



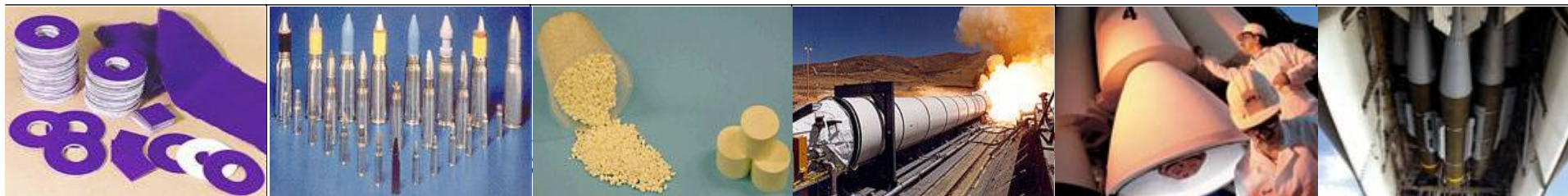
# Caseless Ammunition

(Lightweight Small Arms Technology – LSAT)

## Euro Insensitive Munitions & Energetic Materials Symposium

April 24-28, 2006  
Thistle Hotel, Bristol, UK

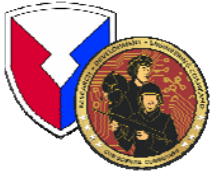
Approved for public release by the US Army (ARDEC/JSSAP) March 2006



# Presentation Outline



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## A) Group Membership

## B) Executive Summary

- Why Caseless?

## C) Team Objective

## D) Background

- Building Upon the Past

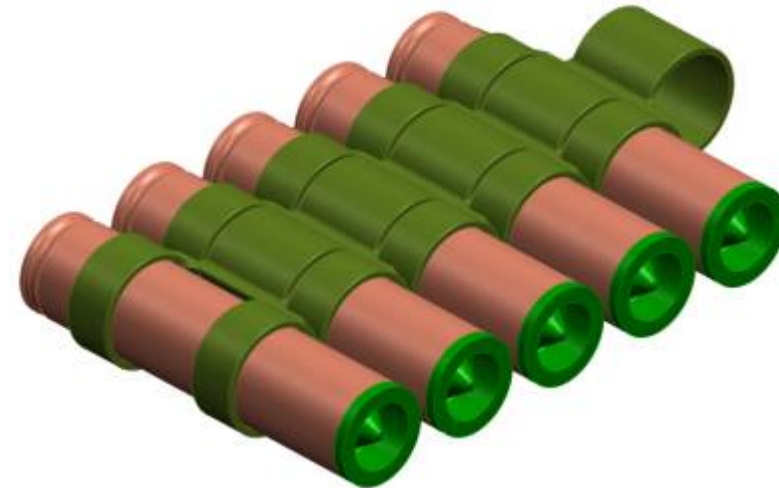
## E) Approach

- Program Outline

## F) Accomplishments & Innovation

- Technology Unique LSAT

## G) Summary



# A) Group Membership



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## Key Team Members

- Ben Ashcroft – ATK Thiokol
- Ed Bray – ATK Lake City
- Dave Cleveland – JHU/APL
- Bo Engel – AAI
- Erin Hardmeyer – ARDEC
- Patricia M. O'Reilly – ARDEC
- Bill Sampson – ATK Thiokol
- Chad Sensenig – ARDEC
- Paul Shipley – AAI
- Korene Spiegel – ARDEC/JSSAP
- Jim Taylor – ATK Lake City
- Dennis Tolman – ATK Thiokol



