ARDEC Rapid Design Projects for Field Support – Part 1

L-Bracket for use with M240B Medium Machine Guns on HMMWVs with Gunner’s Protection Shield (NSN 2510-01-498-4996)

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Objective

- Tasked by PM Soldier Weapons and ARDEC’s Quick Reaction Task Force to make AN/PEQ-2A aiming laser useable on the M240B with HMMWV Gun Shields
- Issue was brought to ARDEC’s attention in October of 2005 by the 4th Infantry Division prior to deployment.
- Fix was needed in time for deployment in Dec 2005.
Gun Shield with M240B
Problem Statement

Shield blocks any aiming laser mounted on forward rails.
HMMWV Gun Shield Information

- Intended for use with MK19 GMG, M2 .50 Cal and M240B MMG
- Mounts on roof of HMMWVs
- Provides gunner with front and some side protection
AN/PEQ-2A Information

- Aiming laser used for small arms
- Has one aiming laser and one illuminating laser with adjustable focus
- Emits only invisible IR light
- Powered by two AA batteries
M145 & TWS Information

- M145 – fixed 3.4 power Machine Gun Optic (MGO)
- AN/PAS-13 - Thermal Weapon Sight (TWS)
Concepts

- Modify gunner’s shield
- Readily available commercial solutions
- Mount extension on top rail (L-Bracket)
Commercial Bracket Evaluation

- Evaluated by 4\textsuperscript{th} ID and 29\textsuperscript{th} IR
- Increases height of optic from weapon
  - Exposes gunner
  - Non existent cheek to stock well; neck strain (poor eye relief and sight picture)
- Requires new offset targets for all sights

Conclusion: AN/PEQ-2A still interferes with back of gunner’s shield.
L-Bracket Prototypes
L-Bracket Evaluation

• AN/PEQ-2A is mounted relatively close to weapon
  – Maintains position of all optics on M240B machine gun feed tray cover rail
  – No new target offsets for optics
  – Reduces possibility of damaging weapon and optic
  – Brings aiming and focused flood light above shield
• Firing done from tripod and HMMWV
• Road test done with HMMWV
  – No cracks, no loss of zero, no screws loosening

Conclusion: Concept solves issues, is durable and reliable.
FABRICATION

- 880 Brackets required for 4th ID
- Design finalized and refined for manufacture at Picatinny Rapid Prototyping Facility
  - Parts to be cut from sheet metal stock
  - Rail grabber features machined
  - Parts bent to create 90° angle
- Standard parts ordered (screws, washers, etc.)
- Rails ordered from spare part system
- Offset targets created for AN/PEQ-2A
- Installation instructions created
- Assembled and packaged
Schedule

• 6 October 2005 – Work Began
• 27 October 2005 – L-Bracket Testing
• 9 November 2005 – Production Began
• 22 November 2005 – First Shipment
• 6 January 2006 – Last Shipment
Fielding

- 880 L-Brackets shipped (Nov 2005 - Jan 2006)
- 700 additional L-Brackets shipped (March 2006)
- Users satisfied with solution
- No need to improve solution
- Additional Brackets are being procured
The M113A2 Armored Personnel Carrier (APC) Degtyarev-Shpagin (DShK) 12.7mm Heavy Machine Gun (HMG) Mount

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Objective

Tasked by U.S. Army Tank Automotive Command (TACOM) and the Afghanistan Office of Military Cooperation (OMC-A) to design, fabricate, and ship a quantity of 63 mounting platforms to interface the DShK 12.7mm HMG to the M113A2 APC in support of the Afghanistan National Army (ANA).
M113 Background Information

- Units produced (of all variants): ~80,000
- Crew: 2 + 11 – used primarily as a battle taxi
- Weight: 12.3 tons
- Armor: Aircraft quality aluminum
- Main armament: M2 0.50 Caliber HMG
- Road Speed: ~41 mph
- Range: ~300 miles
- A2 Variant introduced in 1979 and features cooling and suspension improvements

