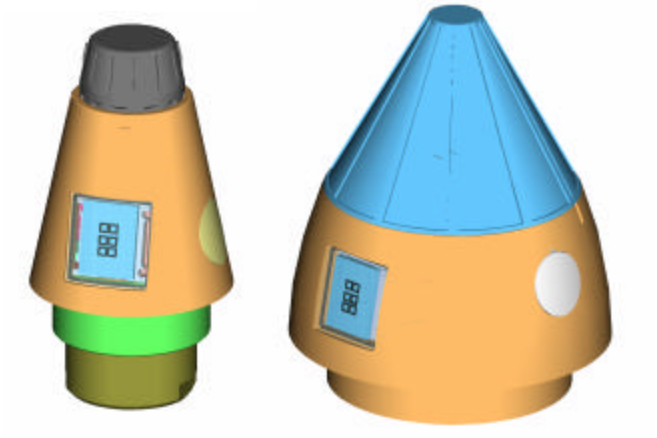
XM784 and XM785

Electronic Time Fuze

For Mortars (ETFM)

9 April 2003



XM784 *XM785*

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XM784 / XM785 ETFM Background

- **No US Fielded ET Fuze for Mortars Exists**
  - **US Requirements Filled By Foreign Source**
  - **M776 / M772 Diehl/Junghans (Germany)**
    - **Under Waiver From US Safety Standards**
- **User Persistently Indicated Need For a US ET Fuze (Since Mid '80's)**
- **No NDI Design Solution Exists**
  - **Foreign Comparative Studies**
  - **Engineering Studies**
  - **Contractor Studies**

XM784 / XM785 ETFM
Need

- **Army Safety Standards MIL-STD-1316 (Dual Environ Safety)**
  - **No Current Mortar Time Fuze Meets Standards**
- **Need For Increased Timing Accuracy**
  - **Effects Cartridge Performance**
- **Three Fuze Types**
  - **PROX: (M734A1 Multi-Option Fuze)**
  - **PD / Delay: (XM783)**
  - **Time: (XM784 (60 / 120 mm) & XM785 (81 mm))**
- **Legacy Fuzes Require a Wrench To Set**
  - **Difficult to Read**
  - **Require External Lighting**
- **Mortar Time Fuze Modernization**

XM784 / XM785 ETFM Requirements

- **Cartridge Compatibility:**
  - **60 mm (M721 Illum & M767 IR Illum)**
  - **81 mm (M853A1 Illum, XM816 IR Illum & M819 RP Smoke)**
  - **120 mm (XM930 Illum, XM983 IR Illum)**
- **Hand Settable Required (Inductive Set Desired)**
  - **Self Illuminating**
- **Accuracy 98%**
- **Set Time 5 – 99.9 Seconds (0.1 Sec Increments)**
- **Cannot Significantly Degrade Cartridge Range**
- **20 Year Shelf Life (Controlled Environment)**

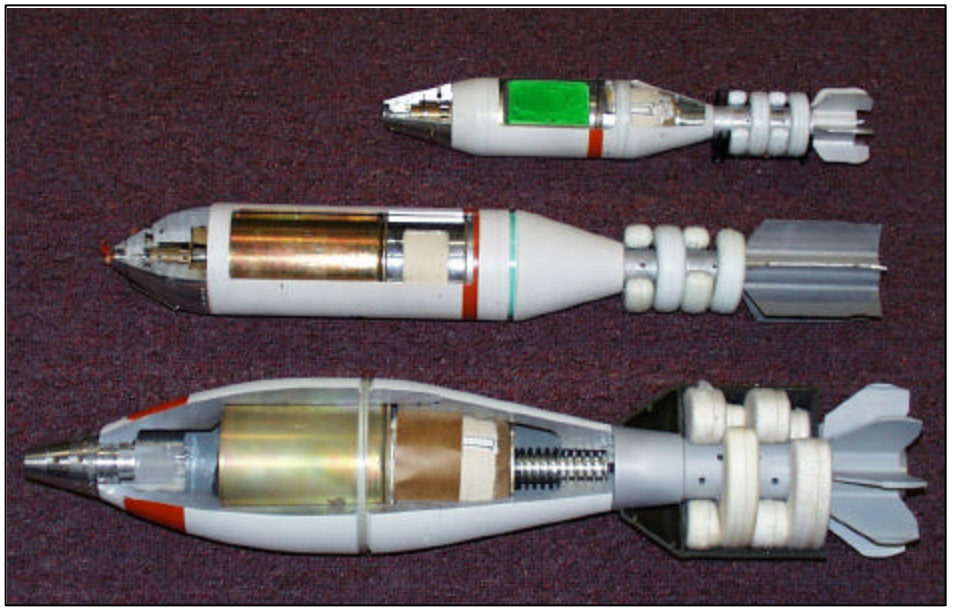
XM784 / XM785 ETFM Ammunition Application

M776
(60mm & 120mm)

XM784

M772 (81mm)

XM785



XM784 / XM785 ETFM
Conventional Mortar Fuze Overview

[redacted]

