



M256 Ammunition DataLink Development – Testing - Fielding



TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

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- 1990s – 2001: US & Germany discuss concepts for an Ammunition Data Link (ADL) under the M256 Joint Configuration Board meetings
 - Germany has a specific requirement to support airburst munition development
 - US has no requirement, but sees potential for future ammunition developments
- 2002: Joint Configuration Board releases Interface Control Document for an ADL utilizing low voltage (below no-fire limits) signals on primary ignitor circuits (separate hot contact, common ground)
- 2001-2004: Germany completes development of 120 mm DM-11 Airburst Munition, does not field the cartridge.
- 2001-2004: US recognizes limited data throughput and safety concerns using JCB ICD protocols. Picatinny based ammunition developers & Watervliet based weapon developers create a US ADL protocol to support advanced ammunition development for FCS.
- 2005: US creates prototype modification kits for M256 to support Mid Range Munition tests
 - US develops XM360 Gun Assembly with ADL – both JCB (German) and US protocol
- 2008: USMC - Urgent Universal Need Statement for a 120mm Multi-purpose High Explosive Tank round which required ADL – focused on acquisition of German DM-11
- 2009 -2010: Benet adapts prototype M256 kits to USMC needs, Benet completes Fatigue Testing of three (3) ADL Modified M256 Breechblocks and Faceplate.

