# Direct Reporting Program Manager
# Advanced Amphibious Assault

# Program Office Response to AAAV Prototype Early Operational Assessment (EOA) of Gunnery

September 2002

# TABLE OF CONTENTS

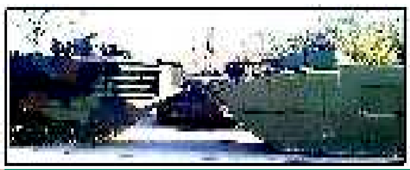
# Executive Summary

The Direct Reporting Program Manager, Advanced Amphibious Assault (DRPM AAA) considers the insight of the operational Marine forces, as the end-users and ultimate customers, to be of the utmost significance to the Advanced Amphibious Assault Vehicle (AAAV) system. The information garnered through the early operational assessments combined with developmental testing information has been exceptionally valuable to the program in driving the focus of next-generation prototype designs. The Gunnery Early Operational Assessment was the first formal exposure of the Program Definition and Risk Reduction (PDRR) first generation prototypes to the operational fleet in quasi-combat conditions. The AAAV prototype outgunned the AAV RAM R/S in every respect during the comparative firepower testing, and demonstrated a Low Rate Initial Production (LRIP) firepower entrance criteria. The EOA identified issues with adequacy of training, experience, and resultant system accuracy, as well as human factors preferences and overall system reliability. Design fixes for these issues are being incorporated in the second generation System Development and Demonstration (SDD) prototypes. Proper training and gunnery experience will resolve the accuracy issue, as has been successfully demonstrated during developmental testing. Additional range time will be incorporated into the preparation of future Operational Assessments to train and qualify novice gunners on the AAAV weapon system. The human factors issues with the controls and displays are being addressed in the second generation SDD prototype. The miscellaneous reliability issues are also being addressed and implemented through the program's aggressive reliability growth strategy through the identification and corrective action of reliability-driving failures. Overall, the SDD prototypes will be better in every aspect of operational effectiveness and operational suitability, and incorporate improvements in other key areas such as maintainability, survivability, and safety, that will allow the program to make greater advancements towards the final production configuration. This report details the lessons-learned and deficiencies from the first generation prototypes weapon system identified in the Marine Corps Operational Test, Evaluation & Activity (MCOTEA) EOA report and provides information on how the next generation prototypes correct the lessons-learned and deficiencies.

# I. AAAV Acquisition Discussion

## System Overview

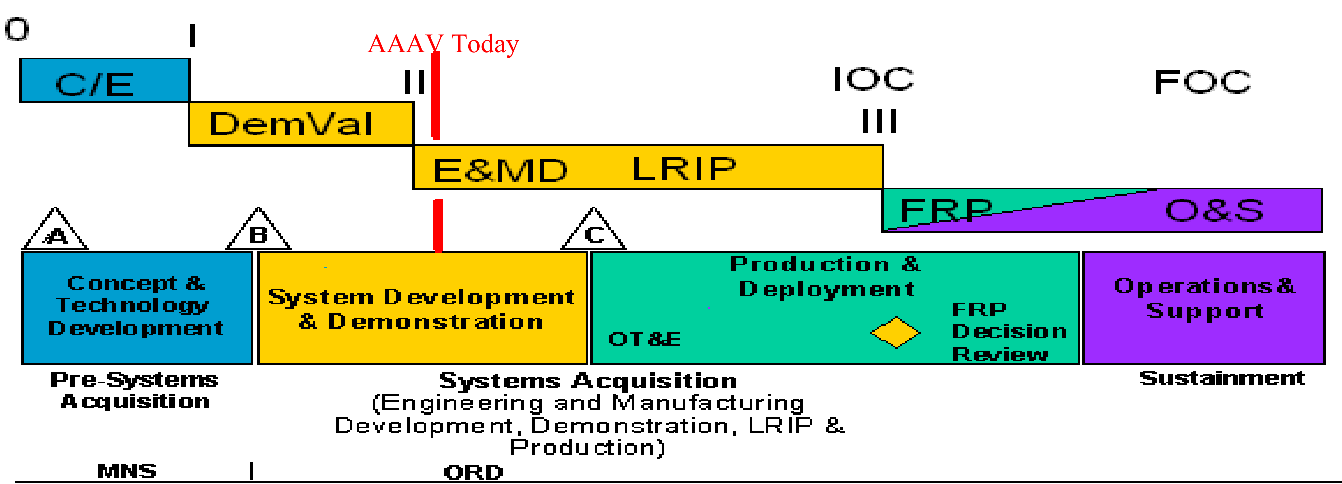
The Advanced Amphibious Assault Vehicle program is the Marine Corps' largest and most significant ground combat development program. Designed to replace the current Assault Amphibian (AAVP7A1), as the principal means of tactical surface mobility for the Marine Air Ground Task Force (MAGTF) during both Ship-To-Objective Maneuver (STOM) and subsequent combat operations ashore as part of the Navy and Marine Corps concepts within the Expeditionary Maneuver Warfare capstone. The AAAV will provide the Marine Corps with the capability to execute the full spectrum of military missions from humanitarian operations to conventional combat operations. The capabilities integrated into the AAAV design represent a revolutionary step forward in Marine warfighting capabilities with "leap-ahead" advancements in water mobility, firepower, integrated and interoperable Command and Control systems, and survivability characteristics unparalleled in the US combat vehicle inventory. The AAAV is ensuring the Marine Corps sustains a dominant presence in amphibious and land warfare capability relevant to the emerging and future combat missions of the 21st Century.



