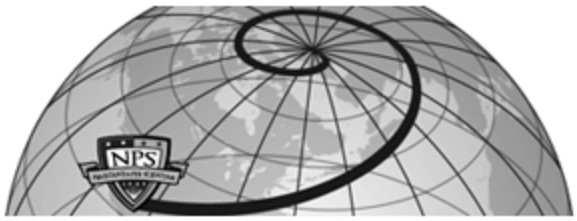

NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA

JOINT APPLIED PROJECT

The Study of the Rapid Acquisition Mine Resistant Ambush Protected (MRAP) Vehicle Program and Its Impact on the Warfighter

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June 2013

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13. ABSTRACT (maximum 200 words)

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The time from the initial needs statement in February 2006 to the first fielding of the first MRAPs was less than 18 months. This accelerated acquisition process provided tremendous benefits; however, it was not without its shortcomings. Were the shortcomings outweighed by the benefits in this particular program, and most importantly, will this accelerated acquisition procedure used serve as a model for future major military acquisition programs? Answering these questions is the major focus of this study.

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THE STUDY OF THE MINE RESISTANT AMBUSH PROTECTED (MRAP) VEHICLE ACCELERATED DEFENSE ACQUISITION PROGRAM

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Submitted in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE IN PROGRAM MANAGEMENT

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LIST OF ACRONYMS AND ABBREVIATIONS

AO	Area of Operations
ASL/PLL	Authorized Stockage List/Prescribed Load List
BAE	BAE Systems
BLSI	Base Line Survivability Index
BMF	Business and Financial Management
CLS	Contractor Logistics Support
COTS	Commercial-off-the-Shelf
D-Level	Depot Level
DCMA	Defense Contract Management Agency
DLA	Defense Logistics Agency
DoD	Department of Defense
DT	Developmental Test
EFDC	Expeditionary Force Development Center
EOD	Explosive Ordnance Disposal
FDB	Forward Deployment Block
FLMNET	Field-Level Maintenance New Equipment Training
FoV	Family of Vehicles
FPII	Force Protection Industries, Inc.
FSR	Field Service Representatives
GDAO	General Dynamics Anniston Operations
GDLS	General Dynamics Land Systems
GDLS-C	General Dynamics Land Systems Canada
GFE	Government Furnished Equipment
GTVF	Ground Tactical Vehicle Fleet
HMMWV	High-Mobility Multi-purpose Wheeled Vehicle
JSP	Joint Support Plan
JROC	Joint Requirements Oversight Council
JROCM	Joint Requirements Oversight Council Memorandum
RFP	Request for Proposal
UNS	Urgency of Need Statement
I-Level	Intermediate Level
ICA	Industrial Capabilities Assessment
IDIQ	Indefinite delivery, indefinite quantity
IED	Improvised Explosive Devise
IMG	International Military and Government, LLC subsidiary

ISS	Independent Suspension System
JPO	Joint Program Office
km	Kilometer
LAR	Logistics Assistance Representatives
LNO	Liaison Officer
MAK	Marine Armor Kits
MAS	Marine Armor Systems
M-ATV	Military-All-Terrain Vehicle
MATV	MRAP All-Terrain Vehicle
MILSTRIP	Military Standard Requisitioning and Issue Procedures
MMBOMF	Mean Miles Between Operational Mission Failure
MNF-W	Multi National Force-West
mph	Miles per Hour
MRAP	Mine Resistance Ambush Protected
MTBF	Mean Time Between Failures
MTT	Mobile Training Teams
MWB	Maintenance Workshop Block
NECC	Navy Expeditionary Combat Command
NET	New Equipment Training
NRA	Non-Repairable Assemblies
NSN	National Stock Numbers
OEF	Operation Enduring Freedom
OEM	Original Equipment Manufacturer
OIF	Operation Iraqi Freedom
OPNET	Operator New Equipment Training
PM	Program Manager
POI	Programs of Instructions
RCV	Route Clearance Vehicle
RPG	Rocket-propelled Grenade
RRAD	Red River Army Depot
RSA	Regional Support Activity
RTM	Real Time Monitor
SAMS-E	Standard Army Maintenance System—Enhanced
SASSY	Supported Activities Supply System)
SDR	Supply Discrepancy Report
SINCGARS	Single Channel Ground and Airborne Radio System
SOCOM	Special Operations Command

SPAWAR	Space and Naval Warfare Center
STOM	Ship to Objective Maneuver
TAGS	Transparent Armored Gunner's Shield
TACOM	Tank-automotive and Armaments Command
TMDE	Test, Measurement, and Diagnostic Equipment
TSP	Training Support Package
ULSS	User's Logistics Support Summary
U.S.	United States
USMC	United States Marine Corps

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I. INTRODUCTION

A. BACKGROUND

In February 2005, Marine Corps senior commanders operating in contingency areas identified an urgent operational need for armored tactical vehicles that would increase crew survivability and mobility of Marines operating in hazardous fire areas against improvised explosive devices, rocket-propelled grenades, and small arms fire. The Marines initially identified the up-armored, high-mobility, multi-purpose wheeled vehicle (HMMWV) as the solution. However, over the next 18 months this vehicle proved to be inadequate, as casualties continued to escalate.

In February 2007, the DoD initiated the Mine Resistant Ambush Protected (MRAP) vehicle program to mitigate the threat from these weapons—particularly the IEDs—which were accounting for about 75 percent of the causalities in the combat operation in both Iraq and Afghanistan. In order to expedite getting these vehicles into the hands of the warfighters as rapidly as possible, the DoD used a specially tailored accelerated acquisition approach. This program approach relied on only proven technologies and commercially available products. Only minimal operational requirements were established, and production, testing, and fielding were done concurrently. Additionally, no mission equipment, such as communications and situational awareness subsystems, were purchased with the vehicles. The government would be responsible for integrating this into the system after delivery from the Manufacturer.

Recognizing that one producer did not possess the capacity to produce MRAPs in the required quantities, the DoD awarded Indefinite Delivery, Indefinite Quantity (IDIQ) contract to nine different commercial companies, and agreed to buy at least four vehicles from each. The DoD also designated the MRAP its highest acquisition priority.

In September 2007, the Under Secretary of Defense for Acquisition, Technology and Logistics designated MRAP as a major defense acquisition program with the Marine Corp Systems Command as the Joint Program Executive Office. The approved

requirement of over 16,000 vehicles is split among the Army, Marine Corps, Navy, Air Force, and Special Operations Command and about $22.7 billion has been appropriated for this procurement. The requirement for additional MRAPs will change over the coming years, and those changes will be discussed later in this study.

There are three different versions of the MRAP vehicle acquired for different missions, termed Categories I, II, and III. The smallest version of MRAP, Category I, is primarily intended for operations in the urban combat environment, and can carry up to 7 personnel. Category II is a multi-mission platform capable of supporting different missions to include security, convoy escort, troop or cargo transport, medical, explosive ordnance disposal, or combat engineer operations, and can carry up to 11 personnel. Category III is the largest of three MRAPs, primarily intended for the role of mine and IED clearance operations, and can carry up to 13 personnel.

B. PURPOSE

The urgent need for a vehicle capable of protecting the warfighters in Iraq and Afghanistan against improvised explosive devices, rocket-propelled grenades, and small arms fire, prompted the approval of an Accelerated Acquisition Program for the development and purchase of the Mine Resistance Ambush Protected (MRAP) Vehicle. The timeframe from the initial needs statement in February 2006 to the first fielding of the first MRAPs, was less than 18 months. This accelerated acquisition process provided tremendous benefits; however it was not without its shortcomings. The Purpose of this study is to document and analyze the benefits and shortcomings experienced by the various stakeholders—in particular the warfighters—as a result of the shortened acquisition cycle. It will also determine if the accelerated acquisition strategy used for the Mine Resistance Ambush Protected (MRAP) Vehicle Program provides sufficient benefits to the warfighter to become the model program for future U.S. military major acquisition programs.

C. SCOPE

The scope of this study will be to analysis the MRAP Accelerated Acquisition Program in terms of the benefits and shortcomings experienced by the stakeholders in the areas of mission suitability, speed of fielding, maintenance support, supply support, and total cost of acquisition afforded the end user (warfighter)? From this analysis, we expect to determine if the MRAP Accelerated Acquisition Program should be a model for other major military weapons systems.

D. WHY IS STUDY IMPORTANT

There are two major reasons that this study is important: one is the lives and well being of service members, and the other is money. First, we need to insure that as we send soldier, sailors, marines, and airmen onto the battlefields, that our acquisition processes and procedures are working to provide them with the best equipment available. We want to provide the best chance for both mission accomplishment and survivability of the warfighters. The second concern is that of money. Military budgets are decreasing. We can no longer afford to hastily buy a major military system, only to have to modify or replace it because it does not fit the requirements. Unlimited funds for military systems are no longer available, so it is necessary for our acquisition community to be more prudent and thorough in negotiating terms throughout the life cycle of a system.

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II. MISSION REQUIREMENTS

A. REQUIRED CAPABILITIES

The MRAP vehicles were required to increase survivability and mobility of Marines and Soldiers operating in a hazardous fire area against known threats such as small arms fire, rocket propelled grenades, and improvised explosive devices.

Marines and soldiers were expected to respond to a variety of missions. To support these mission profiles, the U.S. Government sought two categories/configurations of the MRAP vehicle. MRAP vehicles were described as armored vehicles with a blast-resistant underbody designed to protect the crew from mine blasts, fragmentary, and direct fire weapons. The two MRAP categories would consist of: Category I vehicles (six persons or more including driver) to support operations in an urban environment, and other restricted/confined spaces, including mounted patrols, reconnaissance, communications, and command and control. Category II vehicles (ten persons or more including driver) to provide a reconfigurable vehicle that would be capable of supporting multi-mission operations such as convoy lead, troop transport, explosive ordnance disposal, ambulance, and combat engineering.

The MRAP would provide deployed commanders, various units, Explosive Ordnance Disposal (EOD), and combat engineer teams with survivable ground mobility platforms. In order to perform these multiple missions, it was required that the MRAP vehicles of both types be reconfigurable to meet a wide range of mission requirements for that type. Reconfiguration capability would be primarily accomplished by removing/adding passenger seats, and adding/removing Government Furnished Equipment (GFE) equipment, such as communications equipment, weapon stations, crew served weapons, ambulance litters, and equipment. The contractor was required to provide vehicles that provided flexible reconfiguration, but were not required to design the vehicles to integrate GFE items, unless otherwise specified by system requirements.

Performance requirements for both Category I and Category II MRAP vehicles were set forth in the MRAP performance specification. These requirements were as follows. all categories shall sustain a forward speed equal to, or greater than, 65 mph on a paved surface with a 0 percent grade. Under their own power, all vehicles shall be capable of sustained off-road speeds of no less than 5 mph. Under their own power, all vehicles shall be capable of sustained road speeds over trails of no less than 25 mph. All vehicles shall ascend a reinforced surface with a 40 percent grade at a speed of 10 mph. All vehicles shall ascend and descend a 60 percent longitudinal grade at a minimum of 2 Miles per Hour (MPH). Each category shall ascend a grade of 5 percent at 45 mph in a forward direction. All vehicles shall be capable of operating on fuel carried in internal fuel storage tanks for a distance equal to or greater than 300 statute miles, at an average speed of 45 mph on a hard level surface. Each category shall demonstrate a minimum Mean Miles Between Operational Mission Failure (MMBOMF) reliability of no less than 1,200 miles (1,931 kilometers (km) of operation. The Real Time Monitor (RTM) shall have an operational reliability of 0.90 based on an 18-hour mission day, which equates to a mean time between failures (MTBF) of 170 hours.

Transportability requirements defined as follows. The MRAP shall be fit for self-deployment on highways worldwide, with transportability requirements defined as follows. The MRAP shall be fit for self deployment on highways worldwide, and the vehicle shall be capable of being transported by rail, marine, and air modes in C-17 and C-5 aircraft in accordance with MIL STD 1366, as described in MIL HDBK 1791. The MRAP shall be capable of being transported by a C-130 aircraft (objective). The vehicle design shall enable preparation for fixed-wing air transport and reassembly, to be accomplished in no more than 60 minutes using only onboard tools (objective).

Engine requirements were as follows. The diesel engine shall be capable of meeting all performance requirements in all environmental conditions using JP-8. The MRAP must also have the capability to complete its missions using JP-5 and commercial grade diesel as alternate fuels.

The requirements outline the required protection for the vehicle and its occupants. All variants shall provide integral protection for the crew from blast, shock, fragments,

and fatal acceleration effects of mine blasts. The crew compartment shall withstand the blast effects, without breach of the floor, when a mine is detonated under any wheel, or directly under the crew compartment. All vehicle tires shall have a minimum a 30-mile run flat capability at 30 mph, on a hard surface road, after complete loss of air pressure in any two tires. The weapons turret for the USMC vehicle shall have the capability to support the Marine Corps Transparent Armored Gunner's Shield (TAGS).

MRAPs are a family of vehicles produced by a variety of domestic and international companies that generally incorporate a "V"-shaped hull and armor plating, designed to provide protection against mines and IEDs. Per Joint Service requirements, the DoD AO detailed three categories of MRAP:Category I vehicles, weighing about 7 tons and capable of carrying six passengers; Category II vehicles, weighing about 19 tons and capable of carrying ten passengers; and Category III vehicles, intended to be used primarily to clear mines and IEDs, weighing about 22.5 tons, and capable of carrying up to 12 passengers. Vehicles fitting these descriptions had been in use by the U.S. Army and U.S. Marine Corps since 2003, but in very limited numbers and for specialized missions, such as explosive ordnance demolition and other route clearance work. These vehicles quickly gained a reputation for providing superior protection for their crews, leading to a suggestion that similar vehicles might be a better alternative for transporting troops in combat than up-armored HMMWVs.

Figures 1–3 are photo examples of MRAPs from each Category, I, II, and III.

Figure 1. Category I MRAP

Figure 2. Category II MRAP

Figure 3. Category III MRAP

In Operations Iraqi Freedom in Iraq and Enduring Freedom in Afghanistan, RPGs, mines, IEDs, and small arms fire had been responsible for over 30 percent of Marine Corps level III and IV casualties. According to audiotapes released in November 2004, Abu Musab al-Zarqawi ordered his followers to "Block off all their main and secondary supply lines for these are their main arteries and ambush them along those routes for they are exposed and easy prey." The Corps was responding to the threat slowly because it took time for industry to build what was needed. As a result the enemy adapted before the Corps got a chance to protect Marines.

Marine Corps senior leadership decided it had to develop an MRAP combat vehicle fleet capable of sustained operations in a chaotic, mine-infested, non-linear battle space. As casualties mounted, it became apparent that Marines must improve survivability for troops carried in ground vehicles. Operations in poorly protected vehicles resulted in casualties that degraded operational readiness and that were politically untenable.

As of 2005, the enemy was no longer using conventional fighting tactics, but rather unconventional guerilla tactics. The Marine Corps responded to these guerilla tactics with a proactive-reactive strategy in order to increase the survivability of service members. Marines began armoring vehicles with steel from whatever source was available, and then as the threat grew and evolved, followed this ad hoc armor with

factory produced Marine Armor Kits (MAK) for HWWMVs, and Marine Armor Systems (MAS) for MTVRs. This was then followed with the acquisition of the further improvement in HMMWV protection, the Up-Armored HMMWV. These armoring efforts provided an immediate response to the threat that saved lives and reduced casualties.

However, additional armor did not correct the deficiencies that still existed with the current ground tactical vehicle fleet. The MAK and MAS kits were employed to afford the time needed to launch a counter-attack aimed at the heart of the problem—the vulnerability of the existing ground tactical vehicle fleet.

The existing ground tactical vehicle fleet did not have the survivability needed to support and sustain operations on the modern battlefield. While the U.S. had superior intelligence collection, training, and tactical skill, the enemy continued to exploit the vulnerability of Marines in the unarmored vehicle fleet. The most likely threat the Ground Tactical Vehicle Fleet (GTVF) was expected to encounter under the Ship to Objective Maneuver (STOM) scenario, was a combination of mines and small arms employed by conventional forces. However, unconventional forces, operating in a non-contiguous battle space with IEDs, posed a unexpected threat. The legacy GTVF was not designed to withstand this threat; it was designed to support the Cold War linear battlefield. This created the requirement for a new capability which was addressed in a Universal Needs Statement (UNS) by the Marine Corps for the MIne Resistant Ambush Protected (MRAP) Vehicle. This vehicle was designed from the ground up to increase survivability. This initial UNS was for the 1169 MRAPs for the Marine Corps, but later the numbers would be increased and incorporated into the other services.

