



Lightweight 155mm Howitzer (LW 155)



The Lightweight 155 mm Howitzer (LW155) is a highly successful joint U.S. Army/Marine Corps acquisition program that entered full-rate production in 2005. The prime contractor for the LW155, which is designated the M777, is the U.K.'s BAE Systems. It has delivered more than 725 of the towed howitzers to the Army and Marine Corps. The M777 will become the Corps' sole howitzer.

The proven combat performance in Iraq and Afghanistan of the M777, or "Triple 7," has earned it the reputation of being the most effective towed howitzer of its kind. The goal of the LW155 program was to develop a more capable replacement for the aging and heavy M198 155 mm towed howitzer in both the Marine Corps and Army, one that weighed less than 10,000 pounds. That goal was achieved.

The weight of the M777 is 9,700 pounds, compared with more than 16,000 pounds for the M198. This was made possible by the use of titanium and aluminum alloys in all of its major structures except its steel gun tube, as well as hydraulic systems to operate several components.

This weight reduction translates into greater strategic deployability – two M777s can fit into a C-130 transport, compared with one M198 – and greater tactical mobility. Unlike the M198, the M777 is light enough that it can be airlifted by all Marine Corps medium- and heavy-lift helicopters (CH-53Es, CH-46Es, and CH-53Ds) as well as new MV-22 Osprey tilt-rotor aircraft, providing commanders with significant operational flexibility.

The M777 features greater survivability than the M198 by virtue of its shorter emplacement and displacement times – both under three minutes compared with 10-12 minutes for the M198 – providing it the ability to "shoot and scoot."

The LW155 fires standard unguided projectiles to a range of 15 miles and rocket-assisted projectiles to 19 miles. Its rate of fire is four rounds per minute maximum and two rounds per minute sustained. The latest M777A2 version of the howitzer added a software upgrade and a Digital Fire Control System (DFCS) from BAE Systems that allows the gun to program and fire

a longer-range and more accurate round – the M982 Excalibur Guided Projectile. The Excalibur munition, developed by Raytheon and BAE Systems, can reach ranges in excess of 25 miles while always landing within 10 meters of its target.

With the upgrade Marine Corps' and the Army's towed artillery have the ability to deliver precision fires, allowing them, according to BAE Systems, "to target a specific room within a building, reducing the chance of innocent casualties and allowing supporting fire to be brought down much closer to friendly troops." U.S. forces have used the Excalibur projectile effectively in Iraq. The M777A2's onboard DFCS is used to accurately locate and aim the gun. With the majority of its components mounted on and underneath the gun's main cradle section, the DFCS includes a GPS receiver; an inertial navigation unit; a vehicle motion sensor; a mission computer; a battery power supply; secure voice and data radios for communicating with and passing data to and from the fire direction center; and separate displays for the gunner, assistant gunner, and chief of section.

The hand-held Chief of Section Display is connected to the DFCS by a cable and shows the details of a fire mission transmitted from the fire direction center – the firing azimuth, elevation, and propellant charge – on its screen. The DFCS has made the LW155 guns more autonomous. At many of the forward operating bases in Afghanistan, only two guns are being deployed instead of an entire battery of six. Commanders are actually getting greater coverage by dispersing the guns more geographically.

The M777 achieved an initial operational capability in December 2005. All USMC guns are now M777A2s and Excalibur-capable. The Marine Corps has fully fielded the LW155 to its 10th, 11th, 12th, and 14th Marine Regiments and to its schoolhouses. Additional guns are outfitting the Maritime Prepositioning Ships and war reserve stocks.

The Marine Corps' Approved Acquisition Objective is 511 M777A2s (its original plan was to buy 356). The service had ordered 489 as of this past July, with 372 delivered. The Corps is slated to receive its final deliveries in November 2012.

The prime mover towing the Marine Corps' M777A2s is the 7-ton Medium Tactical Vehicle Replacement (MTVR) truck. The M777A2 is exceeding its reliability requirement of 800 mean rounds fired between system aborts – achieving 880, the biggest reliability issue to date has been the wear and tear incurred by the cables that run to the gun, such as from the Chief of Section Display, and are out in the open.