| AAV7A1 | Performance | AAAV |
|---|---|---|
| 5,000 Yards | Sea-Launch Distance | 25 Nautical Miles (nm) |
| 6 Knots | Water Speed | 20-25 Knots |
| 45 MPH | Land Speed | 45 MPH |
| 300 Miles (25 MPH/Land)<br>7 Hours (2,600 RPM)<br>270 Miles after a 5,000 Yard Waterborne Movement | Range | 300-350 Miles (25 MPH/Land)<br>65nm (20 Kts/Water) or 150-200 Miles after a 25nm High Water Speed Transit |
| Hand Held GPS and Stand Alone PLRS | Navigation | Integrated GPS, INS, Compass and PLRS/EPLRS (Digital Map Displays) |
| M2 .50 Cal HB MG & Mk 19 Mod 3 40mm MG | Firepower | Mk 44 Mod 1 30mm Automatic Gun and 7.62mm Coax MG, Fully stabilized, Full Ballistic Solution, Laser Range Finder & FLIR |
| 14.5mm (with EAAK Armor Kit) | Armor Protection | 14.5mm @ 300 Meters<br>155mm Frag @ 50 Feet |
| None | NBC Protection | NBC Overpressure System (Crew & Embarked Personnel Protected) |

## AAAV and the Acquisition Timeline

The AAAV's acquisition is in accordance with the latest Department of Defense Directive for Major Defense Acquisition Programs, which govern the management, milestone phases and work efforts of the weapons development process. The Program is currently at the midway point of the detailed design phase, known as System Development and Demonstration (SDD), having completed the Milestone II process in December 2000. The next Milestone (C on the chart below) in FY2004 represents the entrance into Low Rate Initial Production (LRIP) and will be followed by the final Milestone decision to enter Full Rate Production (FRP) in FY2007. Each of the four development phases will produce a new generation of prototype vehicles incorporating the lessons learned from the previous phases' developmental and operational testing. The designs discussed in this report are the result of lessons learned over the last 34 months of water, land, and firepower testing as they are incorporated into the SDD 2nd generation prototypes under construction today. It should be noted that every finding in this August 2002 EOA report has corrective actions already incorporated into SDD prototype design as a result of the extensive Developmental Testing and Operational evaluations performed prior to the EOA.




### Prototype History (PDRR – 1996-2000)

The three existing AAAV PDRR Prototypes (P1, P2, and P3) were designed and built during the PDRR (DemVal) phase. In a radical departure from traditional acquisition practice, each of these early first-generation prototypes was designed and built to contain every subsystem of the objective AAAV, integrated into a complete system. The primary objectives of the PDRR prototypes were to: 1) Prove the capability of key AAAV technologies on an integrated platform, and 2) Understand and resolve the considerable integration challenges of the brand-new AAAV design while the program was flexible enough to make improvements cost effectively. The level of detail in these early prototypes is far greater than is normally produced during this initial design phase of development, but were pursued to afford the program greater (and earlier) insight into the whole-system performance and human factors aspects of the system. It should be noted that the PDRR prototypes lack final configuration details (eg heat & noise insulation, seals, etc) with notable effects on human factors and the Marine-Machine Interface. Many of the findings described in the EOA report are a result of these prototype-specific deficiencies that have been aggressively corrected in the SDD 2nd generation prototypes.

