National Defense Industrial Association Small Arms Symposium

Component Technology Investigations for Light Machine Gun Applications

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Component Technology Investigations

Background

Issued a Broad Agency Announcement (BAA)

Sponsor – Joint Service Small Arms Program Office

Support – Future Force Warrior Program

Purpose

Solicit proposals for Component Technologies to support the development of a Lightweight Family of Weapons and Ammunition

Component Technology Investigations

Goals

- Technologies (Weapon and Ammunition)
- Weighing 30 to 35 percent Less than current systems
- Less Volume
- Maintain Current Performance
- Robust
- Reliable
- Easy to maintain

Contracts Awarded

- **5.56 Barrel Weight Reduction**
  - FN Manufacturing, Inc.

- **Enhanced Propellant & Alternative Cartridge Case Design**
  - Knox Engineering Company

- **Alternative Ammunition Case Materials**
  - Frontier Performance Polymers Corporation

- **Alternative Case Material and Enhanced Propellant**
  - Veritay Technology, Inc.

- **Aluminum Cartridge Case**
  - Alliant Techsystems Inc.

Component Technology Investigations

5.56mm Barrel Weight Reduction

Contractor:

- FN Manufacturing, Inc.

Technology:

- Use of new barrel materials
- Stellite MK46 barrel with UltraCem Nickel Boride coatings

Tasks:

- Design – 3D model – FEA – Thermal, Thermoelastic and Structural and Modal analysis.
- Fabricate Prototypes
- Functional Testing, Dynamic Motion Measurements, Thermal Evaluation

Deliverables:

- Contract Summary Reports
- Hardware – 10 Full Lined Barrels

Component Technology Investigations

5.56mm Barrel Weight Reduction

(Continued)

Results:

- Weight savings of 11% for MK46 barrel
- Accomplished by removing extra mass
- Optimized M249 barrel design for an estimated weight savings of 48%

Component Technology Investigations

Enhanced Propellant and Alternative Cartridge Case Design

Contractor:

- Knox Engineering Company

Technology:

- Formulate Enhanced Propellant
- Design Alternative Cartridge Case

Tasks:

- Select, Mill and Blend Propellants
- Conduct Pressure Bomb Tests
- Design and Fabricate Test Fixture
- Fire 250 + Test Cartridges in Test Fixture
- Measure Muzzle Velocities and Chamber Pressures

Deliverables:

- Contractor Summary Reports
- Alternative Cartridge Case Design

Component Technology Investigation

Enhanced Propellant and Alternative Cartridge Case Design

(Continued)

Results:

- Cartridge geometry is approx. ½ volume
- Uses approx. ½ propellant
- Approx. 70% of total weight of M855 cartridge
- Maintains equivalent or better external ballistics
- Low barrel temperature

Component Technology Investigations

Alternative Ammunition Case Materials

Contractor:

- Frontier Performance Polymers Corporation

Technology:

- All-polymer ammunition cartridge case

Tasks:

- Examine past efforts
- Conduct material evaluations
- Design all-polymer ammunition cartridge case
- Conduct FEA simulation for entire ballistic cycle

Deliverables:

- Contract Summary Reports

Component Technology Investigations

Alternative Ammunition Case Materials

(Continued)

