



*Providing America  
Advanced Armaments for  
Peace and War*



ARDEC

# ENHANCED PORTABLE INDUCTIVE ARTILLERY FUZE SETTER (EPIAFS)

PRESENTED TO THE NDIA FUZE SYMPOSIUM  
May 10, 2006



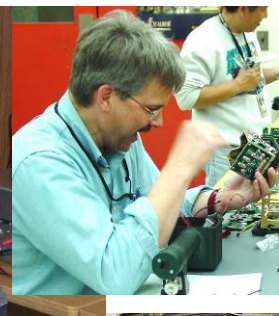
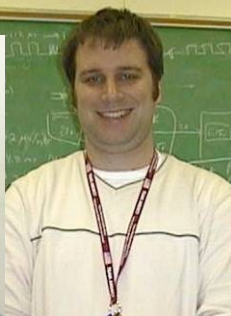
TOM WALKER



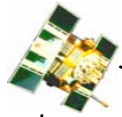
Committed To Excellence

- Sponsor: PM-Excalibur LTC Cole
  - Chris Grassano
  - Mike Burke
  - MAJ Foster
- System: Ray Sicignano
  - Tom Coradeschi
- Platform Integration: Allison Marston
  - Fred Gloeckler
- User: Ft Sill
  - Steve Pearson
  - Bernie Garcia
- Software
  - Andy Leshchyshyn
  - Craig Freed
  - Paul Knors
- Mechanical
  - Jim Hartranft
  - Spencer Hum
  - Jr. Knisley
  - Rob Wood
- Electrical
  - Debbie Calomiris
  - Len Goodman
  - Hai Pham
  - Fred Oliver
  - Mary Labib
  - James Wiltz
  - Tom Walker
  - Jerry Frazier
  - Brent Beauseigneur