# B) Executive Summary



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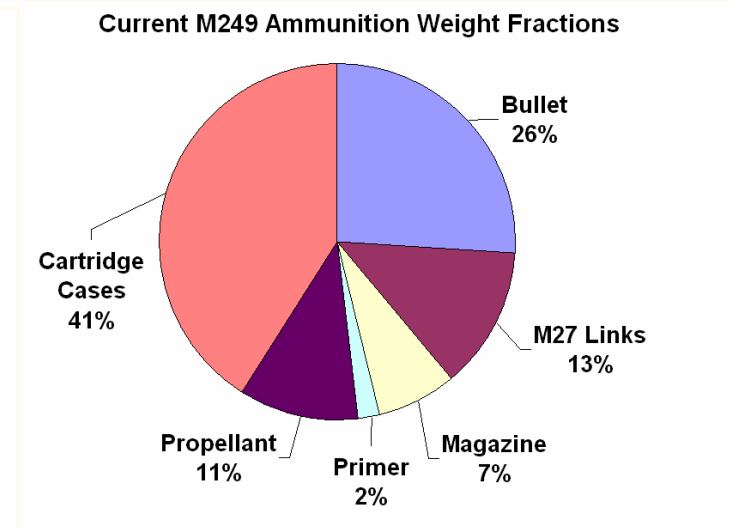
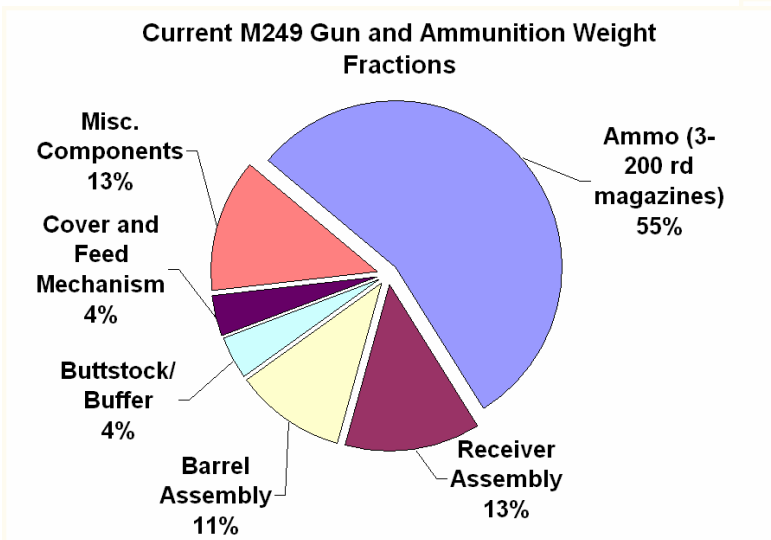
## Why Use Caseless Technology?



- **Provides up to a 50% reduction in ammunition weight**
  - The brass cartridge case accounts for up to 40% of the total ammunition weight
  - 20.8 lbs for 600 rounds reduces to only ≈12.5 lbs



5.56mm M855



5.56mm LSAT Caseless



# C) Team Objective



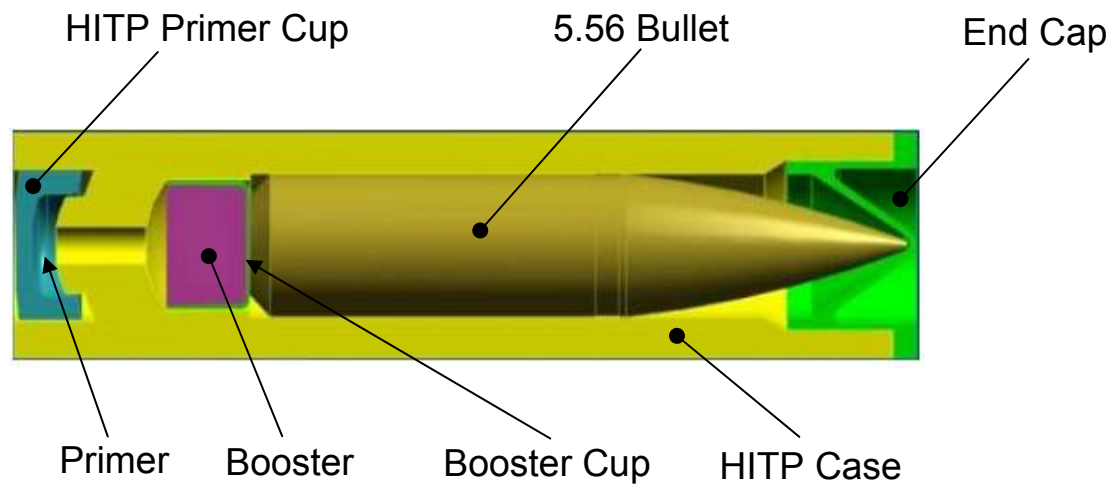
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## Deliver Prototype Caseless Ammunition for Ballistic Demonstration