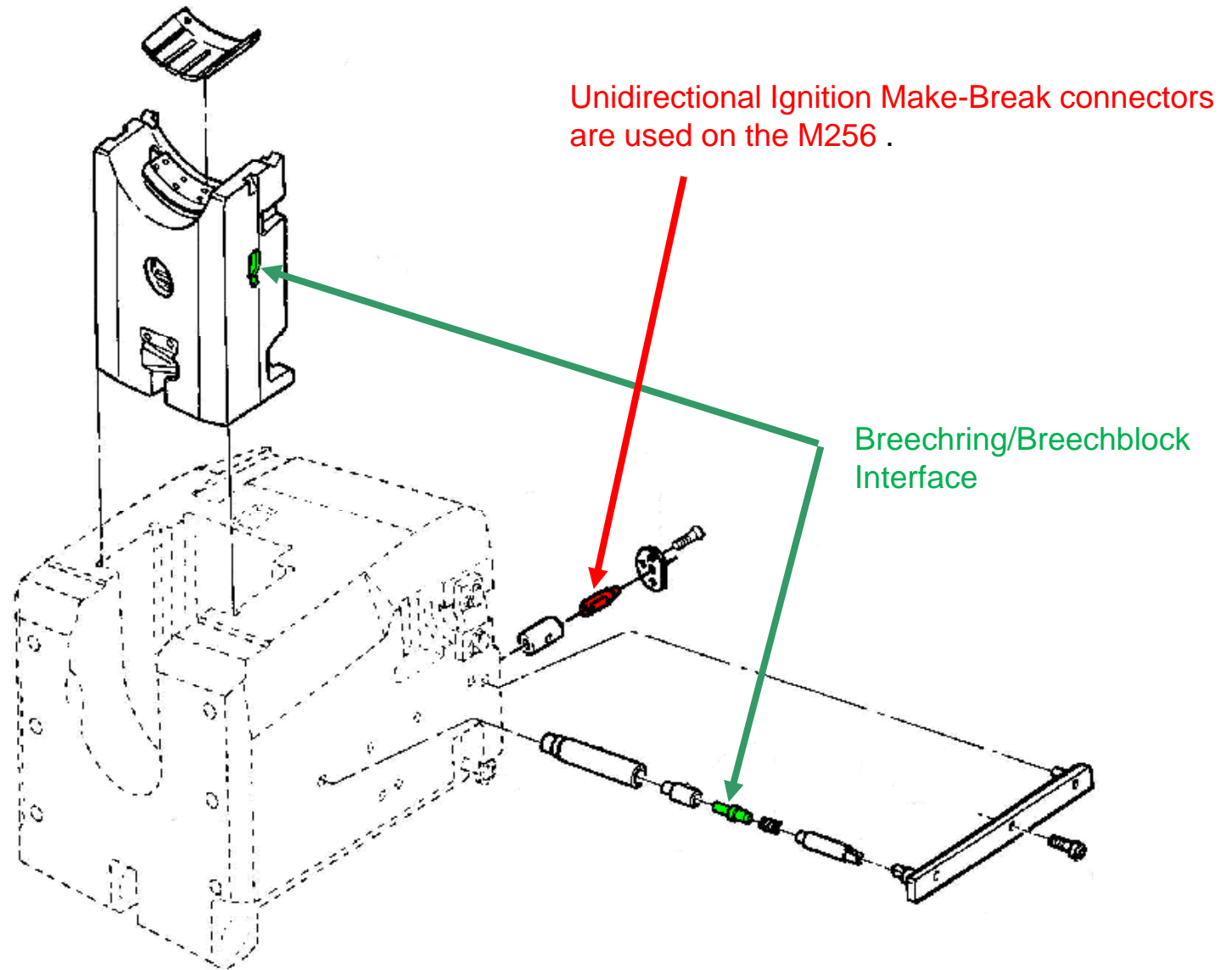




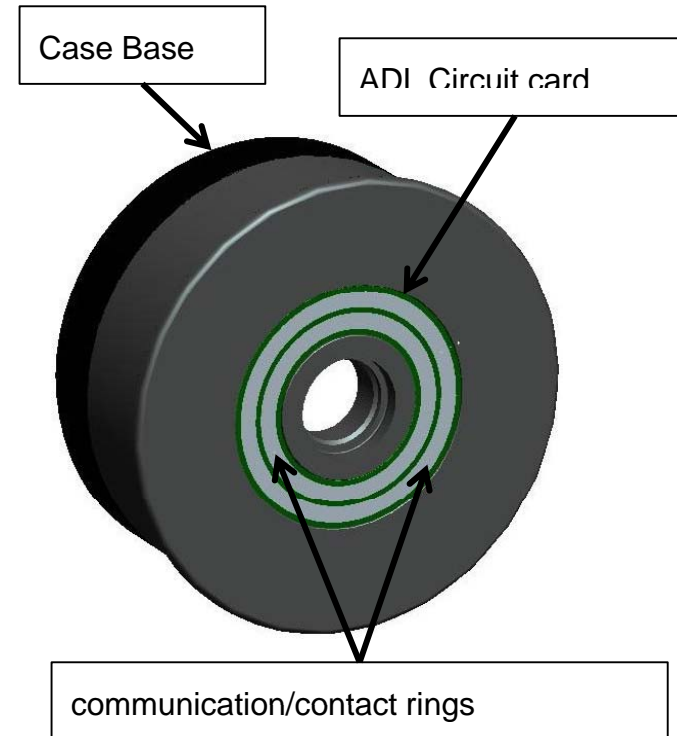
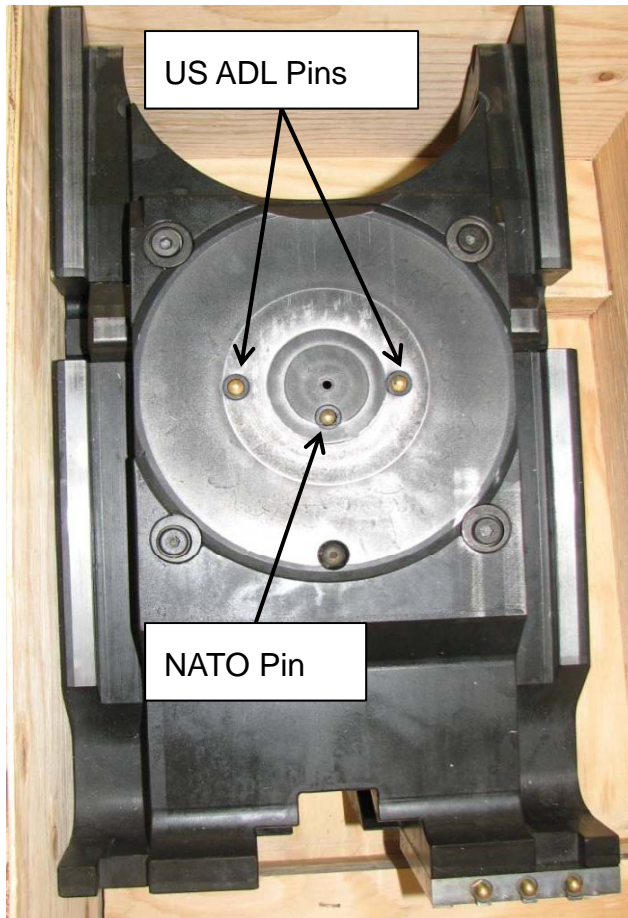
M256 Gun Assembly uses a 'make-break' circuit for ignition pulse