# EPIAFS TEAM



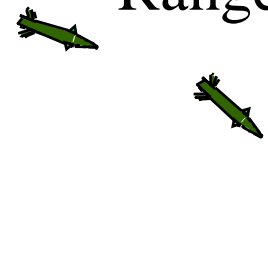
GPS satellite



Canards Steer  
Projectile



Trajectory  
Optimized for  
Range



Canards Deploy

GPS Acquisition and Track

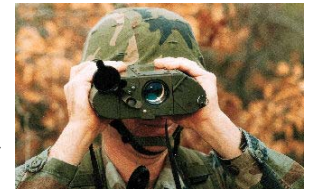


# EPIAFS to Support Excalibur



Target

FO



Fire  
Control

AFATDS

Targeting  
info

## EPIAFS

Gun/Target Locations  
GPS Data, Keys &  
Precise Time  
Power

JLW-155  
Paladin  
Paladin w/ PEFCS

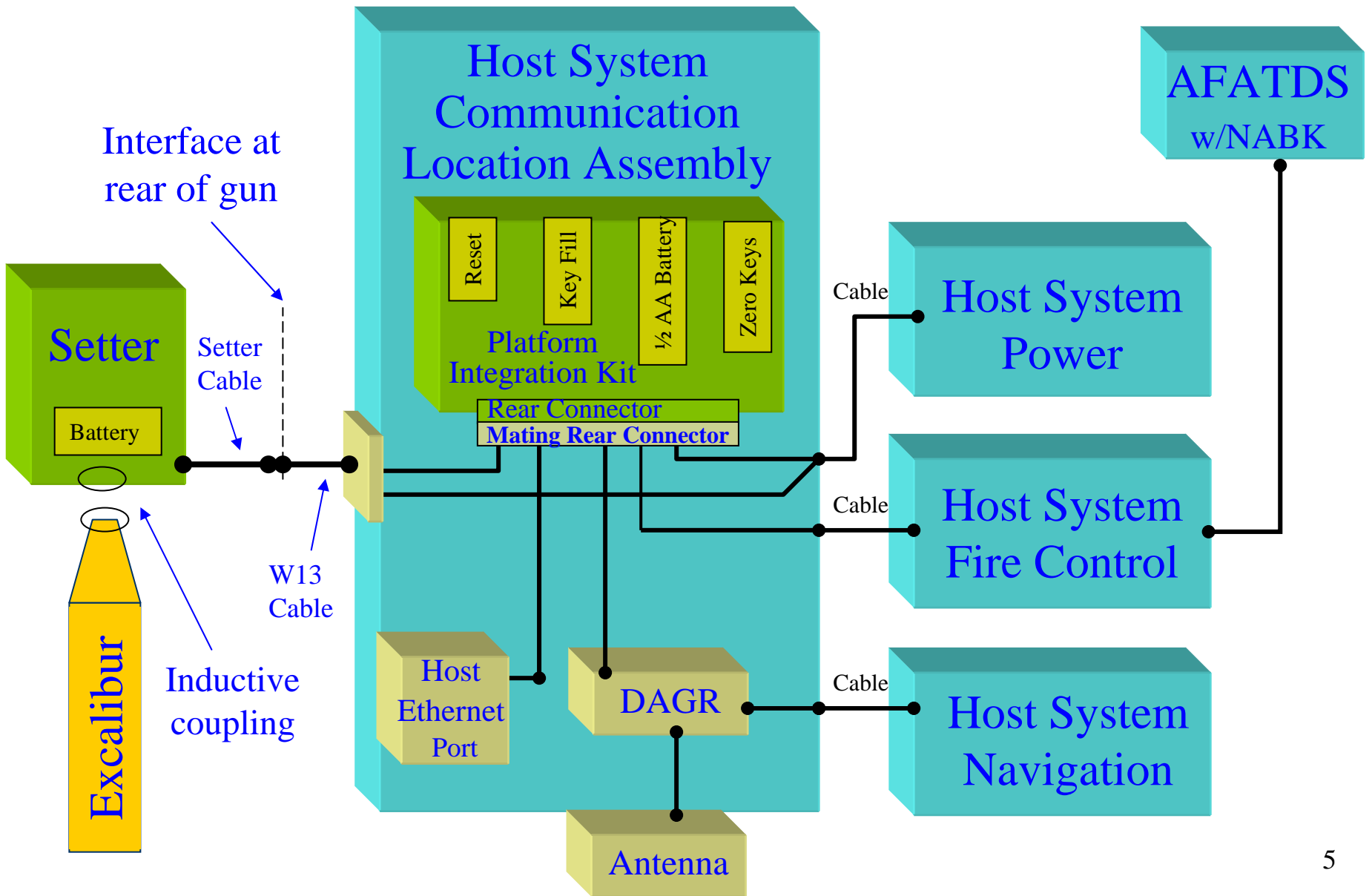
# EPIAFS SYSTEM

- PLATFORM INTEGRATION KIT (PIK)
  - Single board computer
  - Interface circuit
- SETTER and Cable

➤ EPIAFS  
utilizes  
DAGR



# EPIAFS System Integrated into JLW155



# EPIAFS Host: M777E1

DAGR

Communication  
Location  
Assembly (CLA)

PIK  
mounts  
inside  
CLA

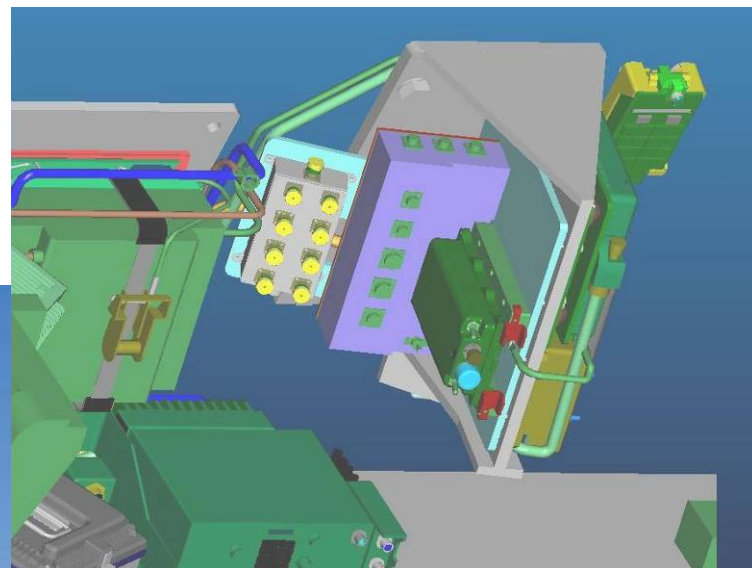
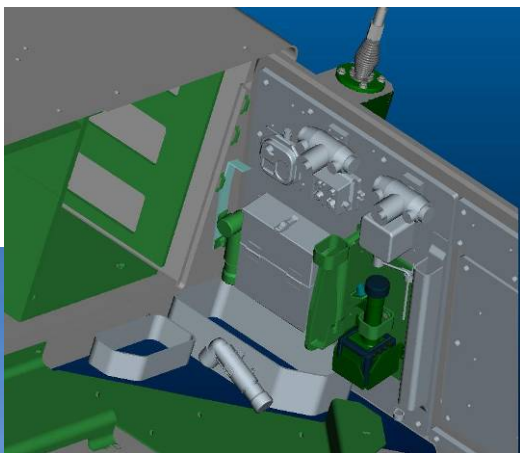