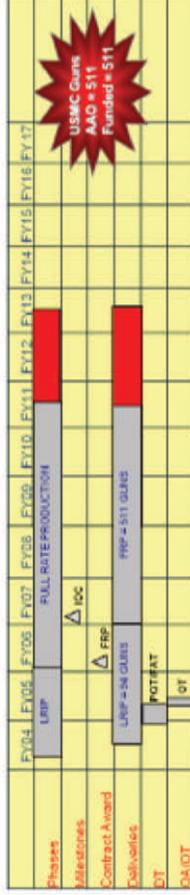
An under way LW155 software upgrade effort aims to allow all of the ballistic computations to be done on the howitzer itself rather than relying on a fire direction center to transmit firing data to the gun. A forward observer would call in a grid location that would come directly to the gun instead of to the fire direction center, reducing the time to fire. Another M777A2 upgrade in the works designed to reduce logistics costs involves removing the DFCS mission computer from the gun and embedding its functionality into the Chief of Section Display.

Canada has received 37 M777s through U.S. Foreign Military Sales (FMS). Australia is buying the M777A2 through FMS. As of May 2011, nine out of 35 weapons have been delivered to Australia. The U.S. government also has been discussing with India an FMS sale of M777s. The M777 program is managed by the Army/Marine Corps Towed Artillery Systems Joint Program Office at Picatinny Arsenal, N.J. BAE System's facility at Hattiesburg, Miss., is responsible for final integration and test of the weapon system. The manufacture and assembly of the complex titanium structures and associated recoil components are carried out at Barrow-in-Furness in the U.K.

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Lightweight 155 Howitzer



Mission:

Provide direct, reinforcing, and general support fires to maneuver forces. Direct support artillery for the Stryker Brigade Combat Teams. Replaces the M198 howitzer as the general support artillery for light forces in the Army. Replaces all howitzers in all missions in the USMC.

Capability / Improvements:

- Improved lethality & strategic deployment
- Increased tactical mobility & reliability
- Improved Survivability (decreased emplace/displace time -- shoot and scoot tactics with digital fire control)
- Digitizes Army and USMC towed artillery
- First artillery platform with Excalibur capability fully embedded

Requirements:

Weight	10,000 pounds or less
Emplace, Displace	<3 min, 2-3 min
Maximum Range	30 km (assisted)
Rate-of-Fire	4/min max, 2/min sustained
Prime Mover	Current 5T truck, FMTV, MTVR
Air Mobility	MV22, CH53D/E, CH47D
Fire Control	Digital & Optical
Precision Fire	Excalibur Capable & PGK Capable

Program Status:

- Nov 04 JORD – All KPP's Met
- Joint USMC/Army Program in Full Rate Production
- >700 Weapons Fielded to USMC and Army
- All Weapons M777A2 (Excalibur Capable)
- Used Very Effectively in OEF & OIF
- FMS Case with Canada & Australia; India FMS Case Expected FY12

	IOC	FOC	AAO	AAO Funded	AAO Unfunded
USMC	Dec 05	Jun 11	511	511	0
Army	Oct 06	Jun 14	542	418	0



Lightweight 155 Howitzer



	FY04	FY05	FY06	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16
Phases	LRIP	FULL RATE PRODUCTION											
Milestones			Δ IOC										
Contract Award		Δ FRP											
Deliveries	LRIP = 94 GUNS				FRP = 511 GUNS								
DT	POT/FAT												
OA/OT	OT												

**USMC Guns
AAO = 511
Funded = 511**



Lightweight 155mm Howitzer (LW 155)

LW 155'S Top Three Program Technology Issues:

1. **Modular Artillery Charge (MACS) Compatibility with the M777A2 Howitzer** - The Joint Program Management Office (JPMO) will pursue a dual path to address compatibility issues with the M232A1 propelling charge. The primary path is to have Benet Labs redesign the breech and primer feed mechanism components to survive MACS loading. The secondary path is to pursue a laser ignition system which will be designed to handle the MACS load. The JPMO will down select and will retrofit the solution starting in 2013. There is currently no funding allocated for this effort.

