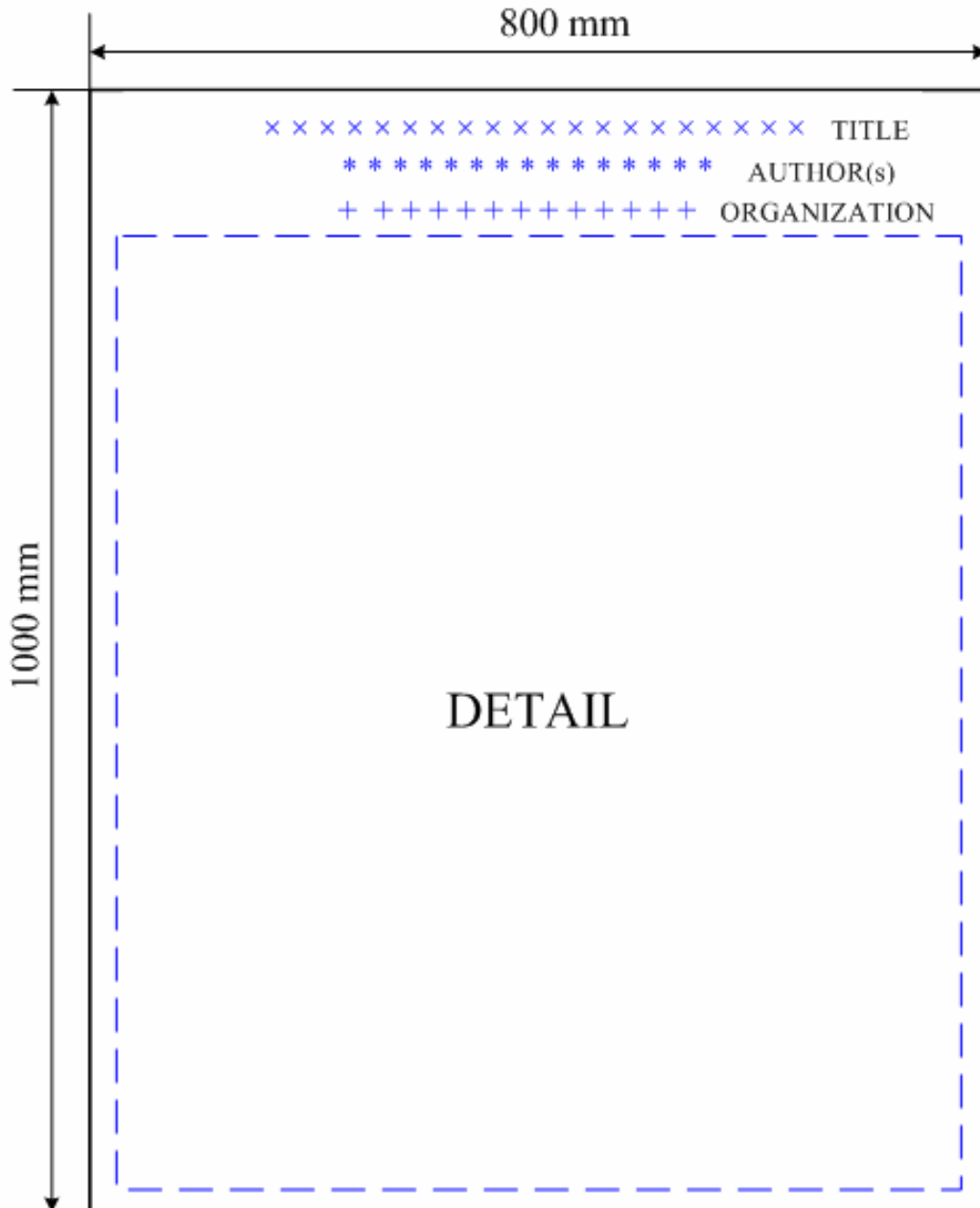


POSTER FORMAT



Note: It is better to make a color poster.

There is a demonstration on the next page.