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FS59149



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Benet Developed A Bi-directional Make-break Assembly



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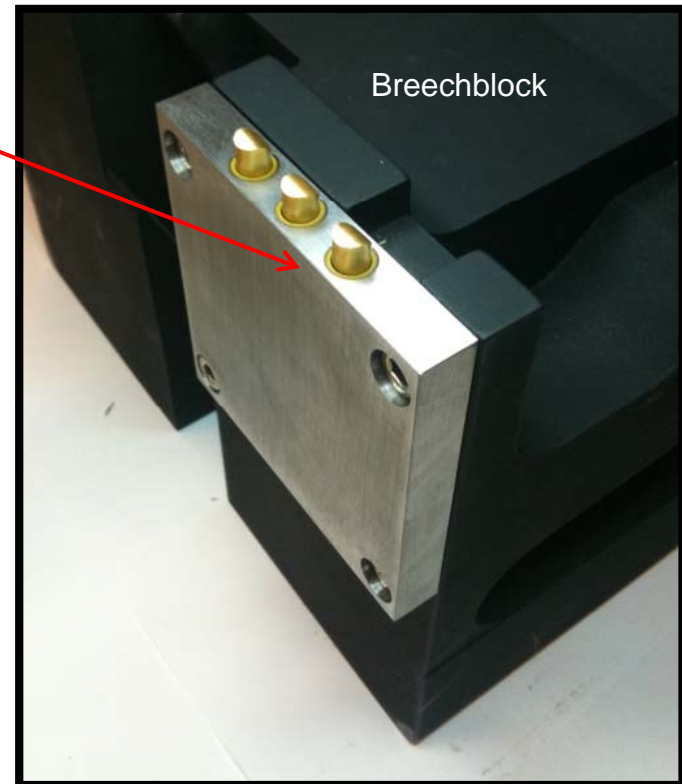


Shoe Assembly

Ramp Assembly



Faceplate



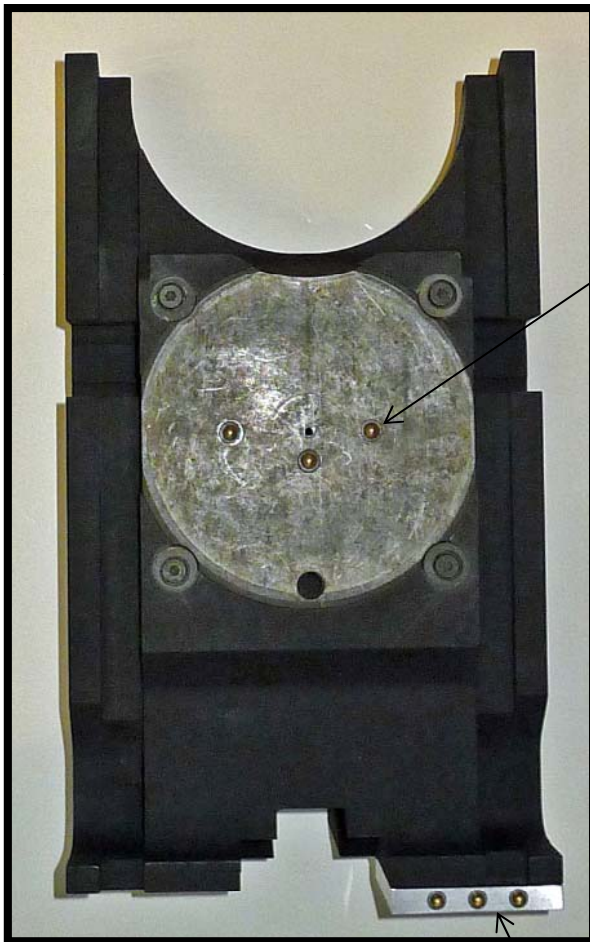
Breechblock

- Ramp Assembly mounted to Safe-Arm Bracket
- Shoe Assembly mounted to Breechblock
- Pin Modules press-fit into Breechblock Faceplate