# JLW Crew Setting Excalibur GNC



FQT Dry Run

# EPIAFS Host: Paladin

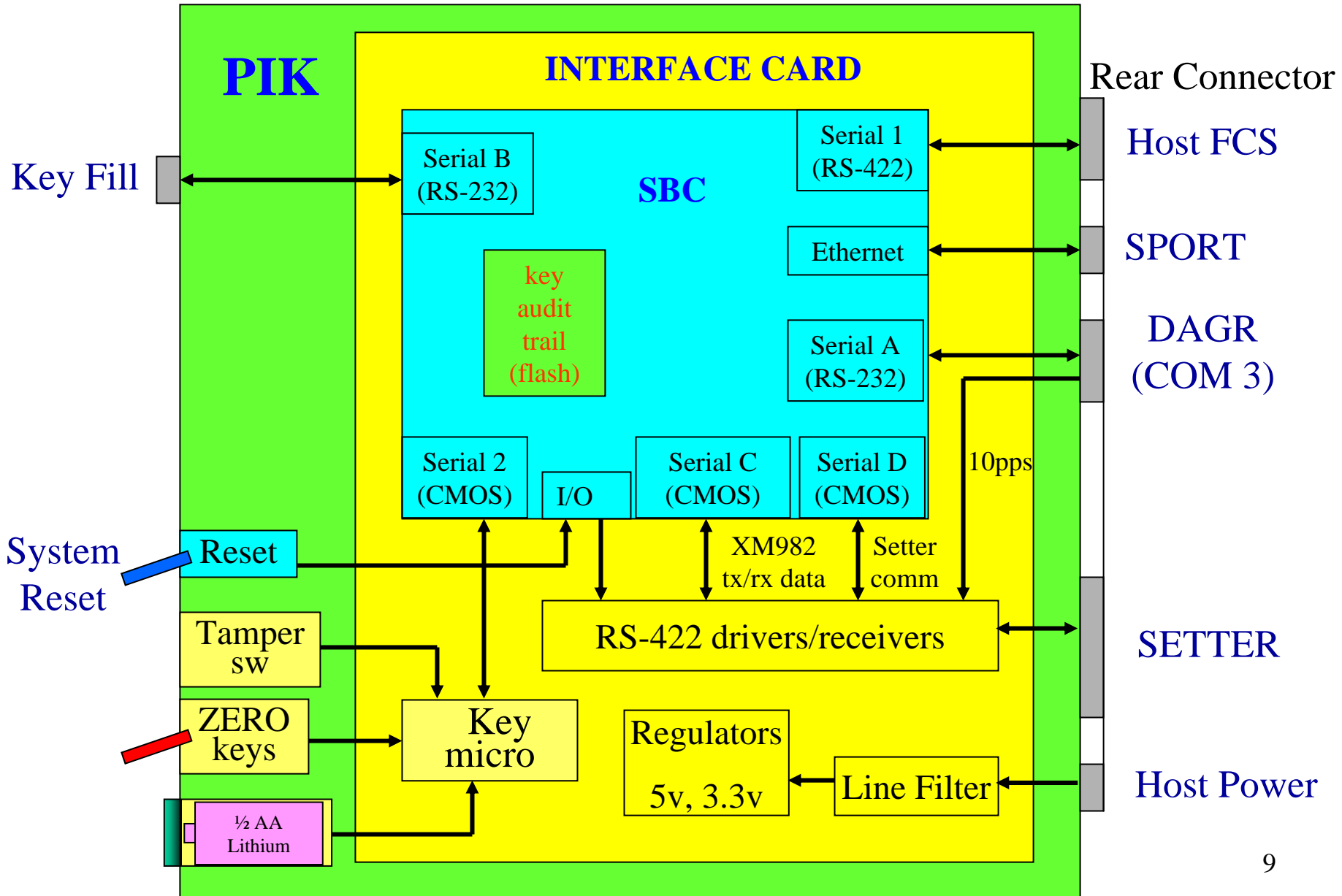


Paladin w/ PEFCFS



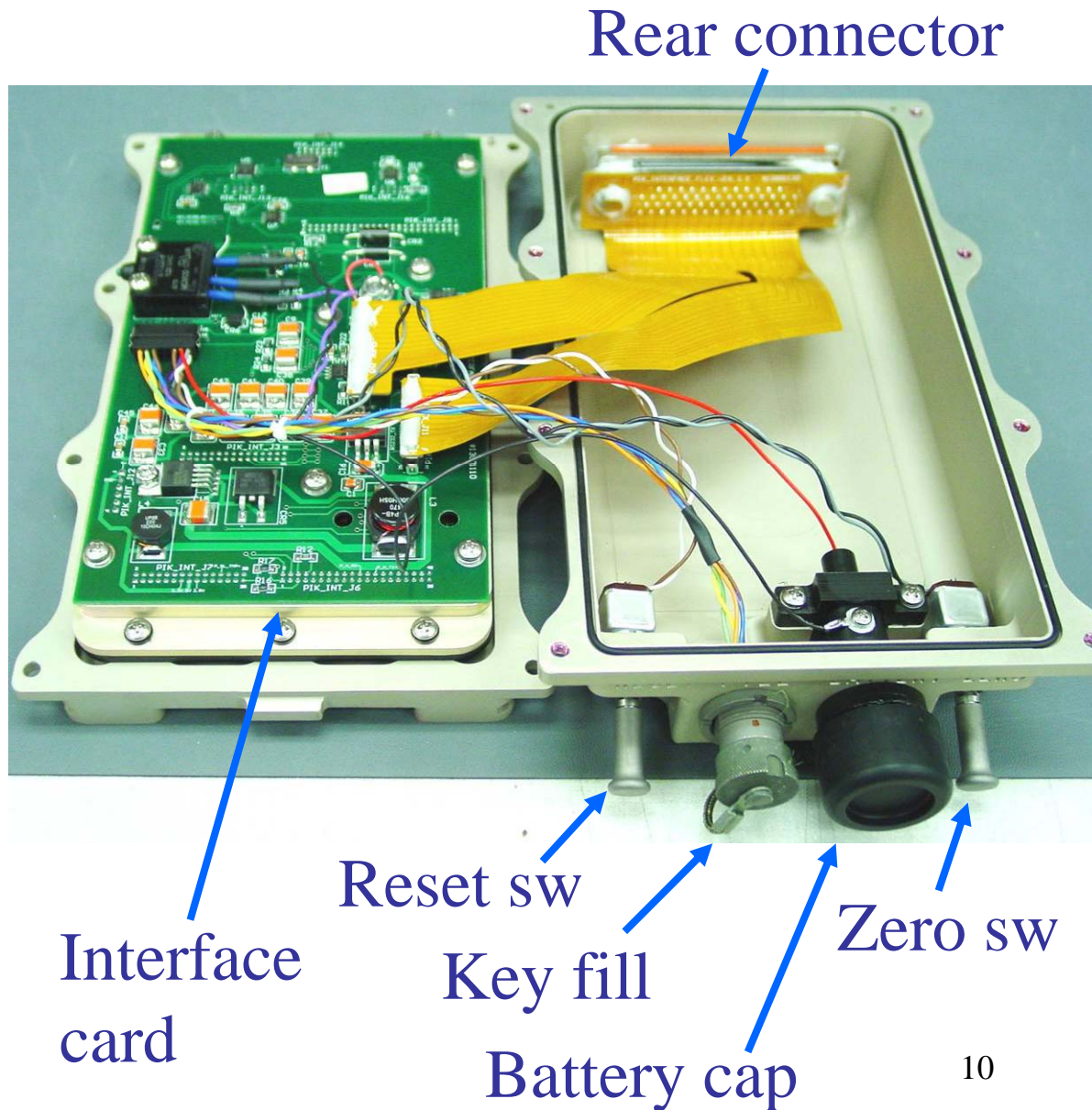


# PIK BLOCK DIAGRAM



# PIK FUNCTIONS

- Formats and sends all XM982 initialization data and TMP's through Setter
- Passes Standard Fuze Data to Setter
- Interfaces with Host system
- Interfaces with Key Loader
- Stores black GPS crypto keys and Audit Trail
- Interfaces with SPORT or MSD



