



Technology Innovations Realized in the M150/M151 Dismounted Fire Control System Development



Authored By
Amit Makhijani
&
Ralph Tillinghast





Overview

The purpose of this paper is to present the technological innovations achieved in the development of the M150/M151 Dismounted Mortar Fire Control System, Winner of the 2007 Dod Top 5 Program Award.

▶ Outline

- ▶▶ Acknowledgments
- ▶▶ M95/M96 Overview
- ▶▶ M150/M151 Overview
- ▶▶ Innovation Highlights
 - Replacement of Legacy Computer
 - Power Distribution / Communication Upgrade
 - Driver and Gunners Display
 - PDMA
 - System Cables
 - Configuration (modular E-Rack)
- ▶▶ Conclusions
- ▶▶ Video & Questions

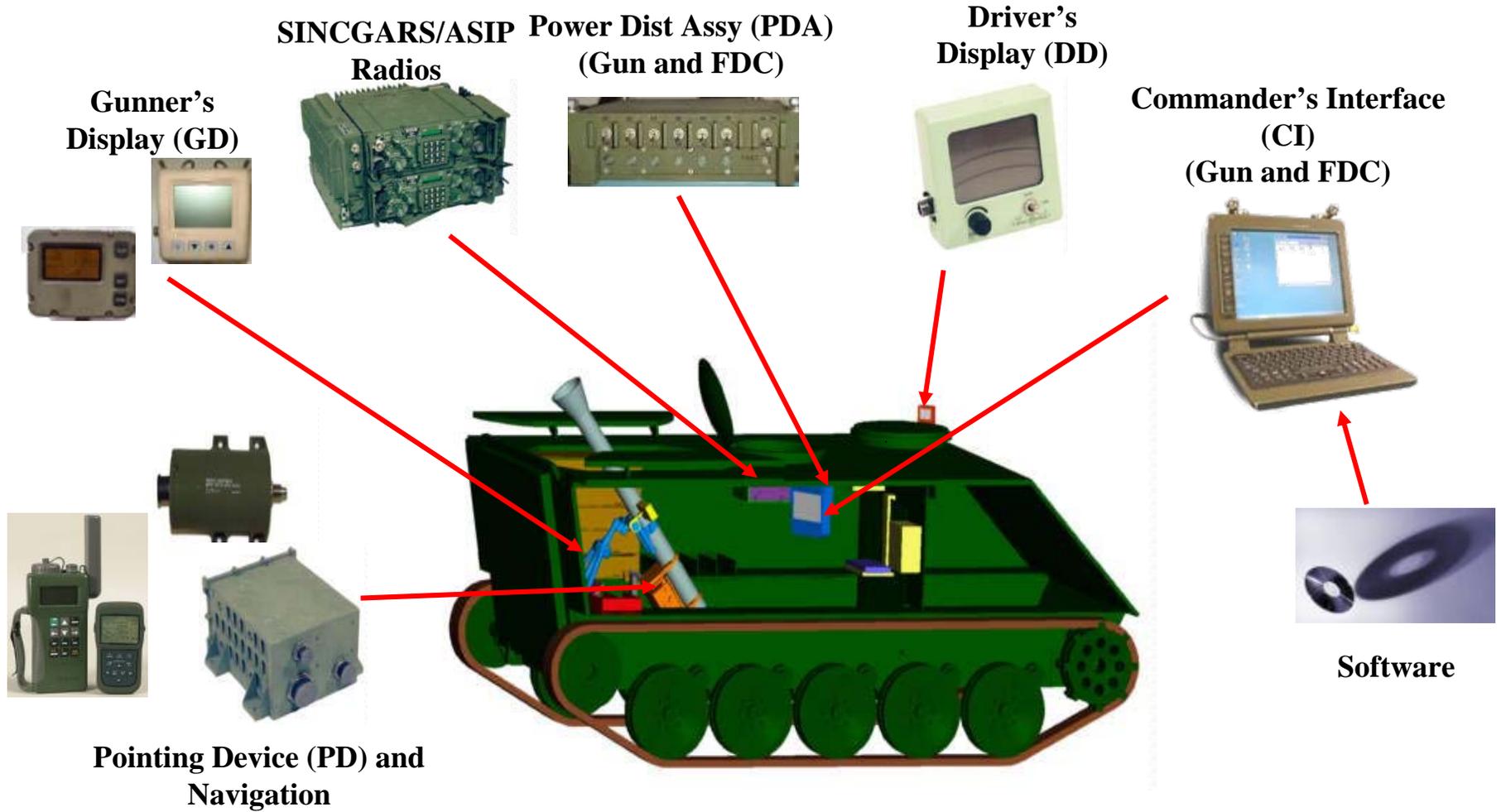


- ▶ ARDEC
- ▶ PM Mortars
- ▶ Honeywell
- ▶ BAE
- ▶ Milpower
- ▶ KVH
- ▶ DRS
- ▶ GRC





- ▶ Provide digital fire control capability for Mortar Carrier Vehicles (M1064, M577, STRYKER)
- ▶ Digital connectivity with AFATDS
- ▶ 4 mil Azimuth and 3 mil elevation pointing accuracy
- ▶ No crew dismount
- ▶ Ballistic calculations within 10 seconds





