Development of a 12.7 mm Limited Range Training Ammunition (LRTA)

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GENERAL DYNAMICS
Ordnance and Tactical Systems–Canada

Outline

- Background
- Objective
- Design Methodology
- Results

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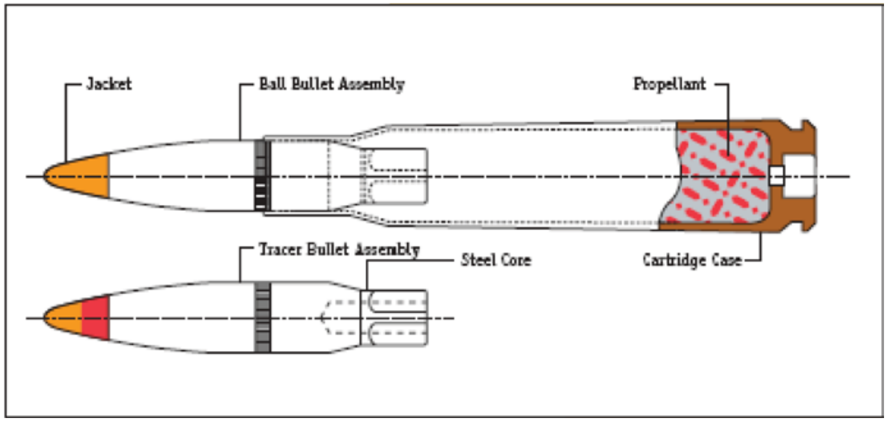
Background

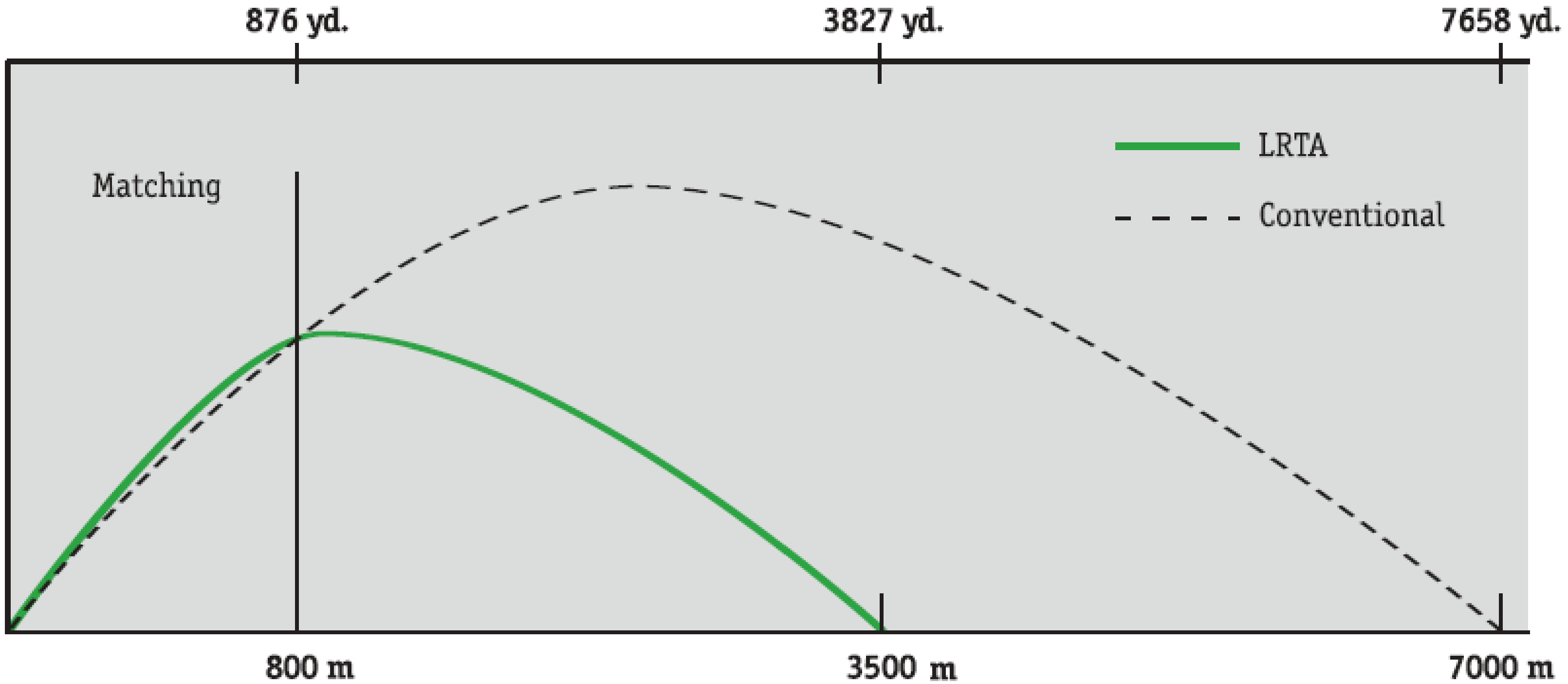
- Limited Range Training Ammunition (LRTA) in production at GD-OTS Canada since 2001
- Projectile with rearward fins, spin decelerates in a controlled manner to render it unstable past its effective training range