User Payoff

Proximity

M734 →  → M734A1

- Go to War Fuze
- Increased Performance & Safety

Point Detonating & Delay

M745 →

M935 →

M783

- Training Fuze
- Over 90% Commonality with M734A1
- 1/2 the cost of M734A1

Time

M772 →

M776/DM93 →

Mortar ET

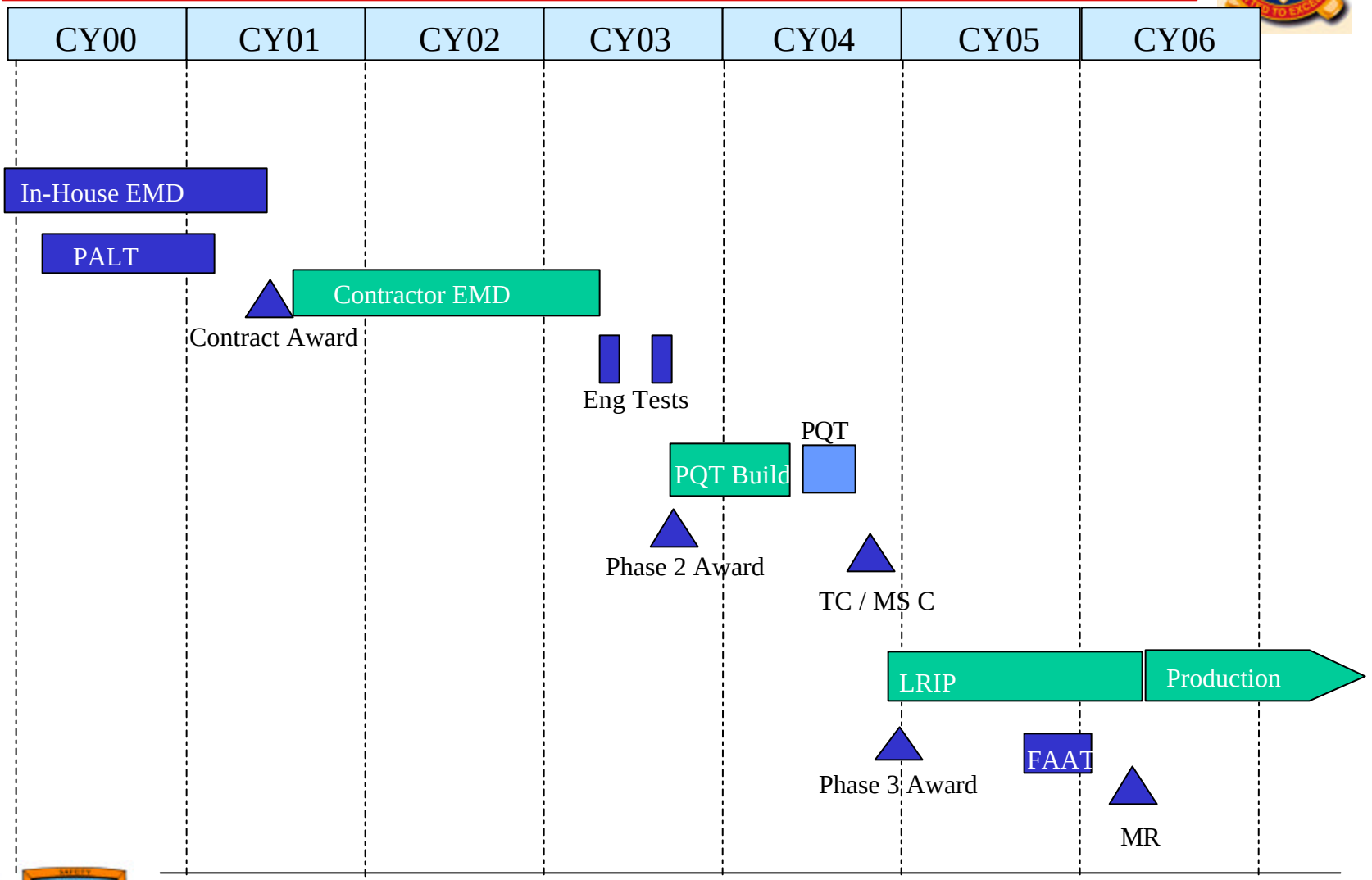
XM784 XM785

- Replaces mechanical with electronic timing
- Increased performance and safety
- CONUS production

XM784 / XM785 ETFM
Overall Program Plan

- **Systems Engineering / IPT Approach**
- **Contract Awarded To ATK**
  - **Phase 1: Develop & Demo Design Solutions**
  - **Phase 2: Production Qualification / TC**
    - **Conduct Government Ballistic Tests (PQT)**
    - **TC Standard**
  - **Phase 3: Low Rate Initial Production**
  - **LRIP Effort (22k – 60k fuzes)**
    - **FAAT**
    - **Three Production Lots to MR**

XM784 / XM785 ETFM Schedule

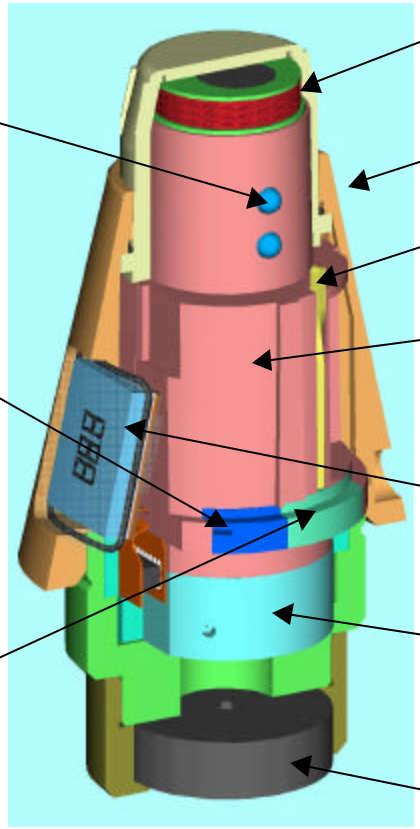


XM784 / XM785 ETFM Design Summary

ETFM Technologies

- Modular design approach - one fuze design fits both housings
- Commercial off the shelf (COTS) surface mount electronics
- Dual micro-controller electronic safety architecture
- Magnetic 2nd environment safety (Non-spin, non-air breathing application)
- Lithium Thionyl Chloride reserve battery
- Miniaturized electromechanical (command-to-arm S&A)
- Hand Settable / LCD Display
- NVM Self-Diagnostics Tool