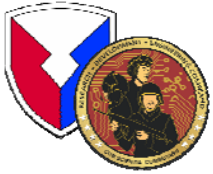
- Demonstrate a viable **H**igh **I**gnition **T**emperature **P**ropellant (HITP)
  - Match or exceed ballistic performance
- Demonstrate production feasibility
  - Process simplification
  - Process control
  - Process scalability



# HITP Caseless Ammunition



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## BACKGROUND



# D) Background



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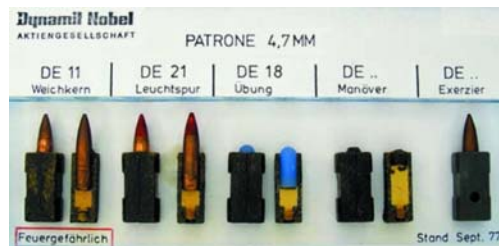


## Building Upon the Past



- **G11 Program (Germany, 1970's thru early 1990's)**
  - Heckler and Koch (H&K)/Dynamit Nobel (D-N) developed a 4.92mm Caseless rifle and ammunition for the German Government
  - Began with non-telescoped ammunition, finalized on telescoped configurations
  - G11 system successful, however, fielding not pursued due to German reunification
- **Advanced Combat Rifle (ACR) Program (US, 1980's thru early 1990's)**
  - H&K/D-N applied G11 technology to US rifle requirement
  - Telescoped ammunition configuration
  - Caseless ACR system successful, however, the program was discontinued due to a failure of the system to meet Army goals (increased hit probability)
- **LSAT Program is applying this technology**
  - US Army ARDEC owns license for H&K/D-N Caseless technology
  - Goal is to re-establish and extend this technology

Early non-Telescoped Caseless Configurations

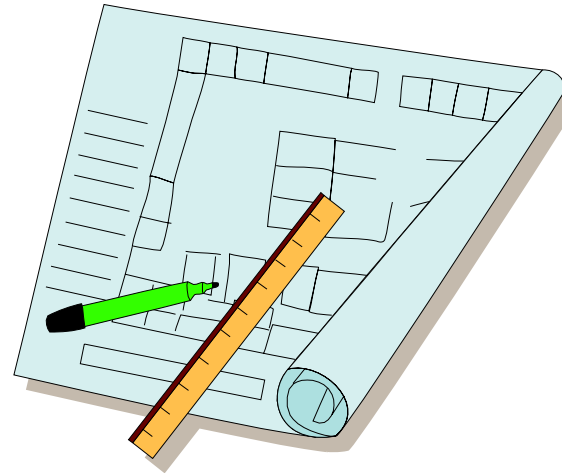


Final G11 Cartridge Configuration (Telescoped)





## LSAT PROGRAM APPROACH



1. Replicate G11/ACR Caseless Ammunition
2. Apply technology to develop 5.56mm configuration
3. Extend/update technology





# E) LSAT Program Approach

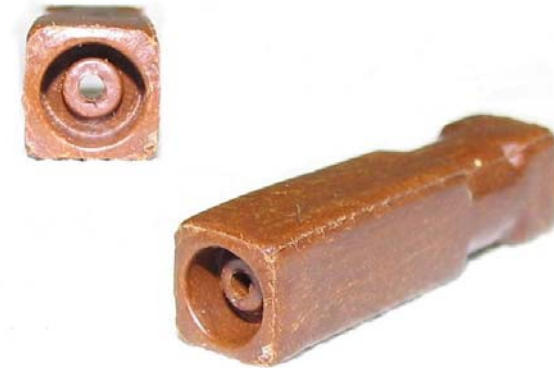


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## HITP Materials & Process Development

- Characterize safety & physical properties of raw materials
- Identify material sources and/or synthesize
- Develop a propellant mixing & fabrication process
- Design & build proof-of-concept tooling for fabrication studies
  - Fabricate both 4.92mm (G11) and 5.56mm cases
  - Fabricate primer cups
- Fire 4.92mm cartridges in Mann Barrel for side-by-side comparison with G11 ammunition
  - Match ballistic performance through process & formulation improvements
- Use 4.92mm cartridge fabrication process as baseline for 5.56mm cartridge production