The Marines establish a Base Line Survivability Index BLSI for every Marine Corps vehicle, which measures the ability of service members and equipment to survive combat incidents.

The MRAP needs to possess the following survivability baseline characteristics:

- Protect the crew from IED/mine threat though integrated V-shaped monologue hull designed specifically to disperse explosive blast and fragmentary effects. Minimum protection should be 30 lbs TNT under any wheel, and 154 lbs anywhere under vehicle.
- Protect the crew against 7.62 x 54mm armor-piercing ammunition at 30 meters.
- Protect from overhead airburst and side protection against fragmentation from 155mm shells, and blast protection against contact-detonated anti-personnel and anti-tank mines.
- Full NBC protected (this is an objective requirement, not threshold).
- Vehicle should have transparent armor with rifle firing-ports on all four sides (similar to the Cougar or Casspir) that permit aimed from the standard service rifle with iron sights or optics.
- Vehicle requires remotely operated weapons system to enable the gunner to operate, air, and engage targets from the fully protected sanctuary of the armored hull. Access hatch to weapon system for loading/unloading or for manual operation of the weapon system is required.
- The vehicle should be easily recoverable and repairable in the field, with modular components that are designed to break away from the vehicle in the case of a blast, with replacement components that can the reattached to the vehicle onsite.
- H-60-like, non-retracting four-point restraint system bolted to floor for every single occupant of the vehicle – no one sits unharnessed. All harnesses have single point quick release feature.
- Crashworthy, shock-absorbing seat cushion material similar to aircraft seats designed to mitigate accelerative effects of mine blasts. Seats should also be multi-positional with the emphasis on ability to fight effectively (outward field of vision to facilitate rapid weapons employment) and remove completely as required.
- Three-hundred-and-sixty degree rollover protection.
- Air conditioning and heat.
- Vehicles should be modular and scalable. Beyond their baseline survivability, they must be capable of having additional armor/stand-off screens attached to increase the protection to predestine ate and defeat the primary kill mechanisms of explosively formed penetrators and shaped charges.

- The vehicle needs to have ample cargo space for pax, and the secure stowage of their equipment in anchored "bussle boxes" to minimize secondary projectiles that acceleration forces produce during a bottom attack mine incident.

The requirement for MRAP was not limited solely to combat operations. However for the purpose of this study the focus will be only on its use in combat operations.

B. QUANTITIES REQUIRED

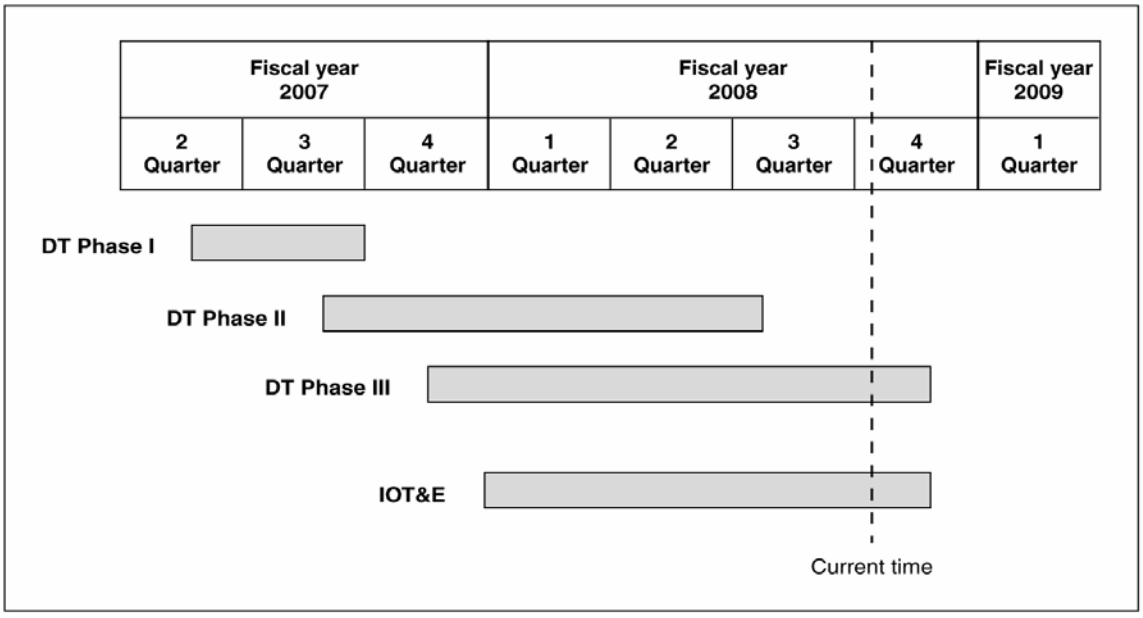
The DoD understood that no single vendor could provide all of the vehicles needed to meet requirements fast enough; therefore, several vendors were invited to offer their non-developmental solutions. This request for proposal made it clear that the government planned to award one or more IDIQ contracts to those vendors that were determined to be the best value to the government. The Marine Corps had the initial lead for this procurement and awarded IDIQ contracts to nine vendors. In early 2007, the first delivery orders were established for four vehicles from each vendor to undergo initial limited ballistic and automotive testing. Of the nine vendors awarded initial contracts, only five were able to produce acceptance vehicles. These five were issued a round of delivery orders for a combined total of 395 vehicles. The quantities that would be purchased initially increased from the 1,169 vehicles for the Marine Corps—that had been identified in the 2005 UNS—to a requirement of 15,838 vehicles by July 2008. These were split between the Army, Marine Corps, Navy, Air Force, and Special Operations Command (SOCOM), plus 133 for ballistic testing. Table 1 displays a breakout of these by users.

Table 1. Approved MRAP Acquisition Quantities by Military Service and Other Users (From GAO 2008, Rapid Acquisition of Mine Resistant Ambush Protected Vehicles)

Service	Total
Army	12,000
Marine Corps	2,225
Navy	544
USAF	558
SOCOM	378
Ballistic Testing	133

C. TESTING REQUIREMENTS

Under conventional DoD acquisition Policy weapons systems are mandated to be fully tested before being fielded to the user. However, because of the need to begin fielding survivable vehicle as expeditiously as possible, a phased testing approach was adopted. This approach was designed to quickly identify vehicles that met the requirement for crew protection only, so that they could be rapidly fielded. The test plan was comprised of three phases of Development Tests (DT) that raised the bar of the Incremental Operational Test and Evaluation (IOT&E). This approach resulted in a great deal of overlap between testing and the actual fielding of the MRAPs. Orders for thousands were placed before operational testing began, and orders for thousands more were placed before any operational tests were completed.



Source: GAO based on DOD information.

Figure 4. MRAP Developmental and Operational Test Plan (From GAO, 2008)

The three phases of developmental testing began in March 2007, and were scheduled to be completed by August 2008. Each phase evaluated both the ballistic and automotive performance of the vehicles. Phase I included a limited evaluation by users. Phase II evaluated further, the vehicles at the desired level of performance against the ballistic threat. It also, added more endurance miles to the automotive portion of the test, and included mission equipment such as radios and other electronic systems. Phase III increased the standard for ballistic performance to the emerging threat, and assessed non-ballistic protection to include near-lightning strikes, high-altitude electromagnetic pulse, and nuclear, biological, and chemical decontamination tests. The automotive portion of the test increased endurance to 12,000 miles per vehicle.

In addition to the ballistic and automotive performance test mentioned above, the DoD also tested vehicles to determine their operational survivability, effectiveness, and suitability when operated by marines, sailors, and soldiers in simulated operational conditions. In the testing, they used profiles that reflected missions found in combat operations in Iraq and Afghanistan. All initial phase testing was scheduled to be completed by August 2008.

III. SPEED OF FIELDING

A. MRAP PROGRAM TIME LINE

On February 17, 2005, the first Marine Expeditionary Force initially requested 1,169 MRAP vehicles (Global Security.org, n.d.). The HMMWV used to this point proved to be incapable of withstanding the blast from the IEDs, now commonly being deployed against warfighters in the current theater of operation (Major Roy Mcgriff, 2005). The MRAP vehicle, UNS, stated that an immediate need existed for an MRAP vehicle capable of increasing the survivability and mobility of Marines operating in a hazardous fire area against known threats. The Expeditionary Force Development Center (EFDC) was engaged in developing a course of action for the development of a future vehicle that provides the requested capability: However, its fielding would be years in the future, while an immediate solution was still needed

On May 21, 2006, the Commanding General, Multi-National Force-West, submitted a Joint Staff Rapid Validation and Resourcing Request for 185 MRAP-type vehicles to the Joint Requirements Oversight Council (JROC). In July 2006, a second Joint Staff Rapid Validation and Resourcing Request were submitted to the JROC for an additional 1,000 MRAP-type vehicles. These requests ultimately resulted in the identification of a requirement for 1,185 MRAP-type vehicles for the Army, Navy, and Marine Corps and the initiation of a Joint MRAP acquisition Program. Listed below are the key dates and events in the MRAP acquisition program timeline. The LRIP dates listed below are further detailed in Appendix A.

- November 2006—program begins
- January 2007—IDIQ contracts awarded to nine manufactures
- February 2007—ACAT II designation
- February 2007—First LRIP production orders for 749 vehicles
- April 2007—First Iraq fielding
- May 2007—Designated as top priority DoD program
- May 2007—Requirement increases to 7,774 MRAPs

- June 2007—DX rating approved
- July 2007—5,690 vehicles ordered
- September 2007—ACAT I designation
- September 2007—JPO formed with representation from all services and USSOCOM; requirement increased to 15,374
- October 2007—JPO Forward established in theater
- December 2007—11,881 vehicles on order
- February 2008—First Afghanistan fielding
- May 2008—First MRAP expedient armor fielded
- July 2008—15,020 vehicles on order
- July 2008—Accepted 10,000th vehicle
- September 2008—RFI for smaller, lighter, and more agile vehicle with MRAP protection
- October 2008—Packard award
- December 2008—M-ATV RFP
- January 2009—Accepted 15,000th vehicle
- February 2009—16,083 vehicle on order
- February 2009—10,000th vehicle fielded in Iraq
- April 2009—Initial ISS contract released for initial purchase
- June 2009—LRIP 15 ADM for 5,244 M-ATVs validated by JROC
- August 2009—1st Cougars with Independent Suspension Systems (ISS) delivered to Afghanistan. 1400 M-ATVs added to JROCM Requirements.
- October 2009—LRIP 16 ADM increased to total MRAPs procurement authorization to 22,882
- November 2009—JROC increased the AO to 26,882
- January 2010—LRIP 17 ADM for 2,818 vehicles
- June 2010—LRIP 18 ADM for 139 vehicles
- October 2010—LRIP 19 ADM for 507 variants
- November 2010—LRIP 20 Mod ADM 250 MRV vehicles
- December 2010—JROC increased the AO to 27,344
- March 2011—LRIP 18 & 10 Mod ADM
- March 2011—LRIP 21 ADM for 648 vehicles

- June 2011—LRIP 22 for 400 vehicles
- July 2011—LRIP 23 ADM for 170 vehicles

The MRAP acquisitions were accomplished through a series of Low Rate Initial Production (LRIP) Decision Memoranda from 2007 to 2011. Appendix A shows a detailed time line of LRIPs 1 through 23 and the quantity of vehicles order and the manufacturers. Figure 1 shows the dates and number of MRAPs for the Joint Requirements Oversight Council Memorandum (JROCM) requirements, LRIP decisions, vehicles produced, and vehicles fielded from November 2006 through June 2011. The chart entitled Operational Demand Signal, Figure 2, shows the JROC validation point through June 2011. Through September 2012, 27,740 MRAPs rolled off the assembly lines of seven different manufactures. The Pentagon officially shut down MRAP production lines on October 1, 2012 (Sisk, 2012).

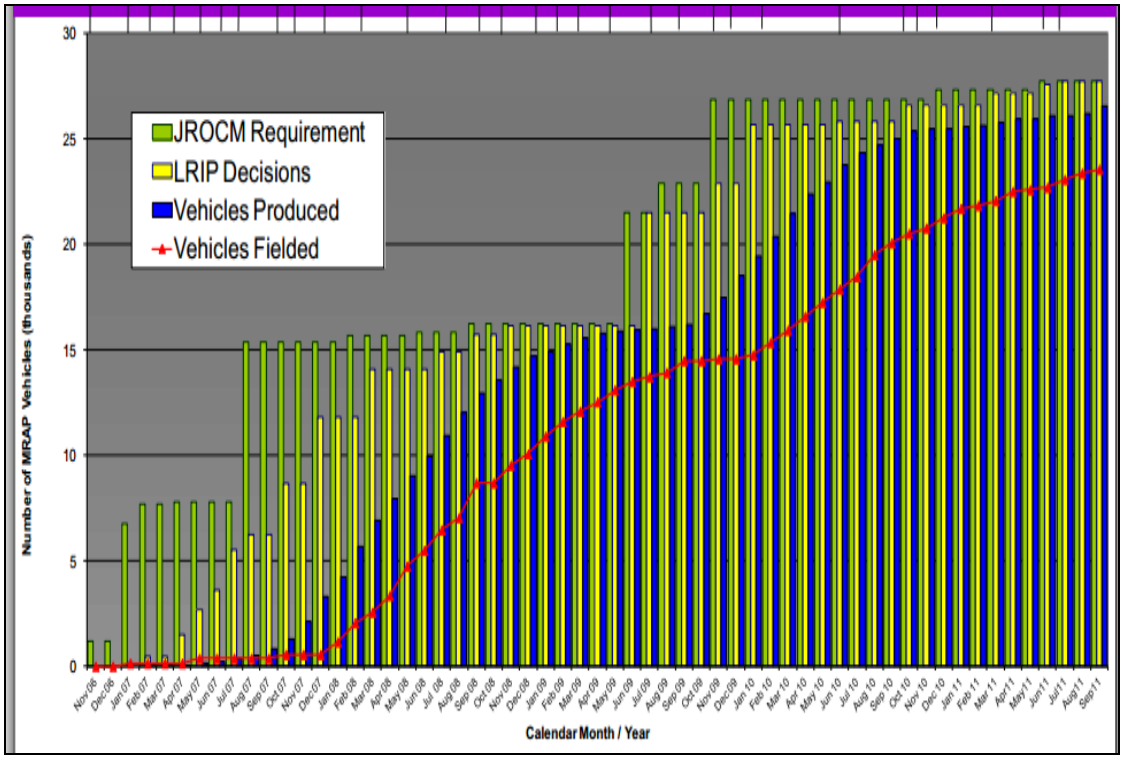


Figure 5. The MRAP Production (From Briefing JPO, 2012)

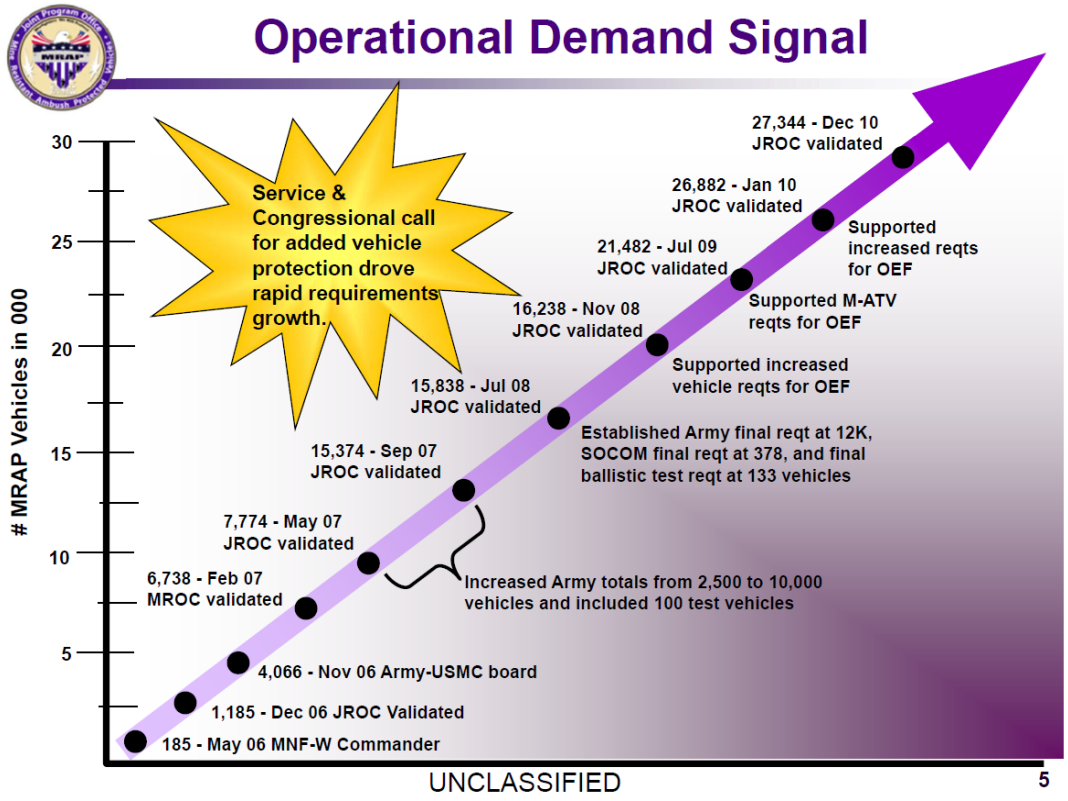


Figure 6. The Operational Demand Signal, (From MRAP Program Overview, August 2012)

1. (SPEED OF) MRAP Manufacturing

On February 9, 2007, then Assistant Secretary of the Navy for Research, Development and Acquisition, Delores M. Etters signed an Acquisition Decision Memorandum (ADM), granting approval for the MRAP program to enter into acquisition at Milestone C under conditions which are outlined in the ADM at Appendix B. This ADM approved the MRAP System entry into the DoD acquisition, at Milestone C (that is, entry into Low Rate Initial Production (LRIP)) as an Acquisition Category II (ACAT II) program and authorizing a quantity of no more than 749 vehicles under LRIP restriction. In Figure 7, the yellow arrow shows where the MRAP entered the life cycle management system. The MRAP used an accelerated acquisition process, and under this

process, most of the life cycle management Engineering and Manufacturing Development Phase was skipped or accelerated to hasten the delivery of the MRAPs to the field.

