40th Annual Armament Systems:
Guns – Ammunition – Rockets - Missiles

The 81mm Non Lethal **Mo**rtar **Ca**rrier **P**rojectile (MoCaP)

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Background

♦ In May 1999, the Joint Non-Lethal Weapons Directorate (JNLWD) initiated investigation of the long range delivery of non lethal payloads.

♦ One year later, RDECOM-ARDEC was asked by JNLWD to oversee the program.

♦ RDECOM-ARDEC has been devoted to find ways to meet a Terminal Kinetic Energy Criterion of 58 ft-lbs.

♦ RDECOM-ARDEC team previously demonstrated technical readiness level (TRL) of 4 by using parachute recovery method and commercial (fireworks industry) electronic time fuze.

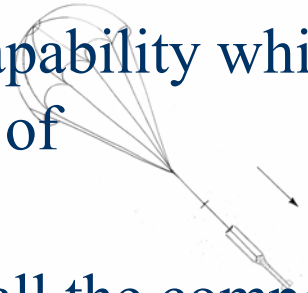
♦Demonstrated a TRL 5 ➔ Prepared for a Milestone A Decision

Mission Needs

- Today's non-lethal capability, such as rubber bullets or tear-gas requires soldiers to put themselves in the middle of a crowd to disperse it, thus putting themselves in harms way of potential suicide bombers or improvised explosive devices.
- Current projectile delivery components can impact and injure crowds or property on the ground.
  - Increase risk of riot and negative image.
  - Liable for collateral damage.
- Providing a non-lethal mortar carrier projectile gives the warfighter a capability of crowd control from a stand-off distance.

MoCaP Meets Mission Need

- Can be fired from an existing weapon system as the conventional munitions without requiring additional training.
- Warfighters have the ability to fire non-lethal and lethal munitions without changing weapon configuration.
- Able to engage combatants with lethal capability while preventing the buildup of concentrations of non-combatants.

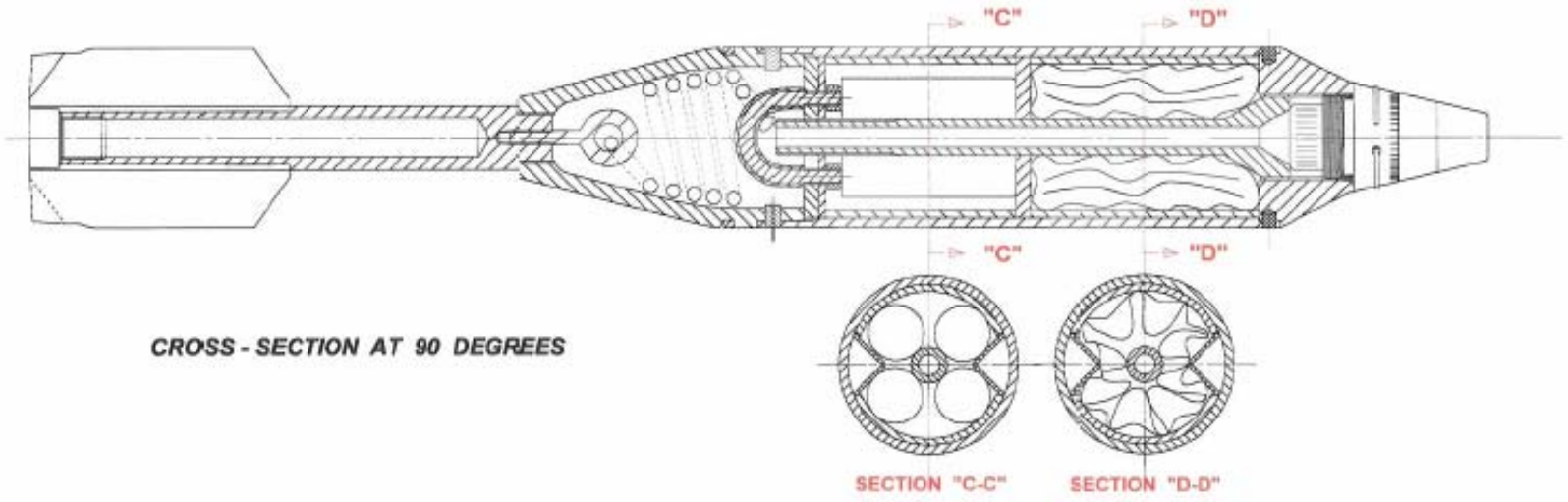


- Decelerator system is deployed to bring all the components to the ground to ensure there will be no fatalities from the delivery system.
- The government will minimize liability due to collateral property damage and human casualties.

