LW155 Howitzer
Towed Artillery Digitization

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What is **Towed Artillery Digitization (TAD)**

An Evolutionary Acquisition Program to develop and integrate a **Digital Fire Control System (DFCS)** onto the new M777 Lightweight 155mm Howitzer.
The Future of Towed Cannon Artillery

Program Overview (1 of 2)

The Lightweight 155mm Howitzer (LW155) Is A Joint Program With The Marine Corps And The Army

- The Marine Corps Developed the Basic Howitzer
- The Army Developed the Towed Artillery Digitization (TAD) Digital Fire Control System

The Marine Corps Is The Lead Service But All Milestones And Documents Are Joint

- ASN(RDA) is Milestone Decision Authority (MDA) for Basic Gun
- PEO Ground Combat Systems is The MDA for TAD
- USADTC Lead for Basic Gun and TAD Developmental Testing
- MCOTEA Lead for Basic Gun and TAD Operational Testing

TAD Major Contractors

- Lead System Integrator – BAE, Barrow, UK
- Major Subcontractor for DFCS – GDATP, Burlington, VT
Program Overview (2 of 2)

- Operation Desert Storm AAR: M198 Too Heavy, Too Slow, Aging
- LW155 Program Was Initiated by USMC and Army in 1996
- M777 Low Rate Initial Production (LRIP) Decision in Nov 2002
  - Authorized production of 94 M777 Howitzers with Optical Fire Control for Marine Corps
  - Currently Fielded to USMC (IOC – Oct 05) and Canada (Afghanistan)
- M777A1 used for Multi-Service Operational Test and Evaluation
- M777A1 Full Rate Production (FRP) Decision February 2005
  - Authorized 495 M777A1 Howitzers with Digital Fire Control System (DFCS) for Marine Corps and Army
  - Authorized production of additional 94 DFCS for retrofit onto the 94 LRIP Marine Corps Howitzers
- Joint Service Multiyear FRP Contract Awarded March 2005
The Future of Towed Cannon Artillery

TAD Evolutionary Acquisition Strategy

M777
With Optical Fire Control

94 Produced for USMC
Retrofitting to M777A2

Towed Artillery Digitization
M777A1 (Hardware & Software)

Aiming & Pointing, Navigation
On-Board Power Supply, Radio, Computer, GPS, INU, VMS

GDU Protocol Messaging
Chief Of Section Display
Gunner & AG Displays

Towed Artillery Digitization
M777A2 – Software Upgrade

• Limited Two-Way Joint Variable Message Format Messaging
• Howitzer Status Message
• Becomes Excalibur Capable With Installation of EPIAFS Platform Integration Kit & Fuze Setter

Towed Artillery Digitization
Objective Capability

• On-Board Ballistic Computation
• Integrated Muzzle Velocimeter
• Ammo Inventory
• Full Joint Variable Message Format Messaging

The Future of Towed Cannon Artillery
M777A2 Howitzer… The Operational Benefit

M777A2 is More Mobile, Rapidly Deployable, Survivable and Accurate than the current heavy and aging M198

<table>
<thead>
<tr>
<th></th>
<th>M777A2</th>
<th>M198</th>
<th>Improvement</th>
</tr>
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<tbody>
<tr>
<td>Weight</td>
<td>9,800 lbs.</td>
<td>16,000 lbs</td>
<td>39%</td>
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<tr>
<td>Emplaces</td>
<td>2:10 min</td>
<td>6:35 min</td>
<td>304% ¹</td>
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<tr>
<td>Displaces</td>
<td>2:23 min</td>
<td>10:40 min</td>
<td>448% ¹ &amp; ²</td>
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<tr>
<td>Terrain Trafficable</td>
<td>83%</td>
<td>63%</td>
<td>32%</td>
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<tr>
<td>C-130 Load</td>
<td>2</td>
<td>1</td>
<td>100%</td>
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<tr>
<td>Digitized</td>
<td>Yes</td>
<td>No</td>
<td>70% ²</td>
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<tr>
<td>Excalibur Ready</td>
<td>Yes</td>
<td>No</td>
<td>One Round Kill</td>
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¹ Contributes to 5 Times the Kills
² Contributes to 70% Increase in Survivability
MERGING OF Multiple DEVELOPMENT PATHS

M777A1 = M777 Howitzer + Towed Artillery Digitization
M777A2 = M777A1 + Software Upgrade

TAD Development
Design Integration
M777 Development
M777 Low Rate Production Decision

