MINE-RESISTANT AMBUSH PROTECTED FAMILY OF VEHICLES


Buffalo


Cougar


M-ATV

Program Background

The Mine-Resistant Ambush Protected (MRAP) Family of Vehicles (FoV) consists of multiple variants that are designed to reduce casualties and increase the survivability of personnel subjected to mine explosions, Improvised Explosive Devices (IED) detonations, and small arms fire. The MRAP FoV consists of the MRAP All-Terrain Vehicle (M-ATV), the Category I and II Cougar variants, and the Category III Buffalo. The MRAP vehicle was designed to meet emerging requirements that have been identified during Operation Iraqi Freedom and Operation Enduring Freedom, with a focus on continual improvement of vehicle and warfighter survivability. The USMC will retain 1231 MRAPs (490 M-ATVs, 713 Cougars, and 28 Buffalos) to satisfy the enduring requirement configuration.

The M-ATV provides better overall mobility characteristics than the original MRAP variants while also providing MRAP-level survivability. It supports mounted patrols, reconnaissance, security, convoy protection, casualty evacuation, data interchange, and command and control functions. The addition of the Underbody Improvement Kit-2 further enhances the platform's protection against underbody threats; this kit combines armor and interior occupant upgrades as well as automotive enhancements to increase survivability while maintaining platform safety and off-road capability.

The Cougar variants support small unit combat operations in complex and highly restricted rural, mountainous, and urban terrains. They consist of Category I (4X4 variant), which is capable of transporting five crew members and one gunner; and Category II (6X6), which is capable of transporting nine crew members and one gunner. The Cougar variants also include an ambulance variant that provides the ability to transport and

conduct emergency care for multiple acute battlefield casualties in an armored ambulance while in close proximity to enemy troops. The Cougar ambulance has the capability to transport up to four wounded patients and two patients carried on litters.

The USMC CAT III MK2A2 Buffalo is a six-wheel, six-passenger, all-wheel drive vehicle that was developed to conduct route clearance operations. The Buffalo is a blast protected vehicle that operates in explosive hazardous environments and that provides a route clearance capability and personnel protection against IEDs and anti-personnel and anti-tank mines. The Buffalo has a 30-ft. articulating arm, with an attached claw and air digger, to remotely investigate suspected IED sites. The claw, combined with the air digger and boom-mounted video camera, is utilized to find and uncover concealed IEDs, and it enables the crew to confirm or deny and classify the explosive hazard with precision and operator standoff protection.

Program Status

The MRAP FoV is currently fielded to all three Marine Expeditionary Forces, to Twenty-Nine Palms, and to the Marine Augmentation Program-Kuwait, and it is also deployed in support of Operation Enduring Freedom. A total of 889 of the 1231 enduring vehicles are scheduled to receive a maintenance reset at a USMC or Army Depot by the end of 2015.

MRAP FoV Top Three Program Technology Issues:

1. Transparent Armor/Ballistic Glass

Advancements are needed in the area of Transparent Armor. The current MRAP FoV Transparent Armor meets the requirements for ballistic performance; however; significant logistics and financial burdens are created by the delamination of this armor. Over time, delamination of the Transparent Armor makes it more difficult for the operator to see the road and surroundings clearly, and eventually the transparent armor will require replacement. The current industry standard is for a one-year guarantee on delamination defects, either in service or for its shelf life. The Program Office has typically seen a 100% replacement rate within three years. Finding a solution for the Transparent Armor that prevents delamination while retaining the armor's ballistic performance, or developing a solution that re-laminates the Transparent Armor, would provide the USMC significant cost and logistic benefits.

2. Increased Survivability and Improved Safety

Continued investments in technologies that maintain or increase the survivability of the vehicle and occupants from emerging threats are required. Such efforts could include increasing armor protection while maintaining or reducing current weight; improvements in blast resistant seats; improved crew egress systems; and advanced fire suppression systems. Improved safety features such as Electronic Stability Control can reduce the number of rollovers and significantly increase the safety of operation. Improvements in these areas could also increase the ability to protect the warfighter.

3. Fuel Economy

The MRAP FoV, like other tactical wheeled and tracked vehicles, could benefit from improvement of fuel economy. Studies completed by the MRAP Program Office suggest that reducing fuel consumption during idling, when over 60% of the fuel is burned over the course of operations, would significantly increase overall fuel efficiency. Methods that reduce the amount of idle time and that reduce idle fuel consumption could significantly reduce the amount of fuel used across the USMC fleet. The average operating fuel consumption rate across the MRAP FoV is 4.8 MPG; thus methods to increase engine efficiencies in operating conditions could potentially realize benefits across the vehicle fleet.

