service Operational Requirements Document for the Javelin was approved in 1986 and amended in 1988 to allow for a higher weight. The Initial Operational Test & Evaluation (IOT&E), which was completed in December 1993, concluded that Javelin was operationally effective, but required further assessment for operational suitability. LRIP was approved by the DAB in July 1994. Follow-on operational testing, in the form of a Limited User Test (LUT) primarily aimed at operational suitability issues, was executed in April-June 1996 at Ft. Hunter Liggett, CA. The results of this test concluded that the Javelin was operationally suitable for introduction into the field.

An Enhanced Producibility Program (EPP) design for the Javelin missile was introduced prior to the scheduled Milestone III decision. At DOT&E's insistence, EPP missiles were tested during a Confirmatory Test in April 1997 at Ft. Benning, GA, in time to influence the Milestone III decision and reduce the scope of follow-on testing. DOT&E's B-LRIP report to Congress of May 1997 concluded that the Javelin EPP system design was operationally effective, suitable, and lethal.

Live Fire Test and Evaluation for the Javelin system was completed in October 1996. It consisted of three progressive phases that challenged the Javelin against current and emerging tank threats. DOT&E's Live Fire Lethality evaluation report was likewise forwarded to Congress supporting the Javelin Milestone III Full-rate Production (FRP) decision.

Subsequent to the FRP decision, several changes had been incorporated in the system to enhance producibility and reduce cost. The LRIP version of the CLU that was originally fielded is now being replaced with the lower cost and more maintainable FRP version. As of the end of FY00, only LRIP versions, including the EPP version, of the Javelin missile have been fielded. FRP I missiles have successfully completed lot acceptance testing.

Several reliability and availability performance thresholds for the Javelin CLU, missile, and training devices were defined relative to "System Maturity," which had been planned to occur at Milestone III plus three years (May 2000). The actual date for assessing missile maturity is under

consideration for delay to May 2001 to ensure reliability problems have been resolved. Testing and analysis of data, primarily developmental in nature, to address all of the System Maturity requirements have been completed.

Failures observed during lot acceptance testing in FY99 caused the Army to reject the first lot of 500 FRP missiles because of a marginal design of the Warhead Initiation Module (WIM) provided by a new vendor. This failure mode, as well as three other subsequently discovered failure modes related to electrical shorting in the control actuation system, flight motor ignition failure, and precursor warhead failure to fire, were exhaustively investigated. Design and manufacturing process fixes were initiated throughout FY00.

The Javelin Enhanced Tandem Integration (JETI) modification, scheduled to be cut into production in the third Full-rate Production year (FRP III), modifies the manner in which the existing precursor and main charge warheads are mounted within the missile (although the warheads themselves are unchanged from earlier production). Because JETI changes are not anticipated to significantly affect Javelin's lethality, DOT&E agreed that full-up, system-level LFT&E was not warranted for near-term testing. If in the future the Army decided to replace the existing main charge warhead, full-up system-level testing would be required. The proposed Lethality Improvement Tracker Enhancement (LITE) is a tracker modification involving software changes to enhance lethality; software issues exist which have not been resolved. A recent move by industry caused several software experts to leave the program. Modified software will be less difficult to cut into production once solutions are developed. However, under the present set of circumstances, it is difficult to say when LITE production will begin.

Flight-testing against Active Protection Systems (enhancements to threat armor vehicles designed to detect and destroy incoming missiles) is underway and has been successful to date.

TEST & EVALUATION ACTIVITY

Javelin testing in FY00 consisted of the PM's continuing technical and lot acceptance testing of missiles and other system components, the missile test-fix-test program associated with the transition from LRIP to FRP, and the completion of the final phase of JETI testing.

Testing to confirm the PM's fixes to the FRP I missile design consisted of flight tests, developmental in nature, conducted at Redstone Arsenal, AL, in May-June 2000. DOT&E provided oversight by insisting that fixes be verified by flight testing vice analysis, recommending that missiles be subjected to temperature and vibrational profiles prior to firing, and seeking to extend testing beyond the first phase in which 9 of 10 missiles performed reliably. The Javelin PM fired an additional 20 missiles from the production line to demonstrate corrective action effectiveness. All of these missiles hit their targets and, as independently confirmed by DOT&E in detailed reviews of high-speed videotapes, evidenced proper timing in warhead events (i.e., precursor firing followed by a main warhead firing). These successful test results supported the Congressionally mandated certification by the Secretary of Defense that all manufacturing and technical issues had been resolved.

A subsequent failure in the warhead initiation circuit in a system qualification test of a design change for the FRP III missile (another new configuration beyond FRP I, that had been tested for Certification to Congress) is a concern. This test was of the design and integration of the new Common Electronic Safe, Arm, and Fire (CESAF) circuit.

The final phase of JETI testing will include three firings of tactical missiles against operational tank targets, conducted as part of the FRP III qualification test program.

TEST & EVALUATION ASSESSMENT

The Javelin system has been adequately tested in accordance with the OSD-approved TEMP, and declared operationally effective, operationally suitable, and lethal. The unresolved operational suitability issues concerned only the following specific reliability and availability parameters prescribed for System Maturity (Milestone III plus 3 years): training device reliability, CLU reliability and availability, and missile round reliability. Analyses of the most recent data indicate that the training devices and CLU meet or exceed their system maturity requirements with confidence.

The missile design continues to evolve in accordance with Acquisition Reform initiatives aimed at minimizing production costs. The 0.97 missile reliability (29 of 30 successful firings) observed during Certification flight testing demonstrated that the technical and manufacturing problems previously associated with the FRP I missile design have been resolved. New failure modes may surface as the missile design continues to be modified in favor of cost reduction efforts (e.g., as in the new ESAF for FRP III).

The planned JETI warhead testing is expected to be conducted in January 2001. The program is experiencing some producibility problems with the CESAFA, which will be installed only in the FRP III missile. Until these component-level problems are resolved, the program does not plan to fire FRP III missiles with the JETI modification. It is anticipated that the firings will demonstrate that the JETI variant is as lethal as the existing warhead with more consistent penetration performance.

CONCLUSIONS, RECOMMENDATIONS AND LESSONS LEARNED

Continued observation and analysis of Javelin missile reliability are warranted. DOT&E concern stems from the difficulties the Army has had qualifying new components in the transition from LRIP to FRP. DOT&E will continue to monitor missile reliability closely. Formal judgment will be reached at missile maturity in May 2001. If it were found after assessment at missile maturity that Javelin meets its requirements, further system maturity follow-on tests and evaluations for reliability will not be required.

Acquisition Reform encourages contractors to reduce cost while holding performance and reliability constant. ***Any post-MS III changes made must be carefully scrutinized and thoroughly tested to verify performance and reliability.*** When the Javelin prime contractor changed the source for WIM, the new WIM had been successful in different environments. However during system testing, prior to lot acceptance, the new WIM revealed a new failure mode as discussed above.

The Javelin program offers a good example of a well-executed lethality product improvement. The Javelin Program Office developed a simple, but effective, means to increase Javelin's lethality without undue risk or significant cost increase. Then, the Program Office conducted a comparative test-based assessment of the simpler alternative with a contractor-developed alternative warhead to determine the preferable option. Finally, the selected alternative underwent an IPT-developed T&E program to assess the performance of the improved Javelin warhead.