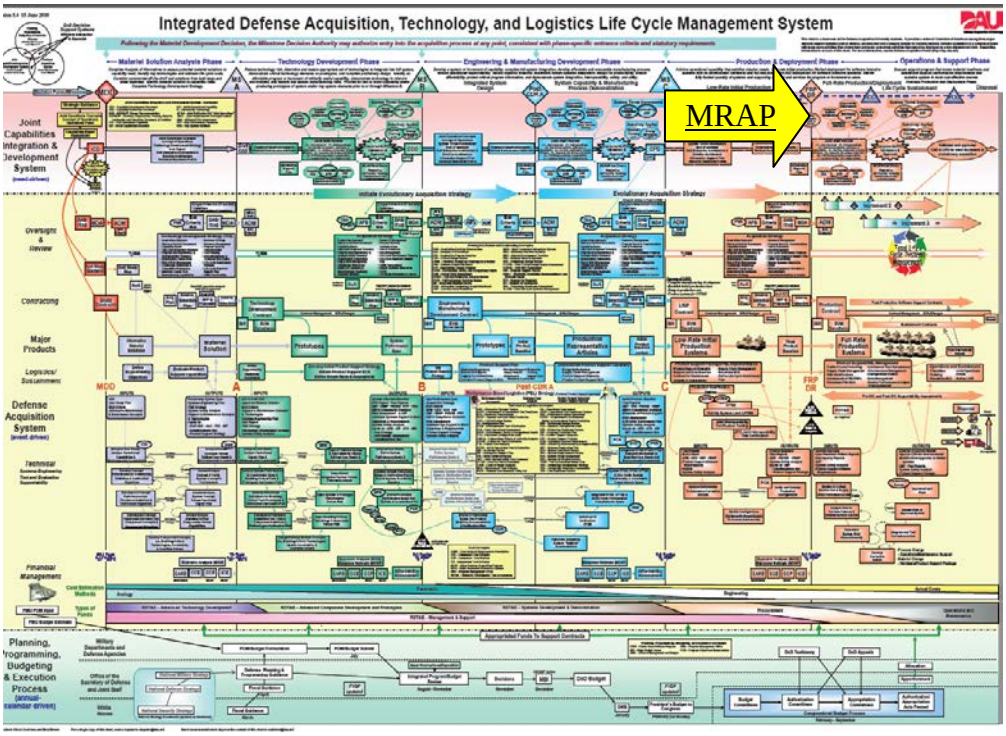


Figure 7. The Defense Acquisition Management System Chart

To accelerate the speed of acquiring and fielding the MRAP vehicle, the DoD used a tailored acquisition approach. The program manager's office did not consider developing a product, but rather relied on existing technologies and commercial-off–the-shelf (COTS) products and only minimum performance standards were included in the request for proposal (RFP). Realizing that one producer would not be capable of producing the number of MRAPs required, and in the specified time frame needed, the DoD awarded indefinite delivery, indefinite quantity (IDIQ) contracts to nine different truck producers, for the purchase of up to 4,100 vehicles per year from each vendor. The DoD initially committed to buying at least four vehicles from each manufacture. These vehicles would be evaluated in the following four areas: design, performance, producibility, and sustainability.

Perhaps supporting all the MRAP manufacturing, the factor contributing most to the ability to accelerate the manufacturing process was that the DoD designated the MRAP program as the DoD's highest priority acquisition rating, which helped contractors and other industry partners by giving them priority access to needed resources to respond more rapidly to the urgent need and meet production requirements.

B. MRAP MANUFACTURES

Of the nine initial manufactures that received contracts to build MRAPs, five survived: FPI, General Dynamics Land Systems Canada (GDLS-C), NAVISTAR Defense, BAE-Tactical Vehicle Systems (BAE-TVS), and BAE Systems (BAE). Oshkosh was added later to produce the M-ATV.

Brief company profiles are listed as follows.

C. MRAP MAJOR CONTRACTORS

- Force Protection Industries (FPI), Inc.—Ladson, South Carolina is a manufacturer of ballistic- and blast-protected vehicles from the United States that have been used in Iraq, Afghanistan, Kosovo, and other hot spots around the world. MRAP Product Category I, II and IIIGeneral Dynamics Land Systems Canada—Ontario, Canada, a subsidiary of General Dynamics, It is a major supplier of armored vehicles of all types, including the LAV-25, Stryker, and a wide variety of vehicles based on these chassis. General Dynamics Land Systems operates the **L**ima Army Tank Plant and GDAO (General Dynamics Anniston Operations) in Anniston, Alabama. MRAP Product Category I.
- NAVISTAR Defense—Warrenville, Illinois (formerly International Harvester Company) is a U.S.-based holding company that owns the manufacturer of International brand commercial trucks, MaxxForce brand diesel engines, IC Bus. Navistar is the prime supplier of MRAP **a**rmored vehicles to the U.S. military. MRAP Product Line, Category I & II.
- BAE-TVS—Rockville, Maryland is a subsidiary of BAE Systems Inc. BAE plays a significant role in the production of military equipment. In 2008, 95 percent of BAE Systems' total sales were military related. MRAP Product Line, Category I & II.
- BAE Systems—Santa Clara, California is also a subsidiary of BAE Systems Inc. MRAP Product Line, Category I & II.

- Oshkosh Corporation, Oshkosh, Wisconsin, formerly Oshkosh Truck, is an American industrial company that designs and builds specialty trucks and truck bodies and access equipment. It is organized into four primary business groups: access equipment; defense; fire and emergency; and commercial. MRAP Product Line: Oshkosh designed and manufactured the M-ATV.

Figure 8 shows the major manufactures of MRAP, the categories, and the number they have produced.

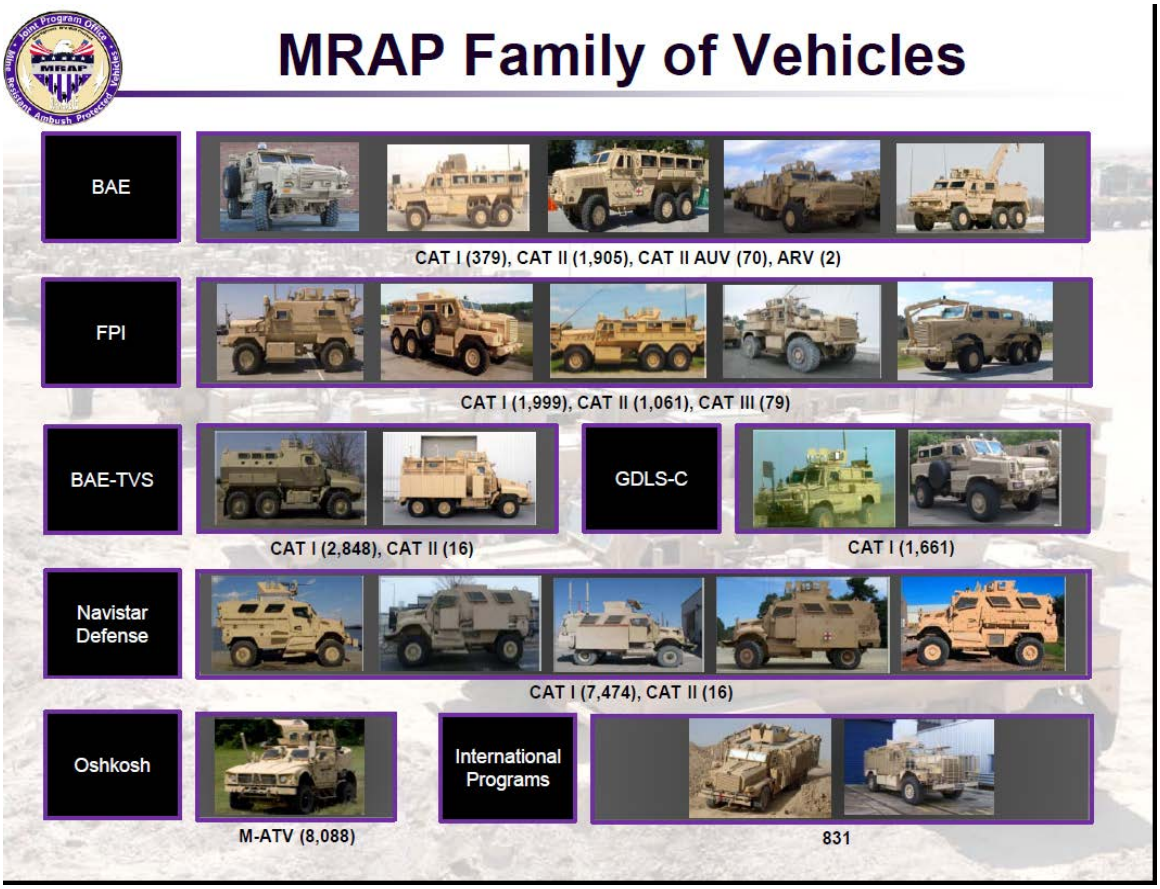


Figure 8. The MRAP Family of Vehicles (From Johnson, 2013?)

D. FIELDING SPEED

The entrance of the MRAP into the DoD acquisition process beyond Milestone C was the biggest factor contributing to the accelerated speed of fielding the MRAP. This

entry alone perhaps cut, by five to 10 years, the time it normally takes for a new system to go from Milestone A, the pre-system acquisition phase to Milestone C, the system acquisition and fielding phase.

To expedite fielding of the vehicles further, mission equipment packages, including radios and other equipment, were integrated into the vehicles after purchase. This equipment had to be installed into the vehicles before they could be fielded to the user. Each military service required different equipment and was responsible for purchasing these systems and providing them as government furnished equipment (GFE) to be installed at a government integration facility located at the Space and Naval Warfare Systems Command in Charleston, South Carolina.

The Space and Naval Warfare Center (SPAWAR) facility was used to integrate MRAP vehicles with GFE prior to fielding. This facility provided an optimal location for GFE integration because it had an experienced integration workforce, an on-site test facility, and accessibility to air, ship, rail, and interstate assets. SPAWAR also opened two other facilities to assist with the integration process. One was located in Orangeburg, South Carolina and provided a surge capability. It also served as a back-up location in case of a natural disaster at the Charleston site.

The second additional site was located in Kuwait, and consisted of five integration bays, which were used to integrate a limited numbers of vehicles destined for delivery to units in that region.

E. TRADEOFFS IN ACHIEVING THE NECESSARY SPEED OF FIELDING AND ADVANTAGES AND DISADVANTAGES

The fast delivery of MRAPs to the DoD to save lives in contingency operations was the biggest advantage of using the accelerated procurement process. However, this accelerated process also created several disadvantages. The accelerated procurement process used in the acquisition of the MRAP took advantage of existing technologies, and eliminated the need for a long developmental process. Contracts were ultimately awarded to five different existing truck manufacturers and each produced their version of the MRAP. Each of these five manufactures produced a MRAP vehicle with unique designs,

different operating procedures, and different maintenance and support requirements. The advantage afforded the DoD in using this approach was quick delivery to the users in order to save lives. However, the disadvantage was that each of these different versions of MRAP required different maintenance procedures and different repair parts.

The maintenance required for five different versions was either five different technicians to support each different version or a single technician with the training to support several or all versions. Maintenance support is addressed in a later chapter, but the maintenance for the MRAP was contractor supported in the beginning. The disadvantage of course included the number of contractors required, the requirements for contractors on the battlefield, and the added cost. The different services have not yet projected or budgeted for the long-term MRAP sustainment costs.

Another factor that enhanced the fast delivery of MRAPs was that they were purchased without mission equipment, such as radios and intercoms, GPS, visual display enhancements, and IED defeat systems. This type of purchase allowed each military service to equip their MRAPs uniquely to their particular mission requirements. Each military service bought subsystems for their vehicles and provided them as government furnished equipment (GFE) to be installed at a government integration facility located at the Space and Naval Warfare Systems Command in Charleston, South Carolina. Although this process afforded accelerated delivery from the manufacturer, it proved to have the exact opposite effect at SPAWAR; it delayed delivery of the finished mission ready MRAP to the warfighter. The fact that five different versions were being made by five different manufacturers further complicated and added to the time required to install the GFE. In addition, each military service, (Army, Air Force, Navy and Marine Corp) had different configurations that resulted in a mix of vehicles being integrated at one time. SPAWAR addressed this problem by cross-training workers to install the GFE on multiple vehicle configurations.

It was a disadvantage to send the finished MRAPs to a facility to have GFE installed, which certainly delayed the delivery of the MRAP to the users. However, since it was necessary to install GFE at a different location after delivery from the manufacturer, SPAWAR provided the best location for this integration. It provided

excellent access to air, ship, rail, and interstate assets. Thus, once the GFE integration had been completed, MRAPs could be shipped out expeditiously. In addition using a government integration facility: (1) simplified contracting issues that might otherwise have caused contractual delays; (2) opened up availability of an additional skilled labor force, which may have relieved labor shortages at the separate contractor facilities; and (3) may have provided opportunities to balance workload among variants, which could not have been accomplished at the separate prime contractor facilities.

Two other SPAWAR facilities, one in Orangeburg, South Carolina provided for a surge capability and served as a back-up location in case of natural disaster at Charleston, and another in Kuwait that was used to integrate limited numbers of a vendor's vehicles for delivery to units in the region. This initial GFE integration at the Kuwait facility was completed May 2008, according to the 2008 GAO document. However the Kuwait facility continued to do upgrades and modifications through 2011.

According to this GAO document, the concurrent test and production strategy for the MRAP vehicle that helped to field the vehicles quickly resulted in the fielding of vehicles with significant operational issues. While most of the vehicles met requirements against the ballistic threat in the first phase of developmental testing, it was later revealed that the initial versions of MRAPs were not suitable for some mission terrain. A number of these issues would require modifying the vehicle designs, postproduction fixes, or adapting the way vehicles were used. Making additional changes in vehicle design or modification added cost in time, money, and operational readiness rate.