- Current LRTA has 50% less maximum range than conventional 12.7 mm (.50 caliber) ball projectiles: 3500 m vs. ~7000 m
- Cartridge available in ball and tracer versions

Current LRTA Performance Characteristics

- Maximum range: 3500 meters
- Precision (ball): 30 cm hor. & vert. std deviation at 550 m
- Precision (tracer): 40 cm hor. & vert. std deviation at 550 m
- Ballistic match at 550 & 800 m: ≤ 1 mil

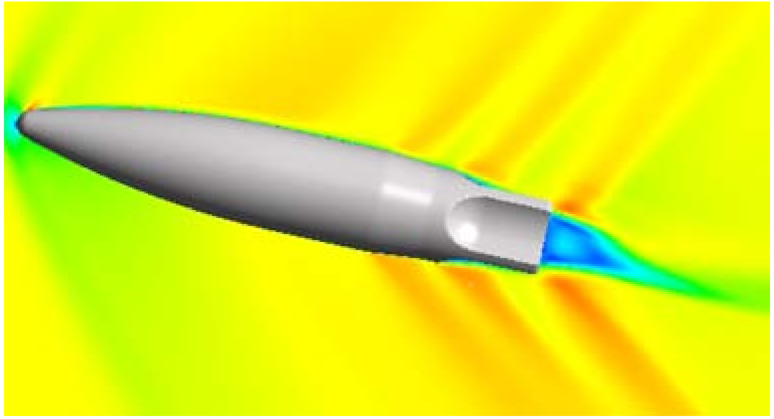


Objective

- Develop Next Generation of LRTA cartridge
- Reduce 3,500 m maximum range of current LRTA cartridge under **2000 m**
- Maintain precision and ballistic match performance similar to the service round (and current LRTA round), up to 800 meters

Design Methodology

- Investigation of all design parameters which could affect the flight dynamics of the projectile
- Incorporated a LDFSS methodology in order to facilitate the development
  - Use of a DFMEA to identify critical design parameters
  - DOEs used in order to maximize information results obtained during testing
- Design focused on maximum range
- Need to conserve same performances in precision and ballistic match



DFMEA

- DFMEA conducted solely on the projectile
- Identification of important design parameters could be regrouped in two distinct categories:
  - Rear fins design:
    - Length, depth, radius, shape, number

  - Projectile shape:
    - Nose radius, meplat diameter, lengths (nose, cylindrical, rear…), boat tail
- Ballistic match results could be impacted by modifications to projectile shape
  - First objective was to see the effect on maximum range

DFMEA

- Also investigated what other parameters could affect flight characteristics
  - Muzzle velocity
  - Yaw at muzzle
  - Cartridge length
  - Projectile weight
  - Position of center of mass
  - Conditioning temperature
  - Gun elevation
  - Etc.