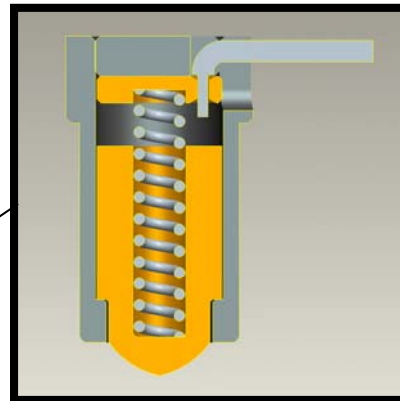


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Breechblock Assembly



Pin Module



Ramp Assembly
(Mounted to Safe-Arm)



Design Overview

- Spring Loaded “Piano Key” Ramp Assembly
- Spring Loaded Pin Modules with 22 AWG wire w/spring as electrical conductor
- Fixed Pin Shoe Assembly
- No Sealing Features
- Removal of Breechblock requires complete removal of Ramp Assembly

Shoe Assembly

Not to Scale

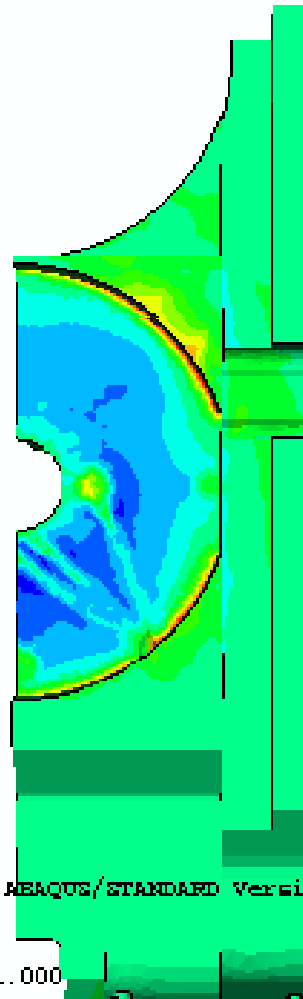
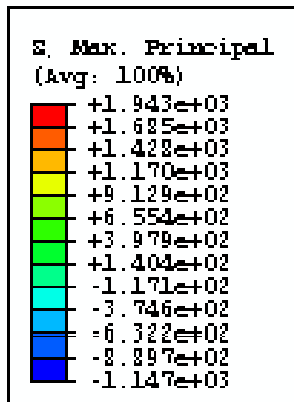




Originally fielded design Analysis of ADL Modifications to the M256 Breech



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2
1

ODB: mymodel_fix_fric_quad.odb

ABAQUS/STANDARD Version 6.6-3

Thu Jun 21 07:29:55 Eastern Daylight Time

Step: Load Applied - 758 MPa

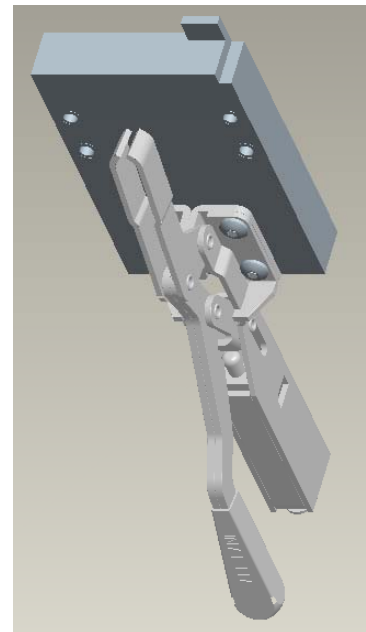
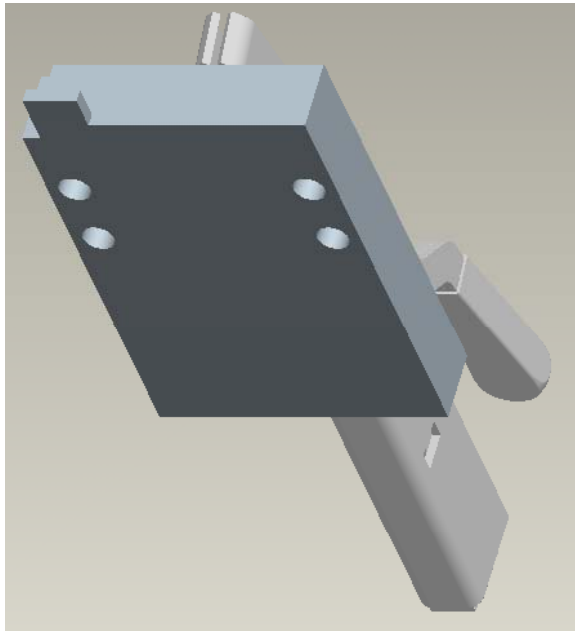
Increment 6: Step Time = 1.000