2. **Power Upgrades** - The power supply of the digital fire control is inadequate to support the type of operations required in Afghanistan. The full combat potential of a digitized M777A2 is not being realized because of the current limitations associated with the power subsystem. The JPMO is pursuing an initiative to replace the power distribution system and the batteries with advanced components that would eliminate this problem.

3. **Thermal Warning Device Reliability** - The current mercury thermal warning device used to measure the outside diameter temperature of the gun tube has accuracy and durability issues. After a critical field failure at Ft. Bragg, the LW155 Program Office began looking into replacing the mechanical device with an electronic thermal warning device. Benet Laboratories has initiated development of an electronic sensor package and handheld display as part of an overseas contingency operation (OCO) effort. The JPMO will leverage this effort and develop a standalone display.

1. Modular Artillery Charge (MACS) Compatibility with the M777A2 Howitzer:

1a. No Active S&T Initiatives for LW 155

1b. Potential S&T Initiatives for LW 155

Other

- Laser Ignition

2. Power Upgrades:

2a. No Active S&T Initiatives for LW 155

2b. Potential S&T Initiatives for LW 155

- The JPMO is pursuing an initiative to replace the power distribution system and the batteries with advanced components that would eliminate this problem.

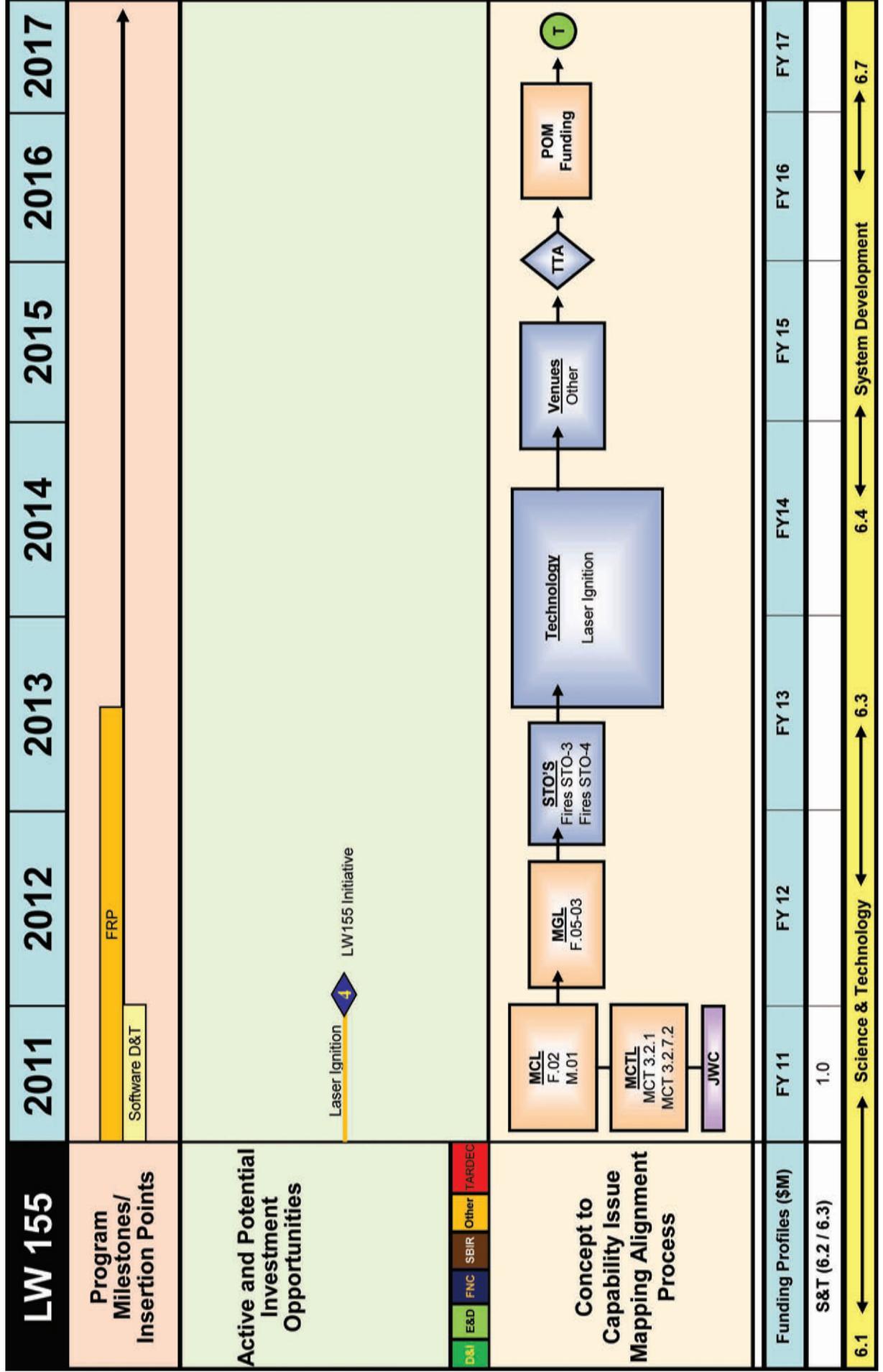
3. Thermal Warning Device Reliability:

3a. No Active S&T Initiatives for LW 155

3b. No Potential S&T Initiatives for LW 155



LW 155 Technical Issue #1 Modular Artillery Charge (MACS) Compatibility



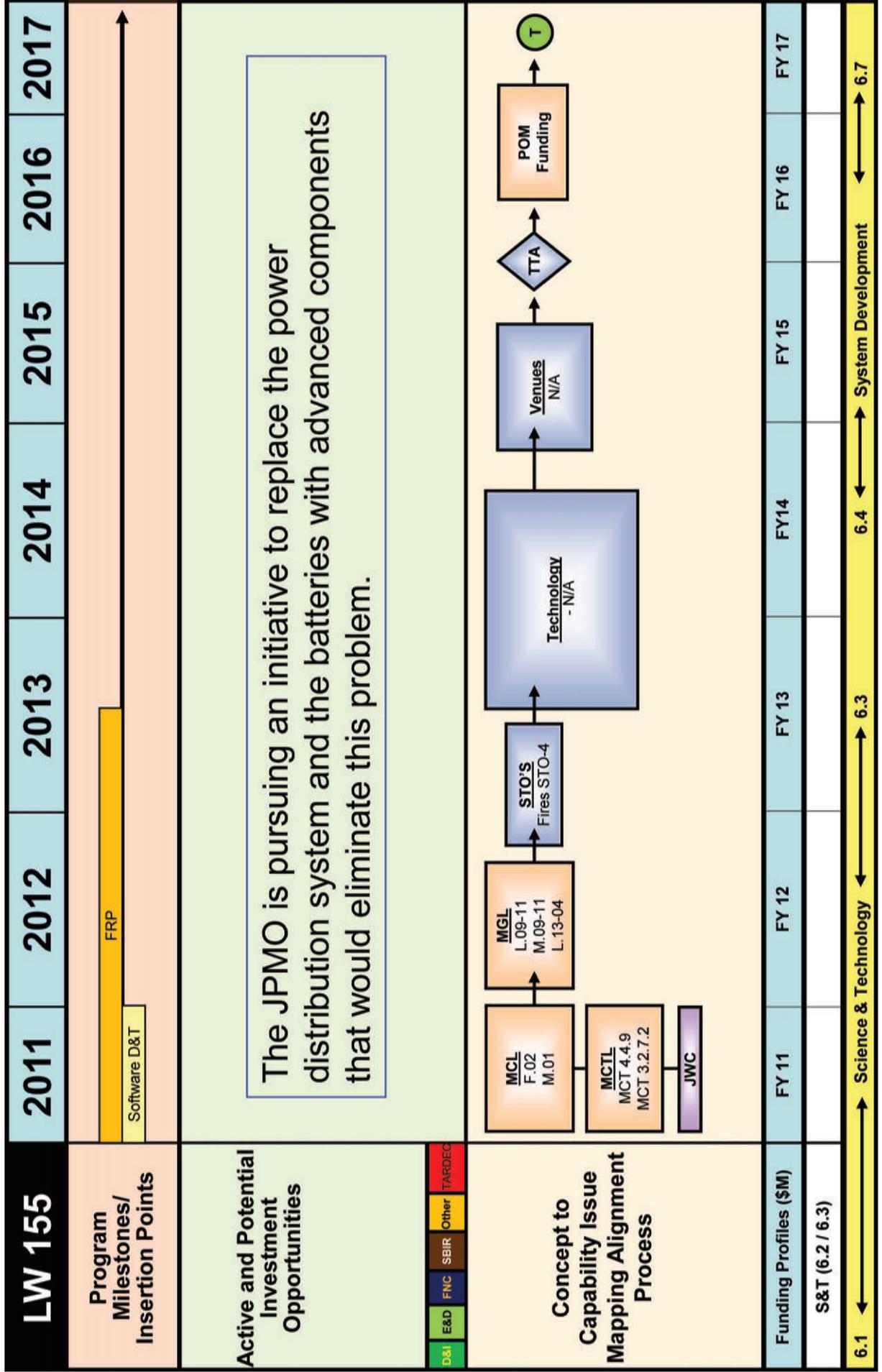


LW 155 Technical Issue #1 Modular Artillery Charge (MACS) Compatibility

MCL	F.02 Engage the adversary kinetically M.01 Maneuver to secure	Potential: N/A
MCTL	MCT 3.2.1 Conduct Fire Support Tasks MCT 3.2.7.2 Control Indirect Fires	
MGL	F.05-03 Ground Fires Sustainment/Enhancement	
STO'S	Fires STO-3 Advanced ammunition Fires STO-4 Increased capabilities and reduced weight of all ground combat weapons systems	
Technology	Active: Laser Ignition	
Venues	Basic Research	
	N/A	
POM Funding	MCCDC integration division	
	Transition to a program of record	Comments/Issues:



LW 155 Technical Issue #2 Power Upgrades





LW 155 Technical Issue #2 Power Upgrades

MCL	F.02 Engage the adversary kinetically M.01 Maneuver to secure
MCTL	MCT 4.4.9 Conduct Tactical Electrical Supply MCT 3.2.7.2 Conduct Indirect Fires
MGL	L.09-11 Alternate Power Sources M.09-11 Exportable Power For On-Board Systems I.13-04 Power generation/ distribution
STO'S	Fires STO-4 Increased capabilities and reduced weight of all ground combat weapons systems
