43rd Gun & Missile Conference

Guided MLRS Electronic Safety & Arming Devices (ESAD) & Electronic Safety & Arming Fuze (ESAF)

communications

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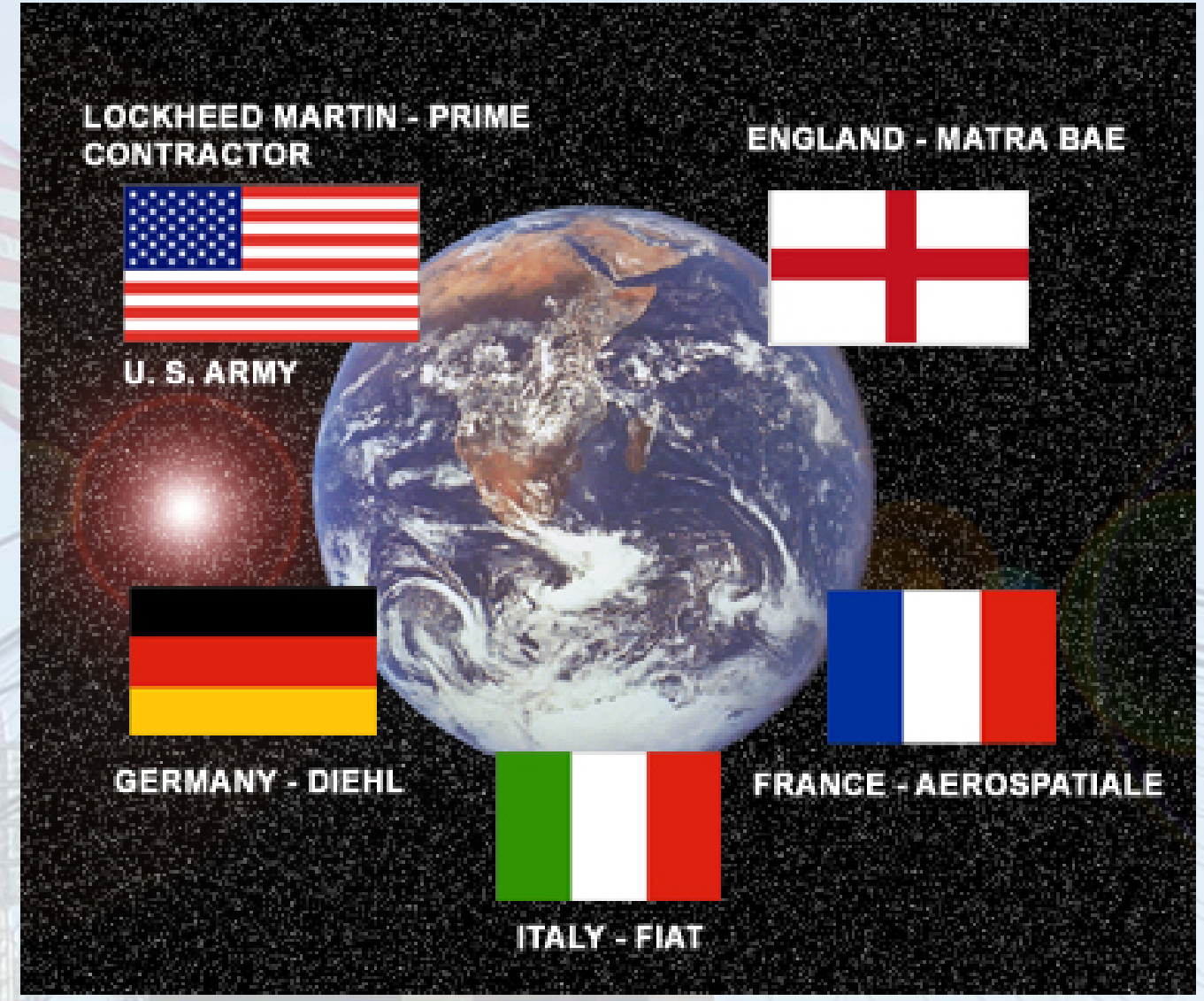
Agenda

- Introduction
- MLRS Overview
- M30 Guided MLRS DPICM
- Guided MLRS Unitary (6” ESAF)
- M31 Guided MLRS Unitary (3” ESAF)
- Conclusion

