Investigation of MIC Materials for Electrically Initiated Lead Free Primers

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This Briefing is Unclassified

BACKGROUND / NEED

- **Background**
  - **MIC - Metastable Interstitial Composites, Nanometer Particles - High Reaction Rates**
  - **Patent - 5,717,159- Lead Free MIC Percussion Primer - Phil Dixon & Don Thompson (China Lake) & Dr. Joe Martin (LANL)**
  - **Army - Small Caliber MIC Primer - In Development**
- **Need - 20mm and 30mm Electrically Initiated Ammo In-Service**
  - **Lead Styphnate – 1700 Pounds / Year**
  - **Barium Nitrate – 2000 Pounds / Year**

PERFORMERS

Team Lead - Ron Jones

Material Safety Characterization - Anita Piaz

Primer Fabrication and Test - Larry Johnson, Brent Reese, Tim Tinkle, Lee Hardt

AUR Fabrication and Test - C.J. Toombs,Jim Denny, (Art Clayson, Bob Gould & Jesse Cavazos - Sverdrup)

Bridgewire Design & Fabrication - Don Thompson, Danny Wooldridge

Materials Engineering & Chemistry - Dr. Kelvin Higa, Phil Dixon, Dr. Curtis Johnson

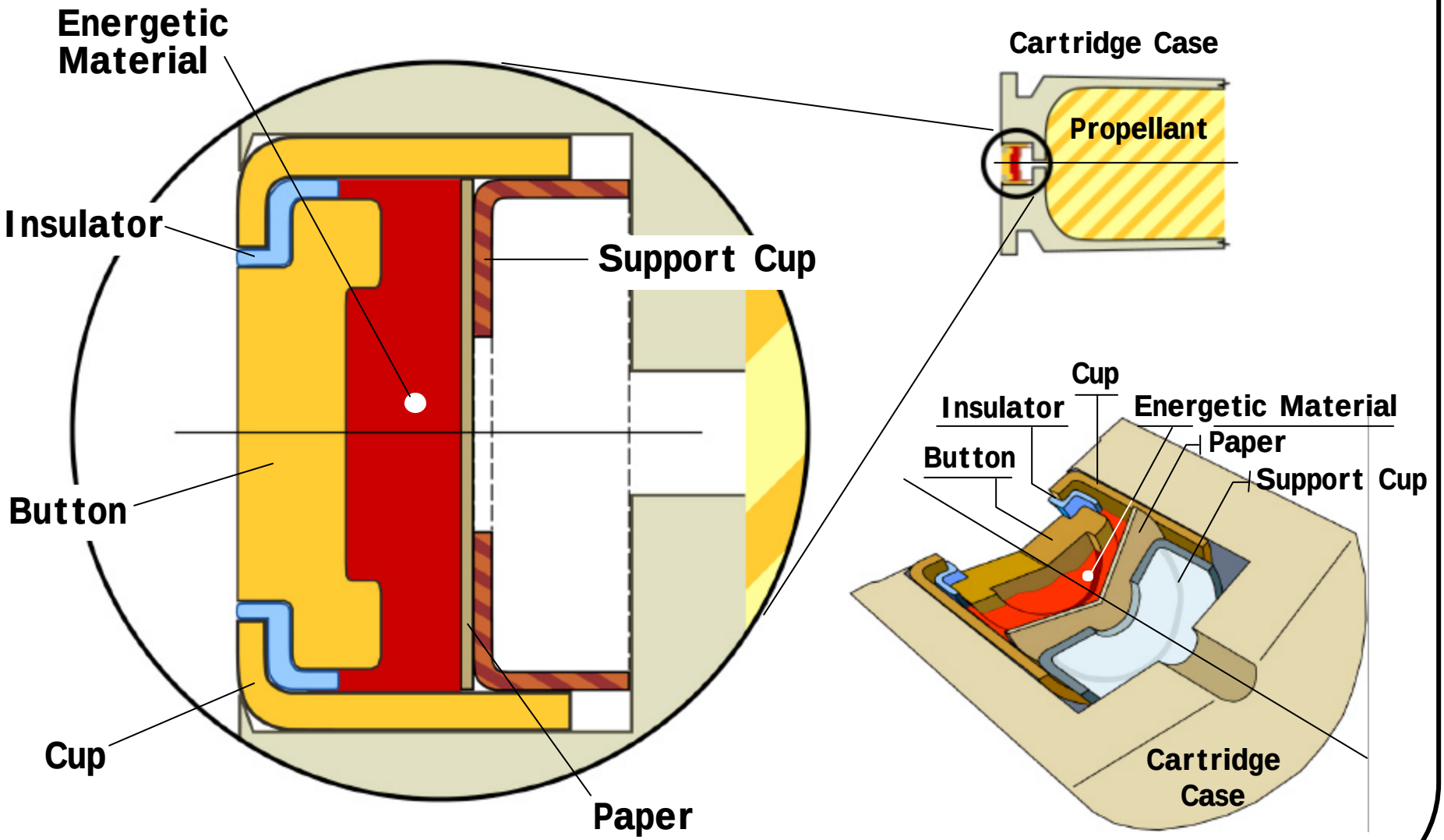
Nano Material Production - Dr. Chris Aumann (Technanogy)

Others - Picatinny / LANL / LCAAP / GDOTS

OBJECTIVE / APPROACH

- **Objective - Demonstrate the Feasibility of Adapting MIC Percussion Mix to Electrically Initiated Primers for Use in Medium Caliber Ammunition**
- **Approach**
  - **Make Primer Mix Conductive by Adding Carbon / Acetylene Black to Basic Lead Free MIC Percussion Primer Mix**
  - **Build "Bridgewire" Primers**
  - **Conduct Component Level (Primer) and Cartridge (AUR) Firings**

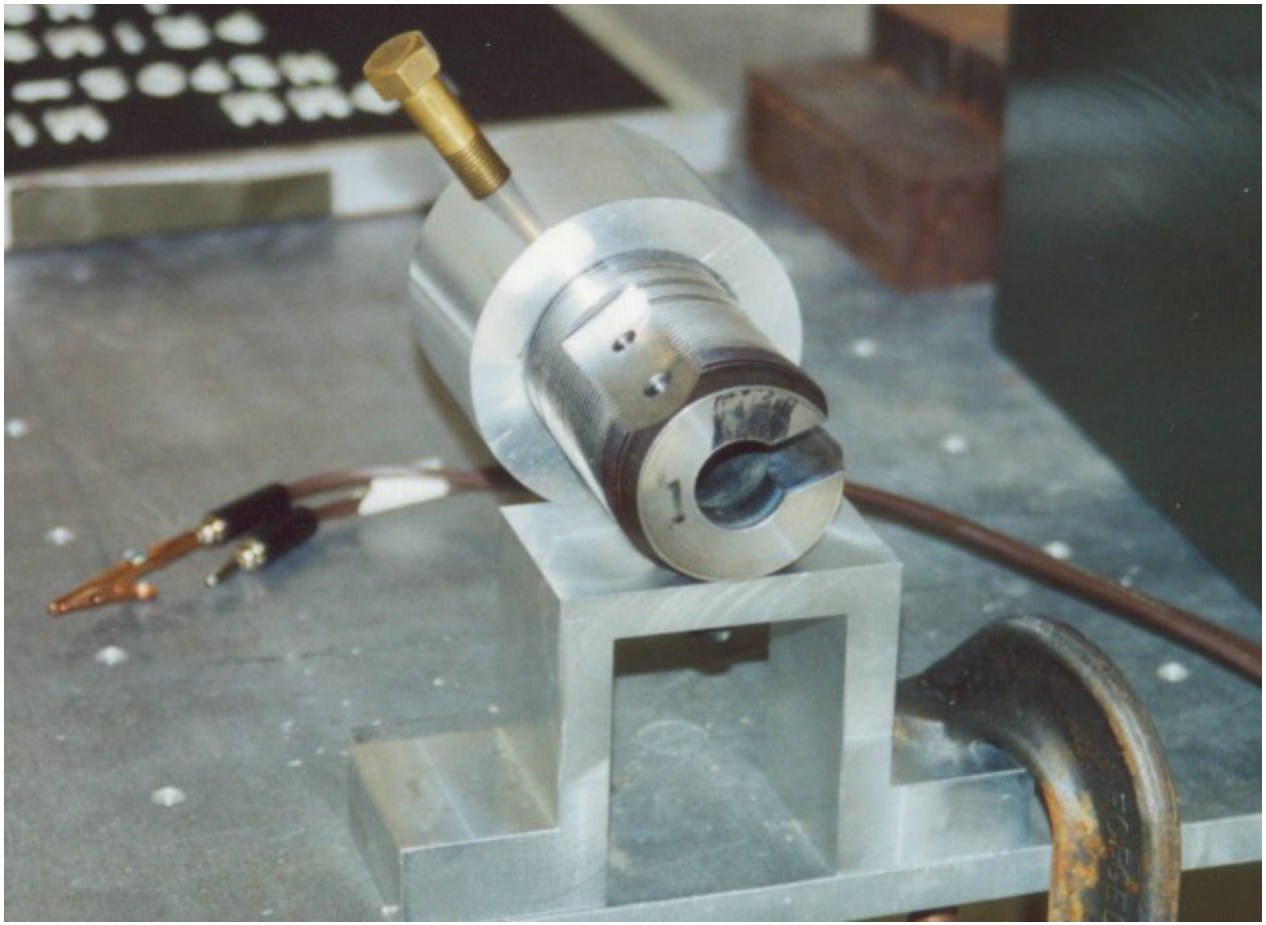
Electric Primer



Primed Cartridge Case

Component Level Test

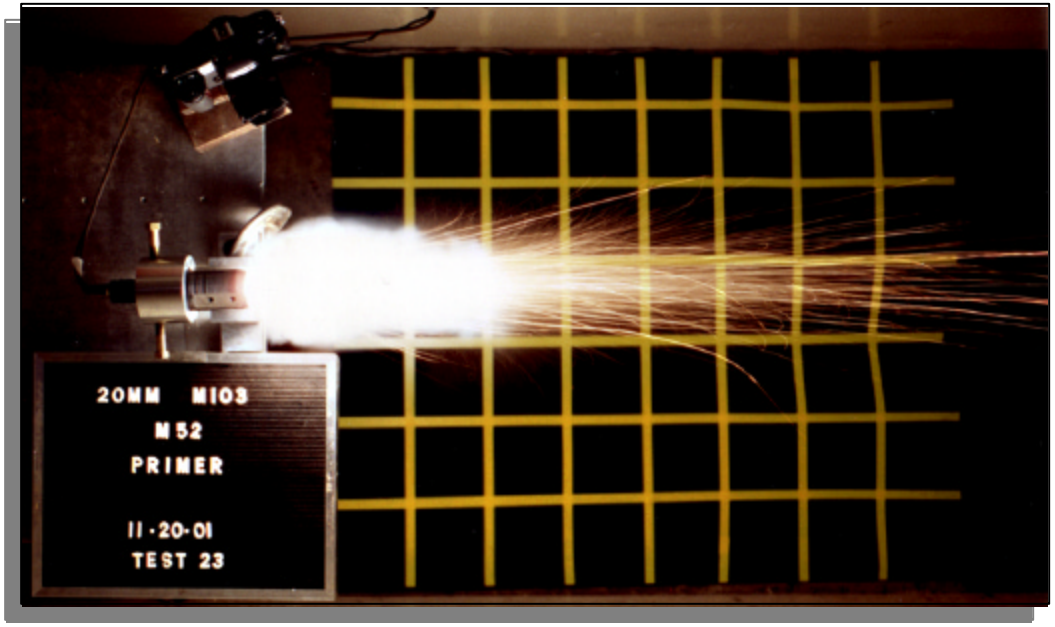
Primer Electrical Resistance Measurement & Test Firing Fixture



M52 Component Level Test

M52A3B1 (Lead Styphanate) Primer (12 Test Items)

First Light	78–96 microsec
Maximum Light	550-628 microsec



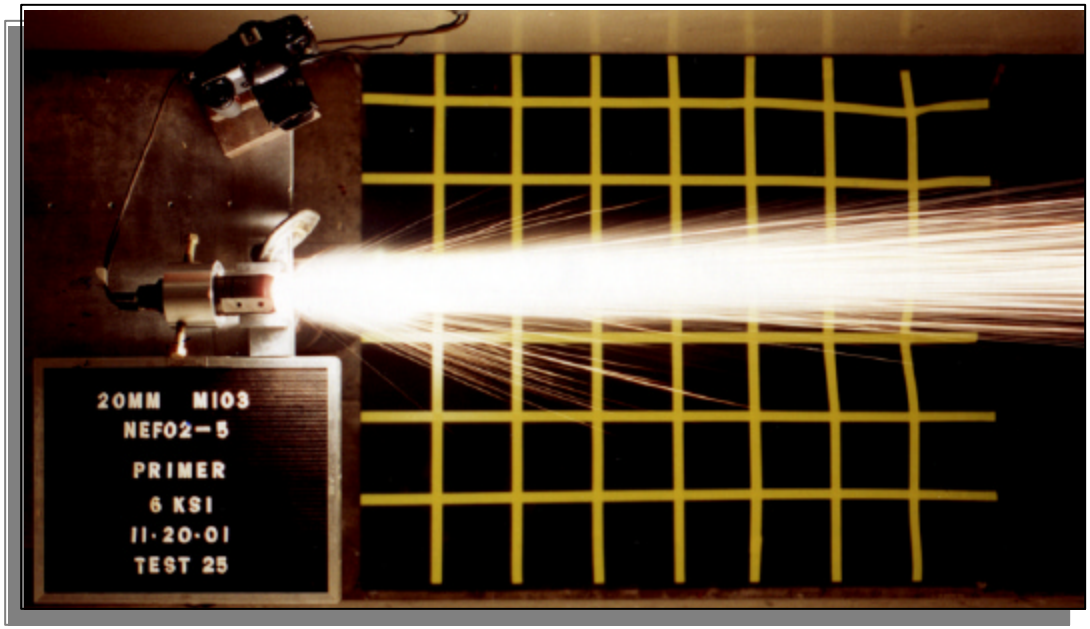
M52 Video

M52 Video (Slow Motion)

MIC Component Level Test

MIC Primer - Al + MoO_3 + AB

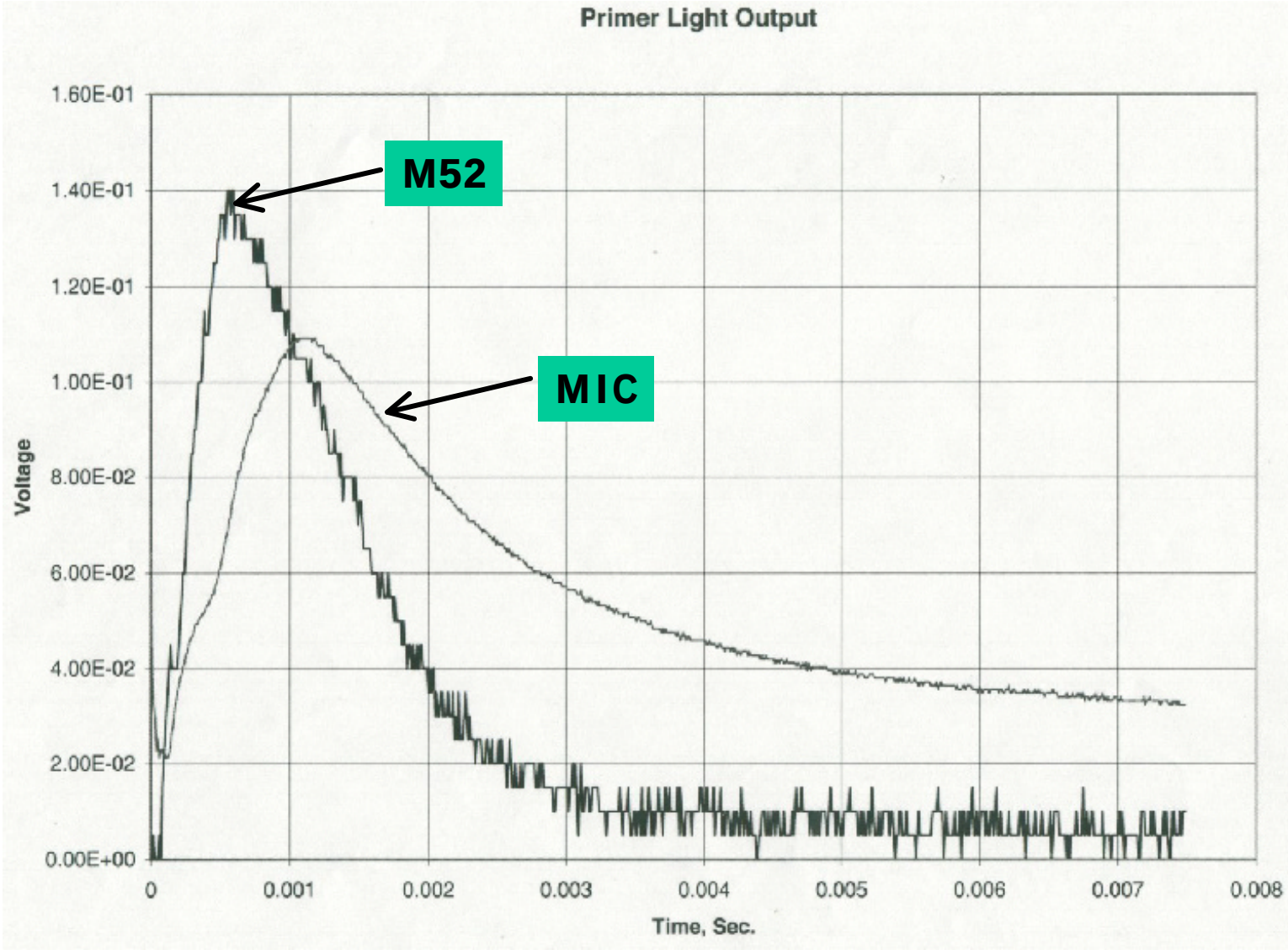
First Light	~150 microsec
Maximum Light	1056 microsec



MIC Primer Video

MIC Primer Video (Slow Motion)

M52 Vs. MIC Output



MIC Component Level Tests

		Function: CM	Function: BW
Sample 1:	Al + MoO_3	N/A	Yes
Sample 2:	Al + MoO_3 + CB (1.2%)	No	Yes
Sample 3:	Al + MoO_3	N/A	Yes
Sample 4:	Al + MoO_3 + CB (2.5%)	No	Yes
Sample 5:	Al + MoO_3 + CB (4.1%)	No	Yes
Sample 6:	Al + MoO_3 + AB (3.3%)	Yes *	Yes
Sample 7:	Al + CuO + AB (3.4%)	No	N/A
Sample 8:	Al + MoO_3 + AB (3.4%)	Yes *	Yes

CM - Conductive Mix, BW - Bridgewire
CB - Carbon Black, AB - Acetylene Black

* Did not function after aging

Stability

Observed Electrical Resistance Changes - Conductive Mix Configuration

Material Loading Pressure	Elec Res (K Ohms) (20 Nov 01)	Elec Res (K Ohms) (28 Nov 01)	Elec Res (K Ohms) (10 Jan 02)
1.0	19.3	7.9	10200
3.0	4.1	3.6	9140
6.0	2.8	2.3	4520

AUR Tests

Conducted 4 successful AUR firings in a Mann Barrel (Bridgewire Design) (No Action Time or Pressure Data)

SUMMARY / FUTURE

- **Accomplishments - Successfully Demonstrated Two Different Configurations of Electrically Initiated Primers**
  - **Conventional Conductive Mix Design W/ Simple Substitution of MIC Materials for Lead Styphanate Primary Explosive**
  - **Non-Conventional Design Utilizing Bridgewire Initiation and MIC Materials**
- **Plan for 2002**
  - **Optimize Composition**
    - **Stability**
    - **Action Time**
  - **Optimize Bridgewire**
  - **Down Select Conductive Mix Vs. Bridgewire**