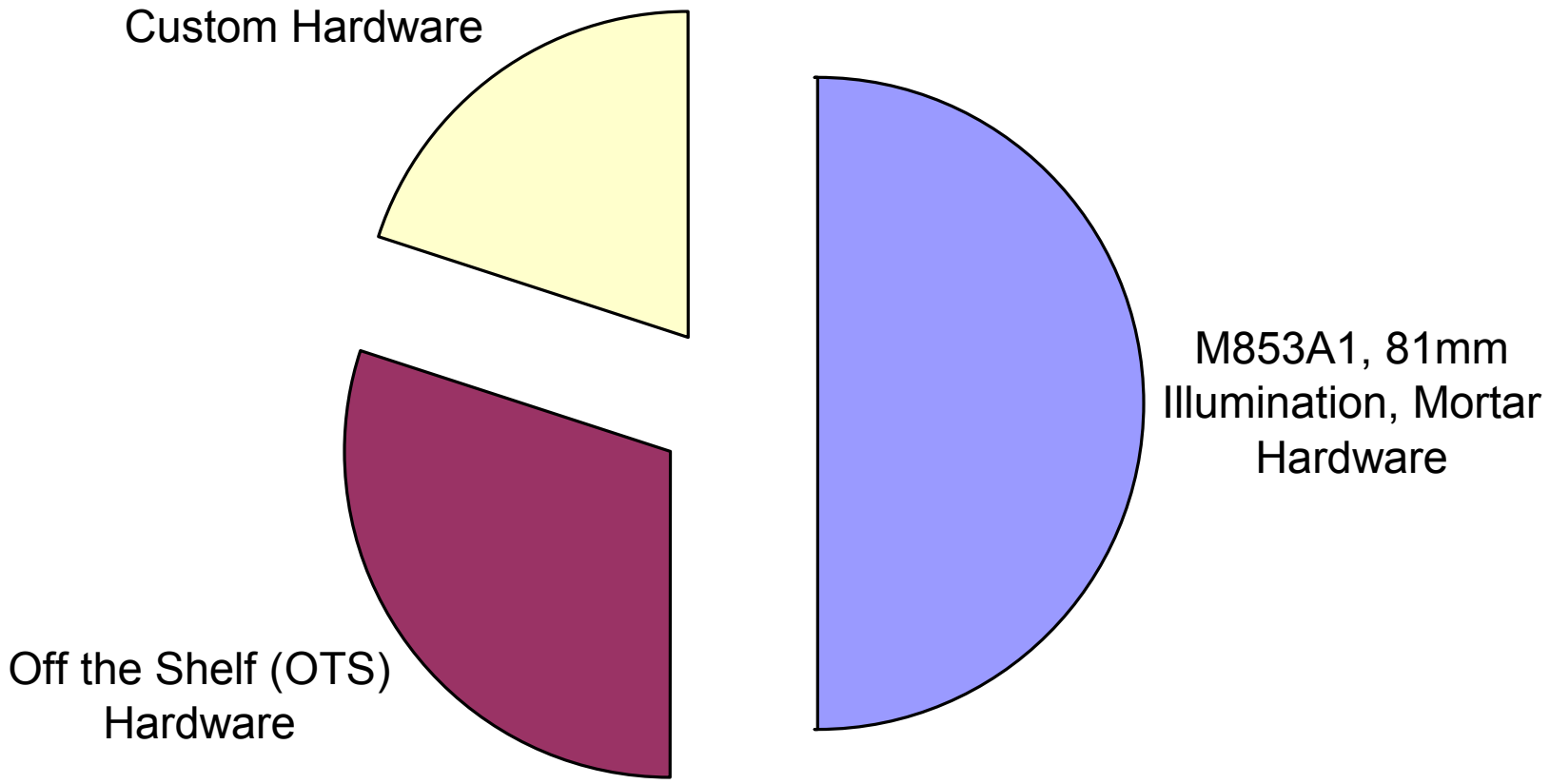
Design Requirements

- Range > 2500 meters
- KE < 58 foot-pounds
- Fire from an existing weapon system
- No additional training requirements.

