



# NDIA – 53<sup>rd</sup> Annual Fuze Conference

“Next Generation Fuzing – Maximum Advantage for the Warfighter”

## XM1156 Precision Guidance Kit (PGK) Overview

*20 May 2009*

*Peter Burke PM CAS*

*Tony Pergolizzi ARDEC AFMO (Presenter)*



# PGK Overview

- **XM1156 Precision Guidance Kit (PGK) Is A GPS Guidance Kit with Fuzing Functions to Reduce Ballistic Dispersion of Artillery Projectiles**
  - Increment 1:  $\leq 50\text{m}$  CEP for 155mm High Explosive (HE) projectiles
  - Future Increments will develop compatibility for 105mm projectiles, cargo projectiles, and future artillery platforms
- **Alliant Techsystems (ATK, Plymouth, Minnesota) was awarded the Increment 1 System Development and Demonstration (SDD) option based on competitive shoot-off**
- **PGK program has completed its Hardware Critical Design Review and is beginning government qualification testing this summer**
- **PGK is scheduled to begin production in 3Q US Fiscal Year 2009, and be fielded in Fiscal Year 2010**

# PGK Projectiles & Platforms

## PGK Projectiles with M109A6 (Paladin)

## M777A2



### M107

- 95 lbs
- Max Range\* 17.5Km
- Warhead 15 lbs

### M549/A1

- 96 lbs
- Max Range\* 30Km
- Rocket Assisted
- Warhead 15 lbs

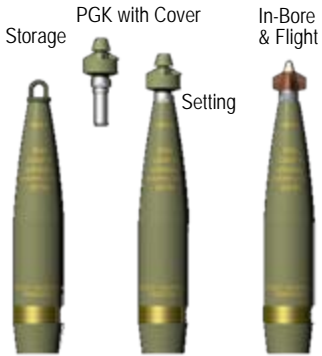
### M795

- 103 lbs
- Max Range 22.5Km
- Warhead 23.8 lbs

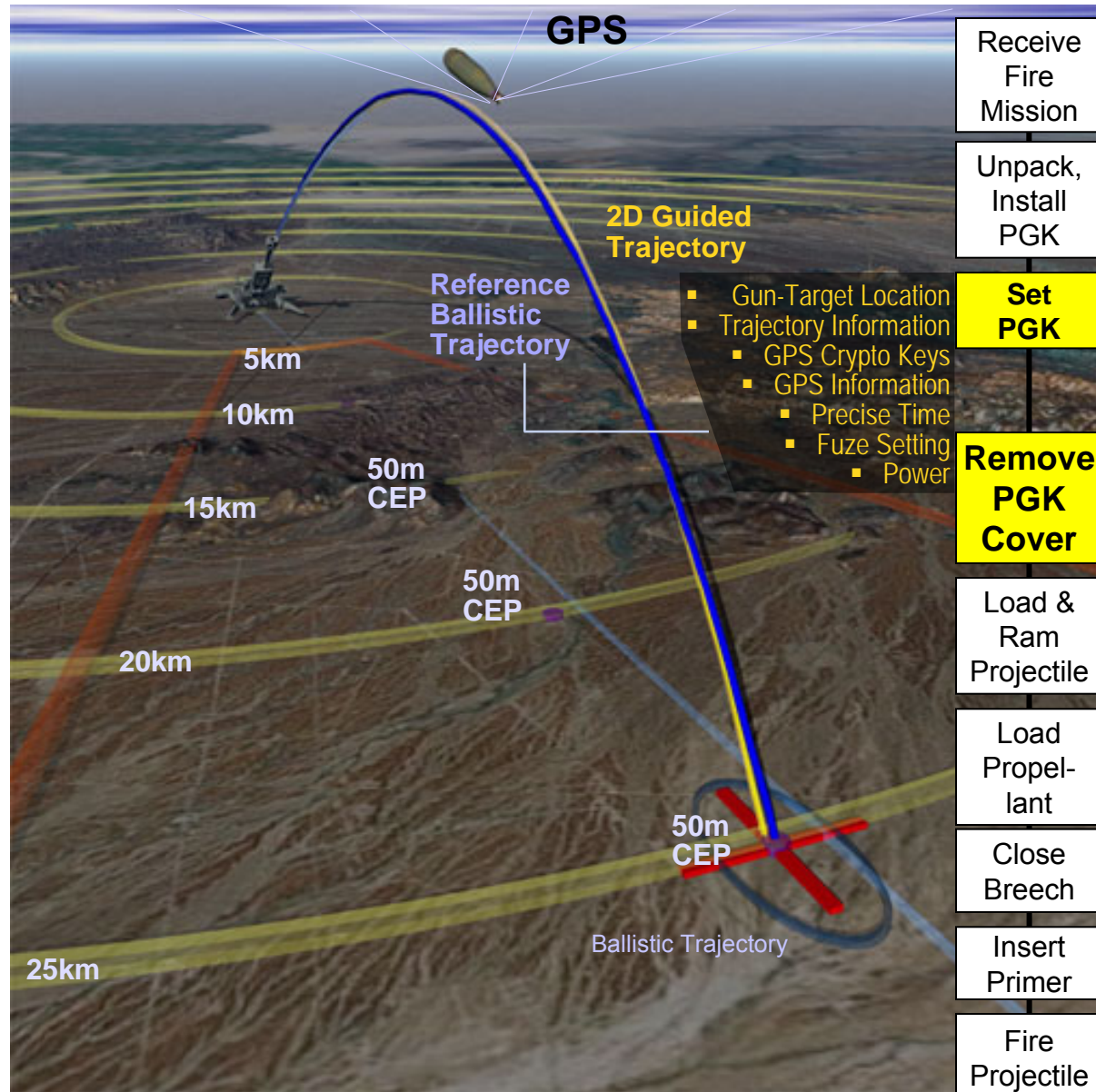
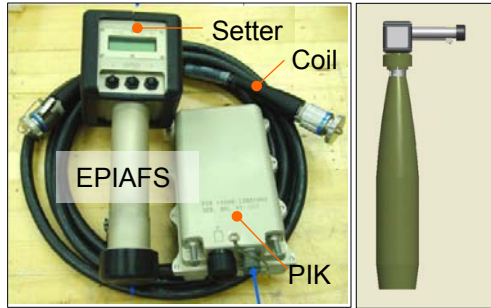
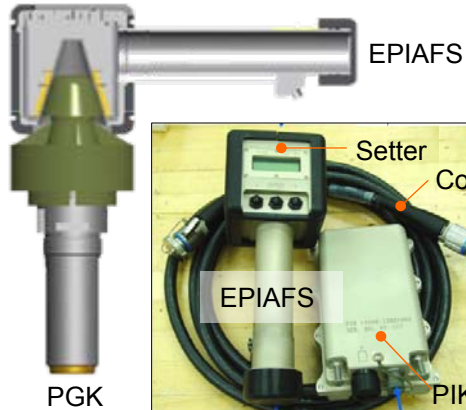
\* Maximum Range without PGK shown. Max Range will be reduced by no more than 10% with PGK