Reference: Jane’s Military Vehicles and Logistics 2005-2006
**DShK / M2 0.50 CAL HMG**

**Background Information**

<table>
<thead>
<tr>
<th></th>
<th>DShK</th>
<th>M2</th>
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<tbody>
<tr>
<td><strong>Ammunition</strong></td>
<td>12.7mm x 107</td>
<td>12.7mm x 99 (.50BMG)</td>
</tr>
<tr>
<td><strong>Muzzle Energy</strong></td>
<td>15,570 J</td>
<td>16,876 J</td>
</tr>
<tr>
<td><strong>Weight, empty</strong></td>
<td>35.7kg (78.5lbs)</td>
<td>36kg (79.2lbs)</td>
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<tr>
<td><strong>Cyclic ROF</strong></td>
<td>575-600 spm</td>
<td>550 spm</td>
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<tr>
<td><strong>Date of Design</strong></td>
<td>1938</td>
<td>1921</td>
</tr>
<tr>
<td><strong>Action</strong></td>
<td>Gas</td>
<td>Short Recoil</td>
</tr>
<tr>
<td><strong>Variants</strong></td>
<td>DShK38, DShKM</td>
<td>M2HB</td>
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Reference: Jane’s Infantry Weapons 2005-2006
The ANA needed to modify the existing weapon platform on the M113A2 APC in order to mount the DShK Soviet 12.7mm machine gun.
User Design Requirements

- Reduce gunner’s exposure by lowering weapon height
- Allow mount to clear all obstructions when rotating turret
  - Including open driver’s hatch
- Extend pintle centerline outward thereby reducing weapon interference with gunner
- Maintain weapon elevation of at least 25°
- Allow for proper bottom ejection of spent cartridge cases
- Limit periscope view obstruction
- Maintain ability to dismount weapon
Design Ideas

This design was decided upon via a telecon with TACOM/OMC-A on 9 March 2005
Final Design Concept

Designed using Pro/Engineer.
Created engineering drawings.
Exported files to machine shop for fabrication.
Initial Prototype
Testing

- 600 Round ARDEC function firing test using M2 0.50 cal HMG and pintle adapter
- Modeling & Simulation at ARDEC using MSC-NASTRAN simulating mount to typical 3000 mile M113 driving loads IAW MIL-STD-810 program data
- Validate M&S at ATC on vibration tables subjecting mounts to the same loads as above
Testing

ARDEC 600 round function firing test using M2 0.50 cal HMG and adapter pintle.
Testing

Aberdeen Testing Center  Vibration Table Setup
Fielding/Feedback Issues

- Confirmation that ANA received mounts on 21 Feb 2006.
- Awaiting user operational feedback.
## Schedule

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<thead>
<tr>
<th>MILESTONE</th>
<th>FY05</th>
<th>FY06</th>
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<tbody>
<tr>
<td>DShK Cradle Available to ARDEC</td>
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<td>Program Approval, Funding</td>
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<tr>
<td>Design Concepts Created and Presented</td>
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<tr>
<td>Customer Feedback and Concept Down Select</td>
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<tr>
<td>Create Pro-E models, 2-D Shop Level Drawings</td>
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<tr>
<td>Fabricate metal prototype, Verify Form/Fit/Function</td>
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<tr>
<td>Modeling and Simulation; FEA Analysis</td>
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<tr>
<td>Test Firing with M2 .50 Cal machine gun</td>
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<tr>
<td>ATC 3000 Mile Vibration Test</td>
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<tr>
<td>Improve design based on results of FEA and vibration test</td>
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<tr>
<td>Finalize drawing package</td>
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<tr>
<td>Begin production</td>
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<tr>
<td>Deliver first lot (24 units)</td>
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<tr>
<td>Deliver second lot (39 units)</td>
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Questions?