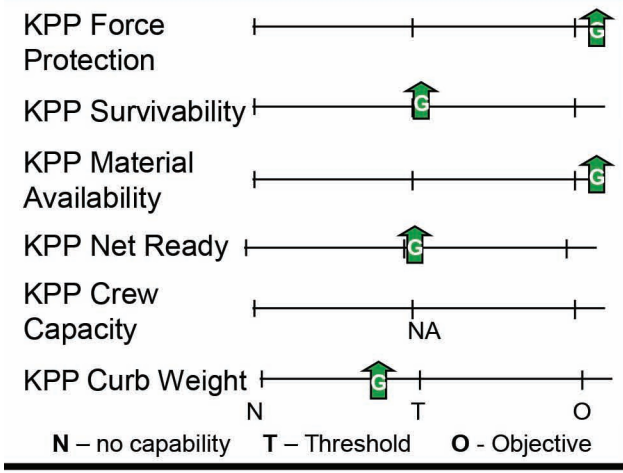
C G S G P G

ACAT III / SUSTAINMENT

BUFFALO

MRAP
21 Jan 14

MS C = 9 February 2007 **AAO =** 28 (ER)
IOC = October 2007 **FOC =** December 2009 **Program Assets =** 3



Contract Data - M67854-07-D-5006 / -12-C-5006
Contractor General Dynamics Land Systems
(Force Protection formerly FPII)

Production/Fielding Complete

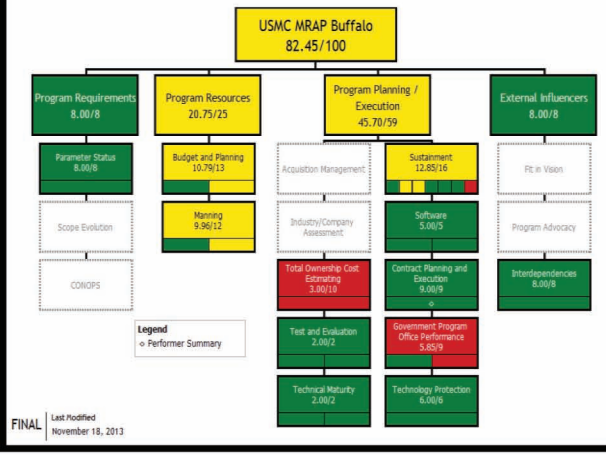
Next Contract: NA

DCMA

CPI SPI

EAC

Issues: None



PROGRAM	FY12				FY13				FY14				FY15				FY16				FY17				FY18				FY19			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Milestones & Phases	**MS C 9 Feb 07 – Now in sustainment phase**																															
SETR Reviews																																
Test Events	ECP 51 testing 2Q FY12 Ride Quality Testing 1-3Q FY12				RDA Testing 1Q FY13 4X Testing Conducted 4Q FY13				TA/3POE environmental testing 1Q FY14																									
Contract Events	W56HZV-11-C-0168 PO23 CLSS Awarded 3Q FY12 M67854-12-D-5003 Awarded 2Q FY12				M67854-12-D-5003 PO0018 Awarded 4Q FY13				W56HZV-12-C-0127 CLSS Option Year 1 Awarded 1Q FY14				IETMs delivery																				

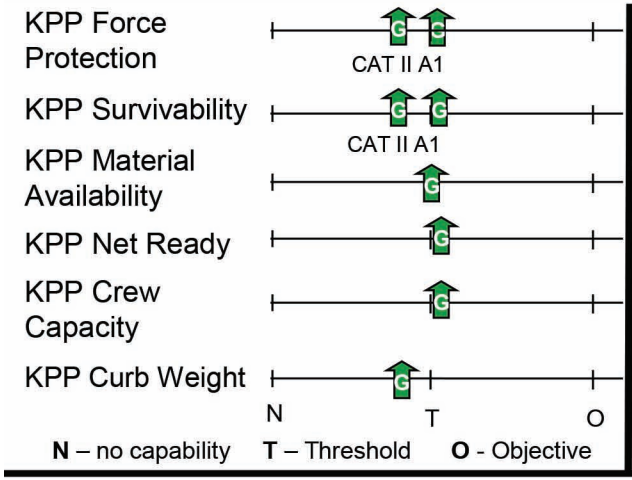
C G S G P G

COUGAR

ACAT III / SUSTAINMENT

MRAP
21 Jan 14

MS C = 9 February 2007 **AAO** = 425 CAT I, 288 CAT II (ER)
IOC = August 2007 **FOC** = July 2009 **Program Assets** = 61



Contract Data - M67854-07-D-5031
Contractor General Dynamics Land Systems
(Force Protection formerly FPII)

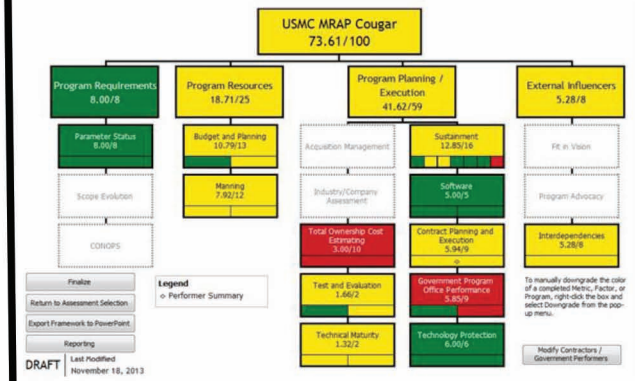
Production/Fielding Complete

Next Contract: N/A

DCMA

CPI SPI
EAC

Issues: None



PROGRAM (More In-depth Schedule Follows)	FY12				FY13				FY14				FY15				FY16				FY17				FY18				FY19			
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Milestones & Phases	**MS C 9 Feb 07 – Now in sustainment phase**																															
SETR Reviews												SSU Reviews																			
Test Events									Egress Buck Test			Egress Reviews Egress FAT / DT&E SSU FAT / DT&E SSU and Egress Automotive																			
Contract Events												SSU Contract				Egress Contract																

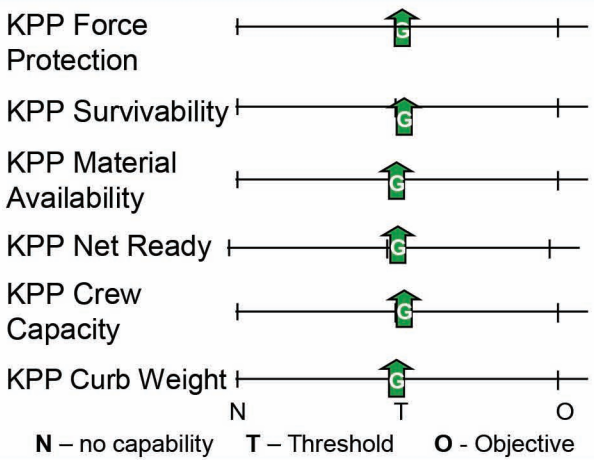
ACAT III / SUSTAINMENT

C G S G P G

M-ATV

MRAP
21 Jan 14

MS C = 9 Feb 2007 **AAO** = 490 (ER)
IOC = December 2009 **FOC** = April 2012 **Program Assets=** 10



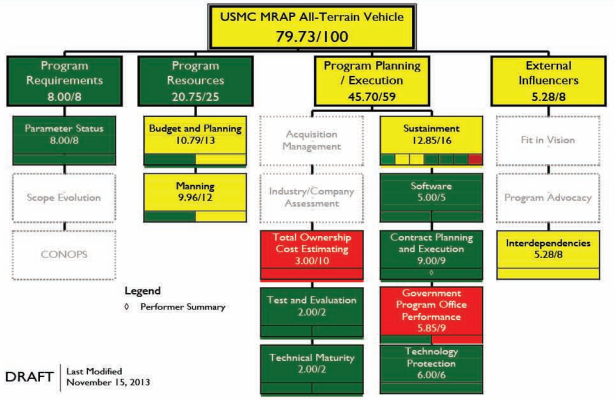
Contract Data -
W56HZV09D0111
W56HZV13C0180

Production/Fielding Complete

Next Contract: NA

DCMA
CPI SPI
EAC

Issues: None

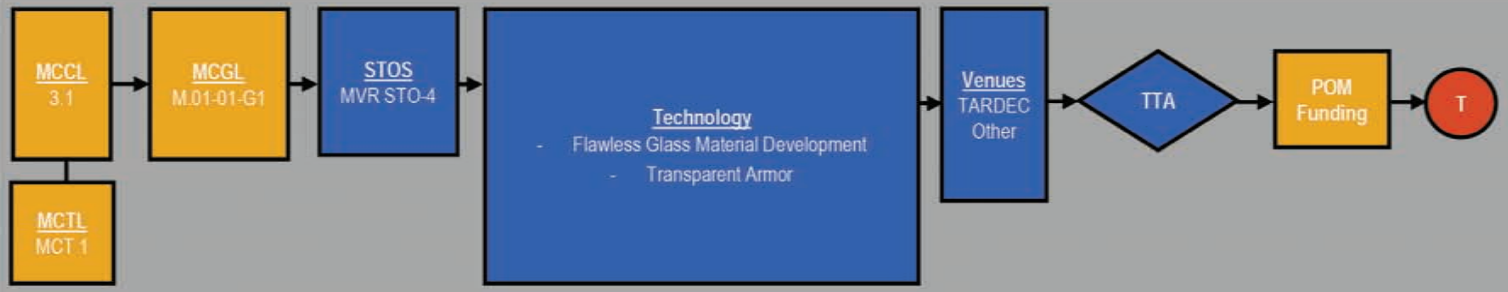


PROGRAM	FY12				FY13				FY14				FY15				FY16				FY17				FY18				FY19			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Milestones & Phases	**MS C 9 Feb 07 – Now in sustainment phase**																															
SETR Reviews																																
Test Events	OWM Shaker Table 3Q UIK Endurance				Pintle/MACAW 2-4Q 4X Conducted 2Q																													
Contract Events																																

MRAP Technical Issue #1 Transparent Armor/Ballistic Glass

MRAP	2013	2014	2015	2016	2017	2018	2019
Program Milestones & Insertion Points	Divesting Actions						
	Reset						
Active & Potential Investment Opportunities	4 Flawless Glass Material Development ($1.45M)			6			
	Transparent Armor ($8.12M)			6			
D&I							
E&D							
FNC							
SBIR/STTR							
TARDEC							
Other							

Concept to Capability Mapping Alignment Process



Funding Profiles ($M)	FY13	FY14	FY15	FY16	FY17	FY18	FY19
S&T (6.2 / 6.3)	2.20	1.32	1.70	0.25			

6.1 ← → Science & Technology ← → 6.3 6.4 ← → System Development ← → 6.7

MRAP Technical Issue #2 Increased Survivability and Improved Safety

MRAP	2013	2014	2015	2016	2017	2018	2019
Program Milestones & Insertion Points	Divesting Actions →						
	Reset →						
Active & Potential Investment Opportunities	6 Autonomous Mobility Appliqué System(AMAS) JCTD ($20.76M)						
	6 SwampWorks Fuel-Tank Protection System for Tactical Wheeled Vehicles ($1.00M) T PM M&HTV						
	(2) Mitigation of Blast Injuries ($1.84M) 6 T PM M&HTV						
	Lightweight HybridSil Nanocomposites for Ballistic, Blast and Flame Protection to MTVR Fuel Tanks and Engine Components($.98M) 5						
	JLTV Blast M&S ($1.15M) 5 T PM LTV						
D&I	6 MTVR Blast-Mitigating Energy Absorbing (EA) Seats ($.65M)						
E&D	Aqueous Based AFES ($.08M) 1 → 3						
FNC							
SBIR/STTR							
TARDEC	High Strength-High Ductility Nano Composites ($1.57M) → 5						
Other							

Concept to Capability Mapping Alignment Process

MCCL 3.1 → MCGL M.01-01-G1 → STOS MVR STO-4 MVR STO-5 → Technology
- Autonomous Mobility Appliqué System(AMAS) JCTD
- SwampWorks Fuel-Tank Protection System for Tactical Wheeled Vehicles
- Lightweight HybridSil Nanocomposites for Ballistic, Blast and Flame Protection to MTVR Fuel Tanks and Engine Components
- JLTV Blast M&S
- MTVR Blast-Mitigating Energy Absorbing (EA) Seats