# Precision PGK Mission



Planning the PGK Mission

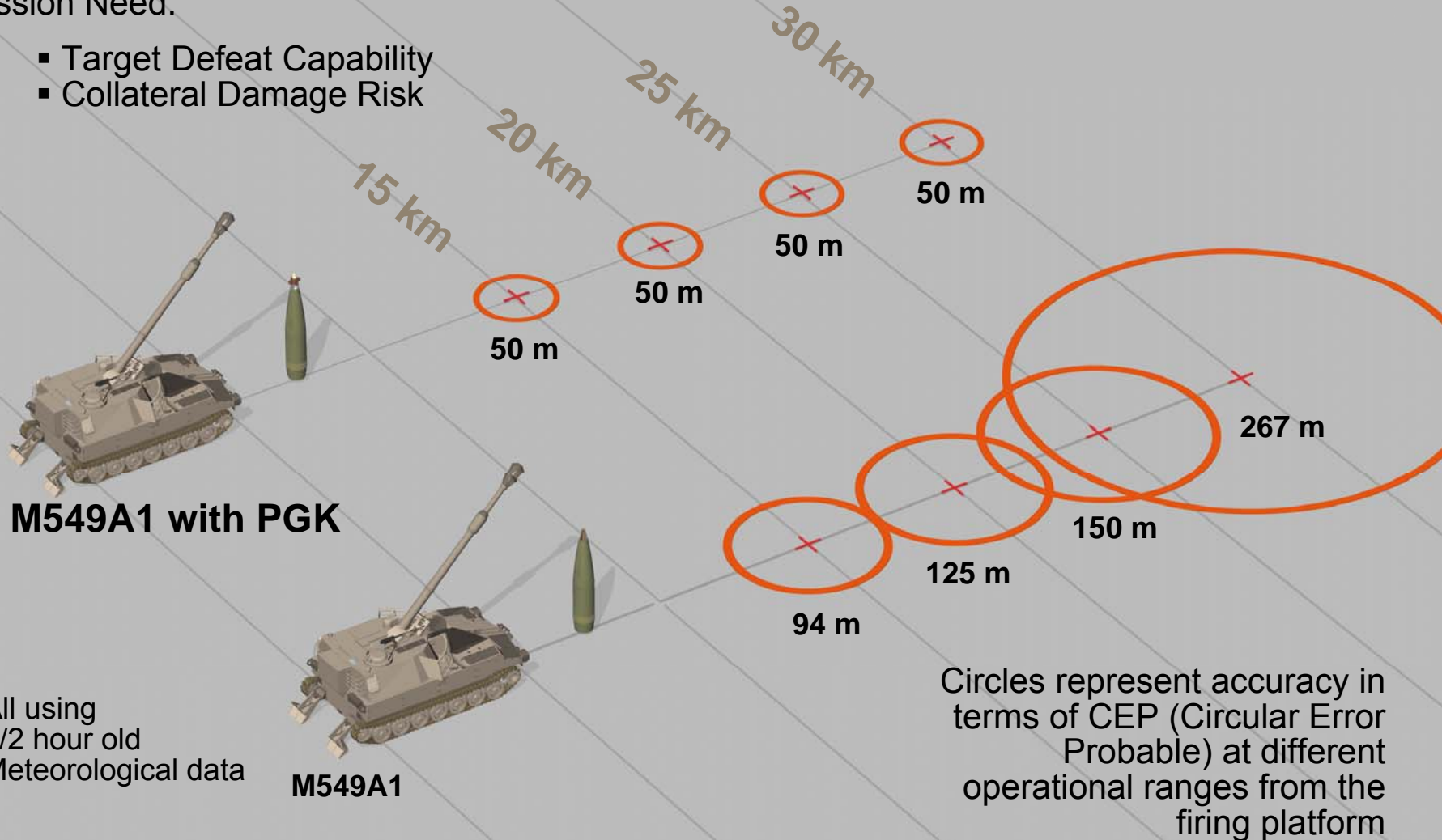


- Receive Fire Mission
- Unpack, Install PGK
- Set PGK**
- Remove PGK Cover**
- Load & Ram Projectile
- Load Propellant
- Close Breech
- Insert Primer
- Fire Projectile

# Comparative 155mm Projectile Accuracies

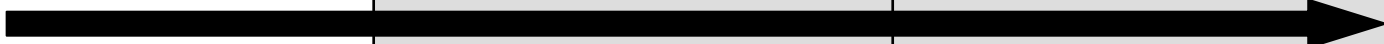
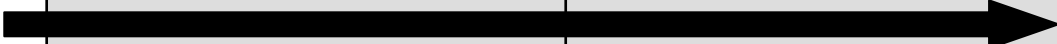
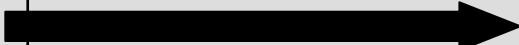
The Most Cost-Effective Munition Will Be Chosen Based on Mission Need:

- Target Defeat Capability
- Collateral Damage Risk



# PGK Requirements

JROC Approved (Increment 1) 22 Jan 2007

	Increment 1 IOC FY10	Increment 2 IOC FY13	Increment 3 IOC FY16
<b>Key Performance Parameters</b>			
1. Net Ready			
2. Reliability	92% (T); 97% (O)		
3. Accuracy	≤ 50m CEP (T); ≤ 30m CEP (O)	≤ 30m CEP (T=O)	≤ 30m CEP (T); ≤ 20m CEP (O)
<b>Attributes</b>			
Munition Type	155mm HE (M107, M795, M549A1)	Adds 105mm HE (T); 105/155mm HE & Cargo (O)	155mm HE (T); 105/155mm HE & Cargo (O)
Platform Types	M777A2, Paladin	Adds M119A3 (105mm) (T); NLOS-C (O)	Adds NLOS-C (T); Paladin, M777A2, M119A3 (O)
Fuzing Function	PD, Proximity	Adds Delay & Time (O)	

T: Threshold Requirement

O: Objective Requirement



# Enhanced Portable Inductive Artillery Fuze Setter (EPIAFS) and Platform Integration Kit (PIK)



DAGR



- EPIAFS:
  - Conventional Fuze & Excalibur/PGK Setter
  - Programs Excalibur & PGK with mission information
- Platform Integration Kit
  - Interface circuit from platform fire control systems, DAGR (GPS receiver) to EPIAFS



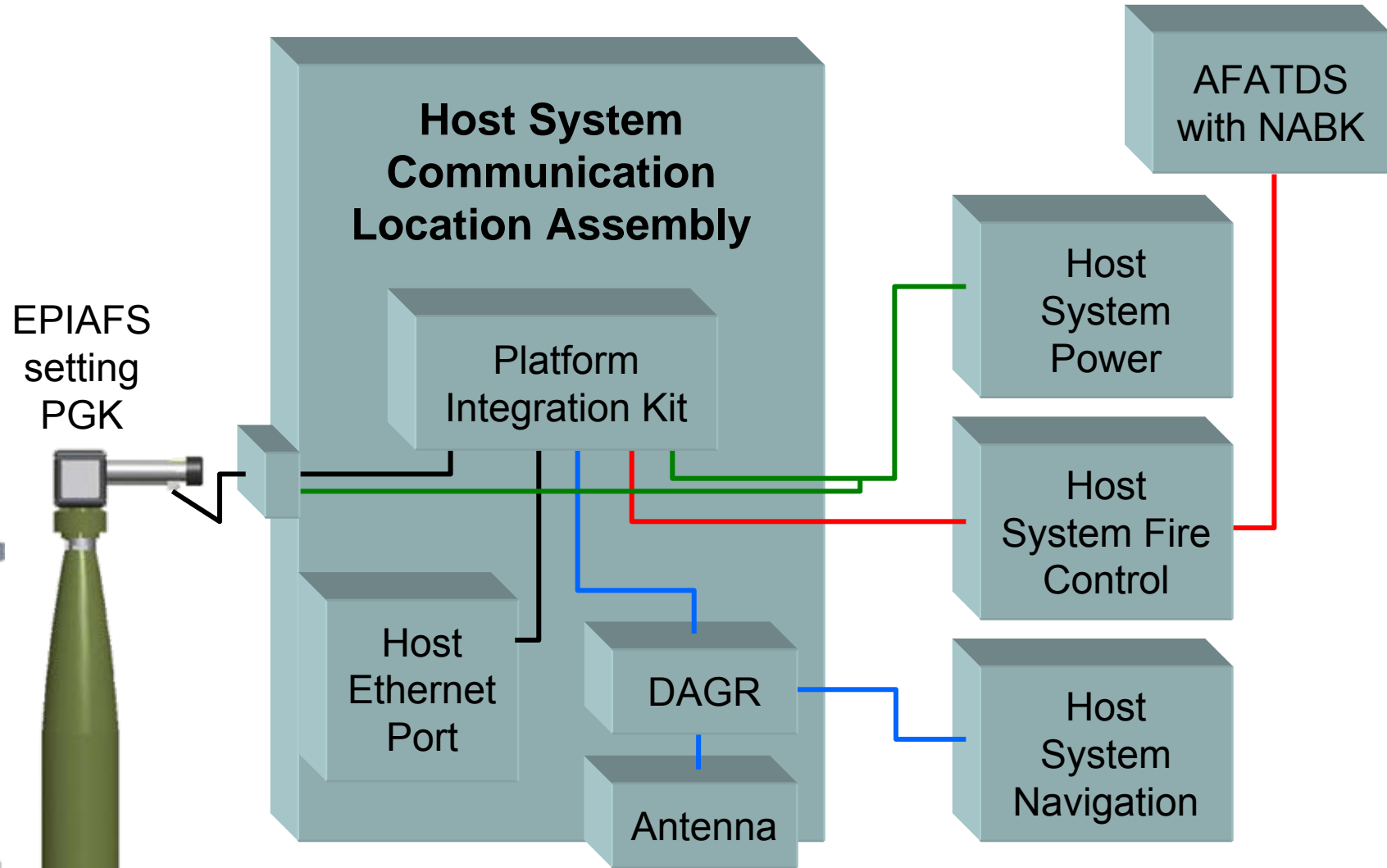
PIK in M109A6 (Paladin)