IV. MAINTENANCE SUPPORT

The MRAP maintenance concept consists of those actions necessary to sustain its operational capability, which include both preventive (scheduled) and corrective (unscheduled) maintenance. The initial maintenance support plan was designed to consist primarily of contractor maintenance support, and then gradually transition into more organic military support. The Original Equipment Manufacturer (OEM) was contracted to provide Field Service Representatives (FSR) who would perform Intermediate Level (I-Level) maintenance at the Regional Support Activity (RSA) sites. I-level maintenance personnel would remove, replace, and repair engine turbochargers, starters, alternators, air compressors, oil pumps, filters, external oil lines, oil pan, and water pumps. They would also remove and replace complete engine assemblies, front and rear seals, valve covers, brake assemblies, intake and exhaust manifolds, and replace fuel pumps, alternators, starters, water pumps, transmissions, and differentials. The OEM FSRs were not authorized to overhaul/repair or rebuild engines or differentials; these items were classified as Non-Repairable Assemblies (NRA) at the organizational and intermediate levels and were to be replaced as assemblies. The using activities were authorized to remove and replace only these items; their repair and overhaul would be accomplished through Depot Level (D-Level) maintenance.

A. LEVELS OF MAINTENANCE

The MRAP maintenance support concept plan consists of three levels of maintenance: organizational, intermediate, and depot.

The organizational operator/crew and organization-level mechanics maintenance includes those tasks that consist of planned and/or corrective maintenance actions performed by the operator/crew, and organization-level mechanics crews, and will generally include the following:

- Preventive maintenance checks and services such as inspections, lubrication, cleaning, preserving, tightening, checking and topping-off fluid levels, inspecting fittings and connectors, fuse replacement, and

performing minor adjustments with common shop tools found at the organizational maintenance level.

- Limited troubleshooting and repair
- Monitoring and reporting system conditions

Crewmembers, whether deployed or at home base, will conduct maintenance at this level on-site. Approximately 90 percent of all malfunctions will be detectable and correctable at the organizational level.

The intermediate [field level] maintenance level involves those tasks beyond the capability of the operating crews and organization-level maintenance. Specially trained mechanics and technicians perform maintenance at this level. Intermediate maintenance includes the following.

- Inspection/in-depth diagnosis, modification, replacement, adjustment, and limited repair or evacuation/disposal of principal end items and their selected repairable, components/subcomponents
- Calibration and repair of Test, Measurement, and Diagnostic Equipment (TMDE), including the fabrication of items, precision machining, and various methods of welding

Maintenance at this level will be conducted in a semi-protected environment on-site, whether deployed or at home base.

Depot [sustainment level] maintenance level maintenance tasks sustain equipment throughout its life cycle by performing the following.

- Major repair, overhaul, or complete rebuild of parts, subassemblies, assemblies, or principal end items
- Manufacturing parts and conducting required modifications, testing, calibrating, and reclaiming
- Support of lower level maintenance by providing overflow maintenance services and performing on-site maintenance services including technical assistance when required

Maintenance at this level occurs at a multi-commodity maintenance center, other services depots, commercial industrial facilities, OEM, or a combination thereof to perform this level of maintenance.

Due to the number of MRAP variants and the number of different manufacturers, it was necessary for the U.S. military to contract with various companies to conduct maintenance work for the MRAP vehicles.

BAE received a contract worth $23.8 million for spare parts replacement, instructor and maintenance support, and other services for the 2,850 Caimans MRAPs in Iraq. The spare parts and replacement items would include improved front seats and electrical connectors, as well as retrofitting door assist systems that were to be completed by January 2010.

U.S. Logistics is another prominent contractor for the MRAP Maintenance Support. The U.S. Logistics (2008) Website stated the following.

> The U.S. Marine Corps in contract M67004-09-F-0581 dated June 30, 2009, mandates 16 to 360 maintenance personnel from Albany, Georgia, to repair and overhaul USMC vehicles at Barstow, California. They also stated that they had provided MRAP support since April 2007 for various OEM programs including an Afghanistan/Iraq SOCOM MRAP Driver Trainers/Maintainers program. In these programs, U.S. Logistics trained U.S. Army SOCOM members on operational and technical procedures of the RG31-RG33 and CAIMAN series MRAPs. USL also assist in maintaining, modifying, and generally supporting SOCOM units with daily maintenance and "upper echelon maintenance issues and procedures. (U.S. Logistics, 2008)

U.S. Logistics (2008) also provides FSR support on all MRAP series to U.S. Army units/Soldiers deployed in Iraq, Afghanistan, and Kuwait. These employees support Army units from Brigade down to Company level by maintaining, modifying, requisitioning of parts, quick fixing, and guiding as support to the MRAP program.

U.S. military operations are dependent on industry partner assistance in the maintenance and combat readiness of MRAP equipment.

The military partnered with MRAP suppliers and contractors in establishing an effective maintenance and sustainment framework. A hybrid approach is used with contractors working in tandem with organization-level mechanics. An evolving effort occurs to place greater emphasis on organic military capabilities. Also, as MRAPs were introduced in the Army and Marine Corps force structures, a limited number of MRAPs

were made available and sent to home stations where the warfighters had familiarization training on MRAP operations and maintenance before their deployment (Buxbaum, 2010).

Non-standard equipment, which is not part of the Army's automotive training and supply support, requires special Contractor Logistics Support (CLS) assistance for maintenance and repair systems. The staffs of CLS contractors were embedded within the Army. Contractor personnel operated MRAP Recovery Vehicle (MRV) support at warzone and regional support levels. Support includes mechanics, parts management technicians, requisition and transportation specialists, trained armor-welders and related personnel (RCV/MRAP Contractor Logistics Support Service Market Survey of Interest, n.d.).

> Buxbaum (2010) stated that MRAP spare parts flowed normally through the military supply chain. The Defense Logistics Agency and TACOM play important roles in gathering data on demand and ordering. Navistar, which has global supply and dealer networks, brings its supply chain capabilities in MRAP repair and sustainment efforts. "This is where Navistar as an OEM and key member of the MRAP family provides a pretty good value offering to the government," said Jim Grooms, director of fleet support at Navistar Defense. Navistar's dealers in Iraq and Afghanistan have been recruited to provide Navistar MRAPs parts service for these areas. "We have leveraged our dealer network to the maximum extent possible," said Grooms. "Our international truck business is supported through a vast international dealer network. Military vehicles are supported out of these commercial dealerships."

The withdrawal of U.S. troops from Iraq meant additional MRAPs could be sent to Afghanistan in which the Marine Corps set up an infrastructure to support the vehicles. MRAPs withdrawn from Iraq passed through Kuwait for suspension system upgrades to support greater off-road movements necessary in Afghanistan.

Aligning the vehicles with institutional requirements became serious as MRAPs became common among U.S. warfighters. Within a few years, technical and operational manuals for MRAPs were developed and parts catalogs for the vehicles were generated. The cataloging effort standardized parts for various MRAP vehicles. MRAPs funded through the normal budget by 2012, as against the current special wartime appropriations,

which made similar efforts more urgent. The expected adoption of MRAPs into the Army and Marine force structures meant the vehicles were brought to the home stations of the troops and MRAPs' repair and sustainment facilities established stateside (Buxbaum, 2010).

CLS support in the war zone was in transition as the level and nature of American engagements in Iraq and Afghanistan evolved. The scope of work of CLS evolved to reflect changes within the Area of Operations (AO). Emphasis was placed on contractor use of the standard Army supply channels. The Theater Authorized Stockage Lists (ASL) was expected to evolve as well, with the presence of shop stock/bench stock in its place assigned and tailored to individual sites and missions. They were loaded to the Standard Army Management Information System (STAMIS), which was expected to result in a decrease in Theater ASL. Low-volume, low-demand, non-standard parts not ordinarily found in the Army supply system were contractor-held and considered as contractor managed ASL. As supported units assumed more ownership and self-reliance in the maintenance of equipment, CLS services shifted to emphasis on battle damaged and/or sustainment-level maintenance, which was contractually required. Military unit partnerships and their CLS support teams shifted to a different footing. Required CLS services transitioned throughout the contract. Any contractor must demonstrate a capability to shift focus and resources, to include fluctuations in required workforce, as the RCV/MRAP Contractor Logistics Support Service Market Survey of Interest document stated.

The contractor provided skilled manpower and logistics support services to maintain a quality MRAP and RCV systems maintenance and sustainment program in Iraq and Afghanistan. The total workforces of approximately 400 personnel were employed at 40 sites in Iraq and Afghanistan. Required skill sets included parts requisition and inventory management utilizing the Standard Army Maintenance System—Enhanced (SAMS-E) processes and procedures. Certified automotive mechanics and/or military MOS-trained mechanics with equipment automotive repair experience, vehicle diagnostics, troubleshooting, component calibration, armor weld repairs (certifiable), transportation management, field-level operations-administration and

maintenance training services. Fluency in English was a must. The U.S. government provided life support to include housing, work areas, and shop tools.

Force Protection's Cougar MRAP was designed not to rely on OEM-unique parts. To minimize stockage requirements, the ready availability of power trains, suspension system and axles was also desired. Equipment could also be repaired at the lowest possible maintenance level and vehicles can be returned to operational status within 48 hours.

As the Afghanistan infrastructure matured, additional repair sites were put in place with supporting troops at each site. Tank-Automotive and Armaments Command (TACOM) maintained four regional sustainment centers in Iraq until the drawdown. They currently maintain five regional sustainment centers in Afghanistan. A full-service facility currently exists in Kuwait where damaged vehicles are withdrawn from the fight, repaired and returned to the battlefield.

B. EXTENT OF MAINTENANCE TRADED OFF FOR SPEED IN FIELDING MRAPS

The rapid acquisition of MRAPs brought challenges in terms of training and sustaining the vehicles in the war zone. MRAPs have been in Southwest Asia for about five years, but they are not yet part of the armed services' force structure. The warfighters have had limited opportunities to train in MRAP vehicle operation or maintenance at their home stations, despite the fact that MRAPs are supplied to troops in war theaters.

Availability of labor and spare parts are the two most common issues in MRAP maintenance. The U.S. Army and the Marine Corps mechanics are less familiar with the MRAPs, so a challenge occurs in simplifying MRAP maintenance and sustainment processes. MRAP suppliers, in designing the vehicles, were considering that the availability of replacement parts could be assured. The MRAP all-terrain vehicle (MATV), the Oshkosh-manufactured MRAP, was built on a chassis of the Marine Corps Medium Tactical Vehicle Replacement (MTVR). This commonality reduces logistics burdens. Oshkosh also provides spare parts that are common to both vehicle models; thus, spare parts and equipment are always available. Factory-trained technicians also

provide instruction and advice, or provide repair and maintenance work themselves (Buxbaum, 2010).

> The rapid acquisition of MRAPs also challenged communications equipment suppliers. Harris Corporation, supplier of SINCGARS (Single Channel Ground and Airborne Radio System) radios to MRAP vehicles, gave priority to the MRAP program over other programs in which it was involved. Harris has worked with the MRAP program for over five years, providing support in several ways such as providing the government with installation analysis to provide optimal solutions for radio placement, cabling, and antennas within the vehicles aside from providing communications equipment. The company initially established a support team consisting of 15 to 18 personnel and deployed them to Iraq, providing forward support for Harris radios systems, especially those installed in MRAPs. As MRAPs were shifted to Afghanistan, the Harris Corporation established a maintenance/repair facility in Afghanistan, expanding their capabilities, and increased their personnel strength to meet the support requirements. (Buxbaum, 2010)

C. ADVANTAGES/DISADVANTAGES

The rapid fielding of MRAP vehicles to the war theater, according to Blakeman, Gibbs, and Jeyanthan (2008), was not without cost. At least 66 MRAP-related accidents happened between November 2007 and June 2008. Bad roads, weak bridges, or driver error, resulted in five soldier deaths and 40 MRAP rollovers. Those incidents could have happened with any vehicle, but may be emblematic of the trade-offs in fielding MRAPs rapidly.

The Naval Facilities Engineering Command's (2008) User's Logistics Support Summary (ULSS) also details several challenges in the MRAP maintenance concept. The diversity of the MRAP vehicles is one of the biggest disadvantages of the current maintenance concept. Spare parts replacement was a problem because of the diversity of the parts used by these vehicles. Furthermore, stocking the spare and replacement parts for these vehicles, to keep them combat ready, is also quite a challenge.

Another challenge has been the limited Internet connectivity/absence of the 3M system in theater. As a result, Navy Expeditionary Combat Command (NECC) units have had capture maintenance history/parts usage data and material movement for MRAPs

using an electronic 4790 2K/CK. Commanders need to document maintenance actions as well, including those performed by supporting maintenance activities. Commanders were responsible for capturing configuration data, including the additions and deletions of MRAP assets to unit inventory. Problems occurring on non-standard equipment that was not part of the Army's automotive training and supply support system required special CLS assistance for maintenance and repair systems.

The newness of the MRAPs in the war theater was also a big disadvantage. According to the RCV/MRAP Contractor Logistics Support Service Market Survey of Interest document, U.S. military operations were dependent on industry partner assistance in the maintenance and combat readiness of equipment. The U.S. military was not immediately prepared to train its personnel to conduct maintenance work on MRAPs.

These disadvantages, however, were offset by the benefits that the Soldiers received in the rapid fielding of MRAPs, which saved the lives of many Soldiers. The lessons learned by the U.S. military in using the rapid acquisition process to field the survivable MRAP vehicles is, perhaps, another advantage that could be used in future defense acquisitions.

D. UNIQUE TRAINING IMPLEMENTED TO SUPPORT ALL VEHICLES PRODUCED BY NUMEROUS MANUFACTURERS: ADVANTAGES AND DISADVANTAGES

The 2008 GAO document stated that procuring MRAPs from different vendors complicated the vehicle maintenance and support process because of the unique design of each vendor, which required specific operating and maintenance procedures (p. 11). In less than 30 months, DoD fleet reached more than 15,000 MRAP vehicles, from at least five different vendors. The Army alone will have more than 10,000 vehicles. The MRAP program office had established a central training establishment at which maintainers were cross-trained on different vendors' vehicles.

According to the Naval Facilities Engineering Command (2008), the training concept for the MRAP is for provision by the USMC Mobile Training Teams (MTTs) of New Equipment Training (NET) to Multi National Force-West (MNF-W) personnel at

the RSA and fielding sites. A “MRAP University” was established at the Red River Army Depot (RRAD), Texas, to cross-train OEM FSRs/instructors, government mechanics/Logistics Assistance Representatives (LARs), and war fighter instructor/key personnel training to support Continental United States (CONUS) training. The Joint Consortium of FSRs that provides CONUS training on all MRAP vehicle variants is the outcome. The Operator New Equipment Training (OPNET) and Field-Level Maintenance New Equipment Training (FLMNET) Programs of Instructions (POIs), consisting of classroom instruction, on-vehicle instruction, and day/night driving instruction, are the basis of the MRAP University Training Support Package (TSP).

For the Navy, the training concept for its MRAP units, consisting of Cougar 4X4 vehicles, is the Operator and Maintainer NET focusing on operator/crew and maintenance tasks. The focus of the joint MRAP NET TSP is critical operator and maintainer tasks for all fielded MRAP Family of Vehicles (FoV) variants. The different units will handle the complete MRAP NET TSPs for sustainment training that accompanies supplemental vehicle training videos. The Navy works with the Marine Corps Liaison Officer (LNO) for the current GFE training in-theater.

As an initial operator and maintenance training requirement, the OPNET is conducted for four days (40 hours) at hand-off sites after vehicle de-processing. The class size consists of 24 operators (four students to one instructor ratio). FLMNET, on the other hand, is held after vehicle de-processing at the unit’s maintenance location and unit-based training locations with a class size of 12 mechanics (four students to one instructor ratio) and runs for five days (40 hours), according to the Naval Facilities Engineering Command (2008).

FSRs and uniformed mechanics train at the RRAD in Texarkana, Texas. Participants of the consolidated training implemented by the Joint Program Office (JPO), and named the MRAP University, are comprised of the different services and the MRAP manufacturers. The MRAP University offers training to familiarize attendees with the most common MRAP vehicles. The MRAP University created to provide a place at which personnel can become familiar with operations and maintenance of the multiple MRAP variants is run by TACOM and has been active since November 2007. It has

offered both the Field Level Maintenance Training Course and the Operator Training Course, which are each 40-hour courses. They provide familiarization and operator training, an overview of maintenance, diagnostics and troubleshooting, and recovery procedures.