MoCaP Design



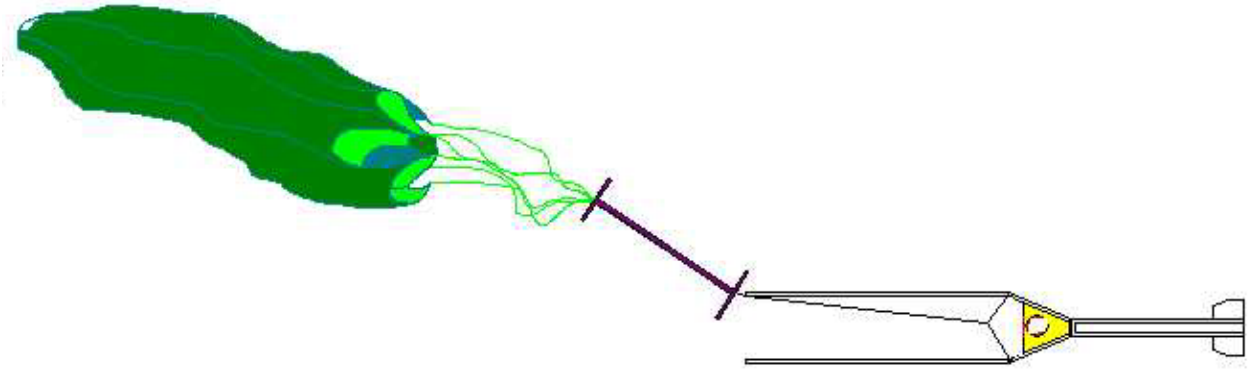
Design Description



Design Features

- Forward Ejection
- Pressure Tube
- Vent System
- Tethering System
- Dual Parachute System

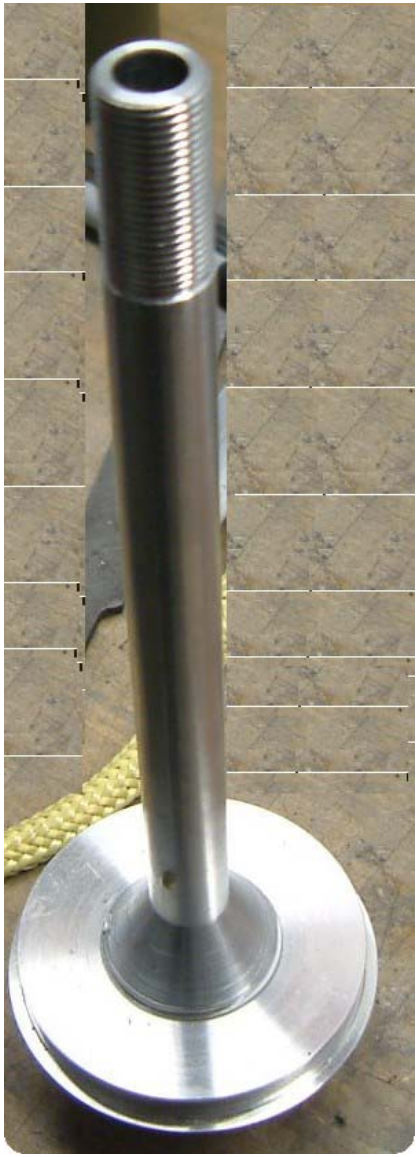
Forward Ejection



- Utilize the ejection concept proven during previous Proof of Principal.
- Utilize an existing fuze for simplicity and provide required stability.
  - Developing a new fuze is a major program that should be avoided.
  - Weight of the fuze is required for static stability.
- Avoid mid-body separation.
  - Ejecting two masses in opposite directions requires stronger tethering which raises packing (volume) concerns.

Pressure Tube

- Provide passage to transfer expulsion gas to boattail for rear pressurization.
- Provide structural support to the system.
  - Support the G-force due to the fuze weight during launch – the body can be made lighter (weight reduction potential).
- Riser is looped around the tube:
  - Provide swivel function (leaning system components).
- Lab test completed to determine optimum size.
  - A close bomb test conducted to check: choking & optimum inner diameter of the tube & determine tube thickness.



Separation Test

- Functioned Fuze to evaluate Performance.
- Results
  - Tethering System failed
  - Need to vent excess pressure