XM784 / XM785 ETFM Modular Design



Increment / Decrement Switches

2nd Environment Sensor Coil

Setting ring

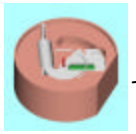
Battery Stab Rod

Potted Electronics Assembly

Battery Primer Assembly

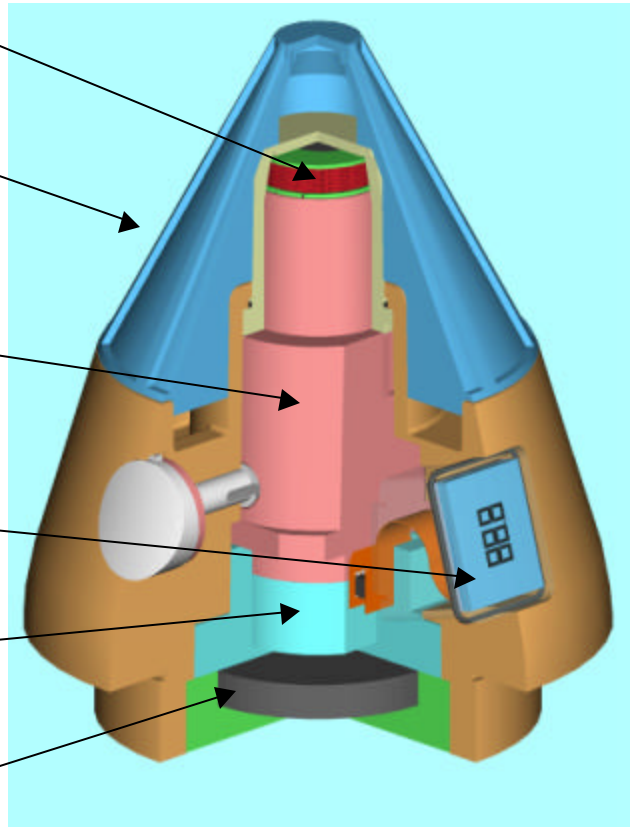
Back-lit LCD

Battery Stab Assembly



S&A

*Expulsion Charge



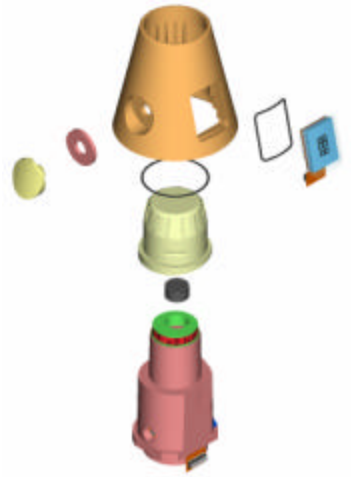
XM784

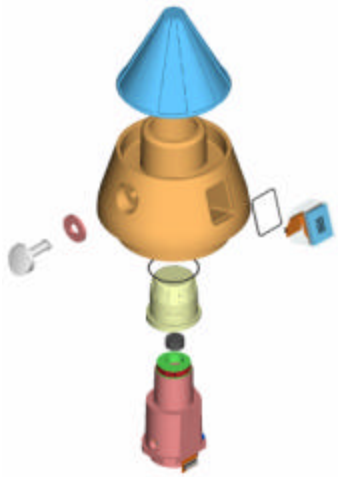
*not common

XM785

XM784 / XM785 ETFM Design Flexibility

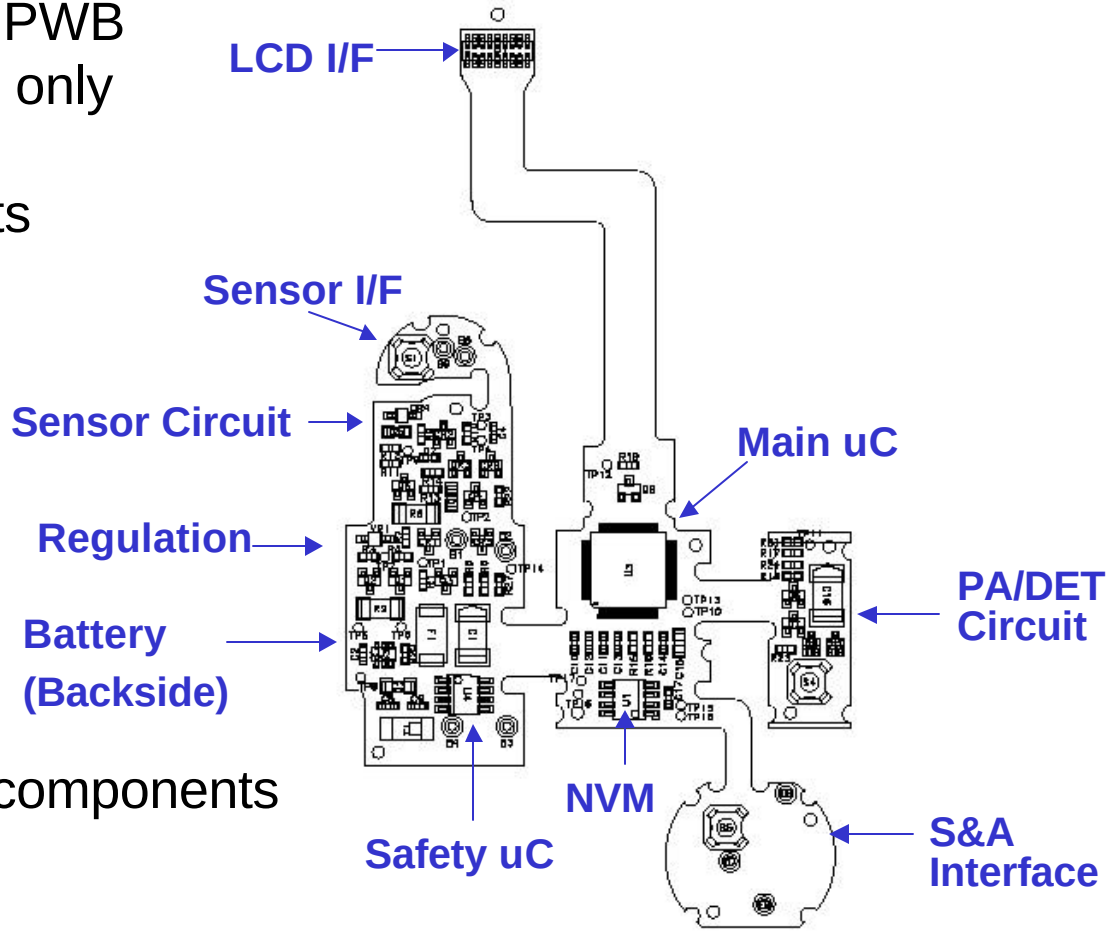
- **Easy to Assemble**
- **Platform for Growth**
  - Adaptable to cargo projectile (Overhead Safety)
  - Command-to-arm S&A applications
    - -Expulsion charge
    - -HE initiation
    - -Rocket motor initiation
  - Magnetic 2nd environment sensor applications
    - -Non-spin
    - -Non air breathing
- **Facilitates Change**
  - Adaptable to embedded fuze applications
  - Add performance enhancements
    - -Velocity measurement
    - -Turns counting