**PDRR PROTOTYPE DELIVERIES**

**P1 – December 1999**

**P2 –June 2000**

**P3 –November 2000**

**System Development and Demonstration (SDD) Prototypes**

The SDD phase is producing 9 second-generation AAAV prototypes (8 P and 1C variant) and one pre-production live-fire vehicle. Similar to the PDRR prototypes but significantly more mature, these SDD prototypes will contain all hardware and software necessary for comprehensive system-level development and operational testing of both the personnel and command variant. The design effort is also concurrently improving the manufacturing and logistics aspects of the design leading to production. These prototypes will undergo extensive engineering and operational evaluations starting in CY03 in support of the CY04 MS C decision. Minor improvements identified through testing will be incorporated throughout the 11 months of SDD vehicle builds such that the final SDD prototypes will be production representative for Low Rate Initial Production (LRIP).

**SDD Prototypes E1, E2,and C1**
**Under Construction**

# II. History of the Mark 46

The MK46 is the product of modern acquisition techniques applied by a close team of Government and Industry to produce a medium caliber weapons system of unequalled lethality. To understand the capability of the MK46, it is important to understand the development of the system since its inception just a few years ago.

Testing of the MK46 armament and fire control began on a M2 Bradley in August 1998, ahead of the AAAV prototype chassis completion. This testing identified the initial settings and configurations for the AAAV PDRR prototype systems. The first AAAV prototype turret was completed in July 1999 and began component testing shortly thereafter. The MK46 was mounted on a naval platform (PB 777) for water shakedown / dynamic firing testing in Aug 2000. The first AAAV system test of the MK46 was in July 2001, due to the significant amount of component and subsystem testing the system performed exceptionally well with trained gunners. By the time the MK46 entered the Gunnery Early Operational Test, the system had fired 10,532 rounds and had 948 hours of system operation. Testing of the MK46 is ongoing, subsequent to the EOA, DT testing is continuing to refine the design and prove out corrective actions and improvements.

The developmental and engineering testing has demonstrated the key capabilities of the MK46. Resolution to problems identified during DT are being incorporated into the SDD designs as discussed in the following sections of this report. In addition, the Gunnery Early Operational Assessment confirmed the importance of training and of experienced gunners to the overall system effectiveness.

# II. 2nd Generation SDD Design Improvements as a Result of Testing

The Marine Corps Operational Test and Evaluation Activity conducted a Gunnery Early Operational Assessment of the AAAV from 22 February to 16 April 2002 at the Eglin Air Force Base, Florida. An AAAV prototype participated in various events, from fully manned, powered weapons operation, to comparative firepower testing with an AAV RAM/RS production system. The AAAV Gunnery EOA was intended to provide in-stride operational insights on the early AAAV prototypes to the program manager during development. MCOTEA documented the Gunnery assessment in an Independent Assessment Report (IAR). This document addresses the findings in that report. References from the IAR are denoted with a **§,** program office responses follow each section, grouped by common areas for clarity.

**Performance (Ph)**

EOA Report Comments:

**§8.1.1.** Probability of hit (Ph). The AAAVP MK-46 weapon system was not able to achieve a Ph of .9 …

Design Improvements

The primary reason for not fully meeting the Ph requirement was due to gunner experience and familiarity with the brand new MK46. The identical system tested at Aberdeen Test Center in May 2002[1] either met or exceeded all threshold accuracy requirements (ORD and S/SS) for stationary-to-moving (as the only scenario tested). The EOA operating force were trained with a "preliminary" training package delivered by the contractor and had very limited range time to sharpen their gunnery techniques. Despite this limited training and practice time, the EOA gunners were able to demonstrate a cumulative Ph of .49, which is nearly 400% greater than the experienced AAV RAM/RS gunners. Although the system did not fully meet the .9 Ph requirement for stationary to moving during the EOA, it did exceed the stationary to stationary Ph cum (.92) required for the LRIP entrance criteria. It is expected that through improved training (see "Training" section below) and greater experience, operational force MK46 gunners will perform at a level equal to or greater than has been experienced during DT which meets or exceeds requirements.