PIK on M777A2



# EPIAFS Interface & Host System Support



Excalibur

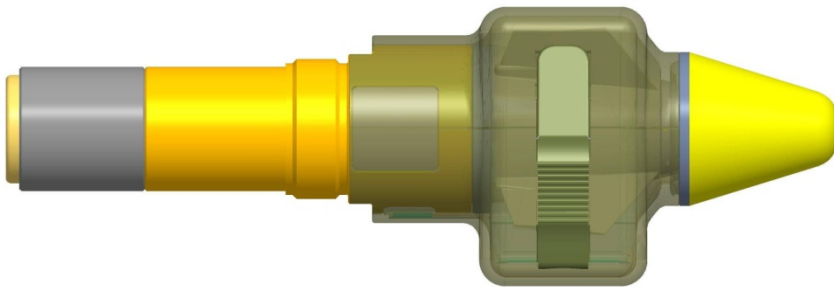
Compatible with Excalibur & PGK



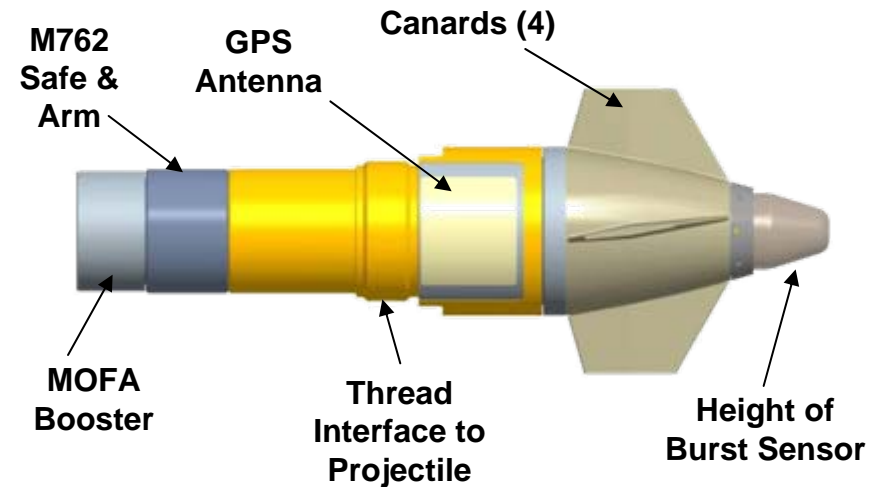
# PGK Design Description

## PGK With Cover

Cover Provides Environmental Protection & Interface to Fuze Setter

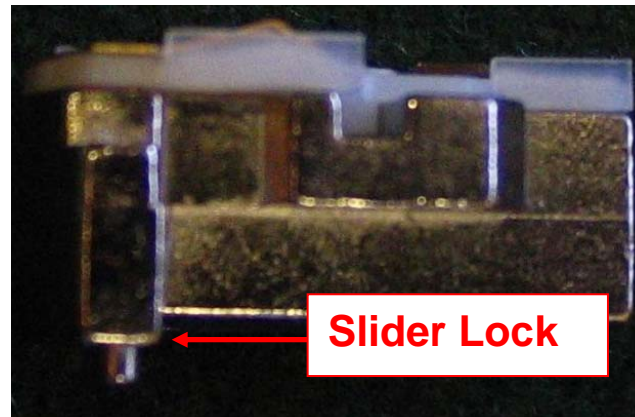
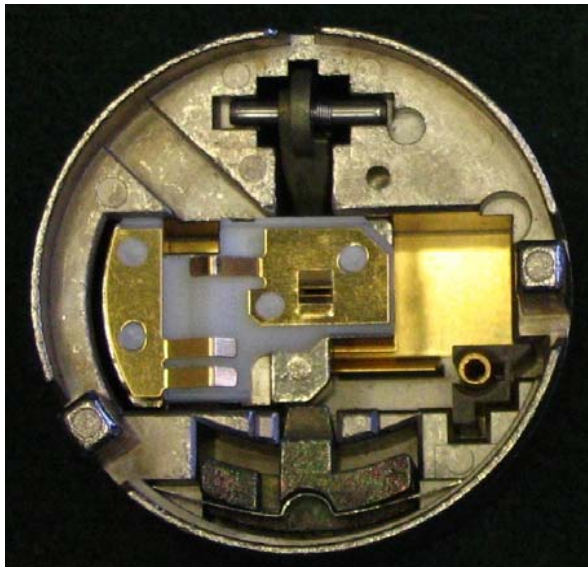
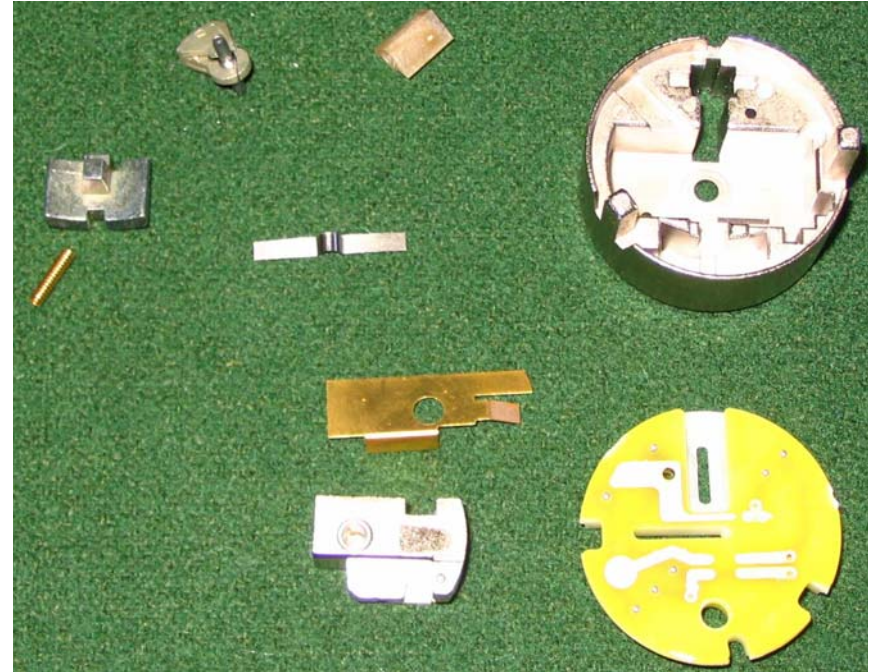
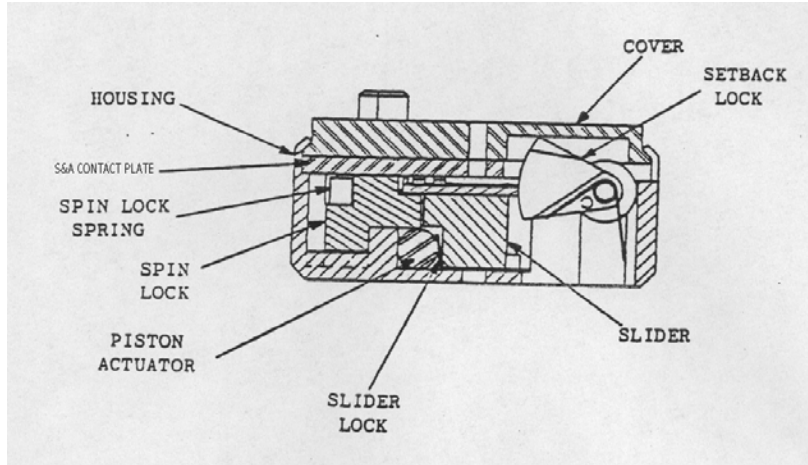


## PGK with Cover Removed



- Fits In Std 155mm HE Artillery Projectile Fuze Wells (Deep Intrusion)
- GPS Guidance (With SAASM)
- 20 Year Storage Life (No Battery)
- Proximity & Point Detonating Fuzing

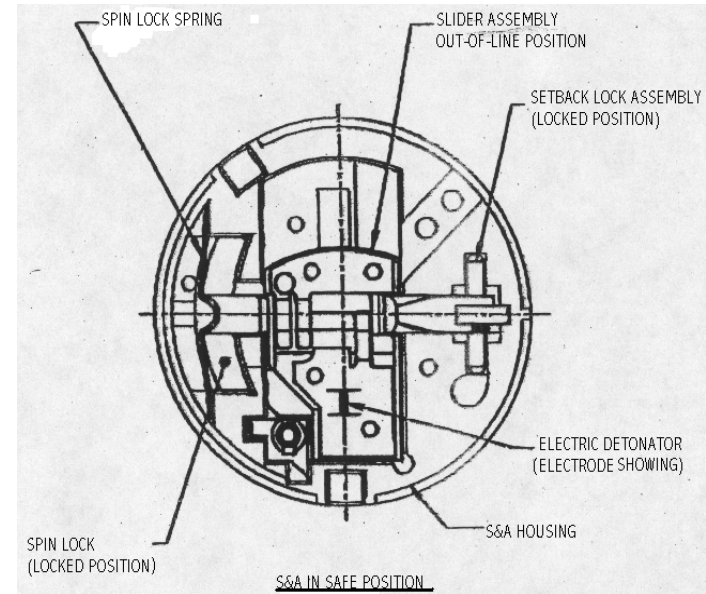
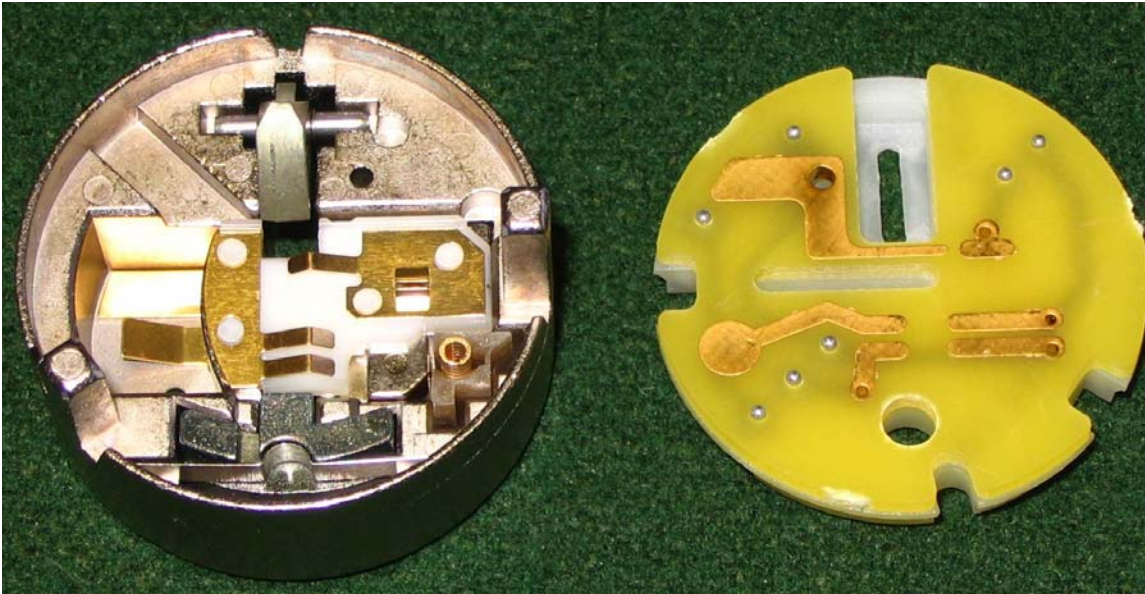
# M767A1 Safe & Arm (S&A) Mechanism