M777A1 Full Rate Production Decision
System Integration & MOTE

Excalibur SW and Integration

TAD Pre-production
System Production

M777 Retrofit
M777A1 First Unit Equipped
M777A2 First Unit Equipped

FY02 | FY03 | FY04 | FY05 | FY06 | FY07
# LW155 Howitzer Program

## Procure

<table>
<thead>
<tr>
<th>Year</th>
<th>Army (FY07)</th>
<th>USMC (FY07)</th>
<th>Army (FY08)</th>
<th>USMC (FY08)</th>
<th>Army (FY09)</th>
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### Prior to FY07
- 94 Retrofit Kits
- 304 Total Procured: Army -- 233, USMC -- 356

## Field

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<thead>
<tr>
<th>Year</th>
<th>Army (Prior to FY07)</th>
<th>USMC (Prior to FY07)</th>
<th>Army (FY07)</th>
<th>USMC (FY07)</th>
<th>Army (FY08)</th>
<th>USMC (FY08)</th>
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### Prior to FY07
- 94 Retrofit

## Support

- **Interim Contractor Support**
- **Performance Based Logistics**

## Equipment Upgrade

- **M777A2 – SW Upgrade Excalibur Capability**
- **SW Block Upgrade**
- **TAD Objective Capability**

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**Total Procured:** USMC – 356  Army -- 233

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*The Future of Towed Cannon Artillery*
The “Heart” of TAD

Position Navigation System

**INPUTS**

- GPS Receiver (DAGR)
- Vehicle Motion Sensor
- External Environment
- Chief of Section Display (Operator Inputs)

**OUTPUTS**

- Mission Computer

**Honeywell High-G TALIN**

Internal Sensors:
- (3) Ring Laser Gyroscopes
- (3) Accelerometers

**INPUTS**

- Position (Lat, Long, Alt)
- Velocity (Vehicle Speed)
- Inertia Measurement (Earth Rotation, Gravity, Gun Rotation)

**OUTPUTS**

- Position (Lat, Long, Alt)
- Orientation (Az, QE, Cant)
The Future of Towed Cannon Artillery

M777A2 Towed Artillery Digitization (TAD)

Asst Gunner’s Display (AGD)

Chief of Section Display (CSD)

Vehicle Motion Sensor (VMS)

Inertial Navigation Unit – (INU) Or (PNS)

Gunner’s Display (GND)

Top Cradle Electronics Assembly (TCEA)
Communication-Location Assembly (CLA):
  Radio (RTA), Radio Power Supply (RPS), RF Power Amp (AMP), Defense Advance GPS Receiver (DAGR) and Antenna (PLA) in Communications/Location Enclosure (CLE)

Under Cradle Electronics Assembly (UCEA)
Mission Computer (MSC), Battery (BAT) & Power Conditioning and Control Module (PCCM or PSP)

Power Control & Conditioning Unit (PCCM)

Batteries

Mission Computer (MSC)

CLAS - SINCGARS - DAGR - PIK

The Future of Towed Cannon Artillery
## LW155 Howitzer Prime Mover Integration

<table>
<thead>
<tr>
<th>Applicable Prime Mover Families</th>
<th>FMTV</th>
<th>M939</th>
<th>MTVR</th>
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<tbody>
<tr>
<td></td>
<td>M1083</td>
<td>M925</td>
<td>MK 23</td>
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<tr>
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<td>M925A2</td>
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### Connectors
- **Rear Connectors**
- **Power Hookup**
- **CAB Mount for CSD**

### Prime Mover Families
- **FMTV**
- **M939**
- **MTVR**
LW155 & TAD – “The Challenges”

- Joint Program – 2 MDA’s…ASN(RDA) & Army PEO
- Decision to Merge TAD & M777 - Risk to execution
- Consolidation of 2 Prime Contractors – BAE and GD
- Multi-Service Operational Test – 2 Independent Evaluators
- Joint Full Rate Production Milestone – Tailoring the Process
- Transitioning Development to Full Rate Production
  - Pre-production in parallel with Production Planning
  - Incorporating Lessons Learned from MultiService Oper Test
  - Obsolescence Management
  - Integrating Excalibur Capability in mid-stream
- Planned Retrofit of TAD Concurrent with Initial Fielding
- Moving from M777A1 to M777A2 with Initial Fielding
- Managing the Changing Interfaces
LW155 Howitzer Bottom Line

- RDTE and LRIP Complete…Program is in Full Rate Production
- M777 Initial Operational Capability (IOC) Dec 05 with USMC
- Initial fielding of Digitized M777A1 Howitzers to Army Jan 07
- Retrofit program to digitize LRIP Guns Almost Complete
- M777A2 (Excalibur Capable) Howitzers issued Apr 07

Fielding of Digitized LW155 Underway…
Time to Start Thinking about Refresh