[1] Aberdeen Test Center in, "Final Report for the Main Weapon Firing of the Advanced Amphibious Assault Vehicle (AAAV), DTC Project No. 1-VG-130-AAA-020, Test Record No. AC-F-04-02".

The following table summarizes the performance of the AAAV Prototype and the AAV:

| Situation | AAAVP Ph – Range of Gunner's Results | AAAVP Ph - Cumulative Result | AAV Ph – Range of Gunner's Results | AAV Ph - Cumulative Result |
|---|---|---|---|---|
| Stationary to stationary day: | .71 – 1.0 | .92 | Not Tested (NT) | |
| Stationary to stationary night: | .83 – 1.0 | .96 | NT | |
| Stationary to stationary cum | NA | .92 | NT | |
| Stationary to moving day: | .27 - .57 | .42 | 0.0 - .22 | .11 |
| Stationary to moving night | .22 - .80 | .56 | NT | |
| Stationary to moving cum | NA | .49 | NT | |
| Moving to moving day **Speeds Limited to 3-5mph | .67 – 1.0 | .88 | NT | |

*** limited speed and day only The engagements utilized a burst of up to 20-rounds.

ATC DT Summary:

The following summary contains the results of the ATC gunnery test performed in May 2002 on the same prototype used in the EOA. It shows the capability of the MK46 in the hands of well trained and experienced gunners. The AAAV team of DRPM AAA and General Dynamics (GD), conducted a period of developmental firepower testing to gain further insight into weapon system performance. The objective of the test was to demonstrate the capability of the PDRR weapon system to meet ORD and System/Sub-System Specification (S/SS) requirements. During this test the system met or exceeded all threshold requirements and very narrowly missed meeting the ORD objective for stationary to moving engagements.

All engagements were Stationary to Moving. Eight scenarios were fired (a total of 134 bursts). Scenarios 1, 2, 5, and 6 were five-round bursts with a target speed of 5 kph, target size of 2.1 by 2.1 meters at a range of 1500 meters. Scenarios 3 and 4 were five-round bursts with a target speed of 25 kph, target size of 4.2 by 2.1 meters at a range of 1500 meters. Scenario 7 was a three-round burst with a target speed of 25 kph, target size of 4.2 by 2.1 meters at a range of 2000 meters. Scenario 8 was a three-round burst with a target speed of 5 kph, target size of 2.1 by 2.1 meters at a range of 2000 meters.

A hit was scored when the burst size was appropriate, all rounds were scored by the Oehler scoring system and at least one round of the burst impacted the designated target. A miss was scored when none of the rounds of a burst impacted the designated target. Two different gunners fired four scenarios each. One gunner was a GD employee and the other gunner was a DRPM AAA Marine. The GD gunner is arguably the most experienced MK46 gunner in the world. The Marine gunner has the requisite training and experience to be termed a fully qualified AAAV gunner.

The results of this test show that with experienced and well trained gunners, the MK46 weapon station demonstrated the capability to meet or exceed the threshold accuracy requirements in the ORD and S/SS and meet, or very nearly meet the objective requirements. Following is a direct quote from the Summary of Results, page 5 of the test report.

" b. The General Dynamics Amphibious System Test Procedures for the MK 46 Weapon Station, 6 May 2002, Addendum 1, 30 May 2002, and Addendum 2, 30 May 2002, states that each main gun stationary-to-moving firing scenario must demonstrate a Ph of 0.9. Scenarios No. 1, 2, 3, 4, and 6 demonstrated a point estimate of 1.0. This exceeds the requirement. Scenarios No. 5 and 7 demonstrated a point estimate of .94, which exceeds the requirement. Scenario No. 8 demonstrated a point estimate of .89, which is not significantly below the requirement."