Technology	Active: -N/A Potential:
Venues	
	
POM Funding	MCCDC integration division
	Transition to a program of record Comments/Issues:



LW 155 Technical Issue #3 Thermal Warning Device Reliability

LW 155	2011	2012	2013	2014	2015	2016	2017
Program Milestones/ Insertion Points	Software D&T	FRP					
Active and Potential Investment Opportunities	N/A						
Concept to Capability Issue Mapping Alignment Process	MCL F.02 M.01 MCTL MCT 3.2.1 MCT 3.2.7.2 JWC	MGL F.05-03	STO'S Fires STO-4	Technology N/A	Venues N/A	TTA	POM Funding
Funding Profiles (\$M)	FY 11	FY 12	FY 13	FY14	FY 15	FY 16	FY 17
S&T (6.2 / 6.3)							
6.1	← Science & Technology		← 6.3		← System Development		← 6.7



LW 155 Technical Issue #3 Thermal Warning Device Reliability

MCL	F.02 Engage the adversary kinetically M.01 Maneuver to secure	
MCTL	MCT 3.2.1 Conduct Fire Support Tasks MCT 3.2.7.2 Conduct Indirect Fires	
MGL	F.05-03 Ground Fires Sustainment/Enhancement	
STO'S	Fires STO-4 Increased capabilities and reduced weight of all ground combat weapons systems	
Technology	Active: -N/A	Potential: -N/A
Venues	E&D	
Army	N/A	
TTA	N/A	
POM Funding	MCCDC integration division	
T	Transition to a program of record	Comments/Issues: