ABRAMS TANK (M1A2)

Army ACAT IC Program

Total Number of Systems:	1155
Total Program Cost (TY$):	$8092.6M
Average Unit Cost (TY$):	$6.210M
Full-rate production:	3QFY94
SEP Production	4QFY99

Prime Contractor

General Dynamics Land Systems

SYSTEM DESCRIPTION & CONTRIBUTION TO JOINT VISION 2010

Changes to the M1A2 Abrams Tank contained in the M1A2 "Year 2000 Production Configuration" (M1A2 Tank 2000), including the System Enhancement Program (SEP), are intended to improve lethality, survivability, mobility, and sustainability, as well as provide increased situational awareness and command & control (C2) enhancements to provide ***information superiority*** to the ***dominant maneuver*** force. The Abrams Tank and the Bradley Fighting Vehicle are two central components of the dominant maneuver digital force.

The mission of the M1A2 Abrams Tank is to close with and destroy enemy forces using firepower, maneuver, and shock effect. The M1A2 is being fielded to armor battalions and cavalry squadrons of the heavy force. SEP upgrades are intended to:

- Improve target detection, recognition, and identification with the addition of two 2nd generation Forward Looking Infrareds (FLIRs).

- Incorporate an under armor auxiliary power unit to power the tank and sensor suites.

- Incorporate a thermal management system (TMS) to provide crew and electronics cooling.

- Increase memory and processor speeds and provide full, color map capability.

- Incorporate Force XXI Battle Command, Brigade and Below (FBCB2) Integrated Combat Command and Control (IC3) to share battle command information and situational awareness with all components of the combined arms team.

In addition to the aforementioned SEP components, additional weight reduction measures, survivability enhancements, and safety improvements applied to the M1A2 will comprise the M1A2 Tank 2000.

BACKGROUND INFORMATION

M1A2 IOT&E was conducted from September-December 1993. Based on the results of the IOT&E, the Director determined that M1A2 was operationally effective but not operationally suitable; it was also determined that M1A2 was unsafe. This assessment was based on poor availability and reliability of the tank and instances of the uncommanded main gun and turret movement. FOT&E I was conducted September-October 1995, to verify corrective actions resulting from IOT&E. This test was halted due to continued instances of uncommanded main gun and turret movements. FOT&E II in June 1996 confirmed the adequacy of the applied corrective actions and M1A2 was assessed as operationally effective and suitable.

The M1A2 SEP is a further upgrade to the M1A2 Tank. FOT&E III is planned to assess the operational effectiveness and suitability of the M1A2 SEP.

The M1A2 Tank 2000 is considered a LFT&E "covered" product improvement requiring a LFT&E program with realistic vulnerability testing of full-up, combat configured vehicles.

TEST & EVALUATION ACTIVITY

A Detection, Acquisition, Recognition, Identification (DARI) test was conducted October–November 1998 at Yuma Proving Ground, AZ. This test involved a side-by-side comparison between the M1A2 SEP equipped with 2nd generation FLIR and the baseline M1A1 equipped with a 1st generation FLIR. The results of the DARI demonstrated an improved capability of the 2nd generation FLIR over the 1st generation FLIRs ability to detect, recognize, and identify targets at operationally relevant ranges.

FOT&E IIIA was conducted April-May 1999 at Ft. Hood, TX. This event consisted of crew gunnery tables involving three M1A2 SEP Tanks and four baseline M1A2 Tanks. The focus of FOT&E IIIA was to assess whether the M1A2 SEP possessed increased capability over the baseline M1A2 to acquire, engage, and hit targets. During this event, the M1A2 SEP demonstrated a marginally better performance (approximately 5 percent) over the baseline M1A2 in the number of targets hit as a

percentage of the total number of target presentations. This improvement in gunnery performance can be primarily attributed to the improved ability of the M1A2 SEP to detect targets as a result of the incorporation of the 2nd generation FLIR. That the improvement in performance provided by the M1A2 SEP is small was not surprising given that, aside from the 2nd d generation FLIR, the fire control systems of both tanks are essentially the same.

FOT&E IIIB was scheduled to be conducted in conjunction with the Bradley Fighting Vehicle System (BFVS)-A3 IOT&E, scheduled for November-December 1999. This event is planned to consist of a series of force-on-force exercises with a platoon of M1A2 SEP's operating as part of a BFVS-A3 led company team. FOT&E IIIB was designed to complete the operational test of the M1A2 SEP.

In September 1999, the Commanding General, U.S. Army Test and Evaluation Command made the decision not to execute the planned Bradley Fighting Vehicle System-A3 IOT&E/M1A2 System Enhancement Program FOT&E IIIB. This decision was made as a result of an assessment that neither the BFVS-A3 nor the M1A2 SEP would be ready to go to test due to a number of system software issues. With regards to the M1A2 SEP, the program had not yet successfully integrated Embedded Battle Command (EBC) software, which supported the system's digital C2 links to FBCB2. As a result of the challenges with EBC, the program modified its technical approach to integrating digital C2. This new approach, called Integrated Combat Command and Control (IC3), is intended to perform the same digital C2 functions as EBC.

The combined Bradley Fighting Vehicle System-A3 IOT&E/M1A2 System Enhancement Program FOT&E IIIB has been tentatively rescheduled for 4QFY00.

The Director approved the M1A2 TEMP Update on June 3, 1999. This update included necessary changes to the M1A2 System Enhancement Program's T&E to address the system's incorporation of the Embedded Battle Command.

In July 1999, the Director approved an M1A2 Tank 2000 LFT&E strategy. This strategy includes a fourteen-shot, full-up system-level live fire to be conducted from FY00-02. During FY99, the Abrams program conducted tests to investigate the vulnerabilities of the new thermal management system and the hull-turret position sensor (HTPS). The HTPS test assessed the ballistic shock performance of a redesigned component for inclusion in M1A2 production, and is identified as a key data source in the M1A2 Tank 2000 LFT&E strategy.

TEST & EVALUATION ASSESSMENT

As noted above, the DARI test established the superiority of the M1A2 System Enhancement Program 2nd generation FLIR's target acquisition capability in comparison to the currently fielded system. However, during FOT&E IIIA gunnery, the FLIR experienced "wash-out" from the main gun muzzle blast, causing it to be ineffective in sighting for a short period after each main gun firing. The program, in conjunction with the FLIR Program Manager, has identified a solution to this problem and is working to apply it to the system.

The development of the Under Armor Auxiliary Power Unit (UAAPU) has proven to be a significant program challenge. UAAPU is intended to provide auxiliary electrical and hydraulic power to the system during the conduct of mounted surveillance, thus reducing engine usage during stationary tactical operations while improving operational fuel consumption rates. Engineering design problems encountered during developmental testing with the UAAPU have led the program to delete UAAPU from

the M1A2 SEP production configuration. The program is not currently funded to continue UAAPU development. The loss of UAAPU is unfortunate given that it was intended to correct operational suitability shortfalls identified during M1A2 IOT&E. For example, during this event, M1A2 experienced frequent battery failures due to electrical system demands during mounted watch operations. M1A2 also consumed approximately 15 percent more fuel than the baseline M1A1 due to the increased frequency and duration of engine idle time needed to keep the electrical system up and batteries charged.

DOT&E concurs with the Army's decision to delay the M1A2 System Enhancement Program FOTE IIIB. IC3 is designed to meet a key system requirement for digital battle command and is the M1A2 System Enhancement Program's link to FBCB2. A full evaluation of the M1A2 SEP requires the system to include functional, production-representative IC3.

Integration of IC3 remains the primary technical challenge to the program. While the M1A2 System Enhancement Program is responsible for integrating IC3 into the platform, it is dependent upon the timely delivery of IC3 software with full functionality from the FBCB2 program. The EBC software delivered to the M1A2 System Enhancement Program had been a prototype version without full functionality. For example, a number of core capabilities, such as the ability to handle unit task organization changes, has yet to be delivered. In addition, the M1A2 SEP program has not yet implemented the complete set of required 32 battle command messages. Also, the capability to send digital map overlays has yet to be adequately demonstrated. These capabilities are expected to be present in IC3.

Laboratory tests provided insights regarding flammability and the generation of toxic fumes for individual fluids and mixtures used in the Abrams thermal management system. Although sample sizes were small, the ballistic container test results were generally favorable in indicating no new hazards resulting from the constituents of the TMS. Initial results from the HTPS test indicate that the redesigned component achieves its goal of reducing vulnerability as compared to the original M1A2 component.