DEMONSTRATION

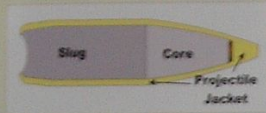
× × × × × × × × × × × × × **TITLE**

* * * * * **AUTHOR(S)**

+ + + + + **ORGANIZATION**

Overview

A Series of Calculations were Performed to Understand the Interaction of Projectile Component During the Initial In-Bore Acceleration as the Projectile is Subjected to the Dynamic Pressure from the Ignition and Combustion of the Charge.



The Three Piece M855 Projectile

The US Army has a Program to Investigate 'Green' Materials for Ammunition.

This Program Evaluated a Drop-In Replacement for the Pb-Sb Slug in the Projectile and Transitioned into Initial Production.

Tungsten (W)-Nylon was a Candidate Material Solution

Projectile Launch Mechanics

Rigid Body Calculations were Performed to Show the Interaction of Each Projectile Component During Launch Initiation

	Mass (g)	% Mass of Projectile	Force (N)	% Force	Acceleration (m/s ²)	Accelerative (g's)
Bullet	4.033		9073.56		2,249,828	229,240
Slug/Core	2.823	70.0	5996.12	66.1	2,123,765	216,490
Jacket	1.210	30.0	3077.45	33.9	2,544,061	259,330

Breakdown of the M855 Components and Their Forces

The Jacket Sees An Effectively Higher Acceleration Than the Slug/Core
This Acceleration Effectively Creates a Pressure Seal Against the Slug

In-Bore Projectile Mechanics

Implicit and Explicit Finite Element Simulations were used to Study the Initial Portion of Launch.

2D Implicit Smooth Barrel Models Studied Projectile Component Interaction.



Radial Displacement of the M855 Projectile at Peak Acceleration

The jacket clamps down onto the boattail
A gap is formed between the core and the jacket

Clamping Down onto the Rear Jacket/Slug Interface Creates a Pressure Seal

The Gap is Formed as the Core is Carried by the Slug

The Entire Cylindrical Section of the Projectile Expands Radially

Peak Displacements Fore and Aft of the Slug Force Obstruction and Engraving

Core Material Analysis

Sized Slugs Components were Tested to Determine Properties.

	Modulus (Msi)	Compressive Yield (Ksi)	Poisson's Ratio
W-Nylon	1.2 - 1.4	9.7 - 10.2	.31
Pb-Sb	1.5 - 2.0	-2.5	.42

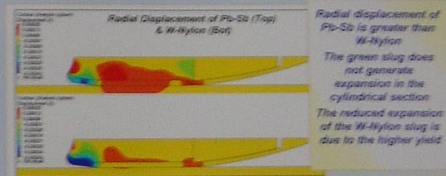
Average Compressive Mechanical Properties of Slug Materials

Green Cores were Found to have a Yield Strength 4X Greater than Pb-Sb



Effect of Different Slug Materials

2D Models were Used to Evaluate the Effect of the Different Slug Materials



Radial displacement of Pb-Sb is greater than W-Nylon

The green slug does not generate expansion in the cylindrical section

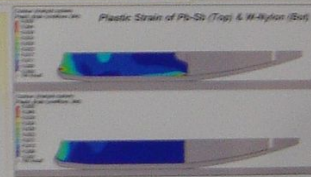
The reduced expansion of the W-Nylon slug is due to the higher yield

Plastic strain of Pb-Sb is greater and broader than W-Nylon

The lower yield of the Pb-Sb slug promotes the expansion

Nearly the entire Pb-Sb slug is inelastic

Less expansion of W-Nylon may reduce the ability of the projectile to engrave



Rifled Barrel Analysis

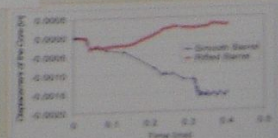
3D Explicit Rifled Barrel Models Studied Engraved Projectile Behavior



M855 Plastic Strain During Engraving

An engraved M855 is supported by the inelastic expansion of the Pb-Sb slug

In a smooth bore the steel core moves rearward and rides on the slug
Rifling engagement locks the core
Further compression of the jacket moves the core forward



Displacement of the Core During Launch

Summary

During Launch the Jacket Creates a Pressure Seal Against the Slug
Obturation Occurs at the Front & Rear Parts of the Cylindrical Section
The Slug Material Properties, Particularly Yield, Effect Projectile Expansion
Rifling Serves to Reduce Core Motion During Launch