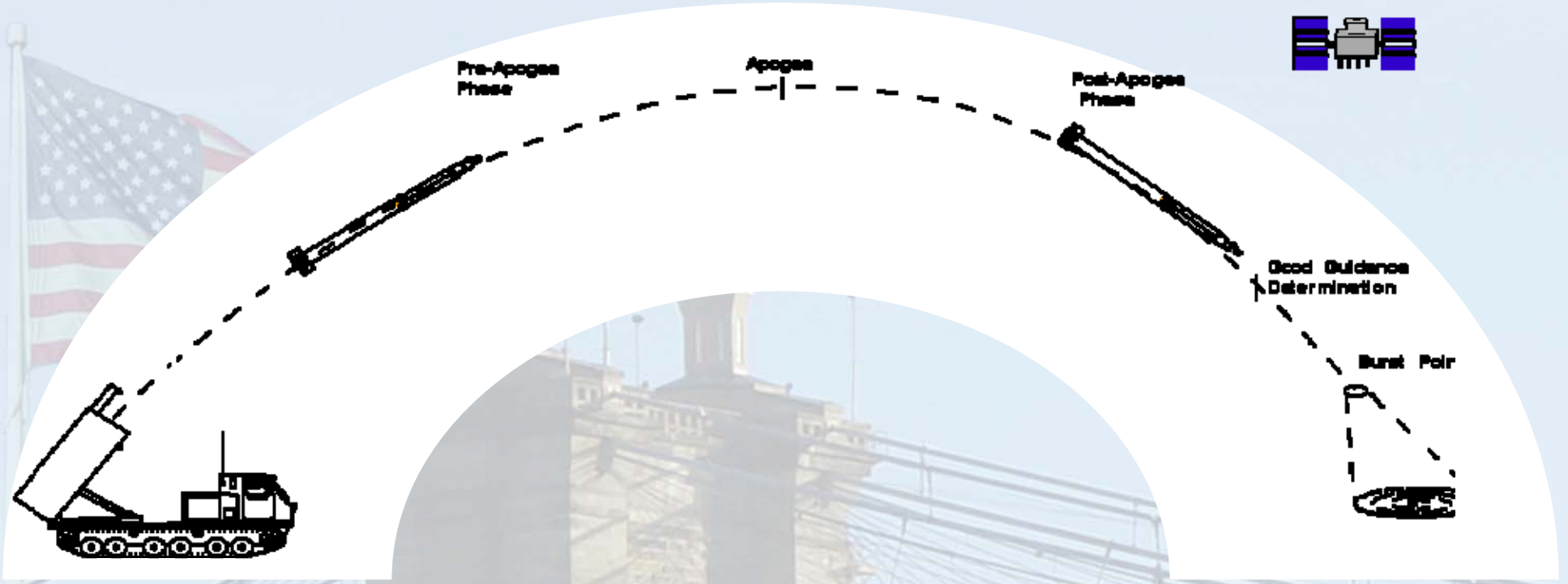
Guided MLRS USA And Foreign Partners

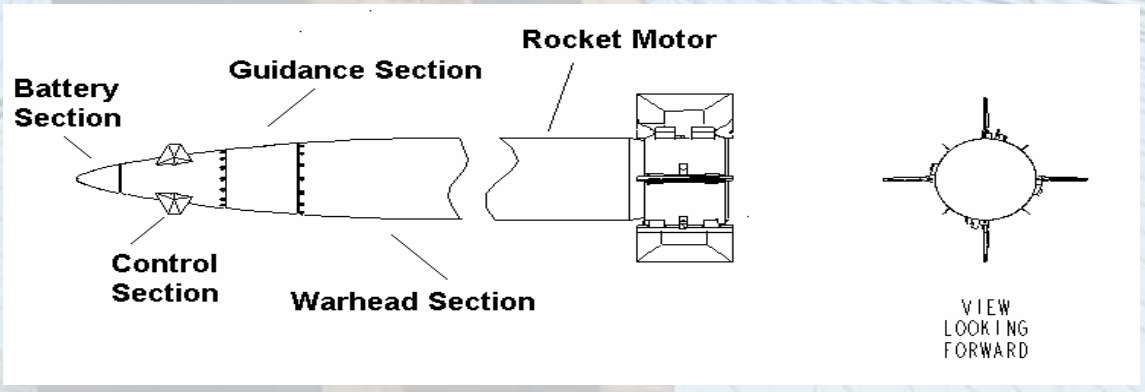


MLRS Background

- MLRS family of munitions includes three rockets and four missiles with others in development
- 13 feet long and 9 inches in diameter
- Tube-launched, spin-stabilized, free-flight projectile
- Range is a function of launcher elevation
- Latest designs utilize canards to correct the trajectory during the flight and rolling fins to provide stability
- Assembled, checked, and packaged in a dual-purpose launch-storage tube at the factory