# PIK Hardware

Flex & Rear Interface Connector

Board mount

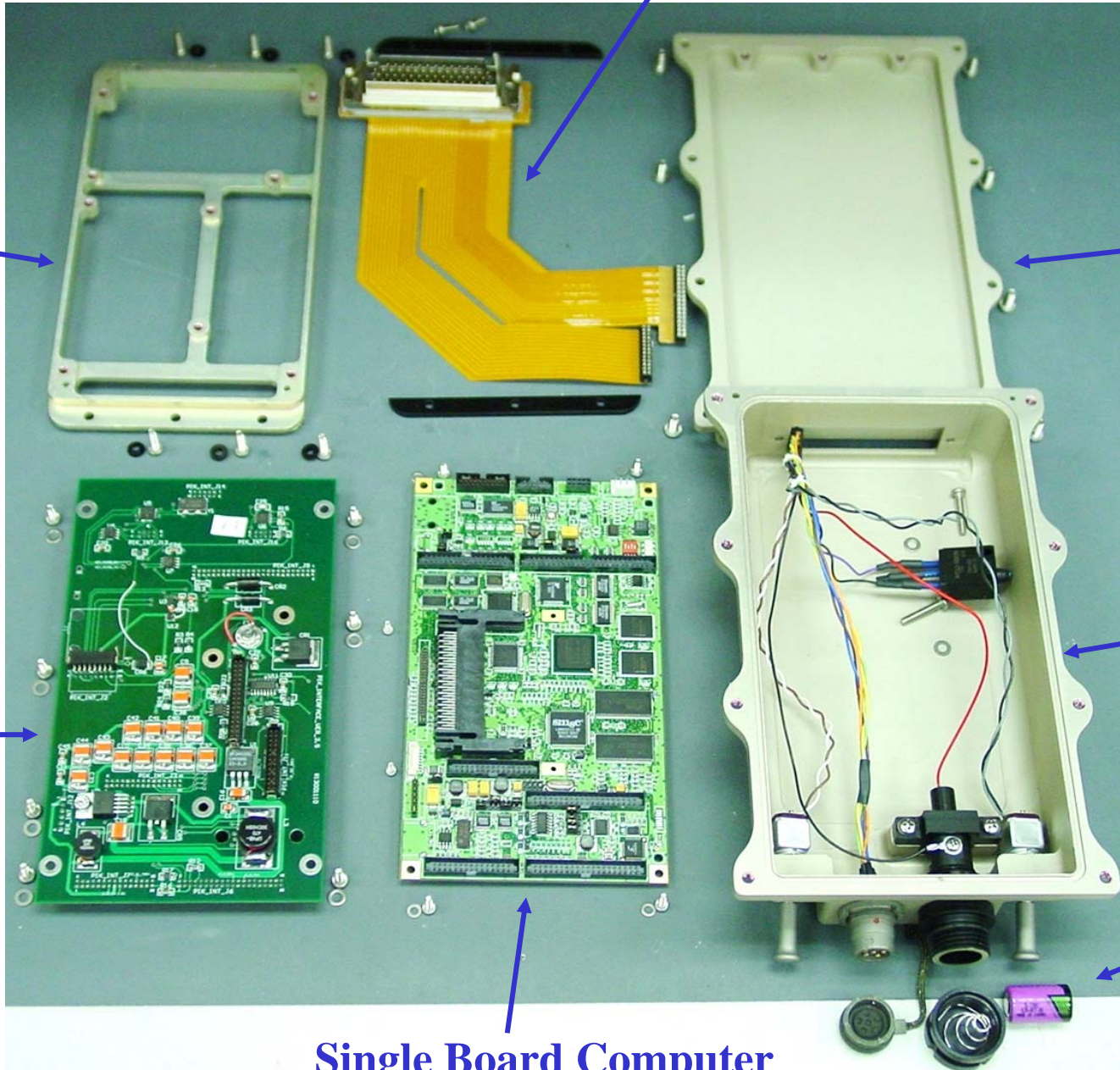
Cover

Interface Board

Box assembly

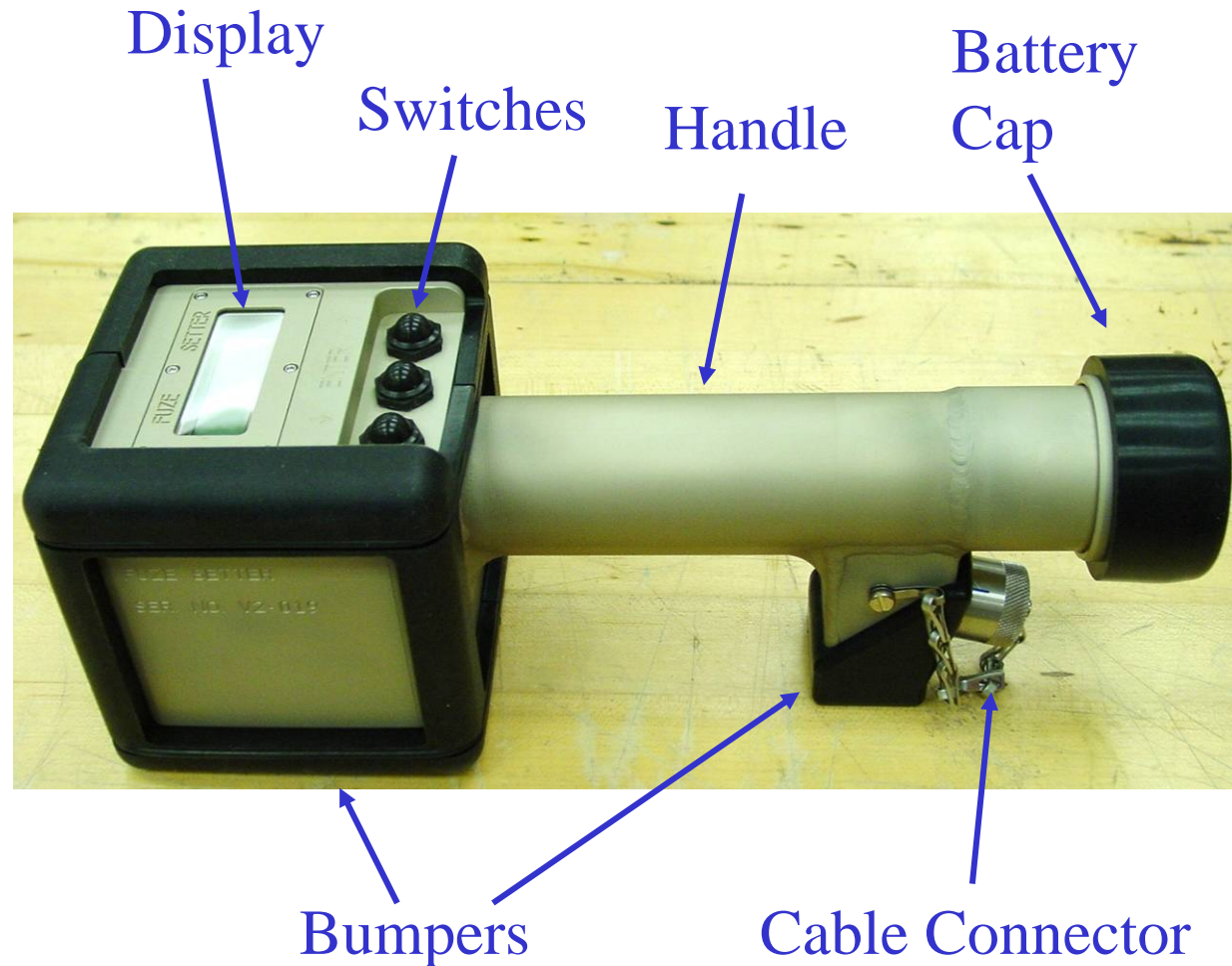
Battery

Single Board Computer



# SETTER FUNCTIONS

- Interface with PIK
- Interface with standard fuzes and XM982
- Convert XM982 data stream to power/data format
- Interface with user via 3 switches and LCD
- Un-cabled setting for standard fuzes