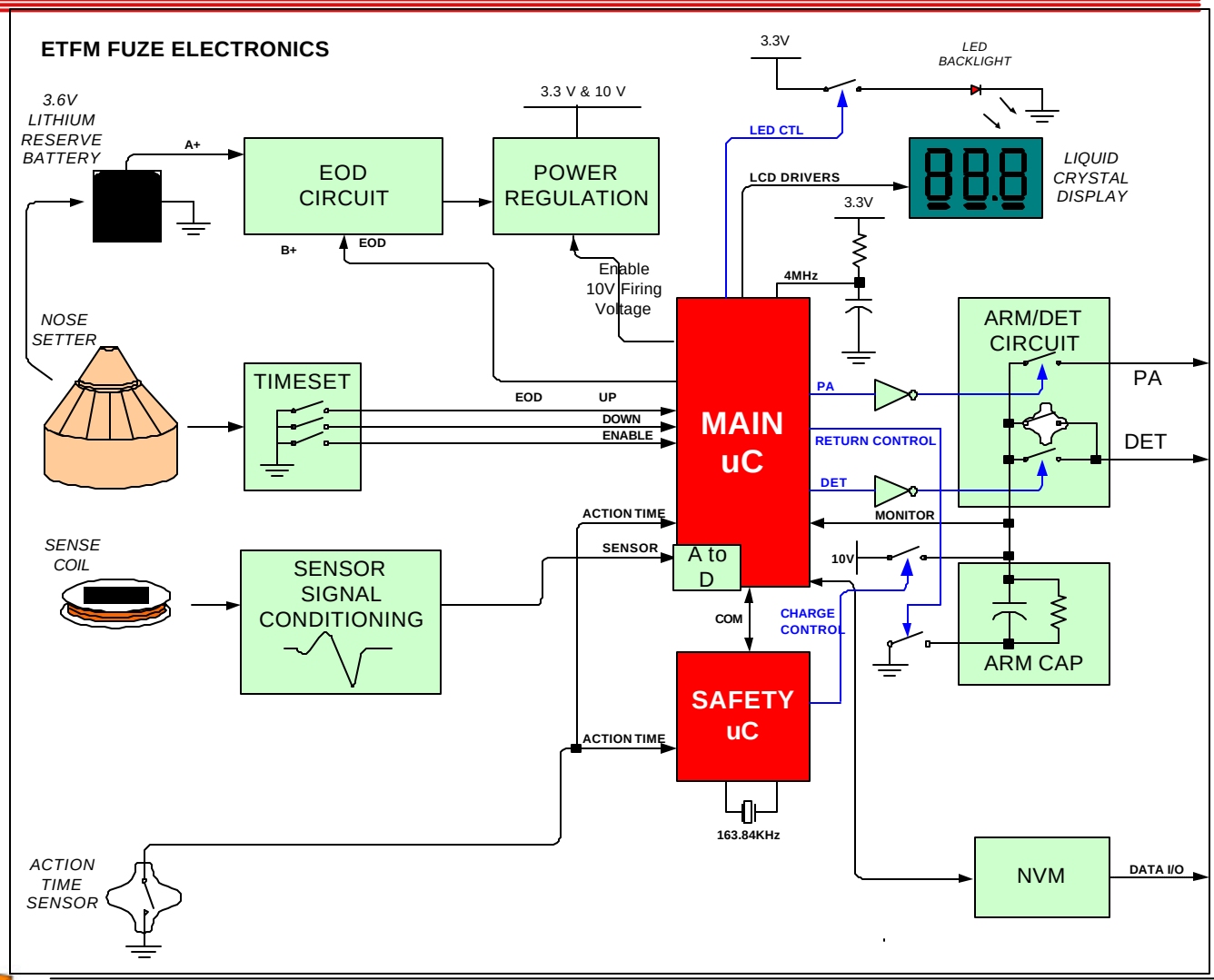
XM784 / XM785 ETFM
Highly Cost Effective Use of COTS

- 2-Layered Stiffened Flex PWB
  - -Top-side components only
  - -Back side stiffener
  - -Minimize interconnects
  - -Easy to package