MRAP University's evolved from basic operator and maintenance training to in-depth familiarization. The maintenance familiarization course now runs five weeks, while the operator familiarization course is now a two-week course.

The Infantry Center at Fort Benning, Georgia, also publishes a *Smartbook* that covers basic vehicle characteristics and employment for all MRAP variants. The MRAP University and the *Smartbook* provide operators and maintainers basic information in employing the MRAP vehicles.

Some manufacturers have established their own facilities and offer training not just to their own personnel but also to service members and FSRs from other manufacturers. FSRs from competing MRAP manufacturers may see the proprietary data and technology of the manufacturer providing the training. However, since this training is considered support for the troops in the battlefront, it is also done for other manufacturers' personnel as well. Force Protection Industries, Inc. (FPII) provides a training program and facilities offering 40 to 50 hours of FSR training per week.

FSRs rotate with counterparts in theater after achieving certain skill levels, and returning FSRs share their knowledge with engineers and management stateside. The returning FSRs thus contribute to recommended changes in MRAP vehicles based on lessons learned from the theater. International Military and Government, LLC subsidiary (IMG), unlike other manufacturers, does not provide its own FSRs, but subcontracts DynCorp to provide FSRs for its vehicles.

DynCorp International provides training and sustainment in the southwest Asia zone. Its personnel provide instruction on using the MRAPs, and its mechanics maintain the vehicles' operational readiness in Afghanistan and Iraq. The corporation has 300 personnel in the war theater, and each has signed a one-year Foreign Service agreement.

The willingness of DynCorp to support the equipment of non-Navistar vehicles is one example of the “consortium approach” in sustaining the MRAP. DynCorp is under contract to support the Oshkosh-manufactured M-ATV. This level of cooperation by DynCorp was groundbreaking.

> We have a number of MRAP OEMs and these vendors are usually serious about protecting their data. But we realized early on that because of the rapid deployment of the vehicles we could not control their distribution and meet the enemy threat. We could not hire indefinite numbers of field service representatives. warfighters have to feed and house these contractors, and we wanted to minimize the burden on the troops. (Buxbaum 2010)

Cross-training of FSRs is vital to the operational availability of MRAP vehicles. FSRs capacitated the DoD to field MRAPs without trained maintenance personnel at the organizational level. Acceptance of this risk was based on urgent need. The process of maintaining the MRAP fleet also was leveraged on FSR knowledge and the skills of the U.S. military mechanics. The latter already possessed basic automotive maintenance skills for working on MRAPs, which is one facet of the JPO-accepted risk of fielding vehicles before developing a maintenance-training program.

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V. SUPPLY CHAIN

A. MANUFACTURING SUPPLY CHAIN

1. Industrial Capacity

In April 2007, the first MRAP vehicle industrial capabilities assessment (ICA) was issued by the Defense Contract Management Agency's (DCMA) Industrial Analysis Center. The goal was to make an initial assessment, analyzing the industrial base to determine the maximum capacity for MRAP vehicle production.

On June 1 2007, the Secretary of Defense approved a DX rating for the MRAP program, this assured priority access to available material for MRAP Manufactures. The DX rating provides the most important DoD programs priority access to scarce production resources; however, it does not resolve fundamental production capacity shortfalls. For the MRAP production, industry leaned forward to increase their capacity in several areas by teaming, renting and buying new space and capital equipment. They also engaged their subcontractors to ensure the subcomponents were ordered and received and available to support the increase in production in the coming months.

In July 2007, Bill Greenwell, Deputy Undersecretary of Defense for Industrial Policy tasked DCMA to update its study and conduct an industrial capability assessment on MRAP prime contractors, and their subcontractors. This study determined the production capacity and delivery capabilities necessary to meet a goal of producing 1,300 MRAP's per month, starting in December 2007. The assessment was completed in September 2007, and concluded that industry's production capability in December 2007 should be between 1,000 and 1,300 per month, which met the requirement of 1,300 per month.

There were initially two primary bottlenecks of concerns in terms of supplies available for manufacturing; they were in the area of tires and steel. In July 2007, production capacity of tires for MRAP class vehicles was less than 1,000 tires per month

but by January 2008 through the efforts of several DoD organizations and the tire manufacturers, MRAP vehicle tire capacity had increased from 1000 to about 17,000 tires per month. This was accomplished by adding Goodyear as a second source to and also the addition of more tire molds at both Michelin and Goodyear. This production rate was believed to provide sufficient capacity to meet projected production rates, and to sustain the vehicles in the field.

Also of concern in manufacturing supplies, was armor plate and high strength steel plate. The United States has production rate of approximately 8,000,000 tons per month. The total DoD demand for steel of was only approximately 21,000 tons per month which is only a fraction of the US total monthly production, there is still, however, a problem.. The issue is, the Defense Department has unique, niche requirements for armor steel plate and thin gauge, quenched and tempered steel. These specialty steels require unique processes and special equipment. and these are not available at plants producing commercial grade steel for the general global market. This demand for specialty steel products at high volume of production, created spot capacity shortages that not only affected MRAP but also other defense programs.

The Department's Priority Allocation of Industrial Resources (PAIR) Task Force was responsible for managing these industrial scarce supply issues. With their assistance, the industrial base was able to increase capacity for specialty steel and to stabilize production rates, avoiding much of the potential material shortfall in steel plate. When the MRAP program began, compliant domestic sources were only able to produce about 8,400 tons of this specialty steel required per month. To increase this capacity, slight specification changes were made to raise throughput and encouraged steel producers to make capital investments.

In the cases where domestic source restrictions limited access to the steel need, there 73were waiver processes available to tap non-compliant domestic sources as well as reliable non-domestic sources.

10 U.S.C. Section 2533b prohibits the DoD from procuring end items, or components thereof, containing specialty metals not melted or produced in the United

States. Section 2533b contains several exceptions, one of which states that the prohibition does "not apply to procurements outside the United States in support of combat operations or in support of contingency operations" (Young, 2007).

On May 22, 207, Dr. Delores Etter, the Navy Acquisition Executive, formally determined that this exception applied to MRAP vehicles supporting ongoing contingency operations in Southwest Asia and the Middle East. She also determined that this exception also applied to MRAP vehicles not in theater but used to for vehicle testing and those MRAPs used vehicles operator or troop training. This exception was not invoked for other similar ground vehicle programs such as Stryker and Bradley.

By January 2008, the DoD had access to about 20,900 tons per month of armor steel plate and thin gauge, quenched and tempered steel. This supply essentially met production demands.

There were other supply resources that were in short supply; however none prove to be challenging as the tires, wheels and steel shortages. After the shortages in these areas were overcome, monthly production schedules for MRAP were always met.

B. SUPPLY SUPPORT OF FIELD OPERATIONS

Because of the rapid acquisition and fielding of the MRAPs, the JMVP employed an Organic/Contractor Logistics Support (CLS) hybrid approach for supply support of the MRAP fleet in theater (Figure 9). This hybrid approach used a combination of military and civilian personnel, in addition to Field Service Representative (FSRs) from the different manufactures, and commercial logistics products and skills. These were to be used as an interim until it would be possible to implement a total organic capability.

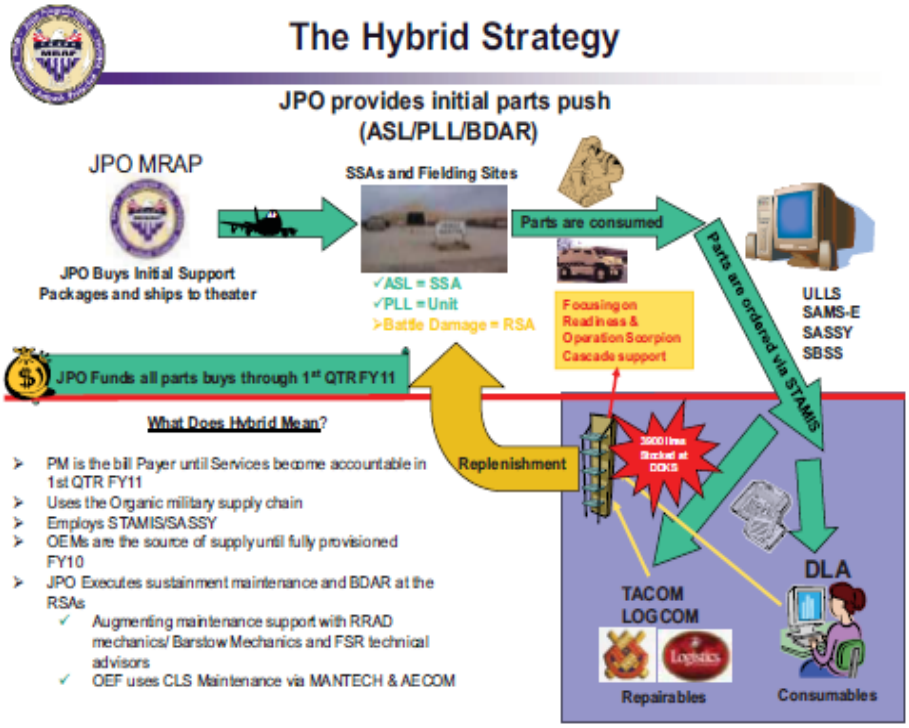

Figure 9. Hybrid Strategy (From JSP, 2010)

The Supply Support goal for the MRAP Family of Vehicles was to acquire Parts though the DoD supply chain. The Joint MRAP Vehicle Program JMVP was responsible for managing the Contractor Logistic Support (CLS) and activities required to transition all support for MRAP spare parts into the DoD Supply System (Figure 10).

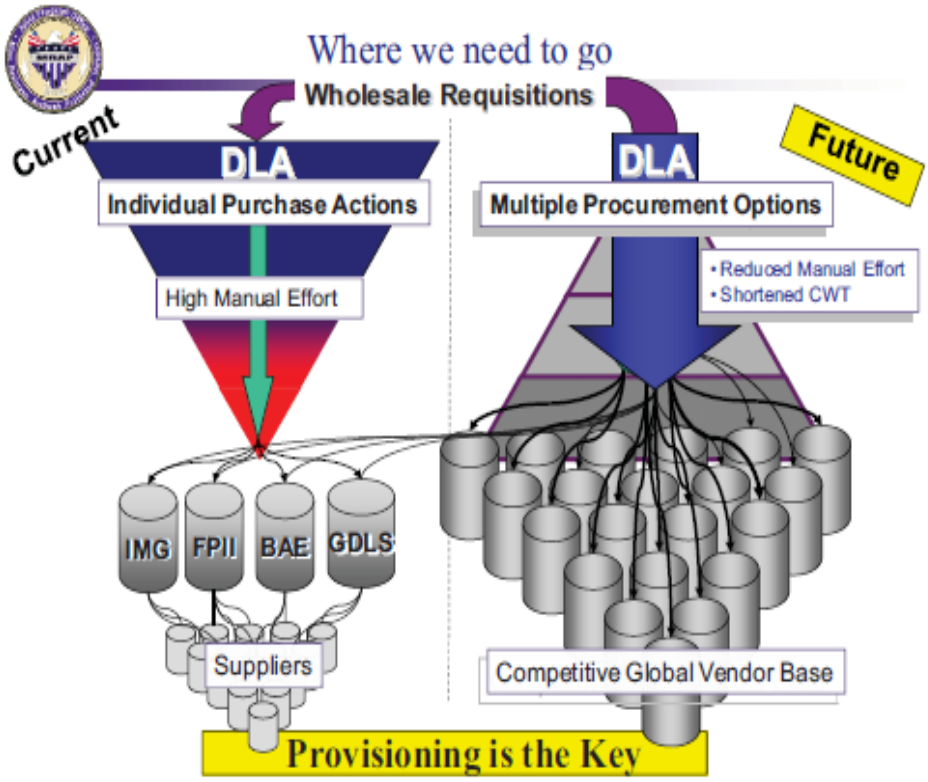

Figure 10. Maturing Supply Chain (From JSP, 2010)

The MRAP Supply Support was executed in a phased manner. Initially, the JMVP, Services and Defense Logistics Agency (DLA) purchased parts from original equipment manufacturers, (OEM) and provisioning data was received and validated by DLA. The Services would procure items from the appropriate supply chain sources. An MRAP Supply Chain Integrated Process Team (IPT) was formed, and it served as an overarching forum to coordinate logistical issues such as transportation, vendor capacity and priorities issues. It also monitored warfighter system issues, contracting methodologies, as well as forecasted requirements for parts.

In order for the government to complete provisioning it purchased the necessary data to include provisioning technical documentation, and engineering data for provisioning. The supply support and provisioning path is shown in Figure 11.

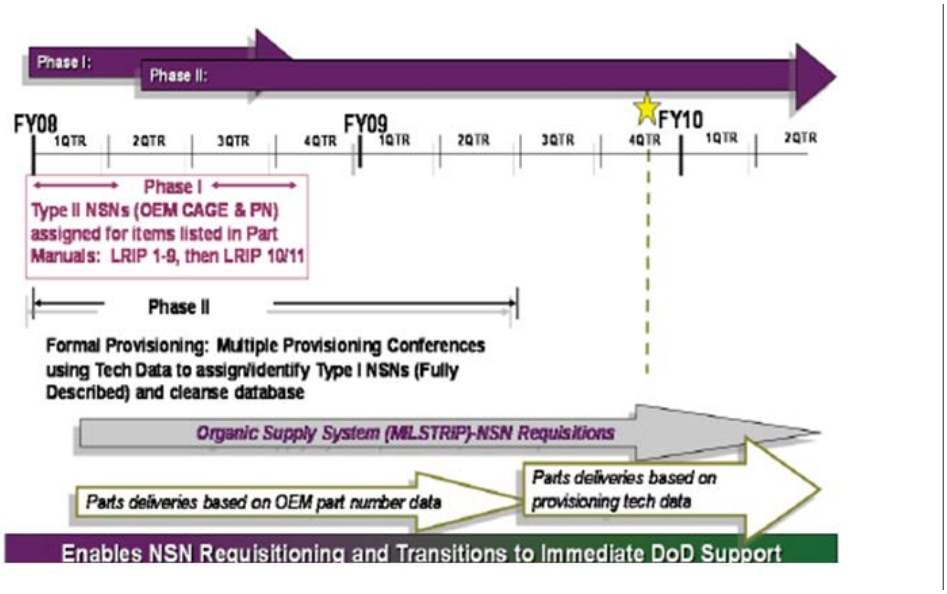

Figure 11. Supply Chain Evolvement (From JSP, 2010)

The JPO funded sustainment spares at the wholesale and retail levels and initial spares in Allowed Stockade List (ASL)/Prescribed Load List (PLL) blocks. As previously discussed, the intent was for the MRAP FoVs to be supported using the current logistics and maintenance structures already established within each Services' policies and to obtain repair parts available though their respective supply systems. Each Service had theater procedures in place to determine when a vehicle has an operational failure and requires a spare part (Figure 12).

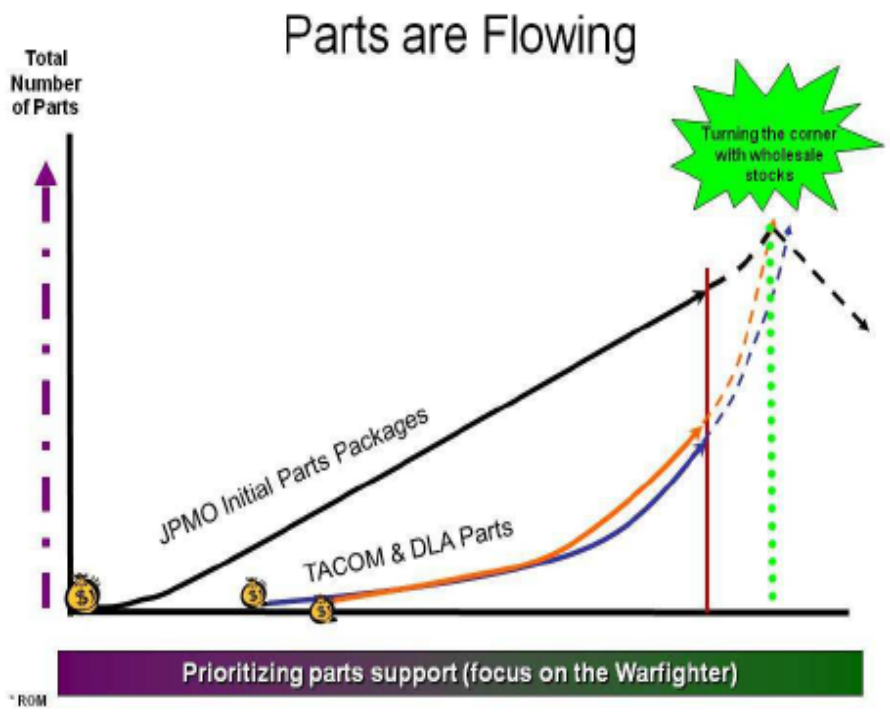

Figure 12. Repair Parts Flow (From JPO, 2010)

Deployment spares facilitate vehicle repairs while deployed, and to maintain the required reorder point . Parts data and demand history was initially a responsibility of the CLS Program. They were responsible for insuring proper spares stockage and distribution plans were in place. Determination of sustainment spares stockage level was based on anticipated consumption rates. To meet the deployment requirements, sustainment spares are configured as follows:

- PLL. The PLL consists of operational spares, bench stock, and consumables such as, fuses, fan belts, filters, and bulbs.
- ASL. The ASL consists of Class IX secondary items, reparables, bench stock, and consumable spares in support of organizational PLLs. ASL is held on the stock record account of each supporting Supply Support Activity.