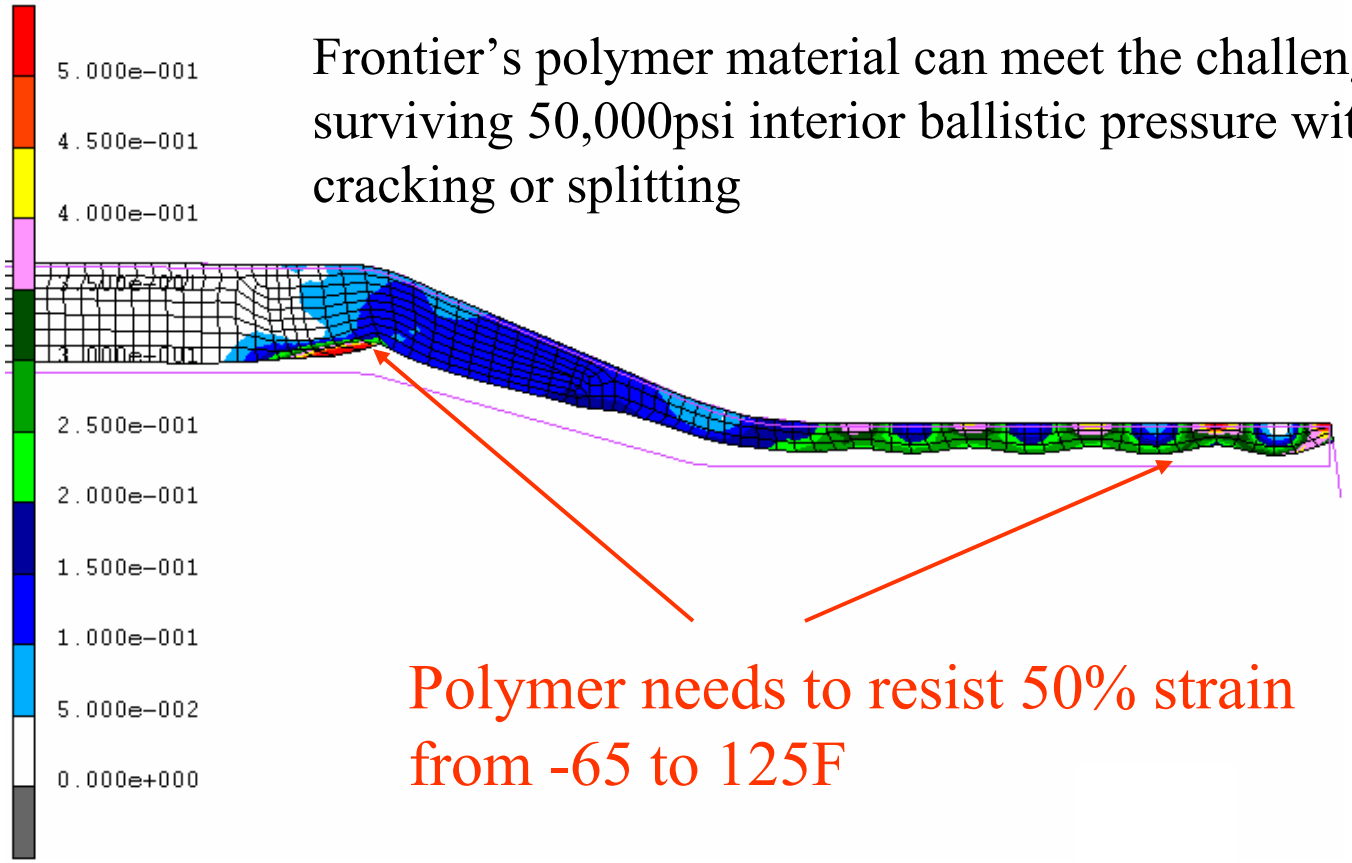
Results:

- Approx. 20% weight savings
- Retains about 90% of the interior volume
- Improved reliability over snap fit designs
- Resistance to case cracking and splitting
- High pull strength
- Better resistance to cook off
- Cost is comparable to brass cartridge case

Component Technology Investigations

Alternative Ammunition Case Materials

(Continued)



Frontier's polymer material can meet the challenge of surviving 50,000psi interior ballistic pressure without cracking or splitting

Polymer needs to resist 50% strain from -65 to 125F

Component Technology Investigations

Alternative Case Material and Enhanced Propellant

Contractor:

- Veritay Technology, Inc

Technology:

- Develop a Small Caliber (7.62 mm) Cased Telescope Ammunition Concept
    - Lightweight Polymer Cartridge Case
    - Thermally-Consolidated Propellant Charge

Tasks:

- Design and fabricate single shot ballistic test fixtures
    - Conduct single shot testing of propellant charge (no case) in gun fixture
    - Conduct single-shot testing of entire cased round in gun fixture
- Design, fabricate, and test lightweight cartridge cases
    - Both machined and injection molded cases
    - Test cases in single shot test fixture
- Instrument 7.62 mm M240 barrel with in-wall thermocouples to quantify barrel heating from new cartridge design