MFCSDismounted is a mortar fire control system for the 120mm mortar weapon system. It is integrated into the Quick-Stow trailer, which was designed to lower and lift the weapon.



- ▶ Provide digital fire control capability for Dismounted 120mm Mortar Units
- ▶ Digital connectivity with AFATDS
- ▶ 4 mil Azimuth and 3 mil Elevation pointing accuracy
- ▶ Ballistic calculations within 10 seconds
- ▶ Integrated with Quick-Stow system for easy emplacement and displacement of weapon

Fire Control Computer (FCC)



Enhanced Power Distribution Assy (EPDA)



DAGR (GPS)



Pointing Device Mount Assembly (PDMA)



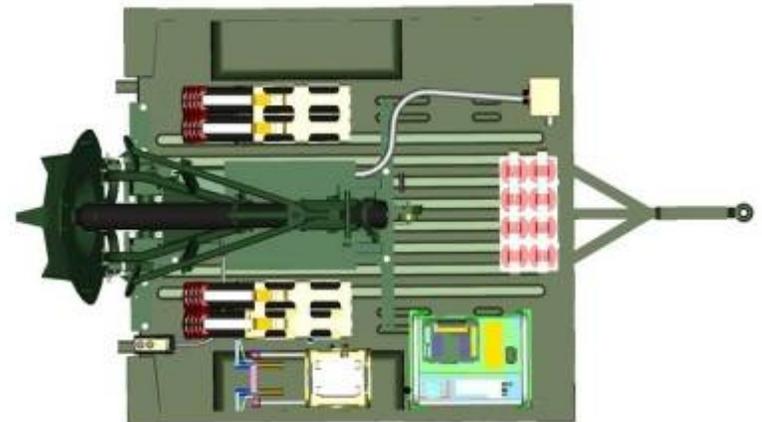
Fire Control Display (FCD)



Portable Universal Battery Supply (PUBS)



ASIP Radio





M151 FDC System Design



ASIP
Ch A



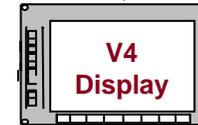
ASIP
Ch B



FCC



V4
Display

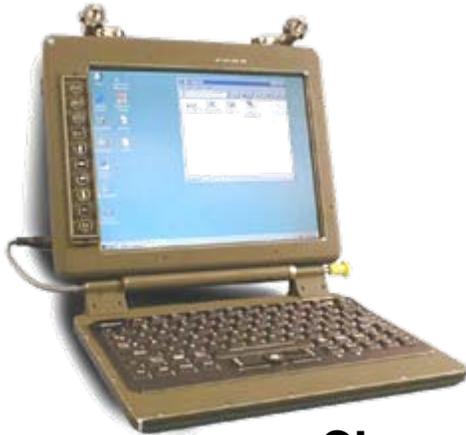


FBCB2





- ▶ Replacement of Legacy Computer
- ▶ Power Distribution / Communication Upgrade
- ▶ Driver and Gunners Display
- ▶ PDMA
- ▶ System Cables
- ▶ Configuration (Modular E-Rack & HMMWV Mount)