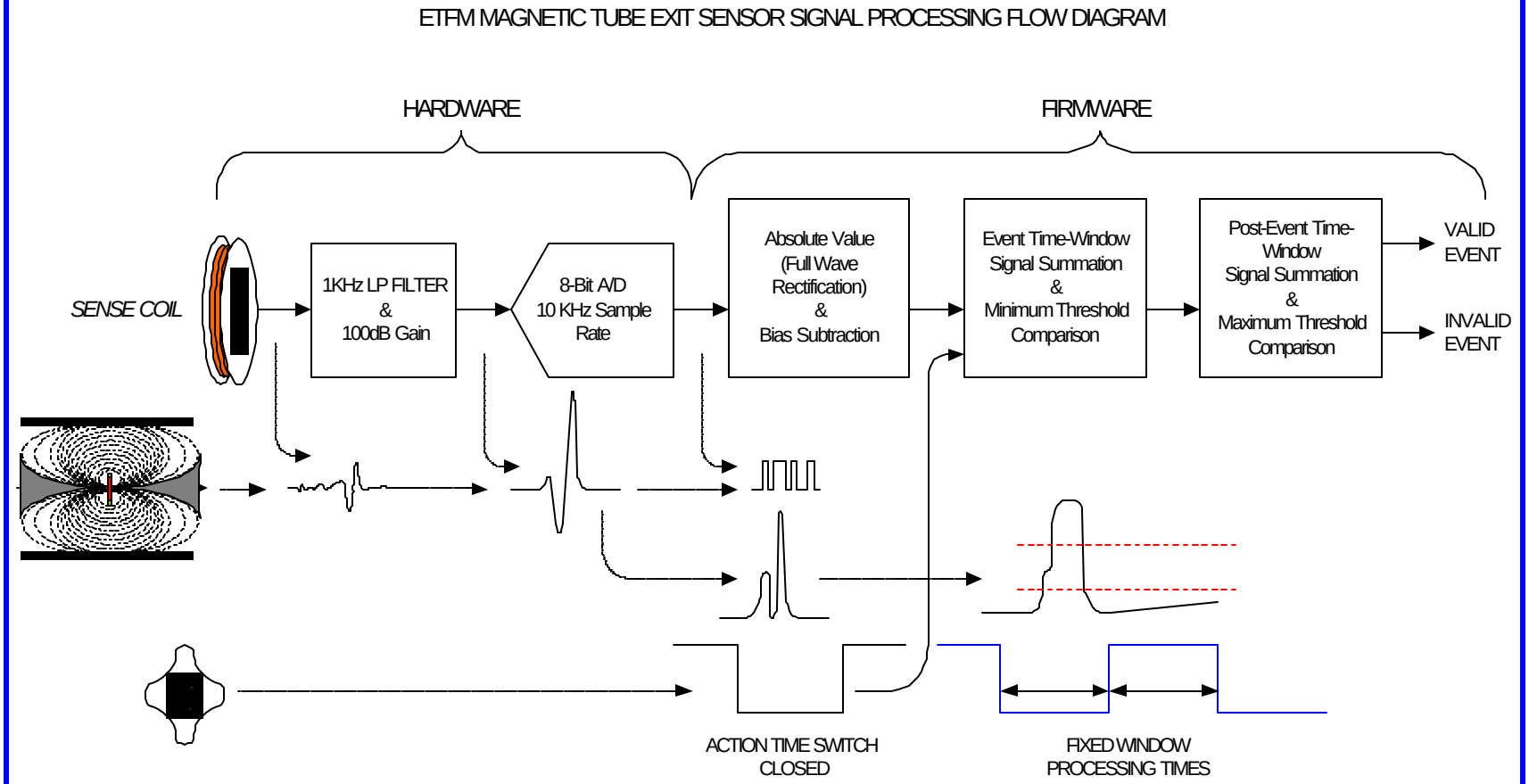


- Standard surface mount components
  - -No ASIC's
  - -SMT connectors

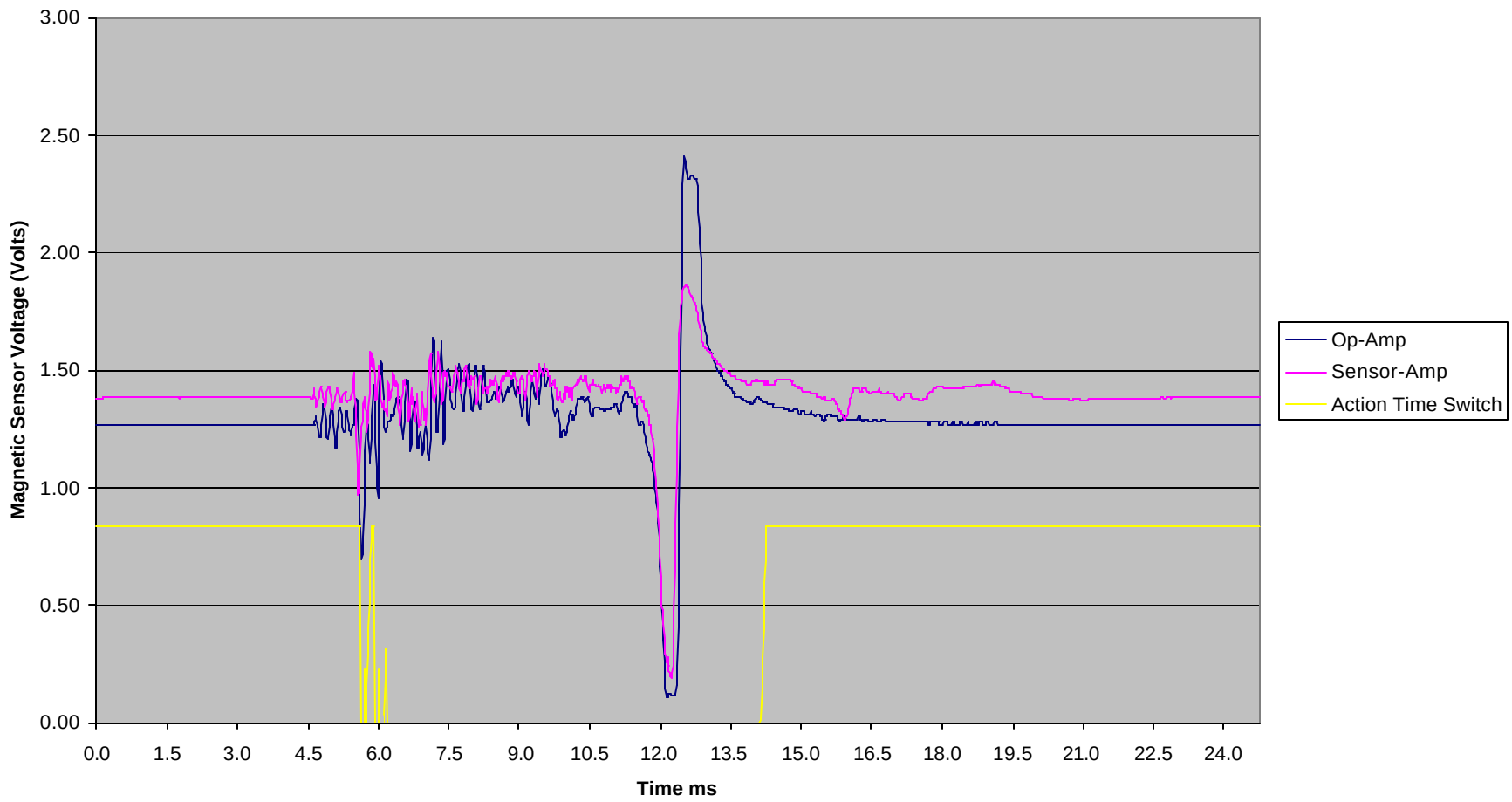
XM784 / XM785 ETFM Functional Block Diagram