1. Consumable Item Support

DLA was the source used for the management and procurement of consumable item support. The DLA was an integral member of the MRAP Supply Chain IPT and coordinated closely with the JMVP to provide consumable items needed to insure that vehicles were quickly returned to a fully mission capable status. In order to maintain organic support so that orders could be processed through normal channels, DLA established stock numbers, initiated buys and placed consumables on the shelves for MRAP vehicle support in advance of final provisioning completion. The JMVP formulated a Part Support Concept of Operations that outlined the organizational responsibilities and processes to provide optimal support to the warfighter regarding dead-lined vehicles. The DLA was an integral part of the solution, along with the vehicle OEMs which used an expeditious Emergency Buy process to quickly buy parts identified on deadline reports.

2. Depot Level Reparable

It was agreed that the Service assigned as Primary Inventory Control Activity (PICA) would be responsible for supporting Depot Level Reparable (DLRs) that had been provisioned and were being supported through normal supply channels. The USMC was designated as the primary inventory control activity (PICA) for Cougars and the US Army (TACOM) was designated the PICA all the other MRAP vehicles.

3. Provisioning

Provisioning includes technical identification of items for maintenance support Considerations, the source of supply and/or the manufacturers of the items. Part-numbered or non-system NSNs (local NSNs) would be processed to Director for Logistics (DOL) via Supported Activity Standard Supply System/Standard Army Management Information System (SASSY/STAMIS). . The local NSN/part-numbered item would be procured from commercial suppliers and the appropriate Military Standard Requisitioning and Issue Procedures (MILSTRIP) status would be given to the unit that entered the requisition. Upon completion of catalog action requests, all files would be

updated with assigned NSNs. The purchases of these parts would be reported to the Integrated Material Manager (IMM) in order to maintain accurate demand records.

4. Initial Supply Support Package for Fielding

MRAP vehicles were initially deployed with the OEM supplying the majority of major Assemblies/subassemblies and parts to maintain the vehicle. Each vehicle was suppose to have a 90-day Consumables Block and a set of a one year worth of Forward Deployed Blocks, These block that consisted of both consumable and repair part items. In addition, Maintenance Workshop Blocks (MWB) were supplied at a ratio of 1:10 vehicles, consisting of consumables, repair parts, and major assemblies/subassemblies. The MRAP vehicle has now been shifted to an ASL/PLL support system and the ASL/PLL packages are provided at a ratio of 1:25 vehicles.

- PLL/Shop Stock. The PLL consists of operational spares, bench stock and consumables.
- PLL is held on the stock record account of the supporting Joint Supply Support Center (JSSC).
- ASL. The ASL consists of Class IX repair parts, reparables, bench stock and Consumable spares. ASL is held on the stock record account of the supporting Supply Support Activity.
- Battle Damage Parts. The BDAR parts are items necessary to repair battle damaged vehicles in Theatre. Battle Damage Parts Blocks are held by the JVP RSA facilities.

Initial support package and pre-fielding support parts vendors for the MRAP sent kits to Defense Distribution Depot, Red River, Texas (DDRT), with the exception of most FPII parts, which were held by LOGCOM Albany prior to shipment? The parts for air shipment at DDRT would be entered into Facilities Assets Catalog and Tracking System for airlift clearance and processed for truck transportation to Charleston Air Force Base (AFB). From there these parts would be airlifted by the Air Mobility Command in support of OIF and OEF. The cargo was tagged and tracked by means of a Radio Frequency Identification Device (RFID). A shipping schedule was also provided to United States Transportation Command for advanced notification to the Tanker Airlift Control Center.

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VI. MRAP PRODUCTION COST

On October 1, 2012, a ceremony was held at the Pentagon to mark the end of production all vehicles in the MRAP program. Nearly 28,000 vehicles from several different manufactures and several different versions had been produced in the preceding five years, and 24,059 of those vehicles had been fielded to Iraq and Afghanistan. In total, from the program's inception in 2007 through FY12, $47.4 billion had been appropriated. These vehicles have been credited with saving thousands of lives.

This chapter depicts only manufacturing and modification costs. Operations and Support Costs are not discussed in this report. Cost benefit analysis of MRAP has been the subject of other research, and will not be analyzed in this report.

A. MRAP BASIC COST WITHOUT GFE

To expedite the fielding of the MRAPs to the warfighters, these vehicles were ordered from the OEMs without GFE, which was integrated into the vehicles after delivery to the government. The average cost of a MRAP without GFE was a little over $500,000.

The following charts show the individual MRAP cost per vehicle starting in FY2007 through FY2011; these are individual vehicle prices divided by category, OEM, and Low Rate Initial Production (LRIP). Figures 13–22 were taken from a Booz Allen MRAP Business and Financial Management (BMF) Team briefing on February 6, 2012. See Appendix D for photos and average cost of MRAPs by category.

FY	LRIP	OEM	CAT I	CAT II	CAT III	M-ATV
FY07 $	LRIP 1	BAE	$542,100	$629,800		
		FPII	$510,540	$570,364	$699,139	
	LRIP 2	OTC	$306,199			
		PVI	$622,974			
		GDLS		$550,533		
	LRIP 3	FPII	$444,311	$530,122		
	LRIP 4	FPII			$699,139	
		IMG	$519,228			
	LRIP 5	FPII	$474,598	$570,364		
		IMG		$530,811		
	LRIP 6	BAE		$479,800		
		BAE (Ambulance)		$776,800		
		BAE (SOCOM)	$498,200			
	LRIP 7	AH	$443,000	$457,599		
		IMG	$548,172			
	LRIP 8	FPII	$510,540	$570,364		
		GDLS-C	$559,581			

Figure 13. FY2007 Production—Per Vehicle (Unit) Costs

FY	LRIP	OEM	CAT I	CAT II	CAT III	M-ATV
FY08 $	LRIP 9	BAE		$479,800		
		FPII	$444,311	$530,122		
		IMG	$537,241			
		BAE (Ambulance)		$776,800		
		BAE (SOCOM)	$498,200			
	LRIP 10	AH (BAE-TVS)	$457,599			
		BAE		$479,800		
		FPII	$510,540	$570,364		
		IMG	$537,241			
	LRIP 11	BAE-TVS	$470,542			
		BAE		$488,500		
		FPII	$526,816	$587,938	$699,139	
		IMG	$535,085			
		BAE (Ambulance)		$794,200		
		IMG (Ambulance)	$557,224			
		BAE (SOCOM)	$514,500			
		BAE (SOCOM) (AUV)	$1,206,526			
	LRIP 12	FPII	$526,816	$587,938		
		GDLS-C	$572,886			
		BAE		$638,600		
		BAE (Ambulance)		$944,300		
		BAE (SOCOM)	$613,000			
	LRIP 13	FPII	$526,816	$570,364	$864,653	
		GDLS-C		$576,302		
		Navistar	$529,610			

Figure 14. FY2008 Production—Per Vehicle (Unit) Costs

FY	LRIP	OEM	CAT I	CAT II	CAT III	M-ATV
FY09 $	LRIP 14	Navistar	$529,610			
	LRIP 15	Oshkosh				$434,445
FY10 $	LRIP 16	Oshkosh				$434,445
	LRIP 17	Oshkosh				$430,408
		Navistar	$572,826			
		GDLS-C	$593,703			
		BAE (SOCOM)	$633,600			
		BAE (SOCOM) (AUV)	$1,746,300			
	LRIP 18	GDLS-C	$593,703			
		FPII	$557,562	$621,185		
		BAE (SOCOM)	$998,096			
		Oshkosh				$430,408
FY11 $	LRIP 19	Navistar	$595,739			
		Oshkosh				$430,408
		Oshkosh (SOCOM)				$461,074
	LRIP 20	Navistar (MRV)	$774,639			
	LRIP 21	Navistar	$572,826			
		Oshkosh (w/UIK)				$560,274
	LRIP 22	Oshkosh (w/UIK)				$560,274
	LRIP 23	Navistar (MRV)	$804,010			

Figure 15. FY2009–2011 Production—Per Vehicle (Unit) Costs

LRIP	OEM	CAT I	CAT II
LRIP 1	FPII	$510,540	$570,364
LRIP 3	FPII	$444,311	$530,122
LRIP 5	FPII	$474,598	$570,364
LRIP 8	FPII	$510,540	$570,364
LRIP 9	FPII	$444,311	$530,122
LRIP 10	FPII	$510,540	$570,364
LRIP 11	FPII	$526,816	$587,938
LRIP 12	FPII	$526,816	$587,938
LRIP 13	FPII	$526,816	$570,364
LRIP 18	FPII	$557,562	$621,185

Figure 16. Cougar Per Vehicle (Unit) Costs by LRIP

LRIP	OEM	M-ATV
LRIP 15	Oshkosh	$434,445
LRIP 16	Oshkosh	$434,445
LRIP 17	Oshkosh	$430,408
LRIP 18	Oshkosh	$430,408
LRIP 19	Oshkosh	$430,408
LRIP 19	Oshkosh (SOCOM)	$461,074
LRIP 21	Oshkosh (w/UIK)	$560,274
LRIP 22	Oshkosh (w/UIK)	$560,274

Figure 17. M-ATV Per Vehicle (Unit) Costs by LRIP

LRIP	OEM	CAT I	CAT II
LRIP 4	IMG	$519,228	
LRIP 5	IMG		$530,811
LRIP 7	IMG	$548,172	
LRIP 9	IMG	$537,241	
LRIP 10	IMG	$537,241	
LRIP 11	IMG	$535,085	
LRIP 11	IMG (Ambulance)	$557,224	
LRIP 13	Navistar	$529,610	
LRIP 14	Navistar	$529,610	
LRIP 17	Navistar	$572,826	
LRIP 19	Navistar	$595,739	
LRIP 21	Navistar	$572,826	

LRIP	OEM	CAT I
LRIP 20	Navistar (MRV)	$774,639
LRIP 23	Navistar (MRV)	$804,010

Figure 18. MaxxPro Per Vehicle (Unit) Costs by LRIP

LRIP	OEM	CAT I	CAT II
LRIP 7	AH	$443,000	$457,599
LRIP 10	AH (BAE-TVS)	$457,599	
LRIP 11	BAE-TVS	$470,542	

Figure 19. Caiman Per Vehicle (Unit) Costs by LRIP

LRIP	OEM	CAT III
LRIP 1	FPII	$699,139
LRIP 4	FPII	$699,139
LRIP 11	FPII	$699,139
LRIP 13	FPII	$864,653

Figure 20. Buffalo Per Vehicle (Unit) Costs by LRIP

LRIP	OEM	CAT I	CAT II
LRIP 2	GDLS		$550,533
LRIP 8	GDLS-C	$559,581	
LRIP 12	GDLS-C	$572,886	
LRIP 13	GDLS-C		$576,302
LRIP 17	GDLS-C	$593,703	
LRIP 18	GDLS-C	$593,703	

Figure 21. RG-31 Per Vehicle (Unit) Costs by LRIP

LRIP	OEM	CAT I	CAT II
LRIP 1	BAE	$542,100	$629,800
LRIP 6	BAE		$479,800
LRIP 9	BAE		$479,800
LRIP 10	BAE		$479,800
LRIP 11	BAE		$488,500
LRIP 12	BAE		$638,600

LRIP	OEM	CAT I	CAT II
LRIP 6	BAE (Ambulance)		$776,800
LRIP 9	BAE (Ambulance)		$776,800
LRIP 11	BAE (Ambulance)		$794,200
LRIP 12	BAE (Ambulance)		$944,300

LRIP	OEM	CAT I	CAT II
LRIP 6	BAE (SOCOM)	$498,200	
LRIP 9	BAE (SOCOM)	$498,200	
LRIP 11	BAE (SOCOM)	$514,500	
LRIP 12	BAE (SOCOM)	$613,000	
LRIP 17	BAE (SOCOM)	$633,600	
LRIP 18	BAE (SOCOM)	$998,096	

LRIP	OEM	CAT I	CAT II
LRIP 11	BAE (SOCOM) (AUV)	$1,206,526	
LRIP 17	BAE (SOCOM) (AUV)	$1,746,300	

Figure 22. RG-33 Per Vehicle (Unit) Costs by LRIP

B. MRAP BASIC COST OF GFE INSTALLED

The addition of GFE to the basic MRAP delivered from the OEM would typically add between $171,000 to $522,000, depending on the service branch and the mission profile of the particular MRAP. The Army typically purchased the least amount GFE for installation, whereas the United States Special Operations Command (USSOCOM) purchased the most, on average $522,000 per vehicle (according to the Department of Defense FY2008 Budget Amendment for Global War on Terror (GWOT), *Request Budget Justification Mine Resistant Ambush Protected (MRAP) Vehicles,* July 2007).

- Government Furnished Equipment (GFE) items included IED jammers, intra-vehicle communication systems, radios, and tracking systems. The GFE items vary among the Services, which affects the overall unit price of the vehicle.
- Army removed some GFE such as radios, tracking and surveillance systems from High Mobility Multipurpose Wheeled Vehicle's (HMMWV) being replaced in theater and installed that GFE into the MRAP, which decreased the Army's GFE cost per vehicle.
- The Army and Marine Corps agreed to standardize GFE turret and intra-vehicle communication systems, while also adopting radio and jammer installation kits that allowed interchangeability.
- Only USSOCOM installed a Remote Weapon Station (RWS), which cost $235,000 per vehicle and greatly increased the GFE per vehicle compared to the Services.
- Table 2 provides an estimated unit cost of the GFE by Service.

Table 2. Estimated Unit Cost of GFE by Service

Service	Estimated GFE Unit Cost Per Vehicle (Dollars in Thousands)
Army	$171
Navy	$300
Marine Corps	$280
Air Force	$297
USSOCOM	$522

C. MRAP BASIC MODIFICATIONS COST

There were several major modifications necessary once the MRAPs had been fielded. Appendix E provides a number of major modifications, the contract number, and unit cost.

VII. CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

This project was conducted to determine if the Accelerated Acquisition Program used in the MRAP program should be a model for future DoD major military systems. The following three questions were asked.

1. Question 1: What are the Benefits of the MRAP Accelerated Acquisition Program in Terms of Mission Requirements, Speed Of Fielding, Maintenance Support, Supply Chain, and Production Cost of Acquisition Afforded the End User (Warfighter)?

The foremost benefit afforded the warfighter in terms of mission requirements was that of survivability, and the saving of Soldiers' and Marines' lives. To this end, the MRAP has performed admirably. Although the lives saved is a difficult metric to calculate precisely, the JPO for the MRAPs estimates that as many as 40,000 lives were saved; 10,000 in Iraq, and 30,000 in Afghanistan. In terms of the benefits produced by the speed of fielding, again, saving lives would be the most important, if imprecise, metric. The time from the initial requirement to the first units appearing in the field was only 18 months. A process that normally takes years under the traditional DoD acquisition system was accomplished in a matter of months.