Design of Experiment

- Design parameters too numerous to test all possible combinations
- Use of DOEs for testing
  - Reduction in number of possible combinations of parameters
- Tests conducted concurrently on 2 fronts
  - Different fins configurations, with same projectile shape
  - Different projectiles shapes, with same rear fins
- Eventually, combination of the most promising results from both groups

Design of Experiment

- Fins Configuration
  - Kept the same jacket for all projectiles
    - Similar to current LRTA & C162 rounds
  - Machining of different fins on “blank” steel cores
- Projectile Shape
  - Different approach needed to modify projectile shape
    - Too costly and time consuming to modify fabrication matrices and punches just for prototypes
  - Machining of monolithic projectiles on a CNC to reproduce desired shapes

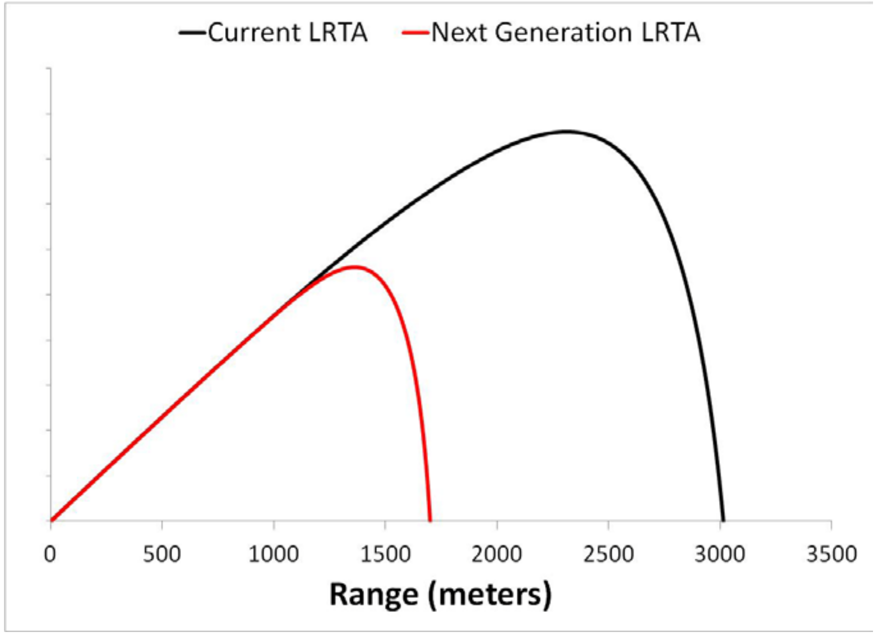
Use of Monolithic Projectiles

- Tested different materials for our needs

- More control over tolerances versus jacketed projectiles
- Different physical properties than jacketed projectiles
  - Results provide information on variation of different parameters
  - Results cannot be directly transposed to jacketed projectiles

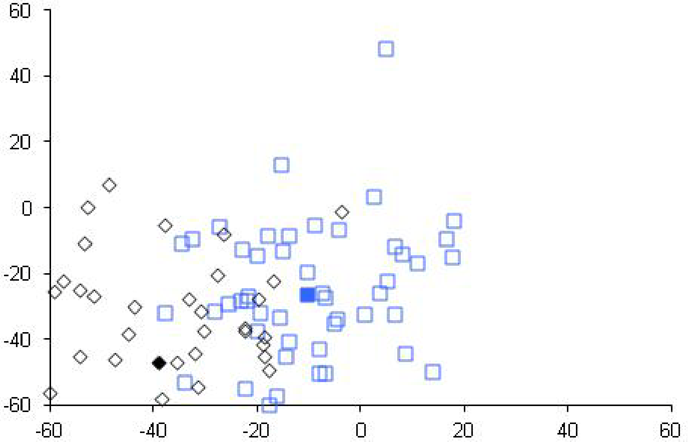
Experimental Results

- Recently tested design configurations which show significant prowess to constantly fall at ranges under 2000 m
- Fired in maximum range on 2 different occasions, each time in 2 different guns
  - Same results obtained on both occasions
- Velocity drop consistent with current LRTA at distances up to ~900 m from muzzle
  - Similar precision / ballistic match results could be expected



Next Steps

- Validate maximum range results obtained
  - Testing, testing, and more testing
  - Even just one projectile with a longer range is one too many
- Need to confirm robustness of design in order to validate the limits of the design tolerances
- Validation of results in precision / ballistic match
- Industrialization process



Conclusion

- Current LRTA
  - Maximum range of 3500 m
  - Match with C162 round at 800 m
- LDFSS methodology used to design Next Generation LRTA
  - Maximum range of 2000 m
  - Same performance in precision / ballistic match
- Designs already tested which could meet requirements
- Additional efforts needed to confirm results & validate robustness of design under all operating conditions

Contact Information

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