**4.92mm Case Forming Studies**



**Primer Cup Forming Studies**



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## ACCOMPLISHMENTS & INNOVATIONS



# F) Accomplishments & Innovations

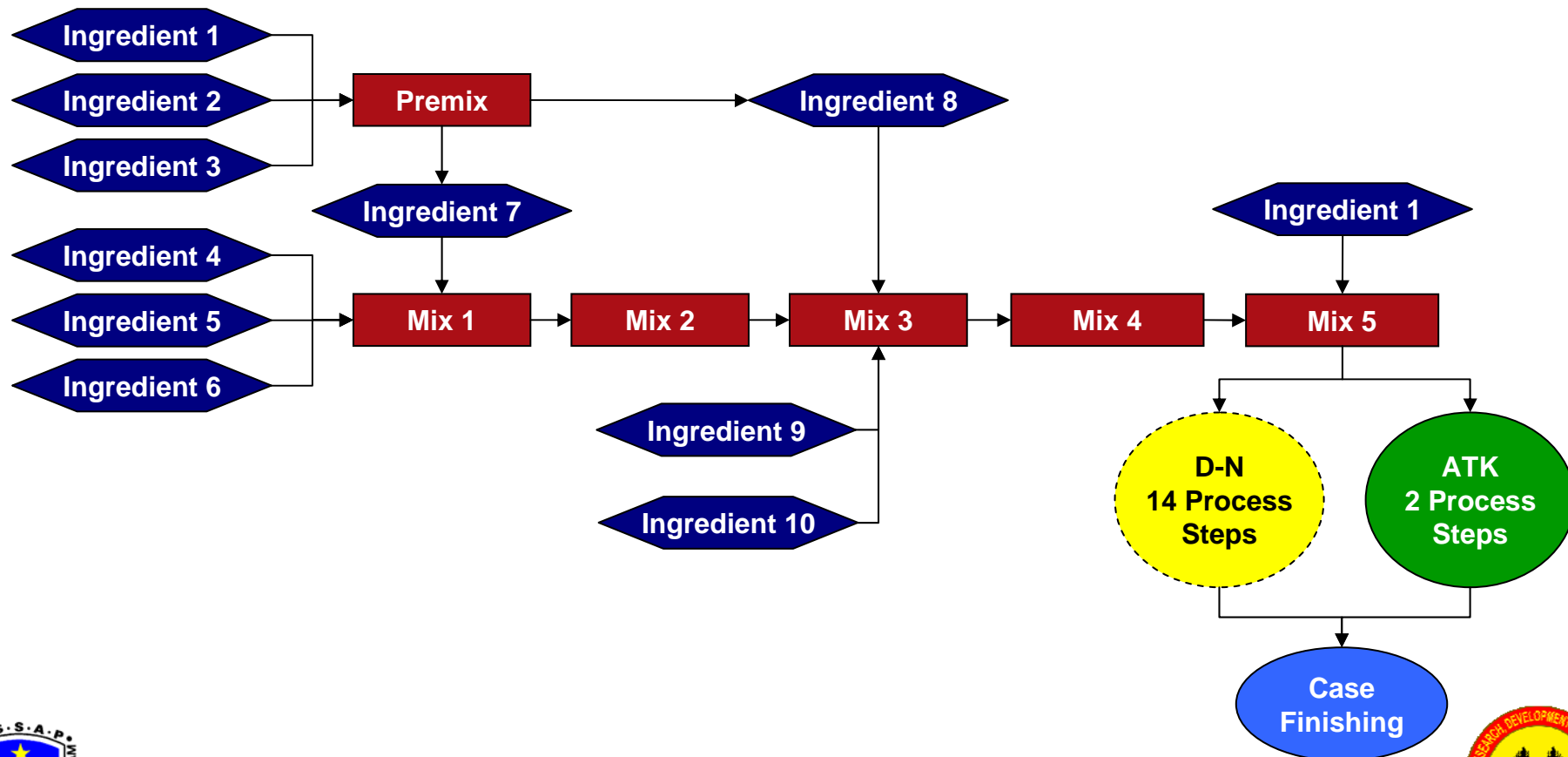


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## Overview of ATK Streamlined HTP Process

- Fourteen D-N processing steps were significantly reduced
  - Resulting in significant reduction in cycle time and production costs



# F) Accomplishments & Innovations



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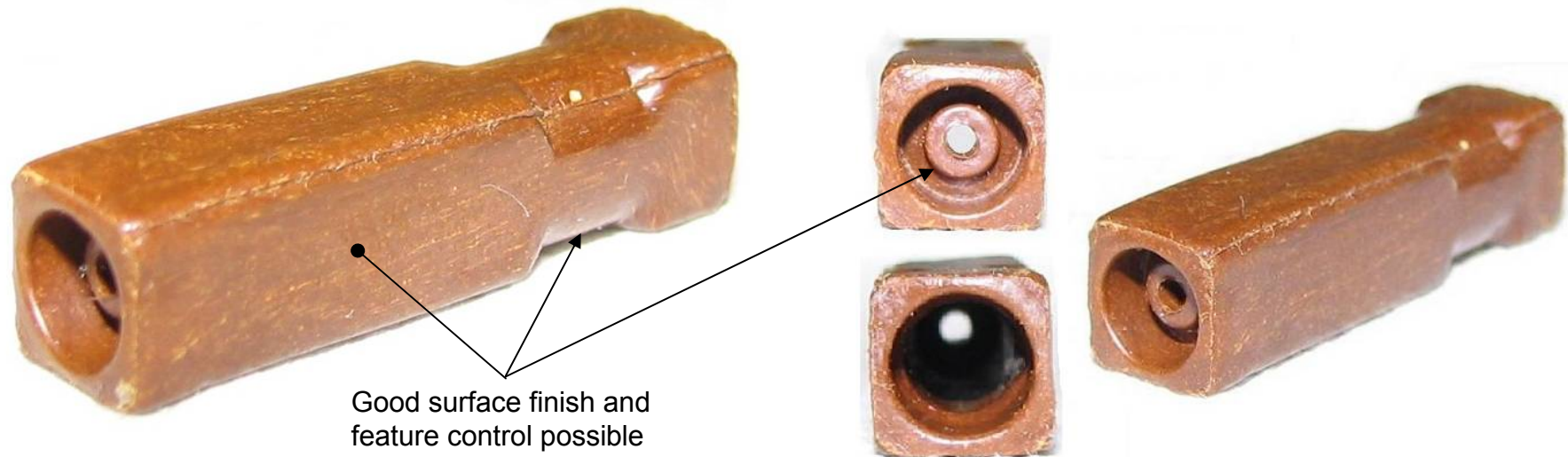


## HITP 4.92mm Propellant Body Fabrication

- Fabricated using improved process- duplicates G11 configuration
  - Demonstrated good dimensional match to G11 ammunition with improved process approach
  - Preparing to conduct ballistic comparison testing vs. residual G11 ammunition



Assembled G11



# F) Accomplishments & Innovations



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## HITP 5.56mm Propellant Body Fabrication

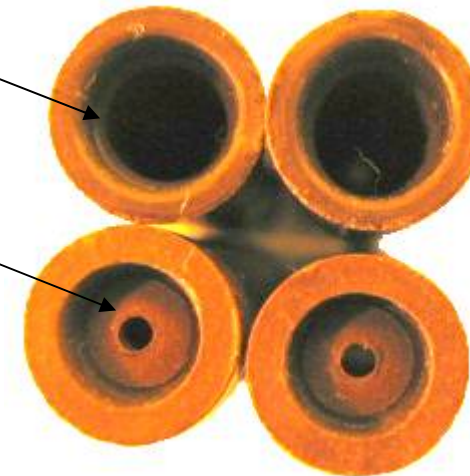
- Fabricated using improved process, circular 5.56mm cartridge configuration
  - Demonstrated good dimensional control
  - Preparing to conduct ballistic testing once 4.92mm cartridge demonstration testing complete



Very uniform surface finish

Formed End Cap seat

Formed Primer Cup Nozzle



# F) Accomplishments & Innovations

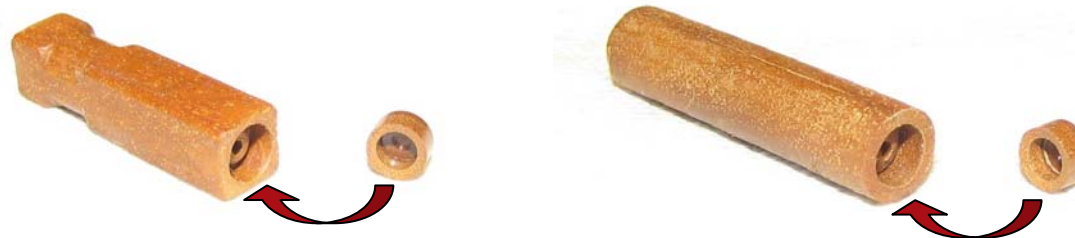


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## HITP Primer Cup Fabrication

- Specialized HITP formulation developed for Primer Cup
  - Cups are loaded with off-the-shelf primer composition and inserted into caseless cartridge bodies
  - The cups are sized to universally fit into either 4.92mm or 5.56mm case configurations
- Demonstrated good dimensional control and good mechanical properties with processing that is amenable to high-rate production
- Preparing to conduct primer charging tests



Primer Cup for both 4.92mm and 5.56mm case configurations



# F) Accomplishments & Innovations



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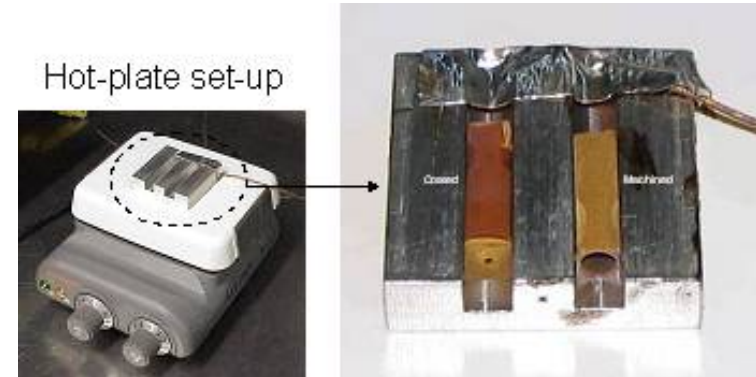
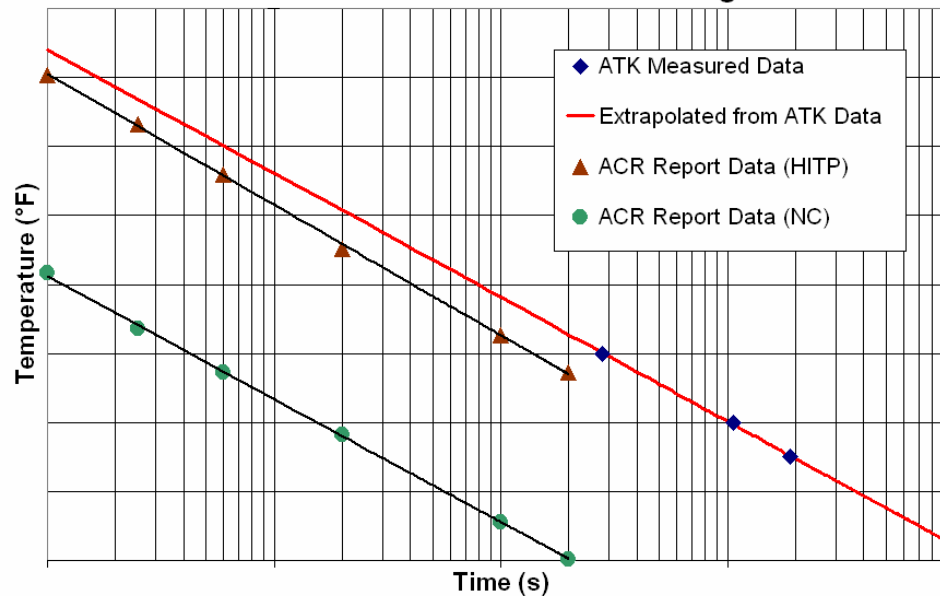


## HITP Thermal Characterization

- The thermal stability and characteristics of HITP were studied through surface heat “hot-plate” cook-off testing
  - Results compared well with published data
  - The threshold cook-off temperature was determined to be significantly higher than conventional NC ball powder



Time to Cook-Off for Caseless Cartridges



# F) Accomplishments & Innovations

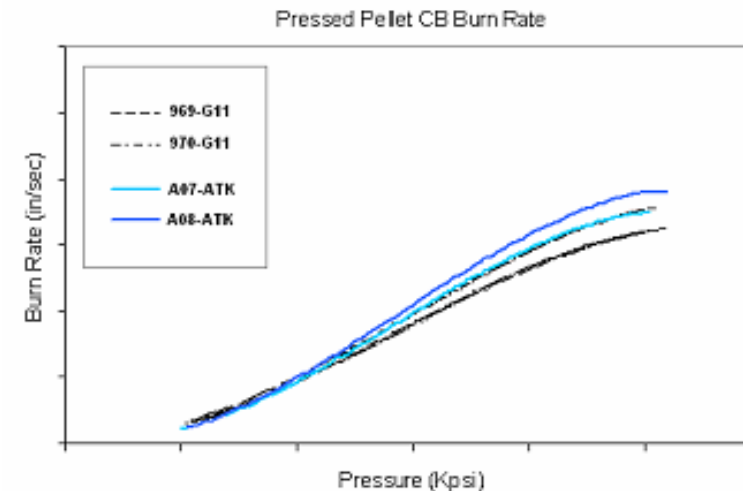
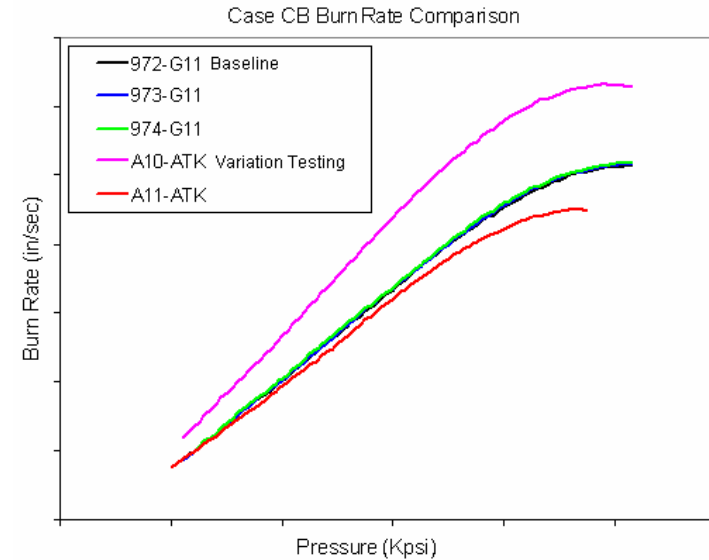


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## HITP Burn Rate Studies

- High pressure closed bomb testing has been performed on HITP pellets & cartridges
- Effects of variation on burn rate being studied
  - Process changes
  - Formulation changes
- Optimal formulation testing continues





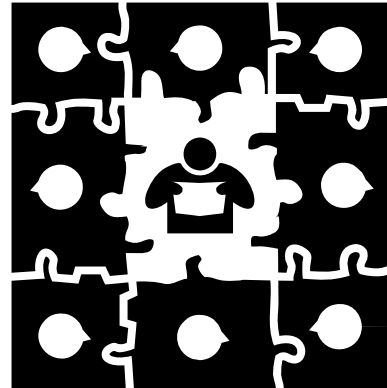
# HITP Caseless Ammunition



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## Summary



# G) Summary



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- **Caseless ammunition provides a 50% weight reduction vs. standard ammunition**
- **Accomplishments**
  - Demonstrated ability to replicate G11 HITP propellant
  - Demonstrated manufacture of dimensionally accurate propellant bodies and primer cups using a process scaleable to production
- **Upcoming Milestones**
  - Cartridge integration- 4.92mm & 5.56mm
  - Validation of integration of ATK 4.92mm cartridge performance vs. G11 cartridges using Mann Barrel
  - Firing of confidence cartridges to demonstrate scale-up to 5.56mm