GMLRS Operation

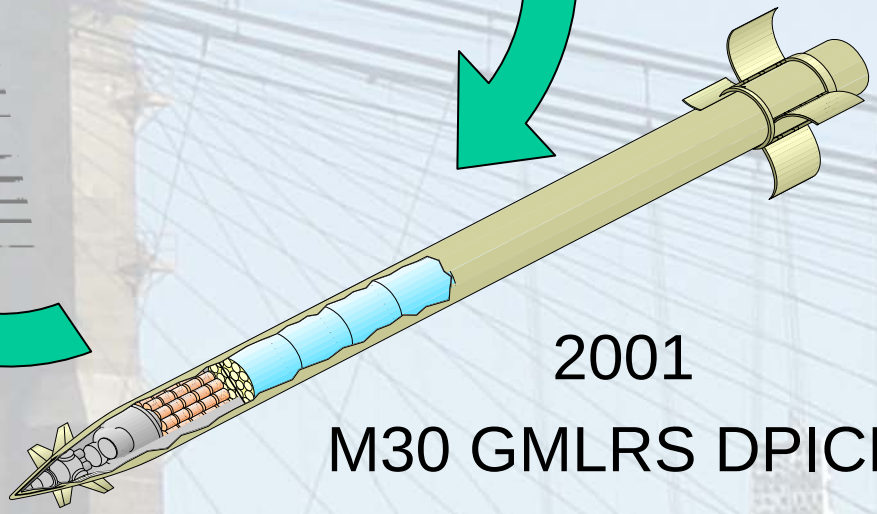




Evolutions in MLRS Rockets

1979
M26 MLRS

1992
M26A1 ER-MLRS

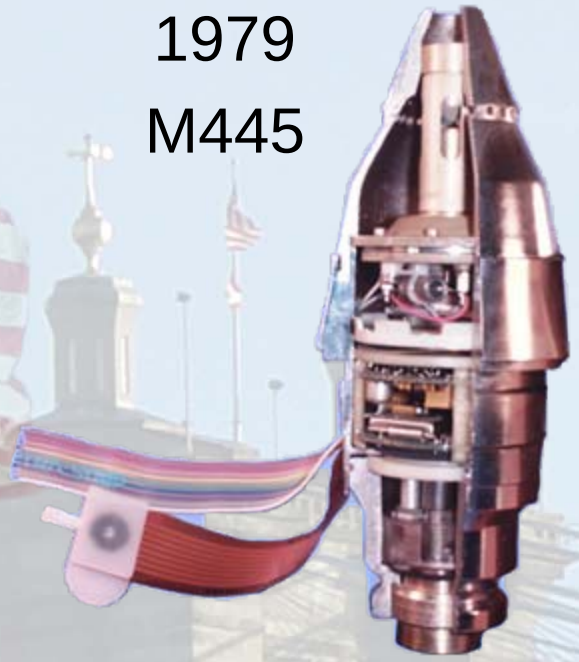


2001
M30 GMLRS DPICM

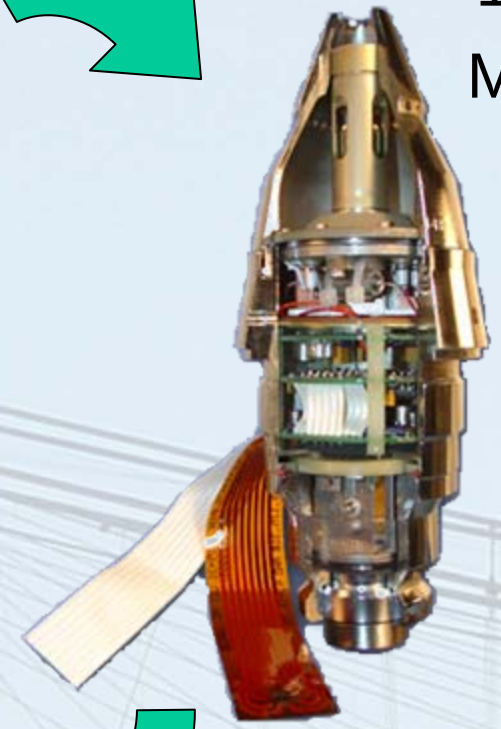
2004
XM31 GMLRS Unitary

Evolutions in MLRS Fuzing

1979
M445



1992
M451



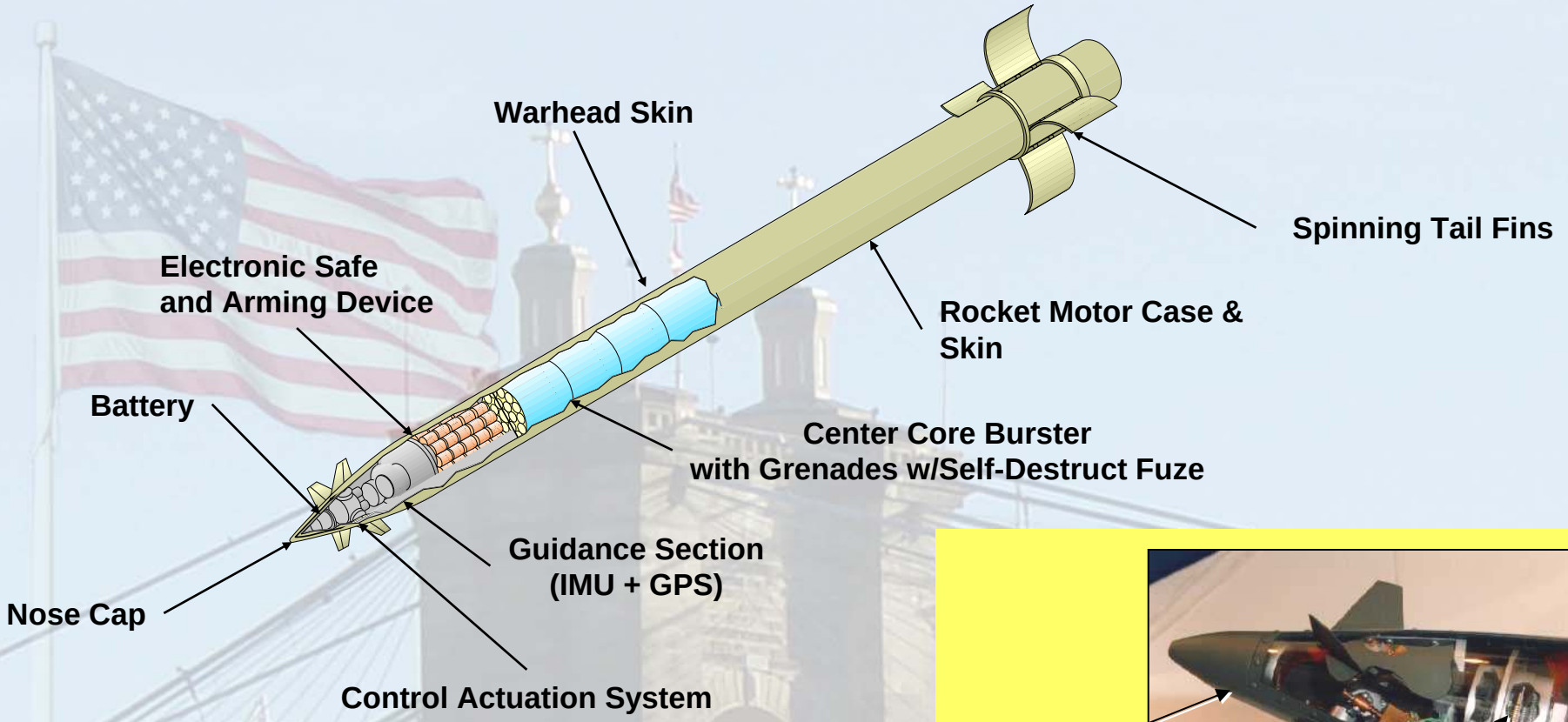
2004
GMLRS Unitary ESAF

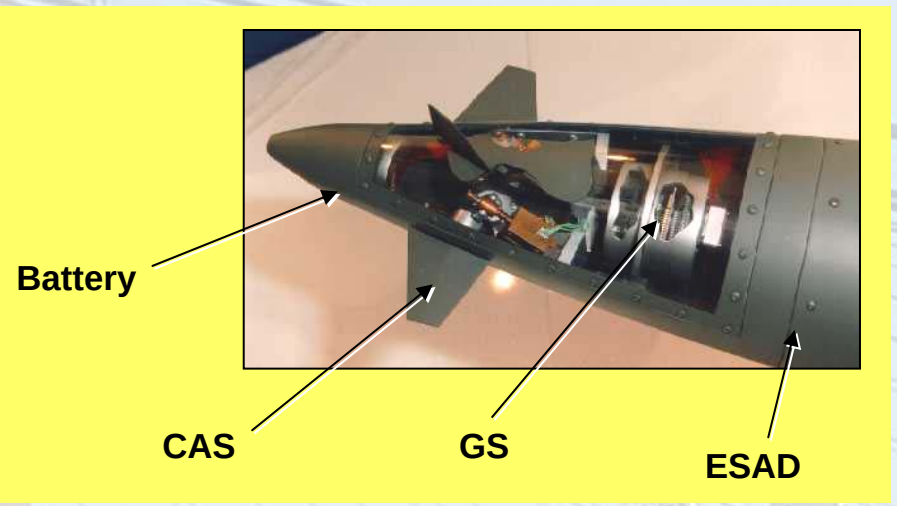
2001
GMLRS DPICM ESAD

M30 Guided MLRS (DPICM)