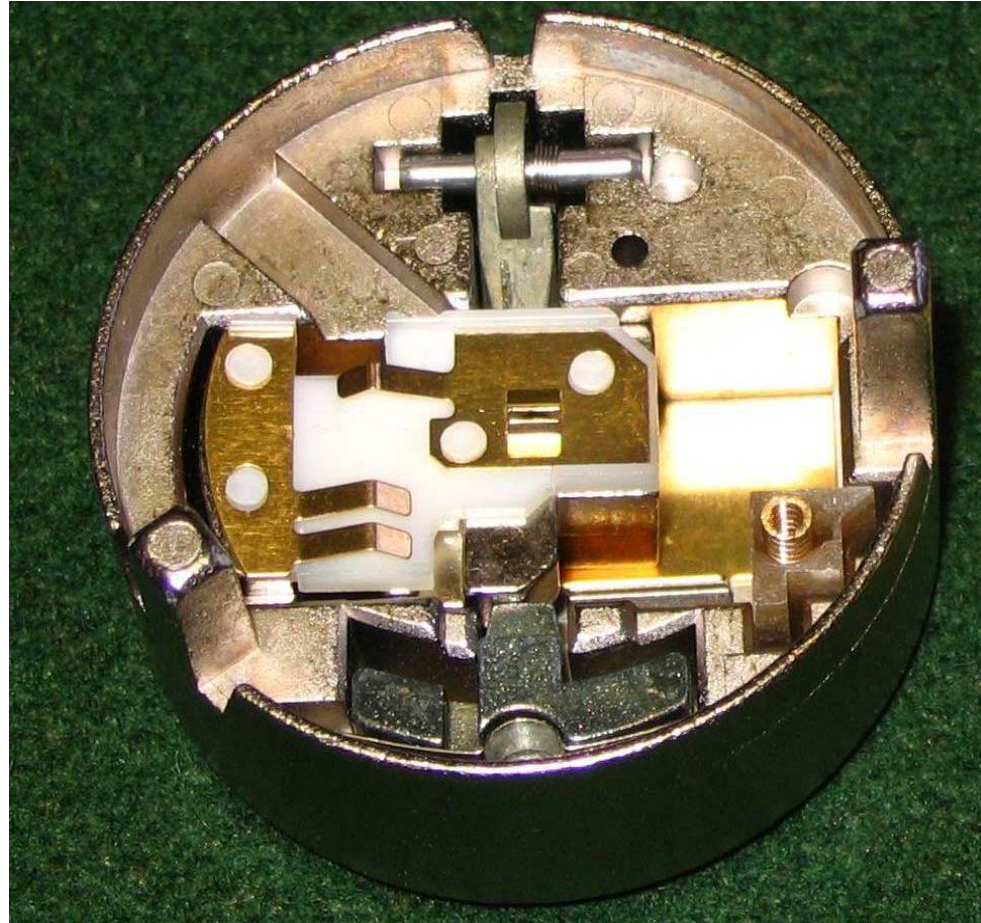
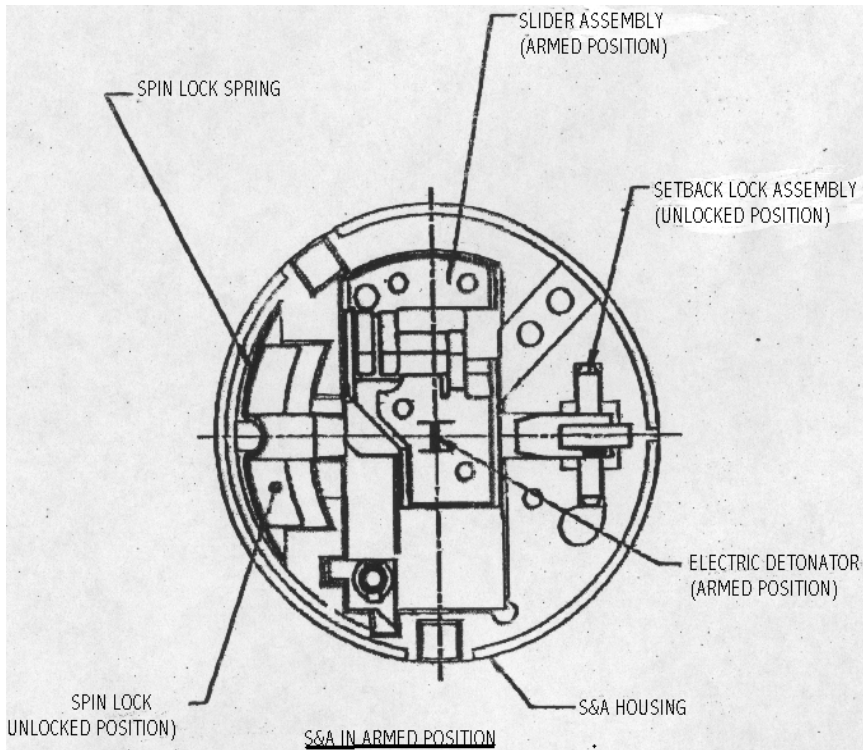
# Safe Position