EOA Report Comments:

**§8.1.2.** Moving Engagements. The AAAVP MK-46 weapon system was not able to satisfactorily engage enemy targets while the AAAVP was on the move at required speeds of 10-15 kph…

Design Improvements

The performance of the AAAV MK46 WS has not been fully characterized in each and every regime, e.g. moving engagements. The current software design restricts allowable gun to sight disturbance to .35 mils, tighter than other production systems. This very "tight" parameter prevents firing at speeds greater than ~ 7 mph. As with other tracked systems with stabilized weapons, the vehicle vibration varies with speed causing some undesirable speed ranges for firing on the move. Analysis is on going to define the appropriate gun to sight disturbance parameter such that the ORD requirement (4.1.3.2)"While on the move, the AAAV main armament shall be able to engage stationary and moving threat light armored combat vehicles (threshold)" will be met

**Training**

EOA Report Comments:

**§8.1.7.** Gunnery EOA Training. The preliminary training package provided by General Dynamics in support of the Gunnery EOA "minimally" supported the objectives of the EOA stated in the AAAV EOA DAP. …The result was the gunners entered the Gunnery EOA unsure of their ability to "put rounds on target accurately."
**§9.1.** Training. "…Recommend training packages fully prepare the test participants with functionality, techniques, and procedures of the AAAVP to support stated test objectives in future test plans. or OA training..".

Design Improvements

It is clearly necessary to institute a robust training program that qualifies assault amphibian crewmen as gunners on the high performance Mk 46 weapons station. The program office has recognized this as a result of prior testing. The EOA has reinforced this necessity. The program office intends to make full use of existing training devices resources associated with the M1 Tank and the LAV-25 which have similar fire control and/or weapons stations to qualify AAV crewmen as gunners prior to the next operational assessment event. This will be training in excess of that required by the OA event. The Mk 46 weapons station is designed to be simple to use but nonetheless does require a significant upgrade of skills for the assault amphibian vehicle crewman to transition from the single man machine gun equipped AAV turret to the AAAV weapons station. Had the AAV crewmen entered the EOA with the skills of a LAV-25 trained gunner the transition to the Mk 46 weapons station would have been fairly seamless.

It is clear that in light of the above an even more aggressive training package is required for AAAV gunnery. The training package for the next OA gunnery event will address more fully that requirement.

**Human Factors**

EOA Report Comments:

**§5.1.** Gunner and VC Redundant Capability. …The VC and gunner must have the same sight capability at both of their positions...
**§5.3.** Day-Sight Location. …The day-sight and TIS should be integrated so that the gunner or VC can look through the same viewer– which should be located in their direct front and have the capability to rapidly switch between the day-sight and TIS as needed.
**§8.1.3.** Single Gunner. …the gunner and VC positions do not have redundant capability and as a result when a single gunner from either position operates the MK-46, the gunner will have degraded capability….
**§9.2.** Gunner and VC Redundant Capability. The VC and gunner do not possess the same capabilities at the gunner and VC positions. …The VC must have the same sight capability as the gunner…
**§9.4** Day-Sight Location. …The day-sight and TIS should be integrated so the gunner or VC can look through the same viewer – which is located in their direct front and switch between the day-sight and TIS as needed…the day sight should have a brow pad..”
**§9.6**. Manual Gunnery Operations. …the embarked crew must have the ability to engage enemy targets while in manual operation mode. Manual capability needs to be assessed during the SDD OA.

Design Improvements

Although full redundancy of all capabilities may have some tactical utility, the additional complexity, cost, weight, and human factors implications make this recommendation highly undesirable. The turret layout and individual station capabilities are a result of deliberate tradeoffs made as part of the whole and subsystem design processes and are balanced between Marine preferences and system constraints. Attention was paid to assuring that key functions such as gunnery had sufficient redundancy to meet the Operational Requirements Document intent of "The weapons station shall be operable by one AAAV crewman (threshold) (Ref: 4.1.3.4)

The location of the sights and displays are optimized for the responsibilities and priorities of each station and for cost, weight and the ability to upgrade the fire control system during the life of the vehicle. The TIS and the day sight are two stand alone modules. While it may be desirable to combine the two sights for ease of use, the modularity afforded by having two separate units allows cost effective upgrades of one module at a time. It is envisioned that the day sight may not need upgrade but the TIS may well be upgraded several times in the life of the vehicle. Additionally the total task loads for both the vehicle commander (VC) and for the gunner are considered in the functional layout of the weapons station. Both of these sights are as near to directly in front of the gunner as space will allow. At the VC position, the command of the vehicle is the primary function, therefore the common display is to his direct front and gunner's sight is linked to his position for gunnery functions. In the SDD design AAAV weapons station the sight video will be fed directly to the common display of the VC allowing him to toggle between command functions (navigation, monitoring vehicle functions, etc..) and gunnery on a single screen to his direct front.