# SETTER Hardware

Board Cage

Box & Handle Assembly

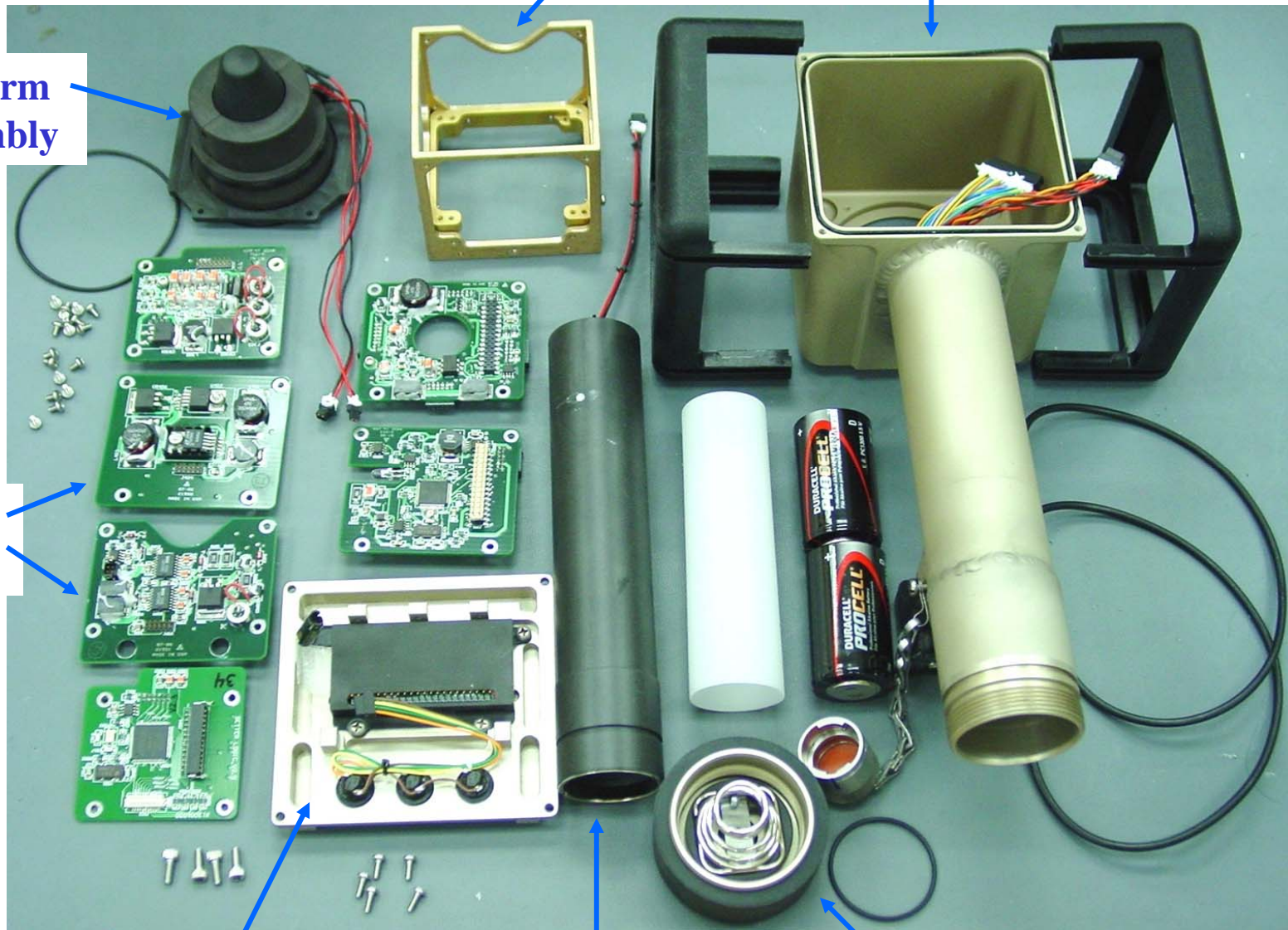
Coilform Assembly

Circuit Boards

Faceplate Assembly

Battery Contact Assembly

Battery Cap



# 3 SETTER MODES

- **Uncabled**
  - Acts just like original PIAFS
  - Standard Fuze capable
- **Cabled Manual**
  - Same functionality as Uncabled
  - Receives power externally
- **Cabled Remote**
  - Receives commands from PIK
  - Standard and GPS Fuze capable

```
FUZE : M782
MODE : UT
TIME : 64 sec
+SETFUZE INTRG
```



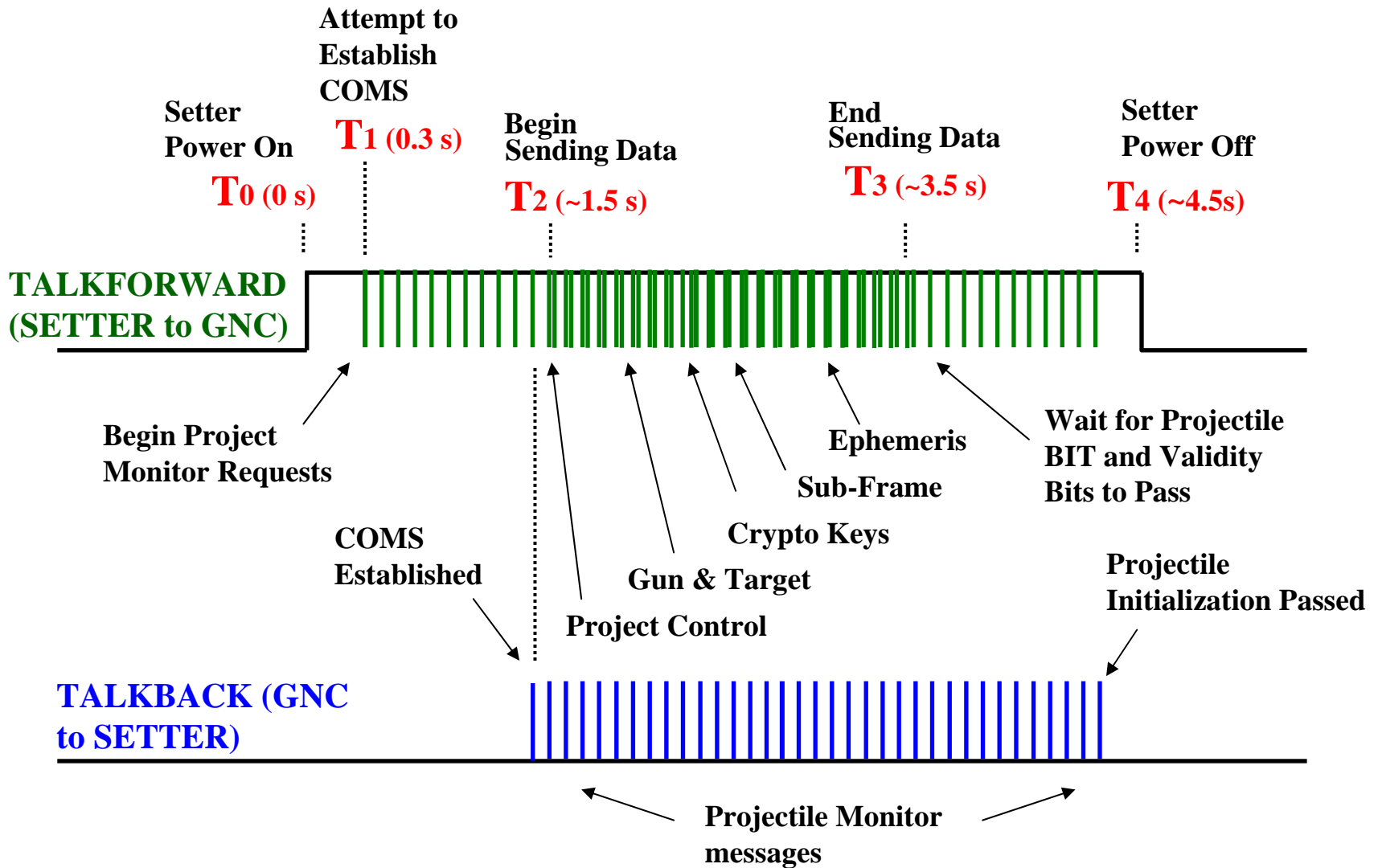
```
FUZE : M782
MODE : UT
TIME : 64 sec
+SETFUZE INTRG
```



```
FUZE : M782
MODE : UT
TIME : 64 sec
+SETFUZE INTRG
```