Primary Var: S, Max. Principal

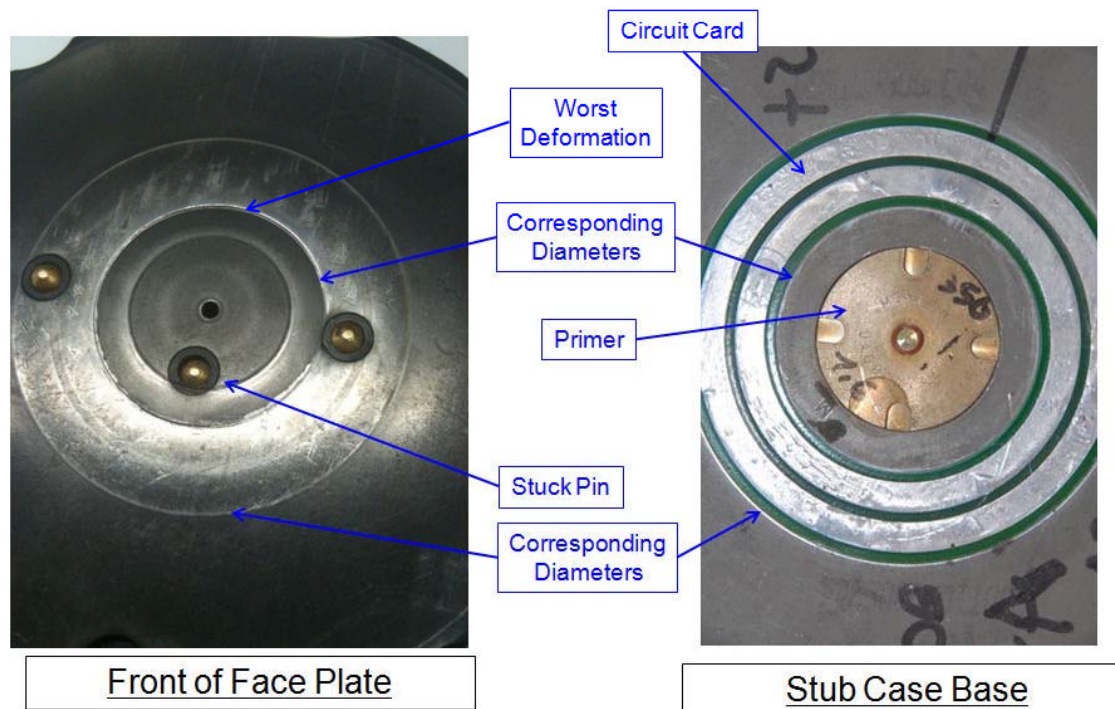
Deformed Var: U Deformation Scale Factor: +1.000e+00



- 2009: Deviation L09T7009 is released in order for USMC to field up to qty 65 M256 ADL Kits.
 - Weapon Systems and Explosives Safety Review Board (WSESRB) Dec 2009 - Approval
- 2010: Benet travels to Kuwait to install M256 ADL Kits in field for USMC.
 - Jig and fixture developed & USMC personnel trained on installation.

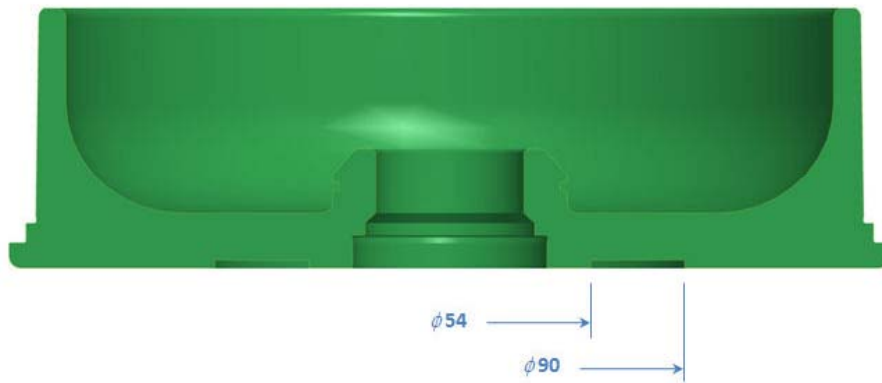


- 2010-2012: Continued testing of more advanced, higher pressure cartridges revealed minor deformations to the breech face plate
- Joint analysis with ammunition developers revealed that the pressures were causing minor deformation.