- Setback weight up
- Spin lock pushed in



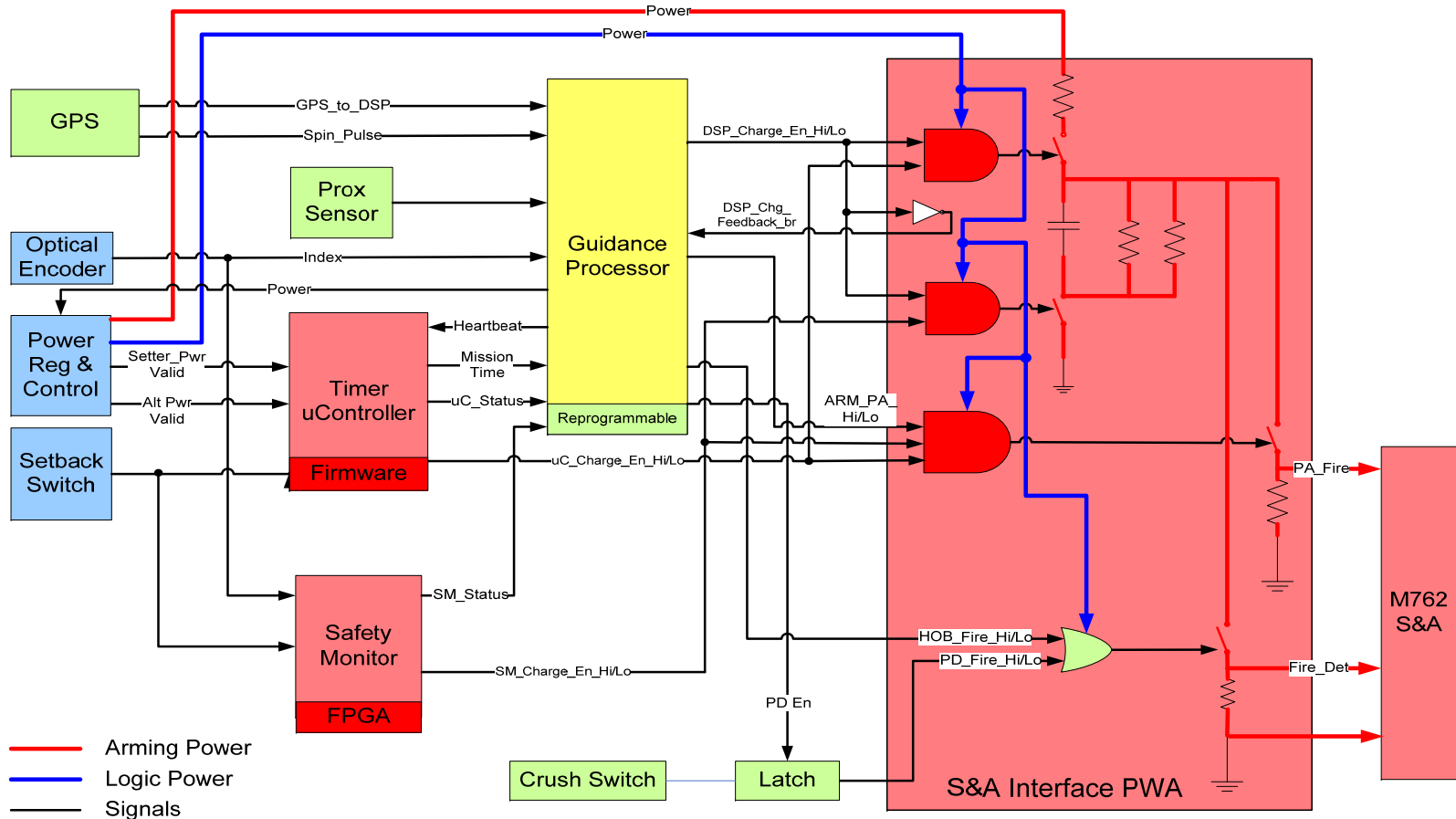
# Armed Position

- Setback weight down
- Spin lock pushed out





# PGK Fuzing Architecture



# PGK Accomplishments & Up-Coming Events



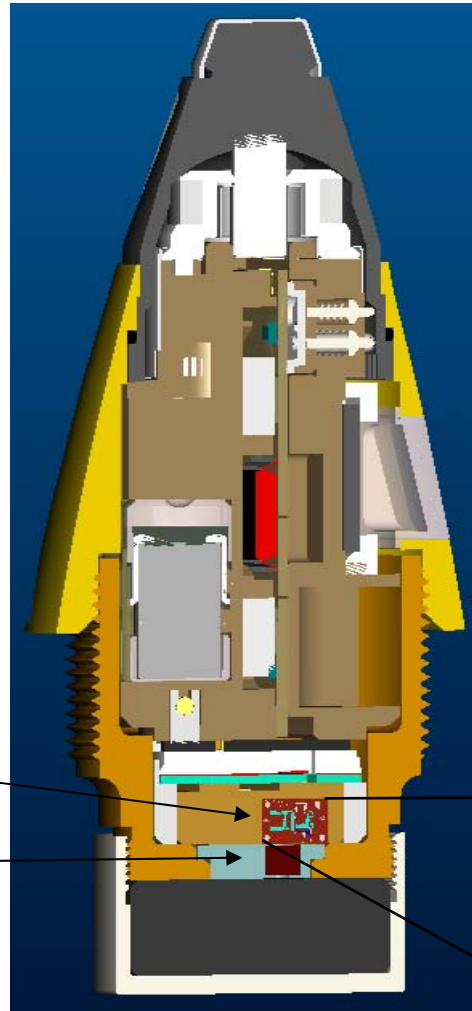
- Hardware CDR -- Jan 09
  - Design Meets All Requirements Via Analysis or Testing
- AFSRB Initial Certification -- Feb 09
- Guide To Flight Tests – Apr 09
  - M795 Projectiles
  - Acquired GPS
  - Tracked and Guided
- Successful User Evaluation – Ft Sill, Apr 09
- Successful Vertical Gun Tests – May 09
  - M795 Projectiles (MACS Charge 4/5)
  - Hardware Survived Launch
  - Currently Being Electronically Evaluated at ATK
- Mil Std 331 Testing – Jun 09
- Environmentally Conditioned Ballistic Safety Tests – July – Sep 09
- Environmentally Conditioned Ballistic Performance Tests – Aug – Sep 09
- TC Standard – Sep 09

# **Future Advancements in Fuzing**

# Micro-Electro Mechanical Systems (MEMS) S&A Development



M762A1/M767A1



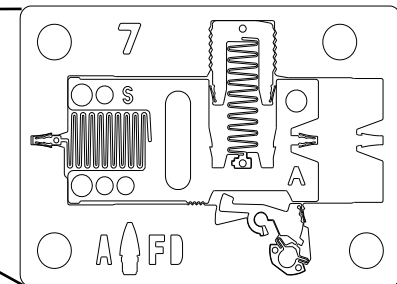
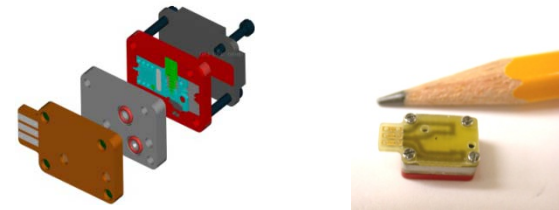
MEMS Integrated