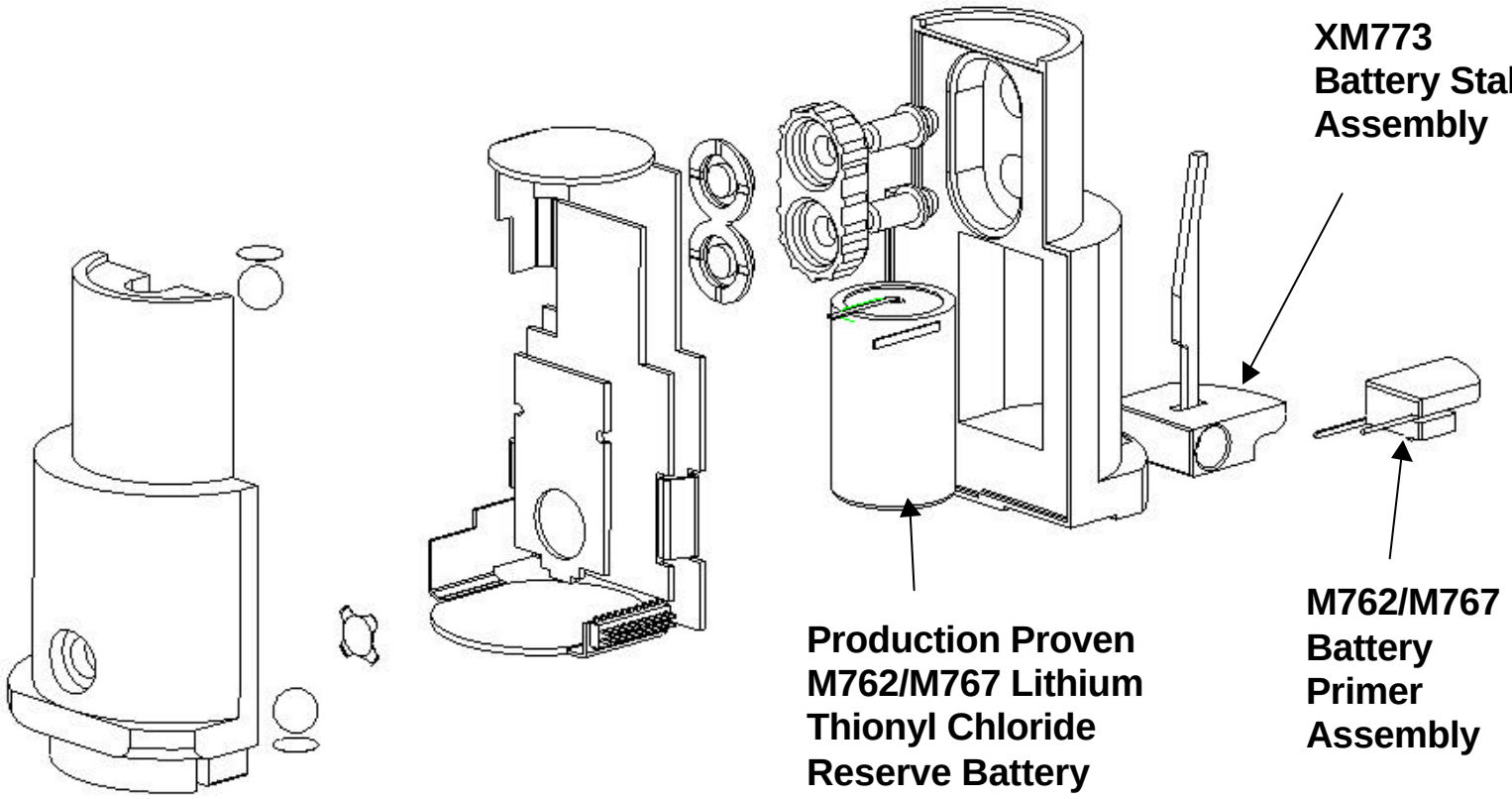
XM784 / XM785 ETFM
Sensor Processing Flow Diagram



XM784 / XM785 ETFM
Typical Magnetic Sensor Profile

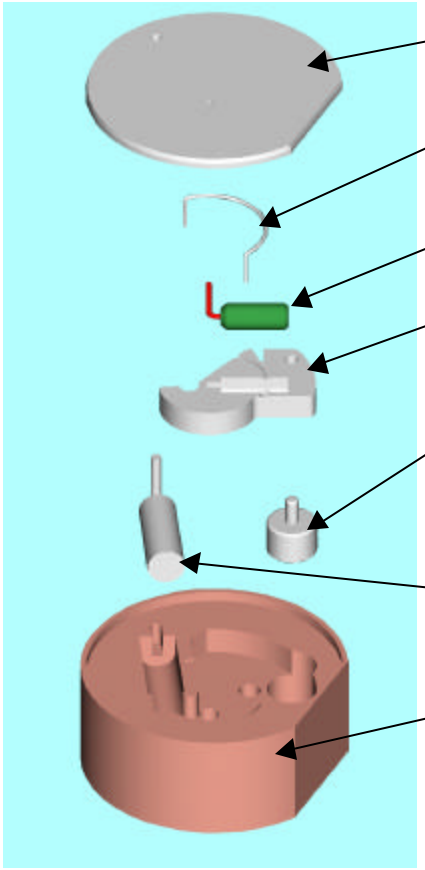


XM784 / XM785 ETFM
Low Risk Power Source

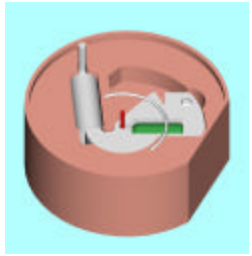


XM784 / XM785 ETFM
Miniature Command-To-Arm S&A

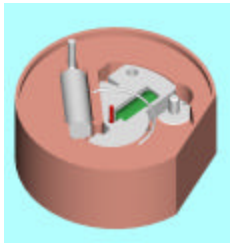
- Fixed Arm time (determined by electronics)
- Explosive train flexibility
  - -Expulsion charge
  - -High Explosives
  - -Rocket motor
- Over head safety achievable