Maintenance support also was designed to save time. Turning to Field Service Representatives (FSR) contractor-maintainers, often former service members, maintenance support could be put in place expeditiously. Since maintenance training for a new piece of equipment is typically done prior to fielding, using FSRs allowed the MRAPs to be ushered into operation much faster because much less time was required to train FSRs than would have been required to set up and fill the pipeline for MRAP maintenance schools. Supply support, initially provided by initial spares, was not adequately provisioned at the onset, and, not surprisingly, resulted in the Original

Equipment Manufacturers' (OEM) being the main source for repair parts, making them more difficult to get and expensive. Parts shortages meant no real benefit was derived for the warfighter in this area.

2. Question 2: What are the Shortcomings of the MRAP Accelerated Acquisition Program in Terms of Mission Requirements, Speed of Fielding, Maintenance Support, Supply Support, and Total Cost of Acquisition Afforded the End User (Warfighter)?

The shortcomings of the MRAP as a result of the accelerated acquisition program were many. In the area of mission requirements, there were numerous shortcomings. The major reason for so many shortcomings resulted because of the inherent tradeoffs necessary in the accelerated acquisition process used by the MRAP program. The MRAP entered the DoD Acquisition Life Cycle at Milestone C and testing, which was limited, was done concurrently with manufacturing and fielding. Many mission requirement shortcomings, such as inadequate suspension, rollover tendencies, and unsuitability for off road operations, would have been detected and resolved in the traditional testing phase. Because MRAP used the accelerated acquisition process, these shortcoming were not discovered until after fielding, making it necessary for numerous modifications and redesigns. Applying these took the MRAP out of service while being repaired. FSRs provided maintenance support; although this support assisted in the speed of fielding, it is not without its downside. One downside was the enormous cost. However, even more important than cost, was that of limitation in terms of where on the battlefield contractors were allowed to go. Equipment damaged in the combat areas was, in many cases, evacuated back to secure bases where the FSRs were located, to be repaired. In addition, supply support became a major shortcoming. Again, supply support was not initially provisioned for as the OEMs had only a limited supply of parts. Contracts to manufacture additional repair parts were not put in place until after the initial MRAPs were fielded. The other problem was that several different variants existed, which also negatively impacted supply support, increasing the logistics footprint on the battlefield. The total lifecycle cost of the MRAP program is still unknown and probably will not be determined

for years to come. However, the initial acquisition cost and average MRAP plus Government Furnished Equipment (GFE) is about 1.5 million dollars, as compared to the HMMWV that it replaced at $360,000.

3. Question 3: Were Benefits Sufficient to Indicate That the MRAP Accelerated Acquisition Program Should Be A Model For Future DoD Major Military Systems?

The biggest and most important benefit was that it saved many lives and the argument can be posed that this savings alone made it a success. The accelerated acquisition process the MRAP program utilized was able to place lifesaving MRAPs into the hand of the warfighters in 18 months from the time the contracts were signed. This shaved years off of the traditional time that it normally takes to develop and field a military system. The fact that the program was responsible for saving many lives and reducing injuries cannot be disputed. However the question remains, "Is this a system that we can use as a model for future major military acquisitions?" It is true that the traditional DoD Life Cycle Management System, which moves a system from cradle to grave, typically takes an average of 7–15 years to field a system. However, these systems that make it through this process often remain in use for 30–40 years or more. In the case of the MRAP and the accelerated acquisition process, after 5 years MRAP production has been ended and only a small percentage of those MRAPs produced are likely to remain in the system. This does not provide a model for future purchasing of future major military systems. This program was done for expediency; it was an emergency, and something was needed fast. This situation was a case of "do you want it fast or do you want it completely right?" In the case of the MRAP and the accelerated acquisition process, the choice was fast, and as a result, many things were not completely as we would like it. "If you want it bad, you'll get it bad." These shortcomings would have to be fixed later at increased cost and equipment down time.

B. RECOMMENDATIONS

Should the DoD continue to pursue shorter acquisition processes, it is recommended that further studies be conducted concerning well known practices, such

as: selection of non-developmental alternatives; dependence on mature technologies; tight controls on proliferation of user requirements; and system improvement through evolutionary acquisition. Specific criteria must be established for determining if a particular item would be better suited for rapid acquisition or the traditional acquisition process. Items that are more fully developed, using current technologies (referred to as commercial-off-the-shelf (COTS) and non-developmental items (NDI)), and already proven in terms of their usefulness may be an ideal fit for an accelerated acquisition, whereas something that needs to be developed would be better suited for development via the traditional DoD life cycle acquisition process. It should be understood that both the accelerated acquisition process and the traditional DoD life cycle acquisition process are useful, but under different circumstances. We need to understand that there is not just one right way and one wrong way. There are many potential right ways to accomplish a particular end; the primary concern is that of efficiently and effectively obtaining the desired results and the understanding and the willingness to accept that there will always be tradeoffs. In the case of the traditional life cycle acquisition process, the major tradeoff is that it takes a long time, but usually arrives at least the 8 percent solution. With the accelerated acquisition process, results can be achieved fast, but the tradeoff is that the solution may be only a 40–50 percent solution and require later changes and modifications. Both the accelerated acquisition process and the traditional acquisition process work; we just need to understand and accept the tradeoffs.

APPENDIX A. HISTORICAL PRODUCTION QUANTITY PROFILES

LRIP 1: (February 2007) (215 vehicles – 592 total)

☐Procured 125 vehicles from FPII (CAT I & II Cougars)

☐Procured 90 vehicles from BAE (CAT I & CAT II RG-33)

LRIP 2: (February 2007) (180 vehicles – 772 total)

☐Procured 20 CAT I from GDLS for Test

☐Procured 100 CAT I from OTC for Test

☐Procured 60 CAT I from PVI for Test

LRIP 3: (April 2007) (1,000 vehicles – 1,772 total)

☐Procured 772 CAT I Cougar (FPII) for the USMC

☐Procured 228 CAT II Cougar (FPII) for the USMC

LRIP 4: (May 2007) (1,214 vehicles – 2,986 total)

☐Procured 14 CAT III Buffalo (FPII) for the USMC

☐Procured 1194 CAT I MaxxPro (Navistar) for the Army

☐Procured 6 CAT I MaxxPro (Navistar) for Test

LRIP 5: (June 2007) (471 vehicles – 3,457 vehicles)

☐Procured 223 CAT I Cougar (FPII) for the USMC

☐Procured 60 CAT II Cougar (FPII) for the USMC

☐Procured 10 CAT II MaxxPro (Navistar) for the Army

☐Procured 172 CAT I Cougar (FPII) for the Navy

☐Procured 6 CAT II MaxxPro (Navistar) for Test

LRIP 6: (June 2007) (441 vehicles – 3,898 total)

☐Procured 5 RG-33 Ambulances (BAE) for the USMC

☐Procured 11 RG-33 Ambulances (BAE) for the Army

☐Procured 1 RG-33 CAT I (BAE) for the Army

☐Procured 169 RG-33 CAT I (BAE) for SOCOM

☐Procured 255 RG-33 CAT II for the Army

LRIP 7: (July 2007) (1,925 vehicles – 5,823 total)

☐Procured 1170 CAT I Caiman (BAE-TVS) for the Army & Test

☐Procured 755 CAT I MaxxPro (Navistar) for the Army & Test

LRIP 8: (August 2007) (725 vehicles – 6,548 total)

☐Procured 100 CAT II Cougar (FPII) for the USMC

☐Procured 600 CAT I RG-31 (GDLS-C) for the Army

☐Procured 25 CAT I Cougar (FPII) for the USAF

LRIP 9: (October 2007) (2,400 vehicles – 8,948 total)

☐Procured 399 RG-33 (BAE) for the Army

☐Procured 112 RG-33 Ambulance (BAE) for the Army

☐Procured 89 RG-33 (BAE) for SOCOM

☐Procured 800 Cougar vehicles from FPII

☐Procured 703 MaxxPro vehicles from Navistar for the Army

☐Procured 297 MaxxPro vehicles from Navistar for the USAF

LRIP 2 Adjustment: (December 2007) (-174 vehicles – 8,774 total)

☐Discontinued the 100 Oshkosh CAT I vehicles from Test

☐Discontinued the 60 PVI CAT I vehicles from Test

☐Reduced the GDLS CAT I requirement from Test by 14

LRIP 10: (December 2007) (3,138 vehicles – 11,912 total)

☐Procured 358 Cougars (FPII) to the USMC

☐Procured 668 CAT I Caiman (BAE-TVS) to the Army

☐Procured 1500 CAT I MaxxPro (Navistar) to the Army

☐Procured 600 CAT II RG-33 (BAE) to the Army

LRIP 11: (March 2008) (2,283 vehicles – 14,195 total)

☐Procured 29 CAT III Buffalo (FPII) for the USMC

☐Procured 1024 CAT I Caiman (BAE-TVS) for the Army

☐Procured 743 MaxxPro (Navistar) for the Army, USAF, and Test

☐Procured 487 RG-33 (BAE) to the Army, SOCOM and Test

LRIP 12: (July 2008) (825 vehicles – 15,020 total)

☐Procured 4 Cougar A2s (FPII) for Test

☐Procured 2 Buffalo (FPII) for Test

☐Procured 4 MaxxPro Dash (Navistar) for Test

☐Procured 2 Caiman (BAE-TVS) for Test

☐Procured 773 RG-31 (GDLS-C) for the Army and SOCOM and Test

☐Procured 40 RG-33 (BAE) for SOCOM

LRIP 13: (September 2008) (848 vehicles – 15,868 total)

☐Procured 8 CAT III Buffalos (FPII) for the USMC

☐Procured 13 Cougars (FPII) for Test

☐Procured 5 RG-31 (GDLS-C) for the Army and Text

☐Procured 822 MaxxPro CAT I (Navistar) for the Army

LRIP 14: (November 2008) (400 vehicles – 16,268 total)

☐Procured 400 MaxxPro CAT I (Navistar) for the USMC

Pre-LRIP 15 Requirements Adjustment (2010) (-30 vehicles – 16,238 total)

☐Adjustment to account for inter-service loans and reprogramming of CAT I and CAT II acquisition

Requirements

LRIP 15: (October 7, 2009) (5,244 vehicles – 21,512 total)

☐Procured 1565 M-ATV (Oshkosh) for the USMC

☐Procured 2598 M-ATV (Oshkosh) for the Army

☐Procured 65 M-ATV (Oshkosh) for the Navy

☐Procured 280 M-ATV (Oshkosh) for the USAF

☐Procured 643 M-ATV (Oshkosh) for SOCOM

☐Procured 93 M-ATV (Oshkosh) for Test

LRIP 16: (October, 30 2009) (1,408 vehicles – 22,882 total)

☐Procured 1,333 M-ATV (Oshkosh) for the Army (includes 8 USAF reduction)

☐Procured 23 M-ATV (Oshkosh) for the USMC

☐Procured 52 M-ATV (Oshkosh) for the Navy

LRIP 17: (January 29, 2010) (2,818 vehicles – 25,700 total)

☐Procured 1,460 M-ATV (Oshkosh) for the Army

☐Procured 1,050 MaxxPro Dash (Navistar) for the Army

☐Procured 250 RG-31A3 (GDLS-C) for the Army

☐Procured 58 RG-33 (BAE) for SOCOM

LRIP 18: (June 28, 2010) (21 vehicles – 25,839 total)

☐Procured the authorized quantities in JDAB (May 10, 2010)

☐Procured 5 RG-31A3 (GDLS-C) for Test

☐Procured 6 RG-31A2 (GDLS-C) for Test

☐Procured 3 Cougar CAT I A2 (FPII) for Test

☐Procured 3 Cougar CAT II A2 (FPII) for Test

☐Procured 4 M-ATV (Oshkosh) for Test

LRIP 19: (October 22, 2010) (507 vehicles – 26,346 total)

☐Procured 175 MaxxPro Dash (Navistar) for the Army

☐Procured 250 M-ATV (Oshkosh) for the Army

☐Procured 82 M-ATV (Oshkosh) for SOCOM

LRIP 20 (Modified) (November 16, 2010) (236 vehicles – 26,552 total)

☐Repeated previous MRV (Navistar) Test Requirement, but reduces the quantity by 4

☐Procured 225 MRV (Navistar) for the Army

☐Procured 15 MRV (Navistar) for the USMC

LRIP 21: (March 8, 2011) (648 vehicles – 27,200 total)

☐Procured 177 M-ATV (w/UIK) (Oshkosh) for the Army

☐Procured 471 MaxxPro Dash (Navistar) for the Army

LRIP 22: (June 20, 2011) (400 vehicles – 27,600 total)

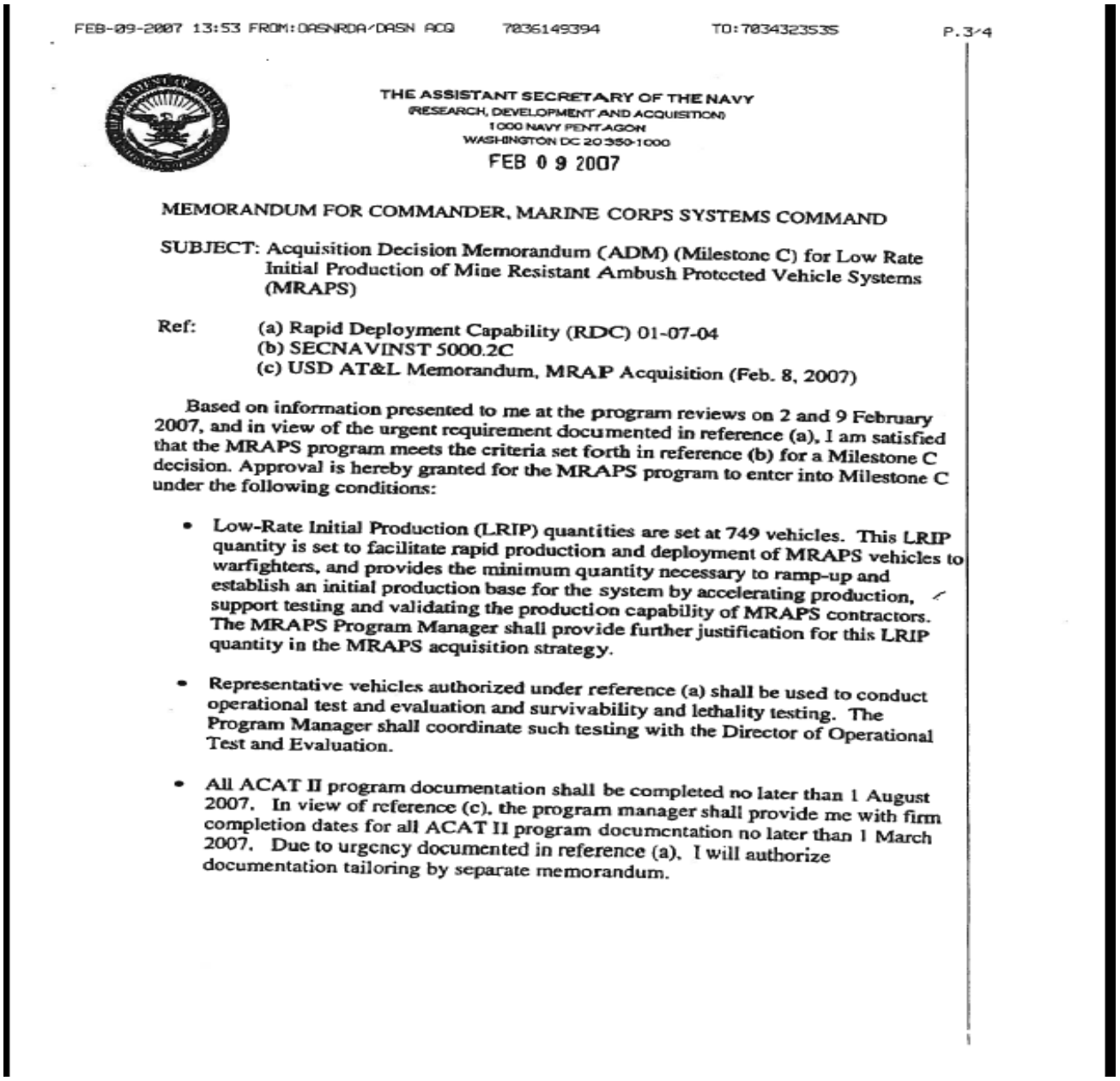
☐Procured 100 M-ATV (w/UIK) (Oshkosh) for the USMC

☐Procured 300 M-ATV (w/UIK) (Oshkosh) for the Army

LRIP 23: (July 1, 2011) (140 vehicles – 27,740 total)

☐Procured 140 MRV (Navistar) for the Army

APPENDIX B. ACQUISITION DECISION MEMORANDUM FOR MRAPS



FEB-09-2007 13:53 FROM:DASNRDA/DASN ACQ 7036149394 TO:7034323535 P.3/4

THE ASSISTANT SECRETARY OF THE NAVY
(RESEARCH, DEVELOPMENT AND ACQUISITION)
1000 NAVY PENTAGON
WASHINGTON DC 20350-1000

FEB 0 9 2007

MEMORANDUM FOR COMMANDER, MARINE CORPS SYSTEMS COMMAND

SUBJECT: Acquisition Decision Memorandum (ADM) (Milestone C) for Low Rate Initial Production of Mine Resistant Ambush Protected Vehicle Systems (MRAPS)

Ref: (a) Rapid Deployment Capability (RDC) 01-07-04
(b) SECNAVINST 5000.2C
(c) USD AT&L Memorandum, MRAP Acquisition (Feb. 8, 2007)

Based on information presented to me at the program reviews on 2 and 9 February 2007, and in view of the urgent requirement documented in reference (a), I am satisfied that the MRAPS program meets the criteria set forth in reference (b) for a Milestone C decision. Approval is hereby granted for the MRAPS program to enter into Milestone C under the following conditions:

- Low-Rate Initial Production (LRIP) quantities are set at 749 vehicles. This LRIP quantity is set to facilitate rapid production and deployment of MRAPS vehicles to warfighters, and provides the minimum quantity necessary to ramp-up and establish an initial production base for the system by accelerating production, support testing and validating the production capability of MRAPS contractors. The MRAPS Program Manager shall provide further justification for this LRIP quantity in the MRAPS acquisition strategy.