S&A

Lead

M762A1 Fuze Used To Evaluate MEMS S&A Performance For Artillery

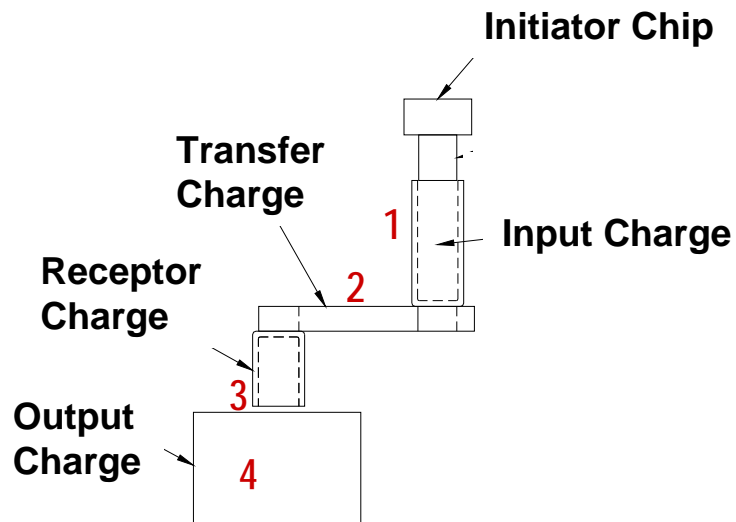
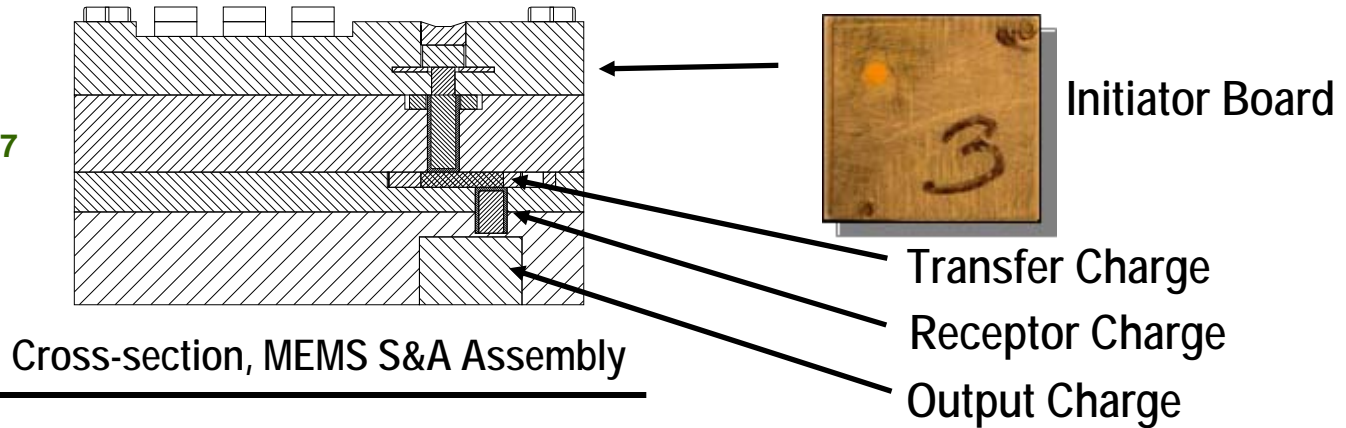
- Improved MEMS Design
- Suitable For High and Low Propellant Charges
- Command-To-Arm Feature
- **S&A Volumetric Savings = 95%**



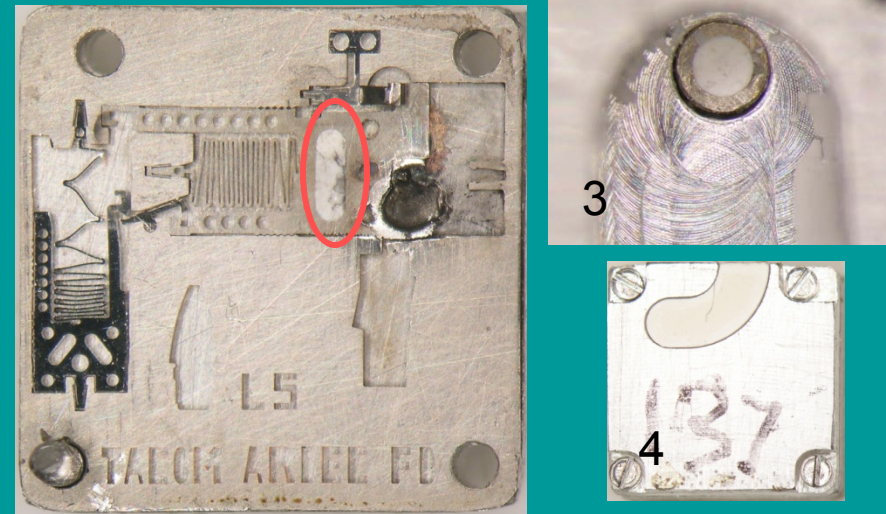


# Micro-Scale Firetrain (MSF)

U.S. Patents 7055437  
and 7069861



## Barrier Safety



Charge 1 Function  
Charge 2 (Transfer) Safe

Charge 3 (Receptor) Safe  
Charge 4 (Output) Safe

# Summary

- PGK (Increment 1) Provides Warfighter  $\leq 50\text{m}$  (CEP)
  - 155mm High Explosive Projectiles
  - Future Increments Increase Capabilities For 105mm & 155mm Projectiles
- PGK Design Leverages Existing Technology (High Maturity)
- PGK Safety Design
  - Uses Proven M762 S&A Design
  - Redundant Electronic Architecture
- Warfighter Benefits Include:
  - Improves Munition Accuracy
  - Improves Munition Efficiency
  - Increased Number of Stowed Kills (Reduces Logistics Burden)
  - Greatly Reduces Possibility of Collateral Damage
- PGK Increment 1 Fielding Planned in US Fiscal Year 2010