JOINT AIR-TO-SURFACE STANDOFF MISSILE (JASSM)

Air Force ACAT ID Program

Total Number of Systems:	2,400
Total Program Cost (TY$):	$1189.0M
Average Unit Cost (TY$):	$495K
Full-rate production:	4QFY03

Prime Contractor

Lockheed Martin Integrated Systems

SYSTEM DESCRIPTION & CONTRIBUTION TO JOINT VISION 2020

The Joint Air-to-Surface Standoff Missile (JASSM) is a ***precision engagement*** weapon that integrates the standoff delivery accuracy and effectiveness required to kill critical enemy targets with the necessary technologies to ensure high missile survivability. This precision engagement capability will enable joint U.S. and combined allied forces to conduct sustained and synchronized operations from dispersed locations to ensure ***dominant maneuver***.

The JASSM Missile System is an Acquisition Category 1D effort to develop a survivable precision cruise missile capable of launch from outside area defenses to kill hard, medium-hardened, and soft/soft-distributed targets. The weapon is required to attack both fixed and relocatable targets. The threshold integration aircraft are the F-16 (Block 50) and B-52H. Although carrier operability remains a Key Performance Parameter, the Navy F/A-18 E/F has been re-designated as an objective platform. The Navy will determine the schedule for integration onto the F/A-18 E/F.

The Key Performance Parameters for the system are: Missile Mission Effectiveness (expressed as a mission-level measure of overall ability to kill a defined target set), Missile Range, and Carrier Operability. Currently, Navy funding issues will prevent carrier operability being evaluated during IOT&E. The program office developmental concept subordinates all other operational requirements to potential contractor performance/cost tradeoffs to achieve the best value weapon for the service users. These cost-performance trades are to be defined through continued and open interaction between the service users, the program office, the OTAs, and the prime contractor. The program requires the contractor to deliver a fully warranted, all-up round for threshold price of less than $700 thousand each (BY95$). The current average unit procurement price is $323 thousand (FY95), well below the objective price of $400 thousand each (FY95) and a 15-year bumper-to-bumper warranty.

BACKGROUND INFORMATION

Seven contractors initially submitted concept study proposals for the program. During this time of technical build-up, prior to the release to industry of the request for proposal, intense intellectual interaction took place between the contractors and the government team. This open interaction and continued aggressive competition in performance and cost assessment are the keystones of the program office strategy. The final competition phase was between two participants in a Program Definition-Risk Reduction (PDRR) phase. Lockheed Martin and McDonnell Douglas (a wholly owned subsidiary of Boeing) were the prime competing contractors for the PDRR phase. Lockheed Martin was down-selected as the winning contractor in April 1998.

The program is currently in EMD. Developmental testing began in 3QFY00. The combined DT/OT test phase will begin in 4QFY01 with mission DT-5. Dedicated Operational Flight Test will begin in 3QFY02. An LRIP decision is scheduled for 1QFY02. The full-rate production Milestone III decision is scheduled for 2QFY03.

During PDRR, Congress directed the Air Force and Navy to perform an updated Analysis of Alternatives (AOA) to determine the relative value of JASSM versus a proposed variant of the Navy Stand-Off Land Attack Missile-Expanded Response Plus (SLAM-ER+). The results of the AOA substantiated the continued requirement for JASSM.

A November 9, 1998 Milestone II Acquisition Decision Memorandum (ADM) approved JASSM entry into EMD and LRIP entrance criteria. Additionally, the ADM approved adding $97.5 million to fund a 6-month EMD schedule extension to reduce overall program risk. As a result, LRIP moved to January 2001, Milestone III moved to July 2002, and B-52H Required Assets Available moved to 4QFY02.

In September 1999, SAF/AQ directed the JASSM program office to re-structure the program master schedule and delay LRIP go-ahead from January 2001-November 2001. This decision was driven by several technical delays in development. These delays were the result of several factors:

- Teledyne engine development was progressing slower due to design changes to the engine main bearing, digital fuel control, and delays in the improved engine compressor. The impact of these delays was an unrecoverable 3 months delay.