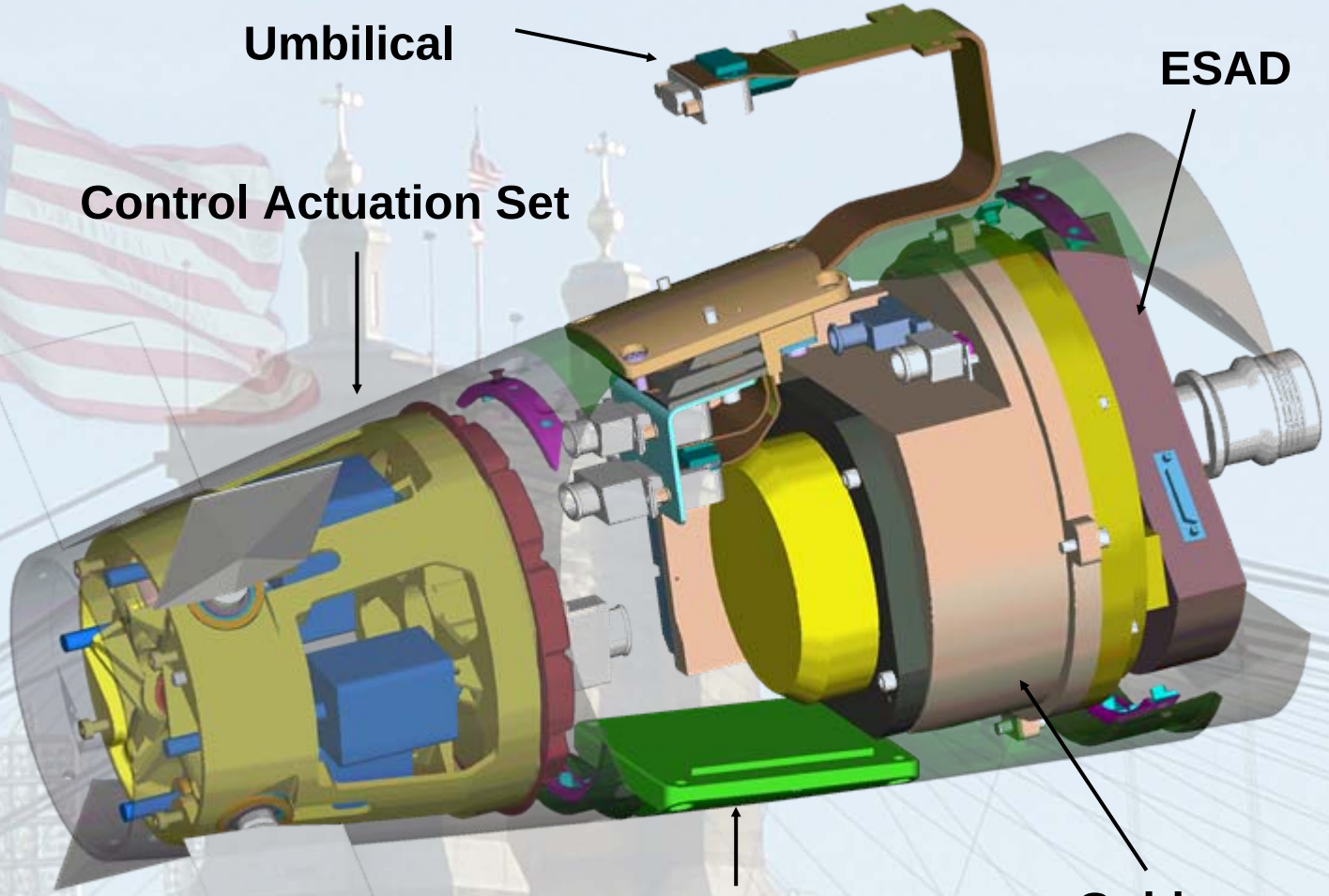
- Began EMD in 1999
- Grew from need for increased range and accuracy
  - GPS aided inertial guidance package
  - Control actuation system
  - Spinning tail fins
  - Canards provide basic maneuverability
- Maximum range 60+ km
- Accuracy measured in meters
- Enhanced anti-jam capabilities
- Dispenses 404 M101 DPICM Submunitions
- Decreases number of rockets to defeat targets by as much as 80%
- New Fuze – GMLRS ESAD

The Guided MLRS DPICM Rocket Design



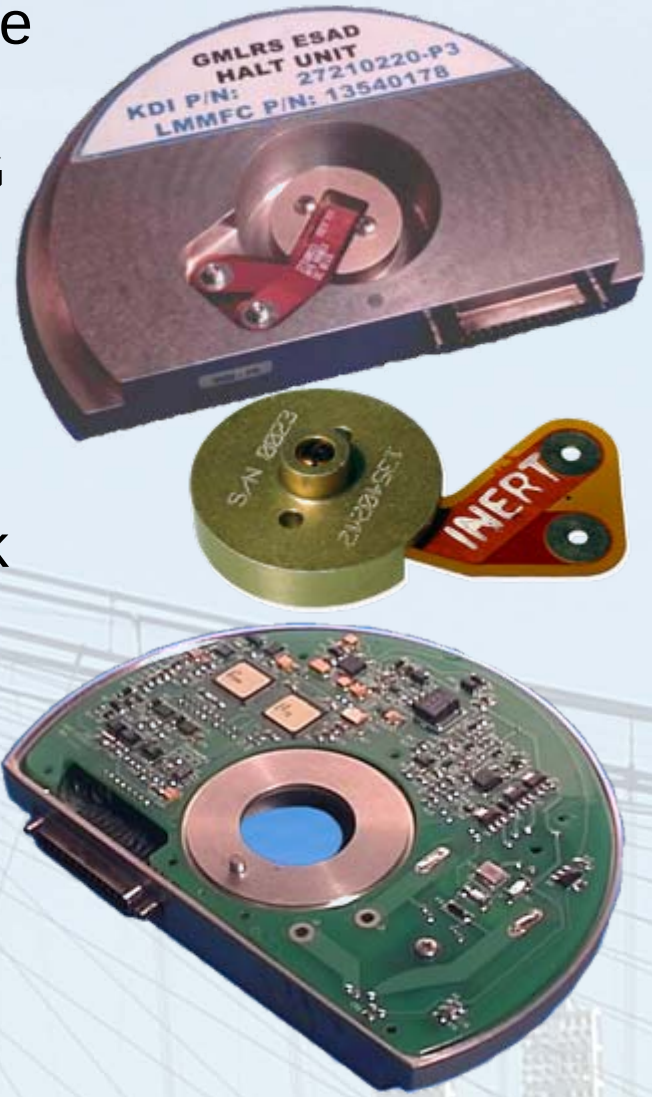


DPICM Round: Guidance and Control Section



Guided MLRS (DPICM) ESAD

- Replaced electro-mechanical fuze with In-Line Electronic Safe and Arm Device (ESAD)
- Design meets MIL-STD-1316D and STANAG 4187
- High voltage generation needed due to removal of mechanical interrupters
- Uses solid state high voltage switch (NMCT)
- Safety environments – changed from setback and ram air to umbilical disconnect and acceleration
- Utilizes MEMS accelerometer
- First motion and safe separation verification
- Sequencing and acceleration for time



Guided MLRS (DPICM) ESAD

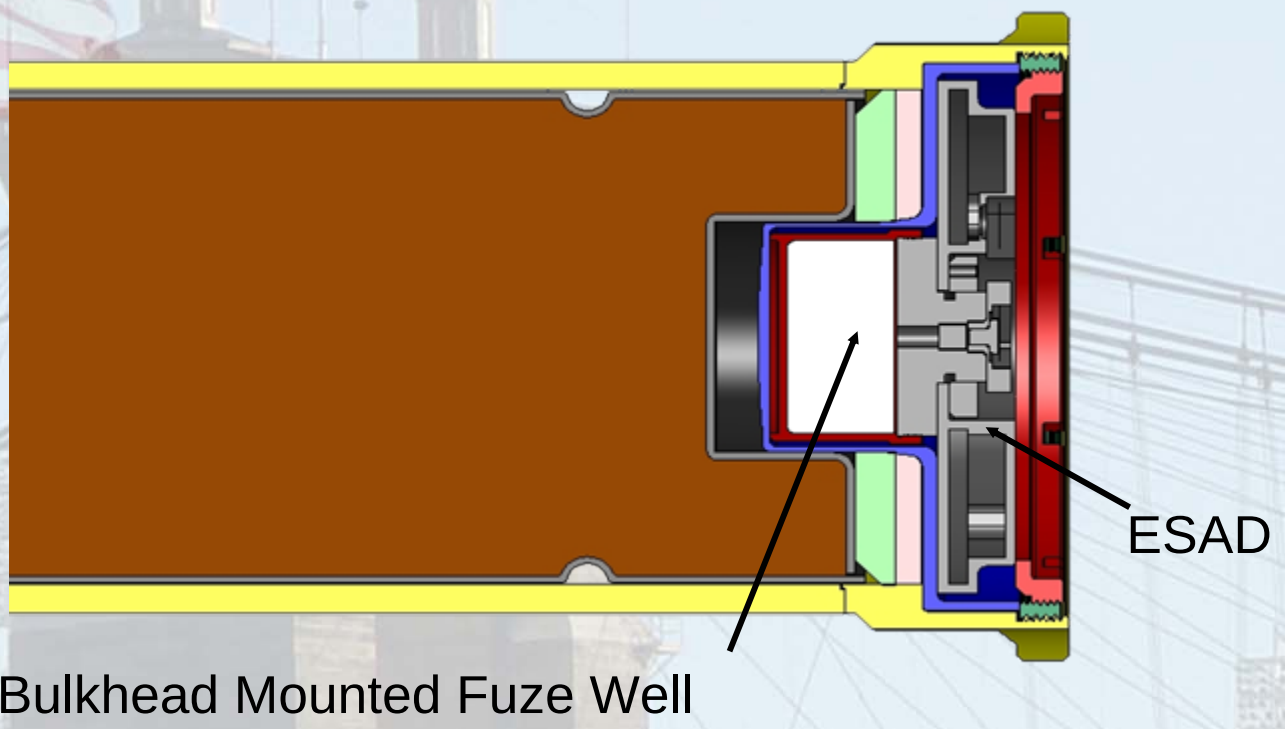
- External Low Energy EFI (LEEFI) used
  - Designed in Unison by China Lake, Reynolds Systems and Silicon Designs
  - The LEEFI Has Been Qualified by China Lake IAW MIL-DTL-23659
  - Specific Tests Designed to Demonstrate the Initiator Meets a Reliability of 0.99 at a 95% Confidence Level Were Performed
- Serial interface
  - Overhead safety timer can be programmed in launcher
  - Provides real time status of events

Guided MLRS (DPICM) ESAD

- Arm/fire command issued prior to desired detonation point
- Fuzing Modes: Arm/Fire
- Increased shelf life & reliability over mechanical system
  - No mechanical parts
  - Hermetically sealed housing
- Increased testability
  - Can be fully tested on bench to verify proper operation
- Qualified in 2002
- > 2300 Delivered to date

6 Inch Unitary ESAF Warhead Design

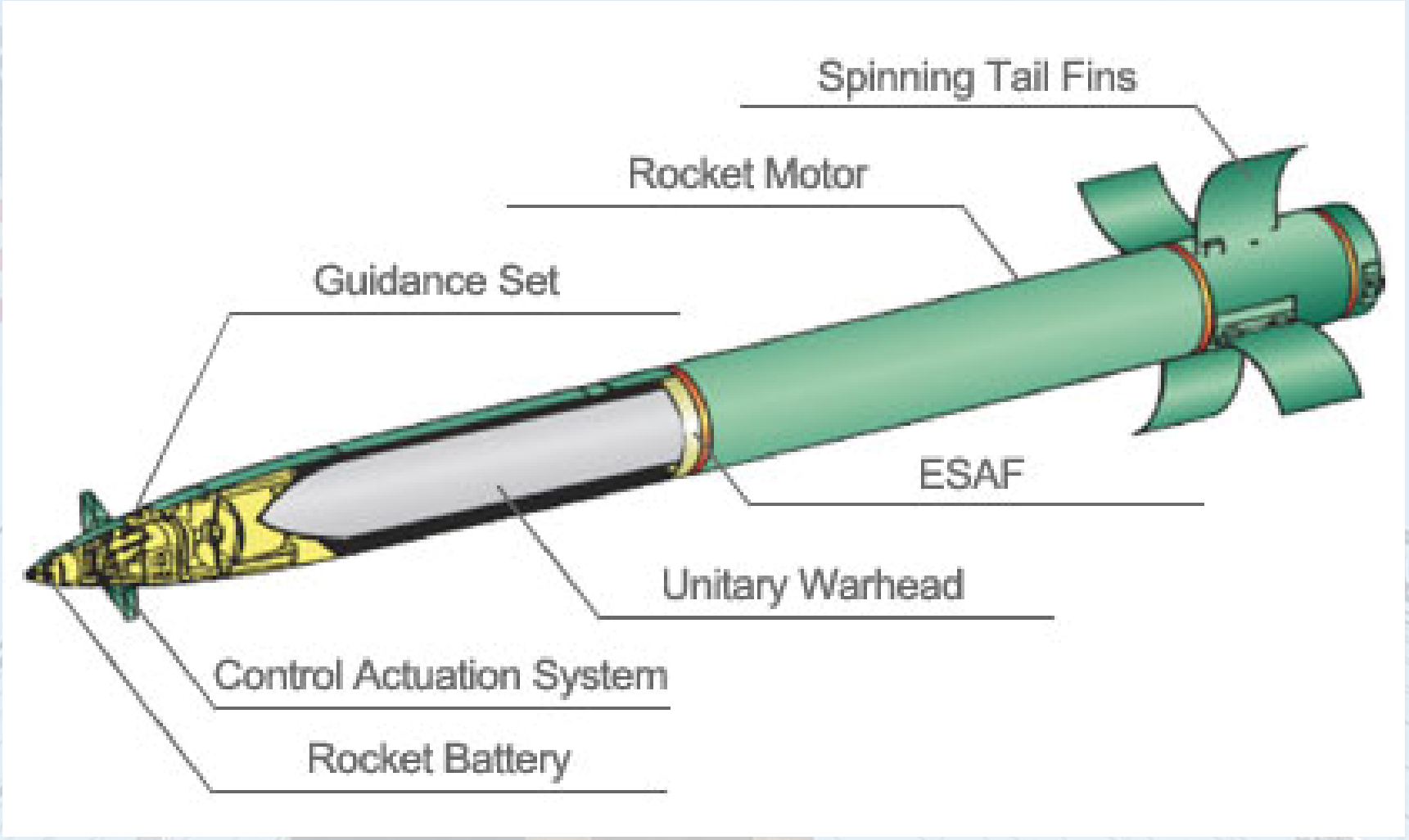
- KDI developed and qualified a variant of the DPICM Round ESAD for use on the Unitary Warhead
- Unit was developed and fielded in < 1 year



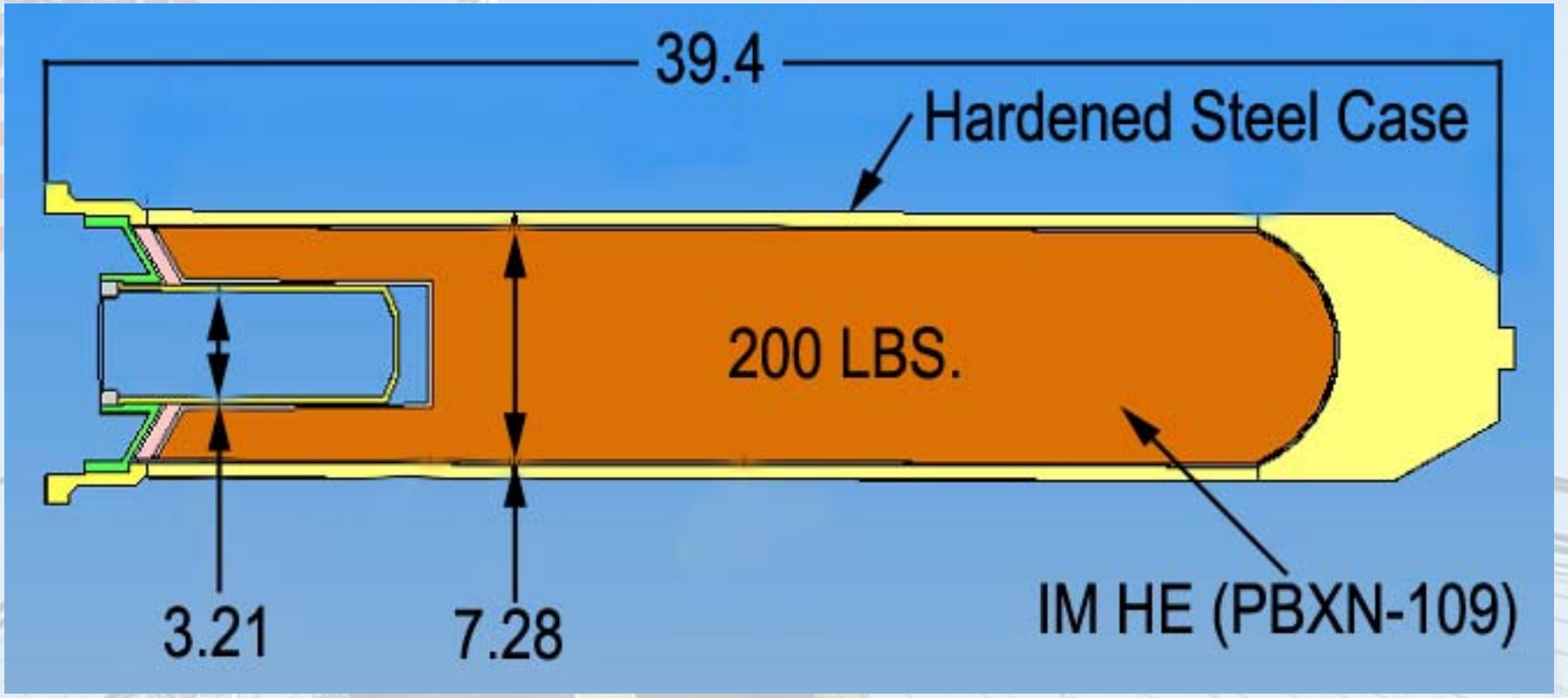
M31 Guided MLRS Unitary

- October 2003 - Lockheed Martin awarded an SDD contract for 86 unitary variant rockets; incorporates new 3” ESAF
- May 2005 - First units delivered - accelerated following a US Army Urgent Need statement
- Aug 2005 - Unitary variant began field testing in Iraq
- Sep 2005 - First GMLRS unitary rockets fired in combat operations by 3rd Battalion, 13th Field Artillery (3-13 FA), 214th Field Artillery Brigade
- > 2100 Produced to date
- Today, GMLRS unitary is the Army’s only surface-fired, precision, longer range indirect fire munition available to troops in contact in an urban environment
- Affectionately referred to as the “70km sniper round”

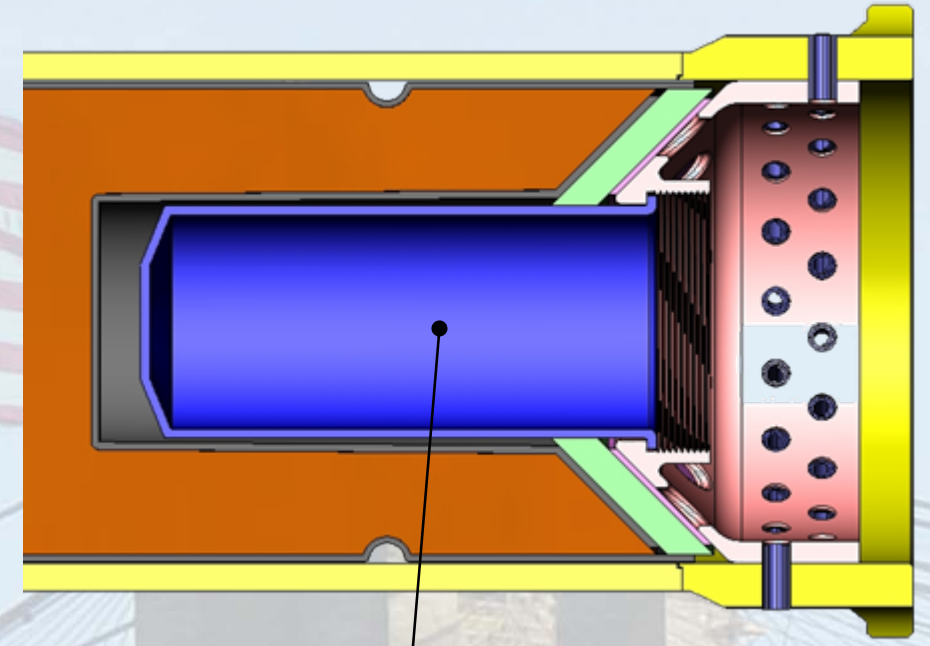
M31 Guided MLRS Unitary



Unitary Warhead Design



3” Fuzewell ESAF Warhead Design



3 Inch Fuzewell

Fuzing Modes

- PD
- Delay
- Proximity

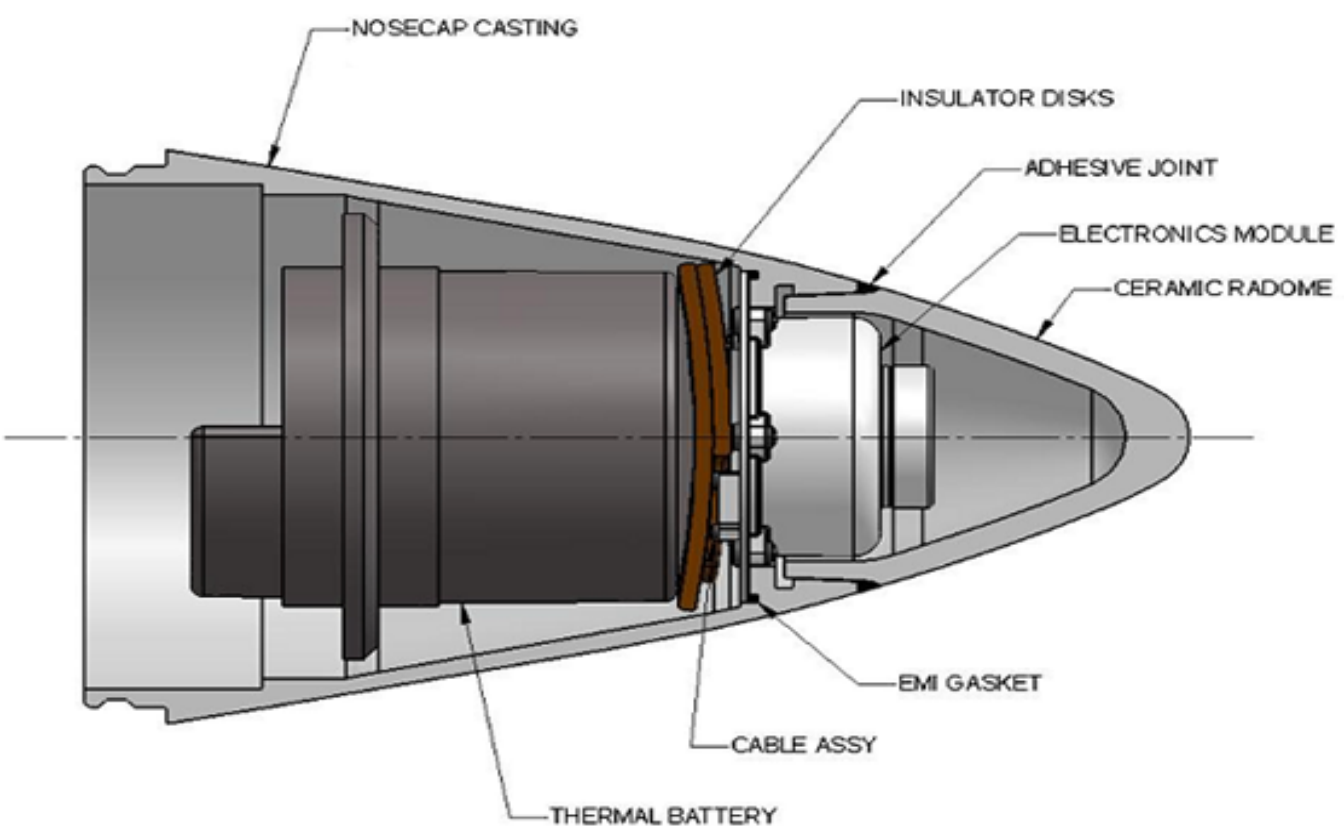
GMLRS Unitary ESAF

- Tri mode fuze functionality – proximity, impact, and impact with delay
- Design compatibility with MIL-STD-1316E and STANAG 4187
- GMLRS (DPICM) ESAD was baseline design
- Added internal impact switches
- Added external impact switch fire input
- Added proximity sensor interface
- Impact survivability
  - Survives high g longitudinal loads
  - Settable detonation delay time
- Safety Environments – Umbilical disconnect and acceleration