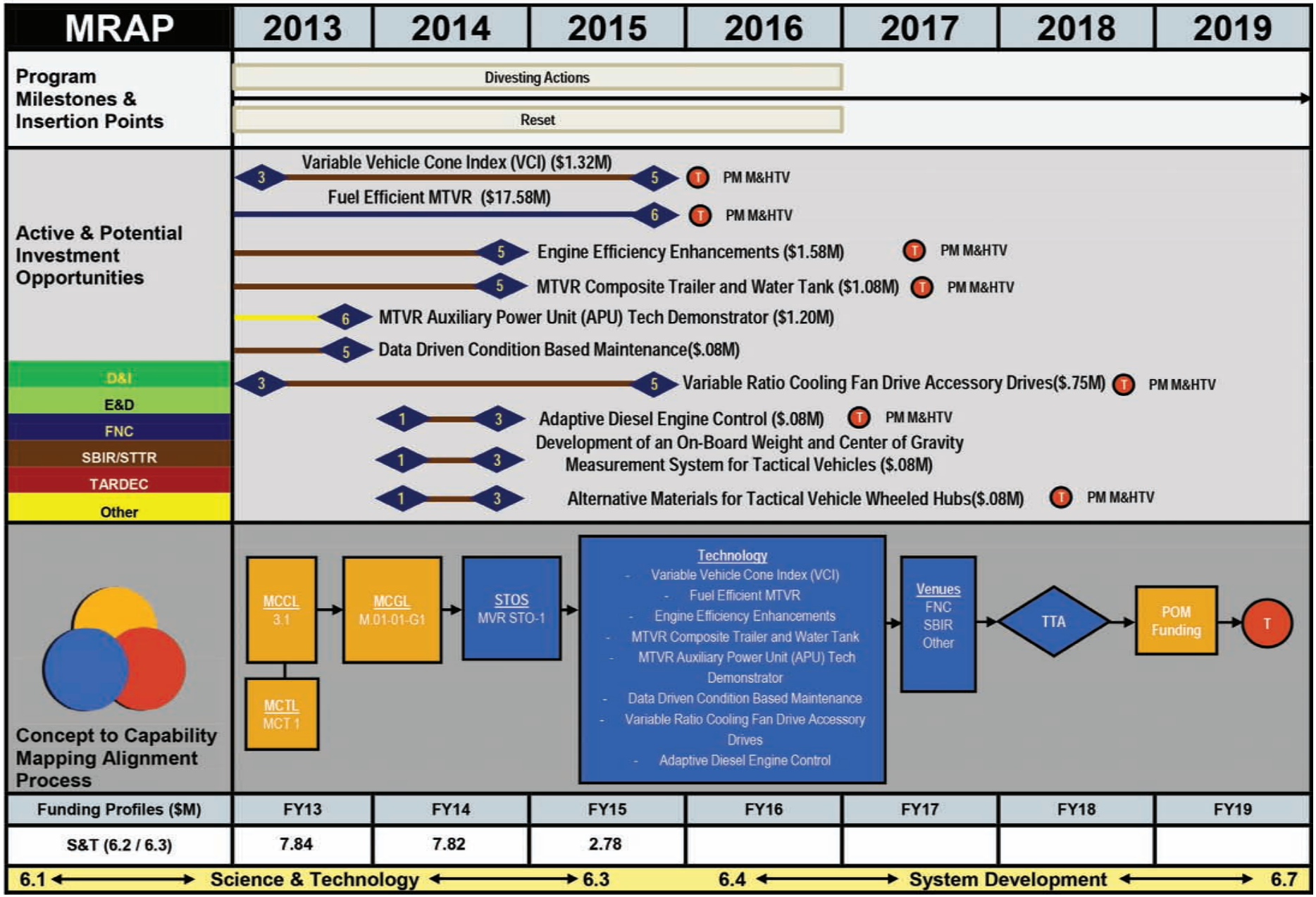
→ Venues D&I SBIR Other → TTA → POM Funding → T

MCTL MCT 1

Funding Profiles ($M)	FY13	FY14	FY15	FY16	FY17	FY18	FY19
S&T (6.2 / 6.3)	13.97	1.80	0.10				

6.1 ↔ Science & Technology ↔ 6.3 6.4 ↔ System Development ↔ 6.7

MRAP Technical Issue #3 Fuel Economy



Funding Profiles ($M)	FY13	FY14	FY15	FY16	FY17	FY18	FY19
S&T (6.2 / 6.3)	7.84	7.82	2.78				

6.1 ⟷ Science & Technology ⟷ 6.3 6.4 ⟷ System Development ⟷ 6.7