S&A exploded view



Safe

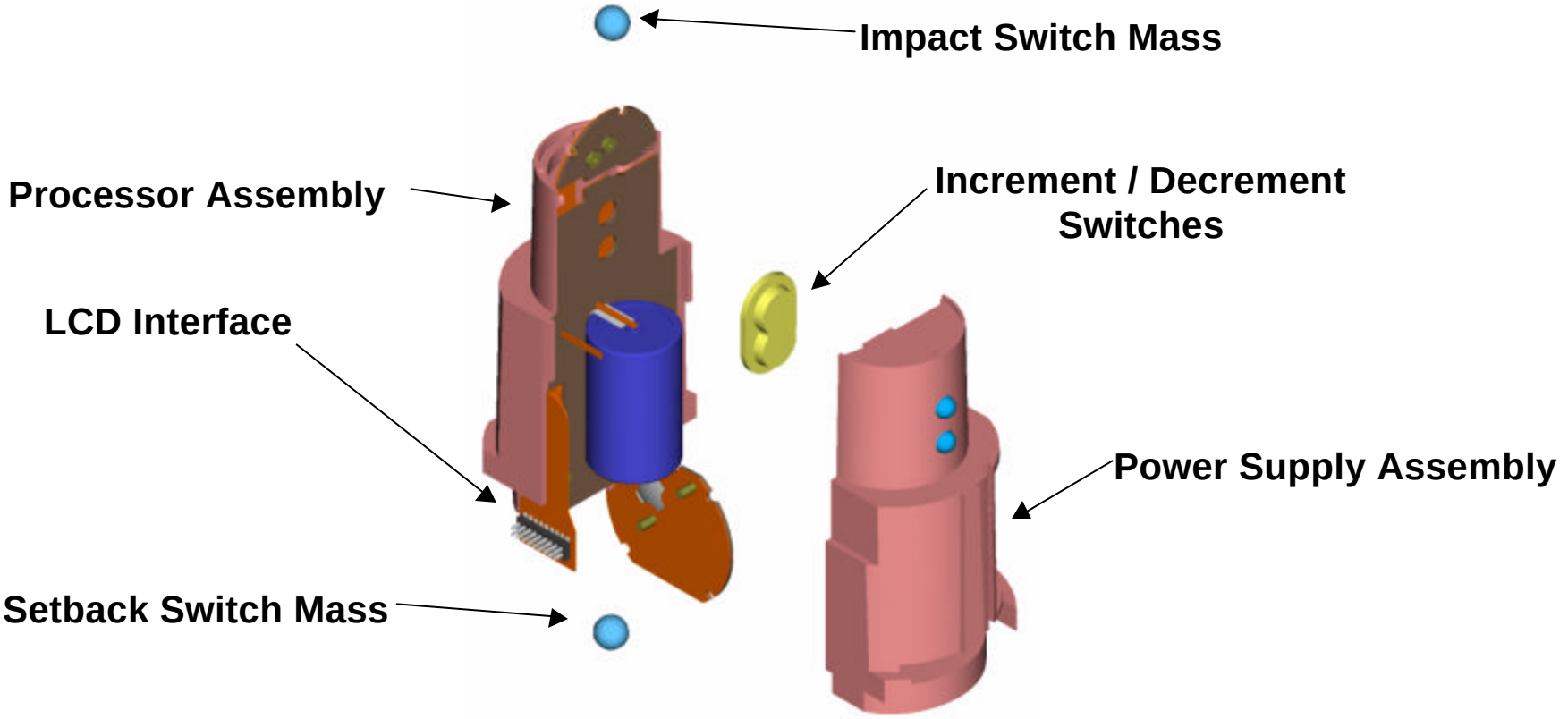


Armed

ATK S&A Patent Pending

XM784 / XM785 ETFM Designed For Production

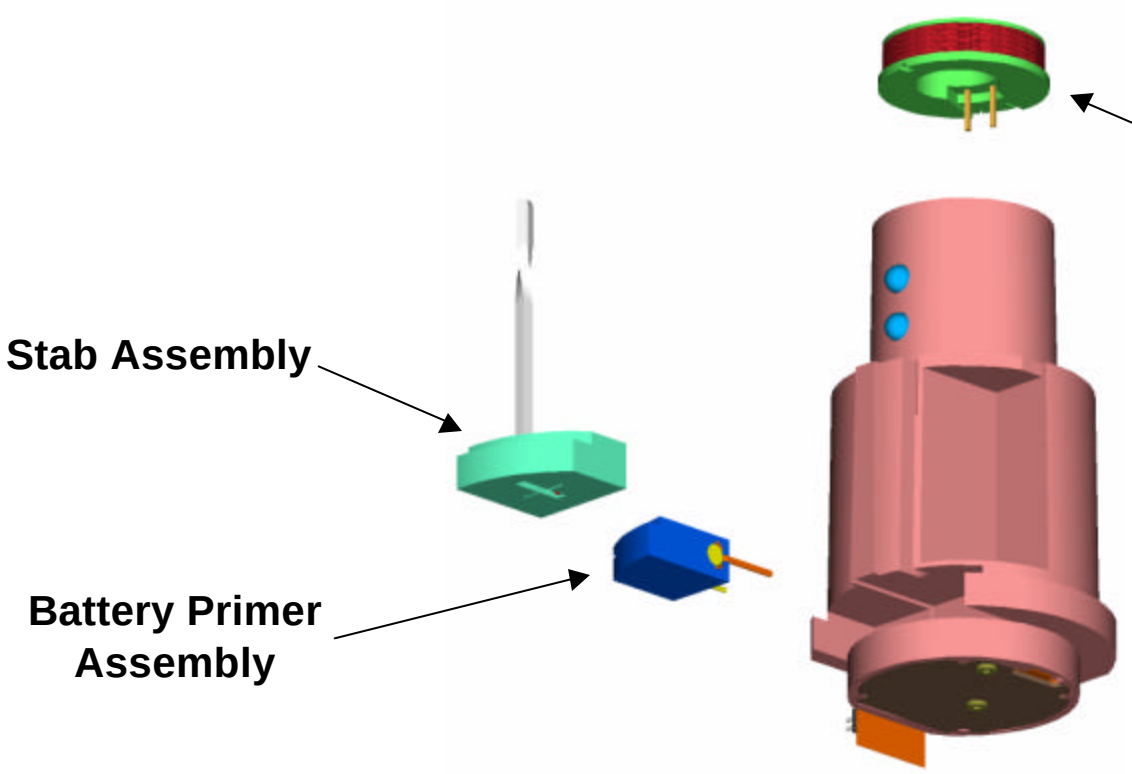
Electronics Assembly



- The Processor and Power Supply assemblies are ultrasonically welded together and then potted with polystyrene.