- Key subcontractors are behind schedule due to outer missile mold line changes made by Lockheed Martin. These design changes resulted from anomalies discovered during a JASSM jettison test from an F-16.

- Changes to the outer missile mold line also drove changes to the pitot static/air data system. As a result, two additional DT flights are now required to calibrate the air data system.

The approved LFT&E strategy for JASSM does not include any dedicated live fire test activity. Instead, the information needed to support the eventual Live Fire lethality evaluation will be derived from contractor-conducted tests and from combined DT/OT and IOT&E attacks of representative targets by missiles equipped with live warheads. A combined DT/OT test phase will begin in 1QFY02.

TEST & EVALUATION ACTIVITY

DOT&E, AFOTEC, OPTEVFOR, the program office, and the contractor formulated a mutually acceptable strategy that: (1) incorporates early OT involvement; (2) makes early and continued use of modeling and simulation to gain T&E efficiencies; (3) takes advantage of planned developmental test activity to reduce the operational test matrix; and (4) incorporates operational units into OT&E strategy to minimize the time required to train these operational units following fielding of the JASSM system.

DOT&E and the service OTAs have been especially active in defining the scope of the overall combined test strategy and assessing the program for opportunities to accelerate OT&E and LFT&E through integrated DT/OT events, where prudent. The JASSM Program Director and the Service test agencies have supported this effort. A key facet of the Program Director's test strategy is that there will be no government-directed developmental T&E of the system. The contractor is responsible for the planning and execution of the DT phase of the program. While the government has a test support role for test aircraft, test ranges, test instrumentation, and so forth, the overall developmental test responsibility resides with the prime contractor. This program supports combined developmental and operational test demands, and eventually leads into independent government IOT&E. This high level of early OT&E interaction with the developer is in response to the joint program office's desire to maximize OT participation in the combined phases in an effort to satisfy OT&E objectives as early as possible.

Three significant flight test events occurred in FY00. Early in the fiscal year, a prototype pre-production JASSM flight test vehicle (FTV-3) was launched from an F-16 aircraft and successfully flew for over 20 minutes. This weapon flew the prescribed flight path using INS/GPS guidance to missile impact (missile IR seeker not active).

Later in the year, the initial release of a production configuration JASSM separation test vehicle (STV-1: non-powered missile) was successfully launched from an F-16 aircraft. Following a clean separation, the missile's wings and tail fin deployed, the strake wedges separated, and stable, controlled flight was achieved. The data show that the missile maneuvered as programmed, and a bomb impact signal was transmitted prior to missile impact in the designated target area. The strake wedges are mold line fixes that directly address the aerodynamic handling anomalies seen in earlier tests.

On September 20, 2000, the first launch of a production configuration JASSM all-up round occurred at the Gulf of Mexico Test Range. The missile flew aerodynamic maneuvers over a pre-planned, controlled route to obtain flight data to calibrate the missile's air data system. The missile was equipped with a flight test boom and flew to impact using INS/GPS guidance (IIR seeker not used in

terminal area). However, after 9 minutes of flight the missile impacted the water. Only 25 percent of the planned mission was completed. The Program Office believes it has identified the problem as a malfunctioning fuel control valve and is working to make corrections. The upcoming flight test schedule remains unchanged at this time.

Throughout FY00, the JASSM Automated Target Correlation (ATC) IIR seeker was primarily tested using the Missile Avionics Simulator (MAS), which is a UH-1 helicopter with production JASSM navigation and seeker hardware mounted externally in a pod. The MAS system was used to evaluate seeker performance and ATC algorithms in a number of different climatelogical and diurnal conditions. Approximately 80 test flights were flown.

Additional flight testing conducted during FY00 consisted of the release of jettison test vehicles in production configuration from the two threshold aircraft (F-16, B-52). Other tests were conducted to obtain SEEK EAGLE data for F-16 certification, including aircraft stability and control, aircraft flutter and loads, and aircraft fuel tank jettison.