- Representative vehicles authorized under reference (a) shall be used to conduct operational test and evaluation and survivability and lethality testing. The Program Manager shall coordinate such testing with the Director of Operational Test and Evaluation.

- All ACAT II program documentation shall be completed no later than 1 August 2007. In view of reference (c), the program manager shall provide me with firm completion dates for all ACAT II program documentation no later than 1 March 2007. Due to urgency documented in reference (a), I will authorize documentation tailoring by separate memorandum.

Figure 23. ADM For Low Rate Initial Production of MRAPs (From Assistant Secretary of the Navy, 2007)

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APPENDIX C. MRAP COST BY APPROPRIATION

The following charts depict the MRAP annual cost by Appropriation for RDT&E and Procurement from FY 2005–FY 2018. Annual Cost is shown for the Army, Navy, Marine Corps, Air Force and defense-wide.

Annual Cost By Appropriation

Then-Year Dollars (TY$)
2040 | RDT&E | Research, Development, Test, and Evaluation, Army

Fiscal Year	Quantity	End Item Recurring Flyaway TY $M	Non End Item Recurring Flyaway TY $M	Non Recurring Flyaway TY $M	Total Flyaway TY $M	Total Support TY $M	Total Program TY $M
2007	--	--	--	--	--	--	20.0
2008	--	--	--	--	--	--	20.0
Subtotal	**47**	**--**	**--**	**--**	**--**	**--**	**40.0**

Base-Year Dollars (BY$)
2040 | RDT&E | Research, Development, Test, and Evaluation, Army

Fiscal Year	Quantity	End Item Recurring Flyaway BY 2008 $M	Non End Item Recurring Flyaway BY 2008 $M	Non Recurring Flyaway BY 2008 $M	Total Flyaway BY 2008 $M	Total Support BY 2008 $M	Total Program BY 2008 $M
2007	--	--	--	--	--	--	20.1
2008	--	--	--	--	--	--	19.7
Subtotal	**47**	**--**	**--**	**--**	**--**	**--**	**39.8**

Then-Year Dollars (TY$)
1319 | RDT&E | Research, Development, Test, and Evaluation, Navy

Fiscal Year	Quantity	End Item Recurring Flyaway TY $M	Non End Item Recurring Flyaway TY $M	Non Recurring Flyaway TY $M	Total Flyaway TY $M	Total Support TY $M	Total Program TY $M
2007	--	--	--	--	--	--	150.0
2008	--	--	--	--	--	--	206.6
2009	--	--	--	--	--	--	13.0
2010	--	--	--	--	--	--	45.4
2011	--	--	--	--	--	--	36.0
2012	--	--	--	--	--	--	35.2
2013	--	--	--	--	--	--	29.8
2014	--	--	--	--	--	--	27.8
2015	--	--	--	--	--	--	23.6
2016	--	--	--	--	--	--	20.7
Subtotal	**179**	**--**	**--**	**--**	**--**	**--**	**588.1**

Base-Year Dollars (BY$)
1319 | RDT&E | Research, Development, Test, and Evaluation, Navy

Fiscal Year	Quantity	End Item Recurring Flyaway BY 2008 $M	Non End Item Recurring Flyaway BY 2008 $M	Non Recurring Flyaway BY 2008 $M	Total Flyaway BY 2008 $M	Total Support BY 2008 $M	Total Program BY 2008 $M
2007	--	--	--	--	--	--	151.2
2008	--	--	--	--	--	--	204.5
2009	--	--	--	--	--	--	12.7
2010	--	--	--	--	--	--	43.9
2011	--	--	--	--	--	--	34.3
2012	--	--	--	--	--	--	33.0
2013	--	--	--	--	--	--	27.5
2014	--	--	--	--	--	--	25.2
2015	--	--	--	--	--	--	21.0
2016	--	--	--	--	--	--	18.2
Subtotal	**179**	**--**	**--**	**--**	**--**	**--**	**571.5**

Then-Year Dollars (TY$)
1109 | Procurement | Procurement, Marine Corps

Fiscal Year	Quantity	End Item Recurring Flyaway TY $M	Non End Item Recurring Flyaway TY $M	Non Recurring Flyaway TY $M	Total Flyaway TY $M	Total Support TY $M	Total Program TY $M
2005	73	43.0	--	--	43.0	--	43.0
2006	--	--	--	--	--	--	--
2007	3081	2133.7	--	--	2133.7	157.0	2290.7
2008	761	1018.3	--	--	1018.3	517.7	1536.0
2009	1365	639.0	--	--	639.0	384.0	1023.0
2010	478	1220.1	--	--	1220.1	28.0	1248.1
2011	--	--	--	--	--	238.2	238.2
2012	--	--	--	--	--	177.4	177.4
2013	--	--	--	--	--	180.4	180.4
2014	--	--	--	--	--	159.3	159.3
2015	--	--	--	--	--	147.2	147.2
2016	--	--	--	--	--	132.2	132.2
2017	--	--	--	--	--	128.3	128.3
2018	--	--	--	--	--	96.1	96.1
Subtotal	**5758**	**5054.1**	**--**	**--**	**5054.1**	**2345.8**	**7399.9**

Base-Year Dollars (BY$)
1109 | Procurement | Procurement, Marine Corps

Fiscal Year	Quantity	End Item Recurring Flyaway BY 2008 $M	Non End Item Recurring Flyaway BY 2008 $M	Non Recurring Flyaway BY 2008 $M	Total Flyaway BY 2008 $M	Total Support BY 2008 $M	Total Program BY 2008 $M
2005	73	45.0	--	--	45.0	--	45.0
2006	--	--	--	--	--	--	--
2007	3081	2124.7	--	--	2124.7	156.3	2281.0
2008	761	998.3	--	--	998.3	507.6	1505.9
2009	1365	619.5	--	--	619.5	372.2	991.7
2010	478	1167.5	--	--	1167.5	26.8	1194.3
2011	--	--	--	--	--	224.4	224.4
2012	--	--	--	--	--	164.3	164.3
2013	--	--	--	--	--	164.3	164.3
2014	--	--	--	--	--	142.7	142.7
2015	--	--	--	--	--	129.6	129.6
2016	--	--	--	--	--	114.5	114.5
2017	--	--	--	--	--	109.2	109.2
2018	--	--	--	--	--	80.5	80.5
Subtotal	**5758**	**4955.0**	**--**	**--**	**4955.0**	**2192.4**	**7147.4**

Then-Year Dollars (TY$)
1810 | Procurement | Other Procurement, Navy

Fiscal Year	Quantity	End Item Recurring Flyaway TY $M	Non End Item Recurring Flyaway TY $M	Non Recurring Flyaway TY $M	Total Flyaway TY $M	Total Support TY $M	Total Program TY $M
2006	113	118.0	--	--	118.0	12.0	130.0
2007	365	265.2	--	--	265.2	29.0	294.2
2008	66	194.8	--	--	194.8	45.0	239.8
2009	65	45.0	--	--	45.0	--	45.0
2010	52	55.2	--	--	55.2	28.0	83.2
2011	--	--	--	--	--	27.8	27.8
2012	--	--	--	--	--	25.5	25.5
2013	--	--	--	--	--	25.9	25.9
2014	--	--	--	--	--	21.2	21.2
2015	--	--	--	--	--	21.0	21.0
2016	--	--	--	--	--	19.1	19.1
2017	--	--	--	--	--	19.2	19.2
2018	--	--	--	--	--	14.4	14.4
Subtotal	**661**	**678.2**	**--**	**--**	**678.2**	**288.1**	**966.3**

Base-Year Dollars (BY$)
1810 | Procurement | Other Procurement, Navy

Fiscal Year	Quantity	End Item Recurring Flyaway BY 2008 $M	Non End Item Recurring Flyaway BY 2008 $M	Non Recurring Flyaway BY 2008 $M	Total Flyaway BY 2008 $M	Total Support BY 2008 $M	Total Program BY 2008 $M
2006	113	120.1	--	--	120.1	12.2	132.3
2007	365	264.3	--	--	264.3	28.9	293.2
2008	66	191.2	--	--	191.2	44.1	235.3
2009	65	43.6	--	--	43.6	--	43.6
2010	52	52.9	--	--	52.9	26.8	79.7
2011	--	--	--	--	--	26.2	26.2
2012	--	--	--	--	--	23.7	23.7
2013	--	--	--	--	--	23.6	23.6
2014	--	--	--	--	--	19.0	19.0
2015	--	--	--	--	--	18.5	18.5
2016	--	--	--	--	--	16.6	16.6
2017	--	--	--	--	--	16.4	16.4
2018	--	--	--	--	--	12.1	12.1
Subtotal	**661**	**672.1**	**--**	**--**	**672.1**	**268.1**	**940.2**

Then-Year Dollars (TY$)
2035 | Procurement | Other Procurement, Army

Fiscal Year	Quantity	End Item Recurring Flyaway TY $M	Non End Item Recurring Flyaway TY $M	Non Recurring Flyaway TY $M	Total Flyaway TY $M	Total Support TY $M	Total Program TY $M
2007	2450	1837.2	--	--	1837.2	247.8	2085.0
2008	10411	10957.1	--	--	10957.1	2882.9	13840.0
2009	1310	1623.7	--	--	1623.7	629.3	2253.0
2010	3630	4755.6	--	--	4755.6	1115.1	5870.7
2011	--	--	--	--	--	711.2	711.2
2012	--	--	--	--	--	615.3	615.3
2013	--	--	--	--	--	625.5	625.5
2014	--	--	--	--	--	521.1	521.1
2015	--	--	--	--	--	505.5	505.5
2016	--	--	--	--	--	461.6	461.6
2017	--	--	--	--	--	459.9	459.9
2018	--	--	--	--	--	344.6	344.6
Subtotal	**17801**	**19173.6**	**--**	**--**	**19173.6**	**9119.8**	**28293.4**

Then-Year Dollars (TY$)
3080 | Procurement | Other Procurement, Air Force

Fiscal Year	Quantity	End Item Recurring Flyaway TY $M	Non End Item Recurring Flyaway TY $M	Non Recurring Flyaway TY $M	Total Flyaway TY $M	Total Support TY $M	Total Program TY $M
2007	262	159.7	--	--	159.7	10.3	170.0
2008	276	471.3	--	--	471.3	145.7	617.0
2009	280	242.0	--	--	242.0	65.0	307.0
2010	--	--	--	--	--	53.8	53.8
2011	--	--	--	--	--	45.1	45.1
2012	--	--	--	--	--	34.3	34.3
2013	--	--	--	--	--	34.9	34.9
2014	--	--	--	--	--	30.4	30.4
2015	--	--	--	--	--	28.2	28.2
2016	--	--	--	--	--	26.3	26.3
2017	--	--	--	--	--	25.7	25.7
2018	--	--	--	--	--	19.2	19.2
Subtotal	**818**	**873.0**	**--**	**--**	**873.0**	**518.9**	**1391.9**

Then-Year Dollars (TY$)
0300 | Procurement | Procurement, Defense-Wide

Fiscal Year	Quantity	End Item Recurring Flyaway TY $M	Non End Item Recurring Flyaway TY $M	Non Recurring Flyaway TY $M	Total Flyaway TY $M	Total Support TY $M	Total Program TY $M
2007	309	283.7	--	--	283.7	93.2	376.9
2008	69	400.3	--	--	400.3	120.8	521.1
2009	--	--	--	--	--	159.0	159.0
2010	58	151.6	--	--	151.6	13.9	165.5
2011	--	--	--	--	--	72.5	72.5
2012	--	--	--	--	--	47.3	47.3
2013	--	--	--	--	--	48.0	48.0
2014	--	--	--	--	--	44.2	44.2
2015	--	--	--	--	--	38.8	38.8
2016	--	--	--	--	--	37.2	37.2
2017	--	--	--	--	--	35.3	35.3
2018	--	--	--	--	--	26.4	26.4
Subtotal	**436**	**835.6**	**--**	**--**	**835.6**	**736.6**	**1572.2**

Base-Year Dollars (BY$)
0300 | Procurement | Procurement, Defense-Wide

Fiscal Year	Quantity	End Item Recurring Flyaway BY 2008 $M	Non End Item Recurring Flyaway BY 2008 $M	Non Recurring Flyaway BY 2008 $M	Total Flyaway BY 2008 $M	Total Support BY 2008 $M	Total Program BY 2008 $M
2007	309	283.2	--	--	283.2	93.0	376.2
2008	69	393.6	--	--	393.6	118.7	512.3
2009	--	--	--	--	--	154.5	154.5
2010	58	145.5	--	--	145.5	13.4	158.9
2011	--	--	--	--	--	68.6	68.6
2012	--	--	--	--	--	44.0	44.0
2013	--	--	--	--	--	43.9	43.9
2014	--	--	--	--	--	39.7	39.7
2015	--	--	--	--	--	34.3	34.3
2016	--	--	--	--	--	32.3	32.3
2017	--	--	--	--	--	30.2	30.2
2018	--	--	--	--	--	22.2	22.2
Subtotal	**436**	**822.3**	**--**	**--**	**822.3**	**694.8**	**1517.1**

APPENDIX D. MRAP AND FOV COST AND PHOTOS BY CATEGORY

Figure 24. MRAP Category I ($300,000–$550,000)

Figure 25. MRAP Category II ($540,000–$644,000)

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APPENDIX E. MRAP MODIFICATION COST AND CONTRACT NUMBERS

Table 3. MRAP Modification Cost and Contract Numbers

Modification	Contract Number	Unit Price
Improved Turret Drive System (ITDS)	W56HZV-11-D-0131	$5,623
Rollover Detection Warning System (RDWS	M67854-11-D-5028	$850
Blast Mitigation Mats M-ATV	W56HZV-09-D-0111	$1,726.14
Bar Armor	W56HZV-09-C-0311	$38K
RPG Nets for M-ATV	W56HZV-09-R-0115	$38,835
RPG Nets for MaxxPro Dash 1	W56HZV-10-D-0014	$46,790.81
RPG Nets for MaxxPro Dash 2	W56HZV-12-C-0201	$43,794.03
M-ATV Underbody Improvement Kits (UIK)	W56HZV-09-D-0111	$63,623.60
MaxxPro Dash Survivability Upgrade	W56HZV-12-C-0404	$63,000
Independent Suspension Systems (ISS)		
MaxxPro Plus ISS 1	M67854-07-D-5032	$168,463.09
MaxxPro Dass ISS 2	M67854-07-D-5032	$142,602.22

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