XM784 / XM785 ETFM
Designed For Production – Con't

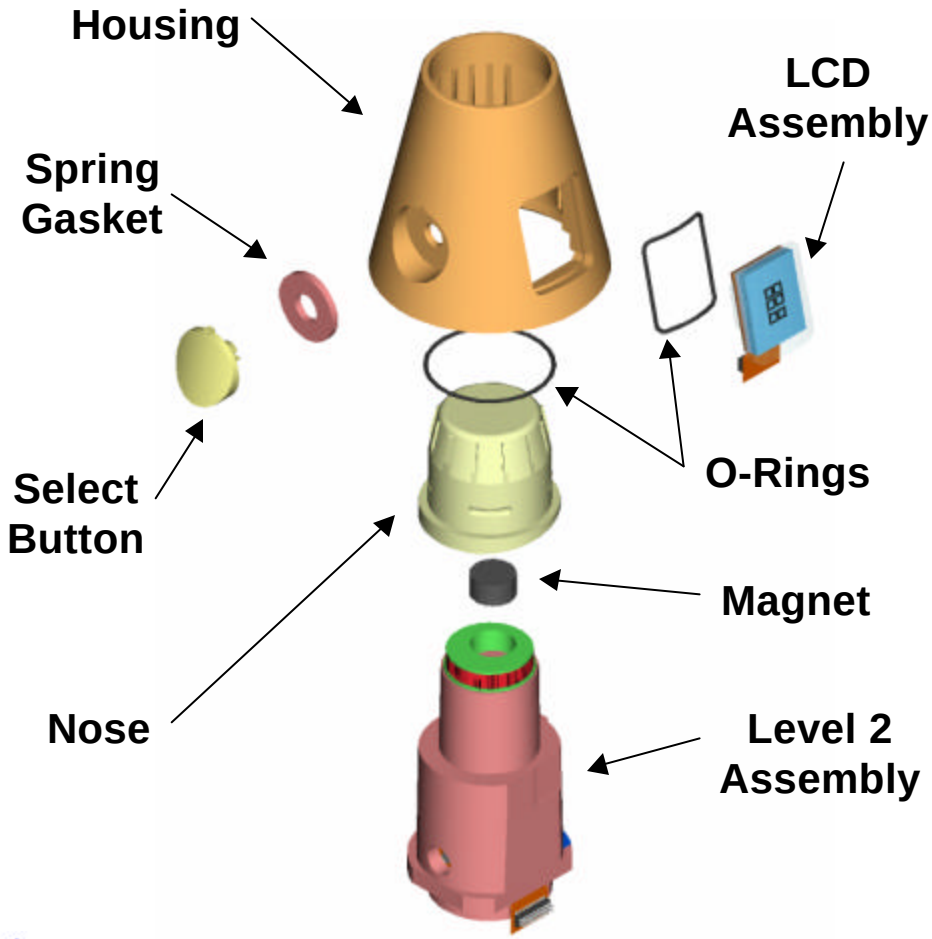
Level 2 Assembly



- The Coil Assembly & Battery Primer Assembly contacts interface with sockets in the CCA.

XM784 / XM785 ETFM
Designed For Production – Con't

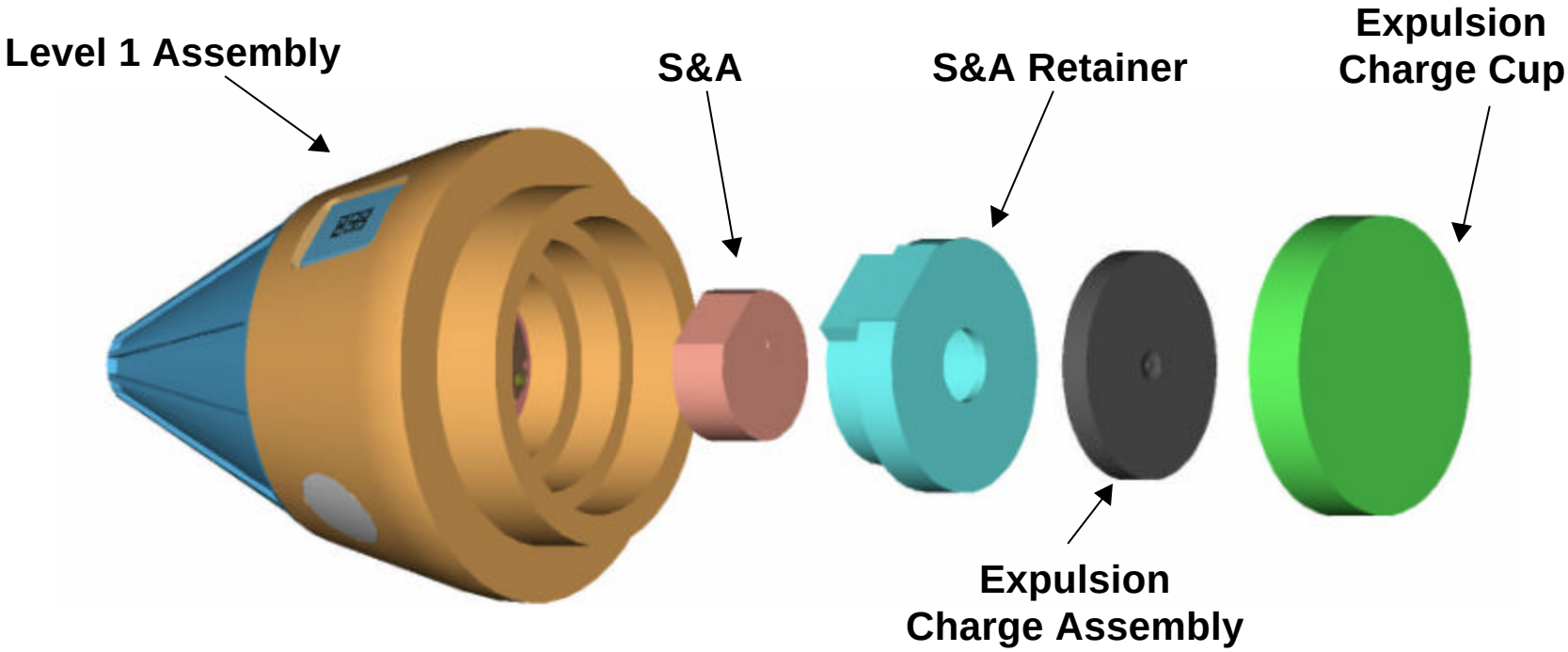
Level 1 Assembly, XM784



- Magnet retained in coil assembly
- LCD Assembly snaps into Housing.
- Nose & O-Ring slide over Level 2 Assembly and this assembly inserts into the Housing.
- The Spring Gasket is placed on the Select Button. Then Select Button snaps into Housing

XM784 / XM785 ETFM
Designed For Production – Con't

Final Fuze Assembly, XM785



• The S&A, S&A Retainer, LCD Connector Support, and Expulsion Charge Assembly are supported within the Level 1 Assembly by the Expulsion Charge Cup.

XM784 / XM785 ETFM Summary

- **Operational Flexibility**
  - Manually settable day or night without tools
  - Future Growth – Inductive Setting
- **Improved Performance**
  - Meets all MIL-STD-1316E safety requirements
  - Supports future mortar fire control systems
  - Achieves Increased time function accuracy
- **Value For The Dollar**
  - Platform for growth (Adaptability)
  - Designed for producibility
  - Up-to-date technologies