With respect to the comment regarding the brow pad on the day sight, the fixture for the brow pad was present but the brow pad was missing. The brow pad is in the SDD design. In addition, the new SDD gunner seat will have more adjustability in an effort to improve gunner body position when employing the CMS.

The manual operation capability exists in the PDRR prototypes. Manual handles are designed and installed in the prototypes for manual azimuth and elevation control as well as manual firing of the main weapon. However, this capability was not adequately tested during DT and consequently was not authorized for use during the EOA. The features of manual operation have been modified in the SDD design to reduce weight and complexity. Manual operation will be tested and proven prior to SDD OA.

**Software Lock Ups**

EOA Report Comments:

**§5.2.** <u>MK-46 Weapon System Software "Lock-Ups."</u> …The fire control software needs to be corrected to reduce the number of "lock-up" incidents and the time required to conduct immediate action to return the weapons system to a fully operational status…

**§9.3.** <u>MK-46 Weapon System Software "Lock-ups."</u> …The fire control software needs to be corrected to prevent the number of "lock-up" incidents and the time required to conduct immediate action and return the weapons system to fully operational status…

Design Improvements

The principal cause of the "lock-up" problem was determined to be a faulty serial communications driver for the input/output (I/O) card located in the Weapons Station Electronics Unit (WSEU), affecting the ability of the Electronics Units (EU) to effectively pass information. The driver software was corrected and verified in software build 4.2.9. All future software releases, to include the SDD releases will contain this modification. In addition, deficiencies in the type of cable used and the ability of the EUs to handle low voltage are secondary contributors to this issue. Higher performance cable and more robust power supplies are being incorporated into SDD designs.

**Feed System**

EOA Report Comments:

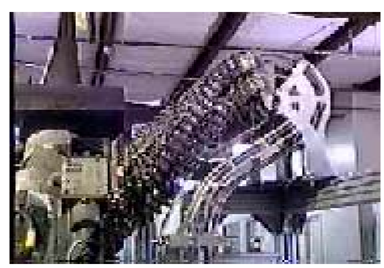
**§5.4.** Link Ejection System. …The link ejection system must be designed to allow expended 7.62mm links to fall away from the weapon without "building up" and causing 7.62mm "jams."
**§9.5** Link Ejection System. …The link ejection system must be designed to allow expended 7.62mm links to fall clear from the weapon without requiring the crew to conduct a "sweep" of the turret to clear the link build-up.
**§9.7**. Articulating Rod Flexible Fittings. …Recommend the Articulating Rod Flexible Fittings be designed to prevent repetitive failures.

Design Improvements

**PDRR Feed**

Spent brass/link eject path and door has been redesigned in SDD to eliminate stoppages and jams. Additionally, a rubber shield has been added to prevent spent brass and links from getting under the turret. Investigation is underway to identify material solution to clear build up of brass outside of the turret.

The Upper Flexible Feed Chute Assembly will be replaced in SDD with a more "standard" flexible feed chute (without guide rods) which will connect the Transfer Feed Chute Assembly to the MK44 feeder. This feed system is being testing on PDRR turret systems prior to installation and testing of SDD prototypes.



**SDD Feed System**

**Other Findings**

EOA Report Comments:

**§8.3.** Toxic Gases. …Toxic gas levels recorded "significant" spikes on three separate occasions as a result of subsystem failure.

Design Improvements

Spikes were noted during the testing when elements of the ventilation system failed. The spikes were transitory in nature and did not cause crew COHb levels to exceed safe limits. The ventilation system is being optimized in the SDD design and further ventilation testing will be done in order to prove out the effectiveness of the new design.

EOA Report Comments:

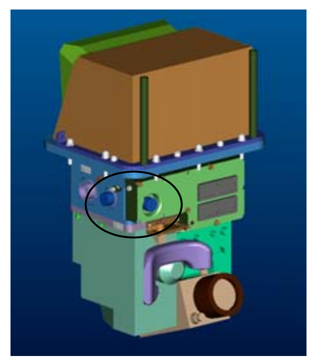
**§8.4.** Bore Sight/Zero Retention. …On two occasions, corrective maintenance action was required on the 30mm main gun that required significant manipulation of the barrel that resulted in the "zero" being lost for the 30mm...

Design Improvements

Following some corrective maintenance, a bore sight/zero validation may be necessary. This requirement will reflect in the IETMs and incorporated in crew training.