Deliverables:

- Contractor Summary Reports
- Demonstration Tests for ARDEC representatives

Component Technology Investigations

Alternative Case Material and Enhanced Propellant

(Continued)

Results:

- Cartridge is 37% lighter than M80 Ball cartridge
- Cartridge Case is 84% lighter than conventional brass case
- Reduced cartridge size envelope
- Ballistic performance equal to M80 Ball
- Cost competitive with conventional ammunition

Component Technology Investigations

Aluminum Cartridge Case

Contractor:

- Alliant Techsystems Inc.

Technology:

- Design, Fabricate and Test an Aluminum Cartridge Case for the 5.56mm M855 ammunition

Tasks:

- Design – weapon/cartridge case compliance analysis
- Fabricate tooling – 7475 Aluminum as a Prototype
- Material testing on Cartridge Cases
- Manufacture 2500 cartridges
- Ballistic testing of cartridges – Single Shot and Automatic Weapon

Deliverables:

- Contractor Summary Reports
- Hardware - 1000 unprimed cartridge cases

Component Technology Investigations

Aluminum Cartridge Case

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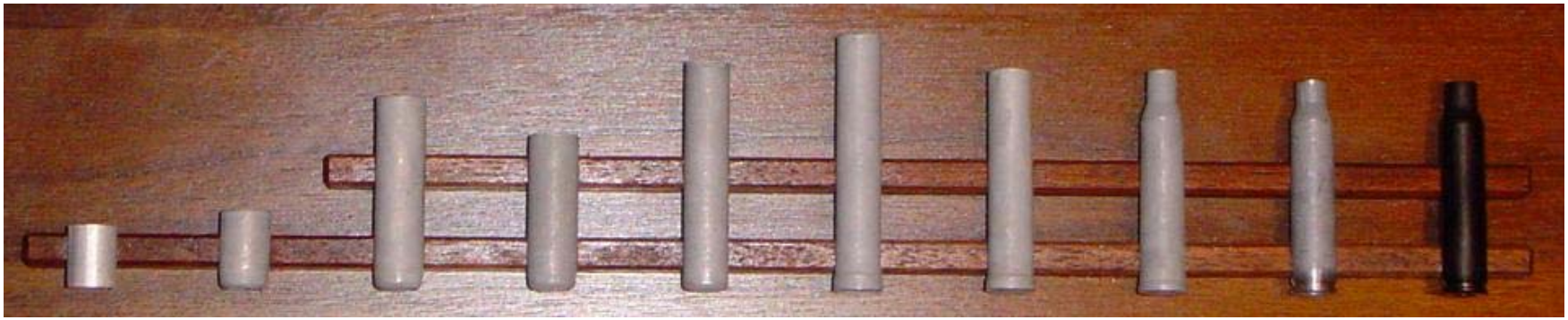
Results:

- Aluminum Cartridge case is 60% lighter
- Retains 90% of interior volume of brass cartridge case
- Ballistic performance matched to M855 cartridge by using WCR 845 S propellant



Component Technology Investigations

Conclusions

- All five technology investigations are applicable to future systems !

- Reduce Barrel Weight
  - Stellite lined barrel with UltraCem

- Reduce Ammunition Weight
  - Energetic Propellants
  - Plastic Cartridge Case
  - Consolidated Propellant
  - Aluminum Cartridge Case

Component Technology Investigations

Further Information

5.56 Barrel Weight Reduction - FN Manufacturing, Inc.
POC: Greg Livermore Phone Number: 803-736-0522

Enhanced Propellant & Alternative Cartridge Case Design - Knox Engineering Company
POC: George Reynolds Phone Number: 309-483-6268

Alternative Ammunition Case Materials - Frontier Performance Polymers Corporation
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Alternative Case Material and Enhanced Propellant - Veritay Technology, Inc.
POC: Todd Cloutier Phone Number: 716-689-0177 x228

Aluminum Cartridge Case - Alliant Techsystems Inc.
POC: Brian Tasson Phone Number: 763-744-5549