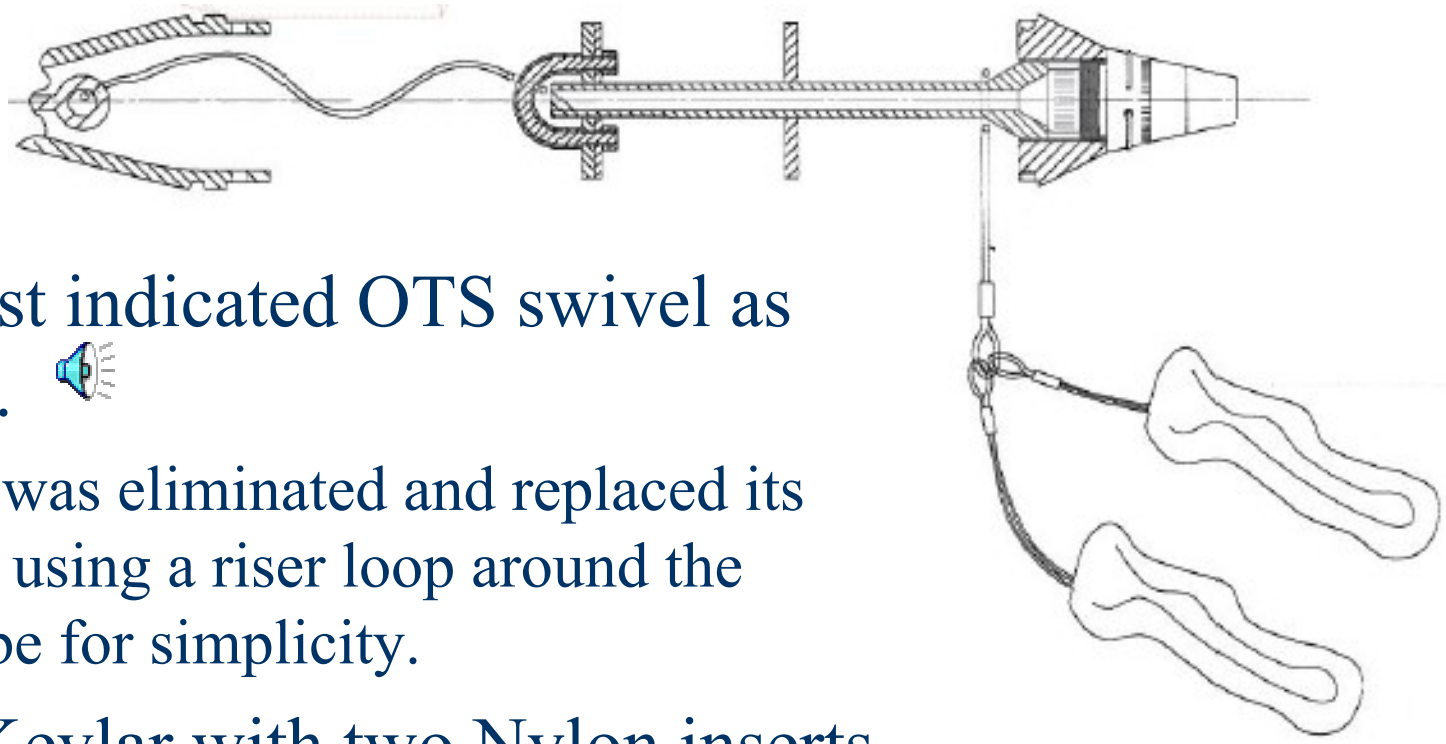
Lessons Learned

- Observed “Gun Effect”.
- Producibility issues during LAP lead team to develop a modular design for easier assembly.

Vent System

- Modification of the fuze expulsion charge is not an option.
- Out-of-Box concept to reduce gun effect.
  - Major setback of the design development required major brainstorming.
    - Able to break the four shear pins.
    - Minimize gun effect to reduce force on the tethering system.
    - Optimize payload volume.
    - Provide reasonable volume for parachute system.
- Performed DOE to determine best venting size.

Tethering System



- Static pull test indicated OTS swivel as weakest link.
  - The swivel was eliminated and replaced its function by using a riser loop around the pressure tube for simplicity.
- Reinforced Kevlar with two Nylon inserts.
  - Nylon inserts were designed and reserved to break to dissipate energy upon an excessive force condition.

Dual Parachute System

- Utilize given volume.
  - Two parachutes were the best option due to two vent tubes on sides and one pressure tube in the middle.
- Increase Reliability.
  - The chutes are independent of each other; increase reliability.
- Meet KE requirements
  - Successful opening of the two small chutes in the design is sufficient to meet 58 ft-lb KE requirements.

Ballistic Firing

- Demonstrated Range > 2500 m.
- Successfully deployed payload and decelerator.
- Met KE requirement.
- Previously fired from the existing 81mm M252 Mortar System.
- Demonstrated TRL of 5.

Possible MoCaP Variants

- Flash-bang
- Malodorant
- Acoustic (Screamer)
- Sensors
- Beacon (Transmitter)
- Jamming System
- Liquid Tagging / Marking
- Location Marking
- Battle Damage Assessment
- Surveillance Imaging
- MEMS Delivery

MoCaP Points of Contact

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