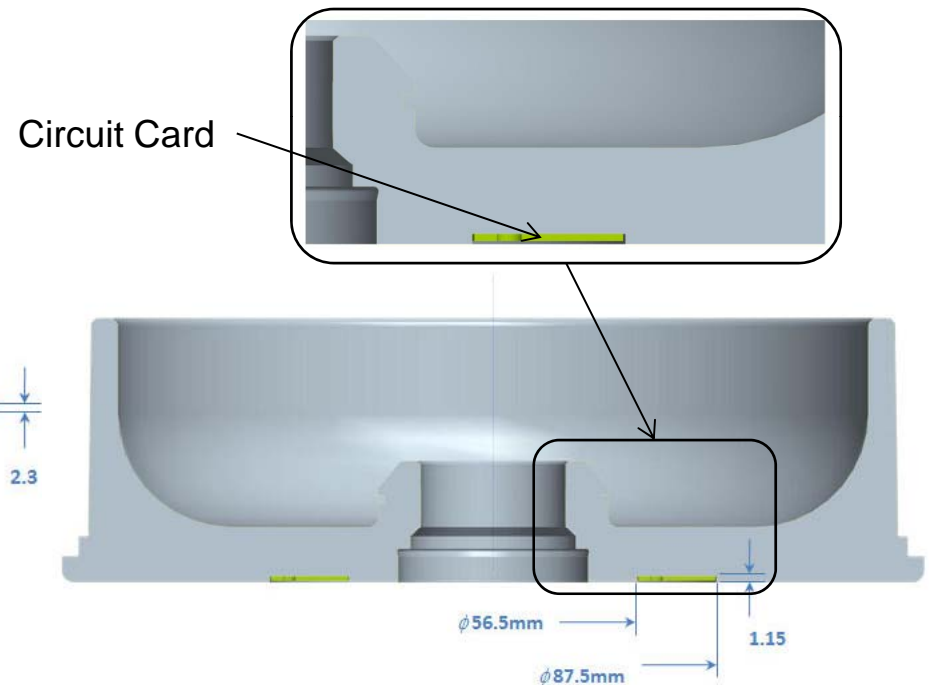


Modeling of New Case Base Configurations Conducted:

- Several case base models were examined
- Tested two new configurations & original configuration
 - Configuration 1: Reduced circuit card thickness (half original thickness), Smaller OD, larger ID.
 - Configuration 2: Reduced circuit card thickness (half original thickness), original ID & OD



Original Case Base Configuration



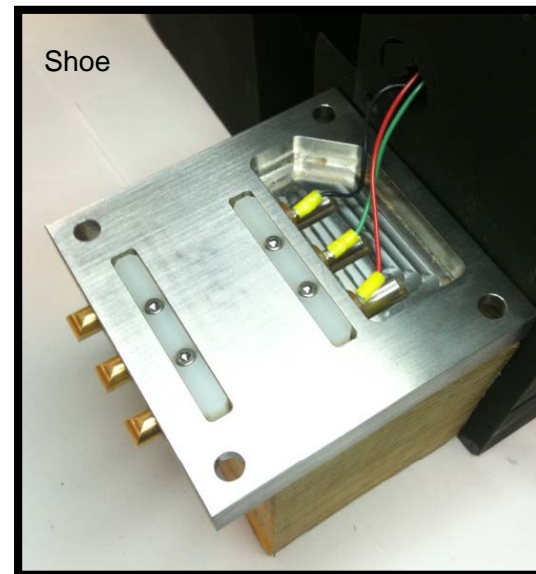
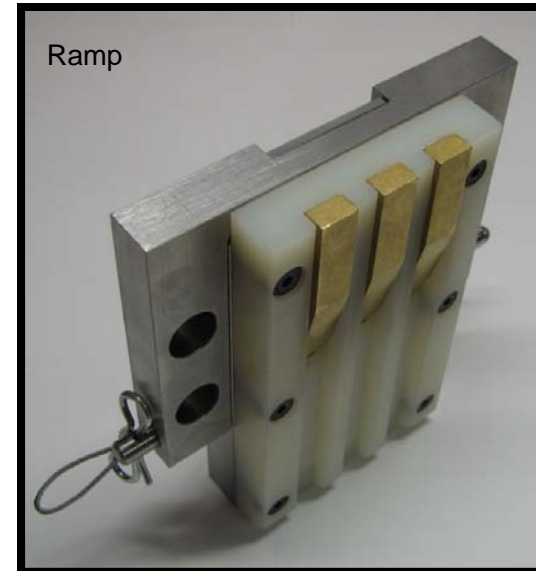
New Case Base Configuration