CI



FCC

- ▶ Introduction of Resistive Touchscreen
- ▶ 18.6lbs vs. 7.8lbs
- ▶ Increased computing power (faster processor, more memory)
- ▶ Smaller footprint
- ▶ ~\$6K cost reduction per unit



PDA



E-PDA

- ▶ E-PDA adds internal Ethernet / Serial Hub
 - ▶▶ Allows Ethernet to serial LRU communication
 - ▶▶ Ethernet communication simplifies and reduces cabling
- ▶ Includes additional power ports for growth
- ▶ E-PDA is backwards compatible with M95/M96 System PDA to allow for drop-in replacement



GD



DD



FCD

- ▶ New display can work as GD or DD
 - ▶▶ Reduces logistics footprint
 - ▶▶ Commonality
- ▶ FCD is backwards compatible with M95/M96 GD and DD to allow for drop-in replacement
- ▶ Improved sunlight readability over current GD
- ▶ ~8K Reduction in Cost for GD





- ▶ Isolates PD from mortar fire shock and vibration
 - ▶▶ Utilizes novel slide rail approach
 - ▶▶ Allows for use on more severe ground mount configuration
- ▶ Quick-Release feature
 - ▶▶ Allows PD to be dismounted quickly during misfires and after completion of mission





- ▶ M150/M151 cables are triple shielded
 - ▶▶ 2 layers of tin-copper braid with a layer of foil in between
 - ▶▶ Meets higher shield attenuation levels
- ▶ Backshells and transitions are molded
 - ▶▶ Increases durability
 - ▶▶ Allows for ease of cable routing
 - ▶▶ Cable attachment points can be molded in



- ▶ Fire control system is mounted in a modular rack
 - ▶▶ Allows system to be mounted on the ground
 - ▶▶ Allows ease of movement of multiple LRU's
- ▶ HMMWV equipped with flip down FCC mount
 - ▶▶ Allows FCC to be operated while vehicle is moving
 - ▶▶ FCC clips in and out between E-Rack and passenger location





- ▶ M150 / M151 Delivers new capabilities to the war fighter
- ▶ Design increases modularity and reduces logistic footprint
- ▶ M150/M151 increases the flexibility of the war fighter
- ▶ M150/M151 allows for development in other weapon systems



Thank you for coming to our
briefing,
Amit and Ralph



BACKUP SLIDES





- ▶ Currently a modified COTS solution
- ▶ Runs Mortar Fire Control software
- ▶ User interface for system
- ▶ 1.6GHz processor, 5Gb solid state HDD
- ▶ 4 RS-422, 1 RS-232, USB, Ethernet
- ▶ MIL-1275 compliant 24VDC input
- ▶ Audio output
- ▶ Tactical modem with two-wire interface



Power Distribution Assembly (PDA)



- ▶ Accepts 24VDC input
- ▶ Conditions power and sends appropriate voltage to each LRU
- ▶ Main and individual circuit breaker / switch for each LRU



- ▶ DD Assembly consists of:
 - ▶▶ DD (currently COTS solution)
 - ▶▶ Shock isolation hardware
 - ▶▶ RAM arm mount
- ▶ Displays vehicle direction and distance from emplacement position
- ▶ Mounted inside and outside of drivers compartment (M1064)



- ▶ GD Assembly consists of:
 - ▶▶ GD (currently COTS solution)
 - ▶▶ Shock isolation hardware
- ▶ Displays ammo info and software calculated pointing solution for gunner
- ▶ Mounted on back wall of track (M1064)