Ground-based testing in FY00 included bare warhead sled and arena testing to meet Live Fire Test and Evaluation objectives, insensitive munitions testing on both bare warhead and all-up rounds, and functional ground testing using a production engineering test vehicle.

TEST & EVALUATION ASSESSMENT

There are four areas of concern: (1) The Teledyne T-407 engine; (2) the validity of proposed models and simulations to accurately predict missile behavior; (3) the adequacy of predicting missile mission effectiveness using a small number of assets against a sub-set of the total target list, and (4) missile lethality. Operational Test and Evaluation are addressing the first three issues while Live Fire Test and Evaluation is addressing the fourth more specialized area.

First, the T-407 engine is being re-designed to extend storage life, recycle fuel, and possibly to extend the missile's range. The re-designed engine's performance is yet untested in an all-up round in flight scenarios.

Second, the ability of models and simulations to accurately predict missile behavior is undemonstrated. Regarding multiple missile hits to the same target, the models do not adequately characterize the target state after the first missile hit, rendering predictions of subsequent hits insoluble. Additionally, the models appear to not characterize target materials well, resulting in very curious results, such as the missile increasing speed as it travels through concrete.

Third, missile effectiveness is predicated on the requirement that missiles will be fired at each target until the target is damaged or destroyed to the required level. In operational testing, missile effectiveness will be predicted by firing only against a sub-set of the total number of targets delineated in the requirements documents. Fewer targets means fewer test assets. DOT&E perceives that the number of test assets is minimally adequate, at best, to predict missile effectiveness, and only if the observed failure rate is very small. The program office has assured DOT&E that additional missile assets will be made available, if required, to ensure that the missile effectiveness requirement can be properly evaluated. In addition, DOT&E will continue to monitor the evaluation of missile aerodynamics and the placement of the air data system.

Fourth, in the lethality area, the principal Live Fire-related activity in FY00 was warhead qualification testing, which included hazard assessment testing, two arena tests and sled tests to assess the ability of the re-designed warhead casing to withstand aging, temperature cycling, and vibration, and to undergo moderate reactions to cookoff testing. DOT&E oversaw two arena tests in which the warheads were detonated statically in a vertical position to gather blast and fragmentation data to support model validation and Joint Munitions Effectiveness Manual effectiveness estimates. Sled testing had been planned for completion in FY00, but correcting fuze functioning anomalies will cause the final four tests to slip into FY01.

Once the root cause of the fuze problem was diagnosed and corrected, the fuze was fired successfully from a Howitzer to simulate the actual environment that it would see. Following the howitzer testing, the contractor repeated the December 1999 test conditions, and the warhead perforated the concrete target and the fuze functioned properly. Thereafter, the contractor completed the fourth and final bare warhead sled test, and the performance expectations of the warhead and fuze were met. The final four sled tests of the warhead installed in a simulated missile body are expected to occur in early CY01. These tests will address fuze performance in a delay mode after perforating concrete targets, and in a non-delay mode upon soil impact when attacking surface targets. Fragmentation data after detonation will also be gathered.

The program office completed its high-fidelity construction of full-scale bunker targets and other selected soft and distributed targets. The targets, which will be attacked during DT/OT and IOT&E flights with live warheads, are located at White Sands Missile Range (WSMR) and Tonapah Test Range. The first target to be attacked with a live warhead will be a soft surface target at WSMR in April 2001.

CONCLUSIONS, RECOMMENDATIONS AND LESSONS LEARNED

The problems encountered with the fuze highlight the need to thoroughly test every component of the warhead assembly to verify proper performance over a range of environments and impact conditions.

The construction of realistic targets for DT and OT launches of missiles supplied with live warheads should provide a clear indication of JASSM's lethality against its expected target classes.

JASSM is an acquisition reform program with no government-directed developmental testing. The program progresses directly from contractor testing to OT&E. This acquisition reform initiative required the successful early involvement on the part of the operational test community. DOT&E and AFOTEC early involvement in the program, during the request for proposal stage, was essential in laying the foundation for data collection during the later portions of the contractor-led DT test phase. The joint program office has created an environment that fosters this early interaction.