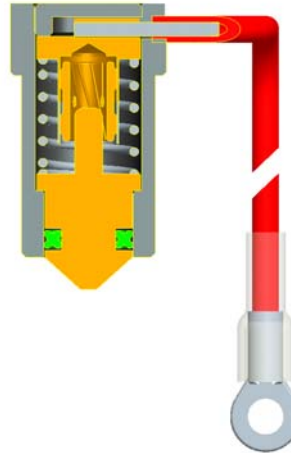
- 2011-2013: PM Abrams – implemented the Ammo Data Link on the US Army test vehicles, Army planning wider fielding as part of ECP 1 for the M1A2
- 2011-2013: Benet support to USMC reveals some issues with the ADL equipped cannons in the field - feedback to Benet translated into design changes on the components.
- 2012: PDR for Army ADL
- 2013: Benet Awarded Patent “WEDGE-TYPE BREECHBLOCK BI-DIRECTIONAL MAKE-BREAK ASSEMBLY “ USPTO Serial No. 8,371,206 Date: 12 Feb 2013



- USMC Redesign of Ramp and Shoe
 - No changes to previous Block/Faceplate Mods
 - No changes to previous Safe-Arm Retrofit Mods
 - No changes made to Pin Module Design
 - 22 AWG wire still used
 - Shoe Assembly has spring loaded pins
 - Hyperboloid socket design added to Shoe Assembly which removes spring as sole conductor
 - Shoe Assembly pins do not fully compress to flush
 - Ramp Assembly has Fixed contacts
 - Ramp Assembly has quick-disconnect pin to allow for easier maintenance when breechblock needs to be removed
 - Ramp Assembly is potted
 - No Sealing features in Shoe Assembly



- Army Optimization Effort (In Progress)
 - No changes to previous Block/Faceplate Mods
 - No changes to previous Safe-Arm Retrofit Mods
 - 16 AWG wire used throughout
- Pin modules optimized to include
 - Sealing features
 - Spring no longer sole electrical conductor
 - Harder pin material for improved wear
 - Pin tip profile changed to improve wear
- Shoe Assembly optimized to include
 - Sealing features
 - Maintains hyperboloid socket concept from USMC Redesign (removes spring as sole conductor)
 - Full compression of pins achieved
 - Quicker assembly onto Breechblock
- Ramp Assembly optimized to include
 - Pigtail cable to eliminate the need to disconnect connector and allows for easier replacement if damaged
 - Stowage bracket allows Sliding Ramp Assembly to be mounted in safe location while its removed from operational mounting location





- Additional Testing Performed Since 3rd Generation Fielded
- Shock and Vibration Testing
 - Breechblock Assembly and Ramp Assembly have undergone vibration testing to ensure parts to not become loose during vibration: No Failures
 - Breechblock Assembly and Ramp Assembly have undergone extreme shock testing with no failures:
- Full environmental testing has been completed. Temperature, Chemical, Waterjet Cleaning, Humidity, Submergence, Sand & Dust, Salt Fog and Fungus
- Continued live fire testing at Yuma Test Center with updated parts - no incidents of communication failure or safety issues.
- Conclusions
 - No changes have been made to the Breechblock and Faceplate since the initial SAR was approved (ie. Critical components remain unchanged)
 - ADL components (Pin Modules, Shoe, Ramp) have been optimized to increase durability and lifespan
 - All components have undergone some form of live fire testing
 - All components have completed shock and environmental testing.



- ARDEC – Weapon and Ammunition developers have successfully developed and tested an Ammunition Data Link that modifies the current 120 mm M256 Gun Assembly.
- The Ammunition Data Link is being fielded by the US Army in the M1A2 tank upgrades right now. The Ammunition Data Link was urgently fielded in USMC M1A1 Tanks and is being upgraded with improved components to improve durability.
- The ADL System developed by ARDEC has substantial growth potential in data throughput and will enable a future generation of smart rounds