- ▶ TALIN™ 3000 manufactured by Honeywell Aerospace currently used
- ▶ Provides navigation and weapon pointing functionality
 - ▶▶ Initial position either manually entered or provided by DAGR handheld GPS
- ▶ Mounted in PDMA, which isolates PD from shock and vibration (1064 configuration only)
- ▶ PLGR or DAGR are use for GPS assist
- ▶ Vehicle Motion Sensor is used for vehicle speed assist



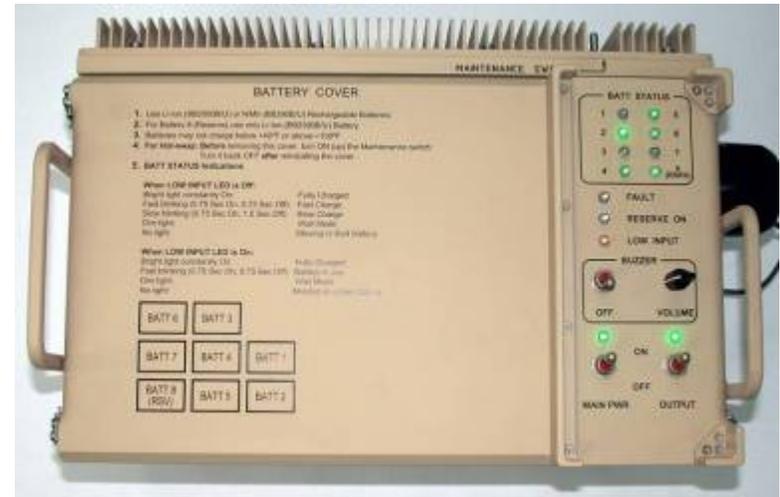


- ▶ Currently a modified COTS solution
- ▶ Runs Mortar Fire Control software
- ▶ User interface for system
- ▶ 10.4" resistive touch-screen
- ▶ 1.1GHz processor, 1Gb RAM, 8Gb solid state HDD
- ▶ 4 RS-422, 1 RS-232, USB, Ethernet
- ▶ MIL-1275 compliant 24VDC input
- ▶ Audio output
- ▶ Tactical modem with two-wire interface
- ▶ Glenair Mighty Mouse mini rotating connectors used
- ▶ Mounted in HMMWV passenger side when moving and is hand-held or mounted on e-rack during firing operations



- ▶ Accepts 24VDC input from PUBS or any NATO source
- ▶ Conditions power and sends appropriate voltage to each LRU
- ▶ Main and individual circuit breaker / switch for each LRU
- ▶ Internal 4-port Ethernet switch and Ethernet-serial server that allows for 4 virtual RS-422/RS-232 serial ports
- ▶ In MFCS Dismounted, acts as commo link between FCC and LRUs
 - ▶▶ FCC connects to EPDA via ethernet
 - ▶▶ LRUs connect to EPDA via serial
- ▶ Mounted on E-Rack

- ▶ Main power source for MFCS Dismounted
- ▶ 8 user swappable batteries
 - ▶▶ 1 is semi-permanent “reserve” to prevent catastrophic system shutdown
- ▶ Accepts BB2590, BB390 (A and B), BA5590 batteries already in Army inventory and widely used
- ▶ Individual LEDs provide status and diagnostics for each battery
- ▶ Fault LED
- ▶ Audible Alarm with volume control sounds when reserve battery is in use
- ▶ Currently best system runtime using PUBS is ~10 hrs. using BB2590s at ambient
- ▶ Mounted on E-Rack





- ▶ Mounted in front curbside of trailer
 - ▶▶ Can stay in trailer or be dismantled during firing operations
- ▶ Holds ASIP, EPDA, PUBS, DAGR
 - ▶▶ Currently holds GD assy when moving, but a new location for the GD assy on the trailer body itself has been selected
- ▶ For convenience includes mount to hold FCC during firing operations
- ▶ Swings open to allow access to PUBS for battery swapping