EOA Report Comments:

**§9.11.** MK46 Weapon System Factory Bore Sight Knobs. The factory bore sight knobs for the MK-46 weapon system are currently unprotected and are easily altered by accidentally being "bumped" into by embarked crewmen. These bore sight setting "knobs" need to be protected to prevent accidental altering.
**§17.8.** MK46 Weapon System Factory Bore Sight Knobs. … These bore sight setting "knobs" need to be protected to prevent accidental altering. Recommendation to have these knobs housed in the sight itself to prevent inadvertent altering.



Knobs to be Removed in SDD

Design Improvements

The SDD generation of the Compact Modular Sight has eliminated the factory bore sight knobs.

EOA Report Comments:

**§8.6.** "Thermal Neutral" Weather Conditions. The AAAV TIS becomes degraded during "thermal neutral" conditions. …Inability to fully utilize the TIS prevents the AAAVP from being employed with "hatches" closed as the embarked crew relies on thermal sight capability to conduct gunnery and land operations.

Design Improvements

"Thermal Neutral" is not a peculiar characteristic of the AAAV TIS. This is a characteristic of thermal sensors. If environmental conditions cause a lack of temperature differential there is nothing for the thermal to sense.

EOA Report Comments:

**§9.8** Overpressure Sensor/Alarm. …A sensor or alarm needs to be installed on the vehicle to inform the Gunner and VC when overpressure is lost…

Design Improvements

There is a sensor for loss of overpressure that provides a Low Compartment Over-pressure Warning on Driver and Vehicle Commander Display when operating NBC system. That function was non functional during the period of the MCOTEA Gunnery EOA testing period, and will be operational in SDD vehicles.

EOA Report Comments:

**§9.9** Stowed Ammunition Location. A "stowed" ammunition location must be identified and incorporated into the SDD prototype….The stowed ammunition location is required to be inside the vehicle and such that it does not require the embarked crew to exit the vehicle to access stowed ammunition.

Design Improvements

The ORD, section 4.1.3.9., requires that "The AAAVP shall carry sufficient ammunition, for both the Main and Secondary weapons, to conduct the amphibious assault, and subsequent operations for a period of 24 hours without resupply. This shall provide each AAAVP the capability to destroy or suppress the light armored vehicles and associated infantry of a motorized rifle platoon (three vehicles and associated personnel), (threshold)/motorized rifle company (ten vehicles and associated personnel) (objective)."

The AAAV has the capability to achieve the threshold and approach the objective requirement with ready ammunition only.

EOA Report Comments:

**§8.5.** AAAVP Support Equipment. The PDRR prototype AAAVP requires substantial support equipment not currently established in the AA Bn. During the EOA, it was discovered the AAAVP requires charge carts to recharge the ECS (freon), Hydro-pneumatic Suspension Units (HSU) (hydrogen), and a generator and hydraulic pump are needed to refill the hydraulic fluid (filled under pressure). The AAAV is supported using metric tools whereas the AAV is not. The AAAV uses special multi-purpose slings for removal of the engine, transmission, and Power Transfer Module (PTM) and a turret sling to remove and install the turret.

Design Improvements

As per SL-3-00456A (Tool Kit, Mechanics General) metric tools are contained in the General Mechanics Tool Kit. However, as metric tools are not currently required by AAV units, they have been intentionally removed from the tool boxes to avoid loss and pilferage.

During EOA, an A/C powered hydraulic transfer pump was used for speed of maintenance; a hand pump is currently planned to accomplish this function.

# Future Plans

In addition to the above listed design improvements, the Program is incorporating thousands of other improvements in weight and cost reduction, safety, reliability, human factors, survivability, manufacturing, maintainability, and producibility that will appear in the SDD 2nd generation prototypes. These prototypes will begin extensive system level developmental and operational testing in FY03 to further refine the designs for the 3rd generation systems and ultimately for the full rate production units. Each of the thousands of new and modified designs in the AAAV are deliberate balances and trade offs between competing considerations. As new test information is gained, further improvements and refinements will be made in the design and incorporated at the earliest opportunity in prototypes. The program has carefully planned the build-test-analyze-fix cycle to coincide with the acquisition and fiscal timelines such that each prototype is progressively better than the last; and useful test information can be transformed into a higher quality, more cost effective, more operationally suitable and effective AAAV design.