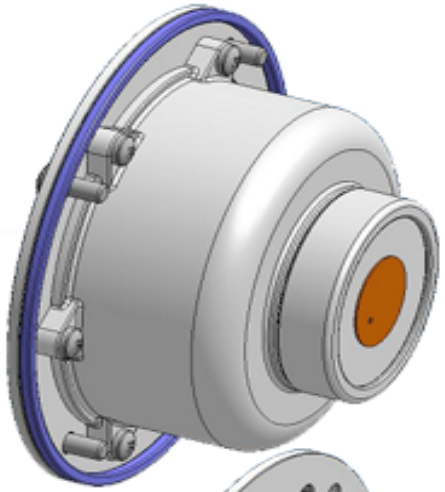
GMLRS Unitary ESAF

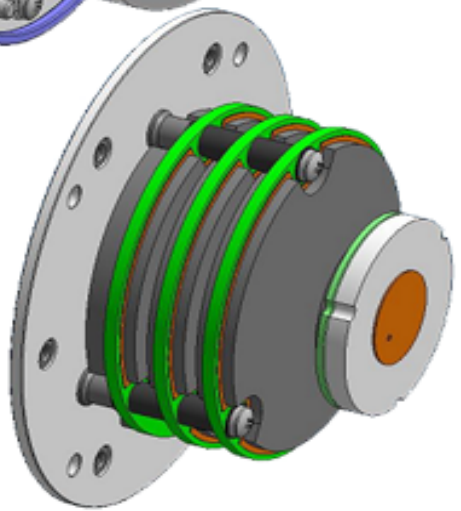
- Serial Communications to set overhead safety time, detonation delay time, function mode, receive arm command and provide status during test and flight
- Proximity sensor interface
  - Selectable HOB
  - High approach velocities
- Fits 3” fuze well
- Designed to be insensitive munitions (IM) compliant
- Qualified 2006

GMLRS Proximity Sensor Location



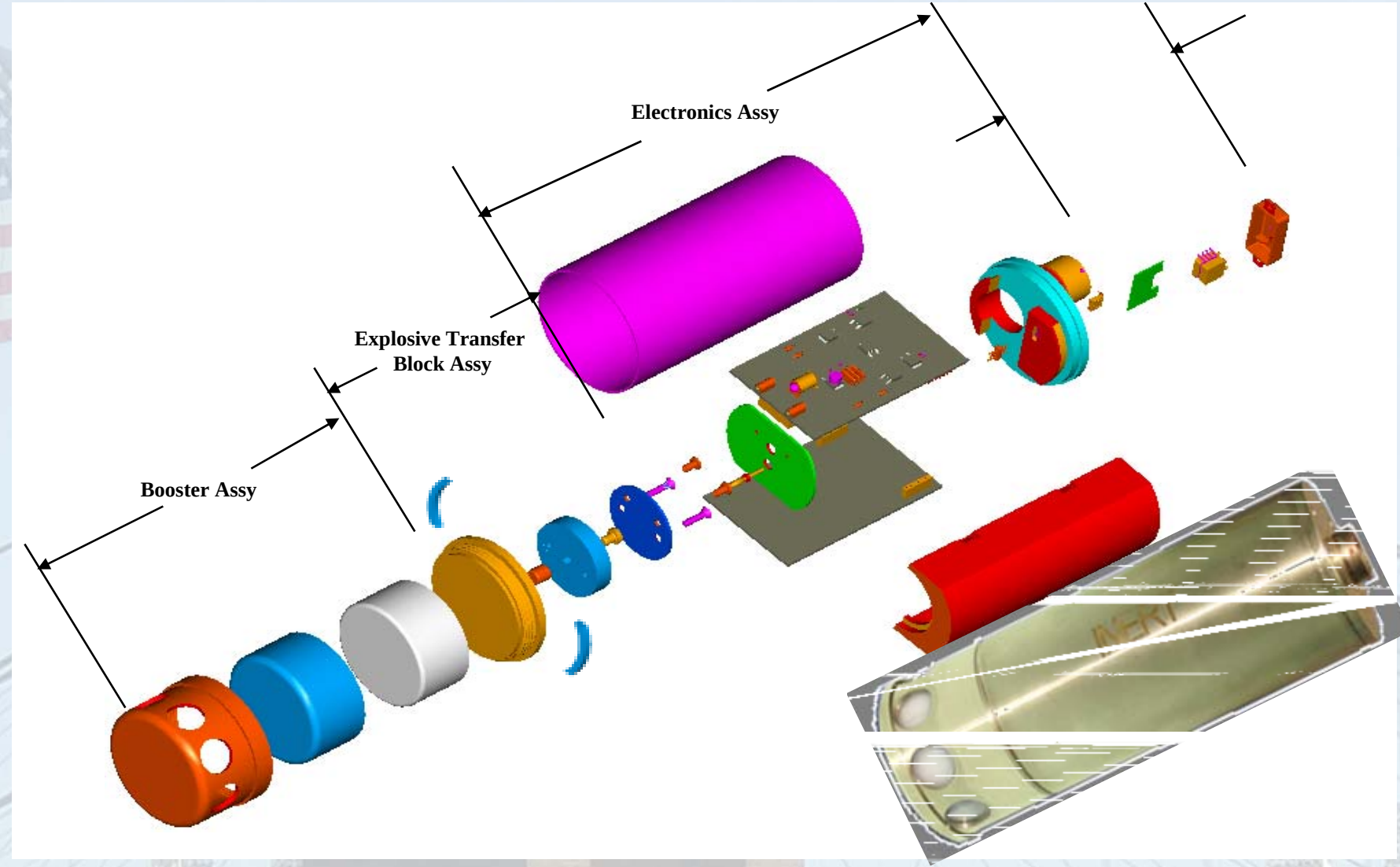
Proximity Sensor





Electronics Boards

3” Fuze Exploded View



Conclusion

- MLRS program has evolved over the last 30 years
  - MLRS improvements have focused on upgrading launcher responsiveness and enhancing the range and precision of its munitions over the last 10+ years
  - Increased range – from 30km to 70km+
  - Improved lethality and reduced collateral damage by changing submunitions / warhead – DPICM, Unitary
  - Systems have adapted to evolving technology – GPS/INS, control systems, Fire Control, Fuzing improvements
- Program team always focused on delivering weapon to meet war fighters needs - “one round, one kill capability”