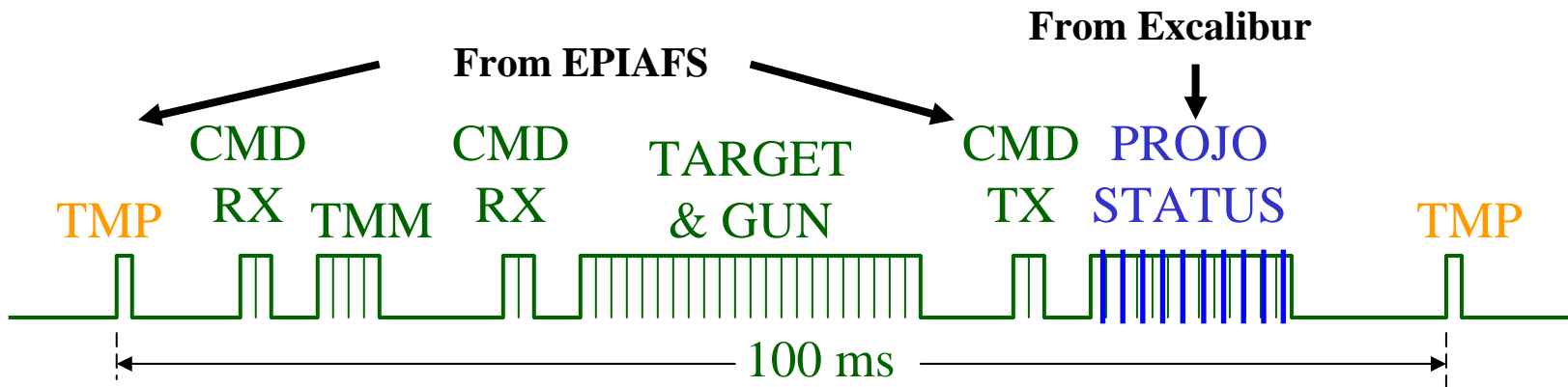


# INITIALIZATION TIME-LINE



# EXAMPLE 100 ms PIK TO PROJECTILE MESSAGE FRAME

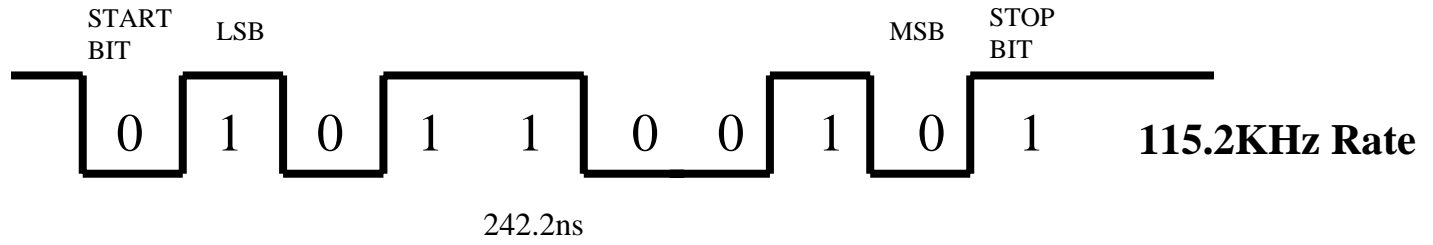
- Sense when Time Mark Pulse (TMP) arrives
- Read Time Mark Message from GPS receiver
- Send Time Mark Message to Projectile
- Send Target and Gun data to Projectile
- Request a Status Message from Projectile
- Receive and Process the Projectile Status



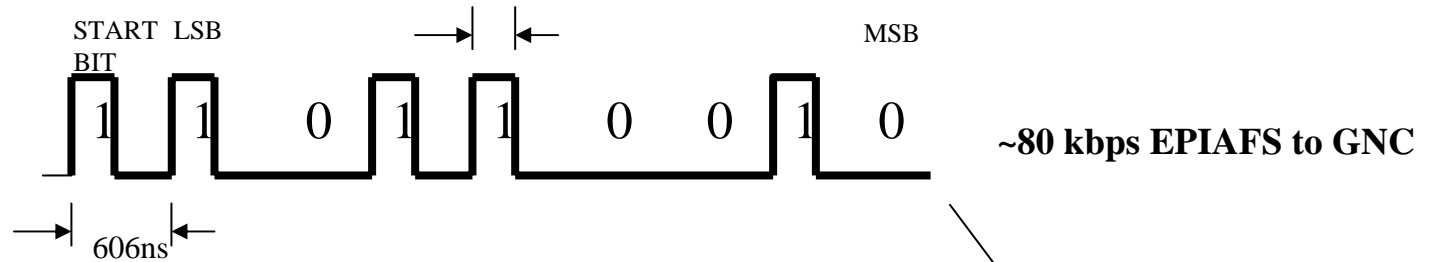


# Time Multiplexed Power/Data Format

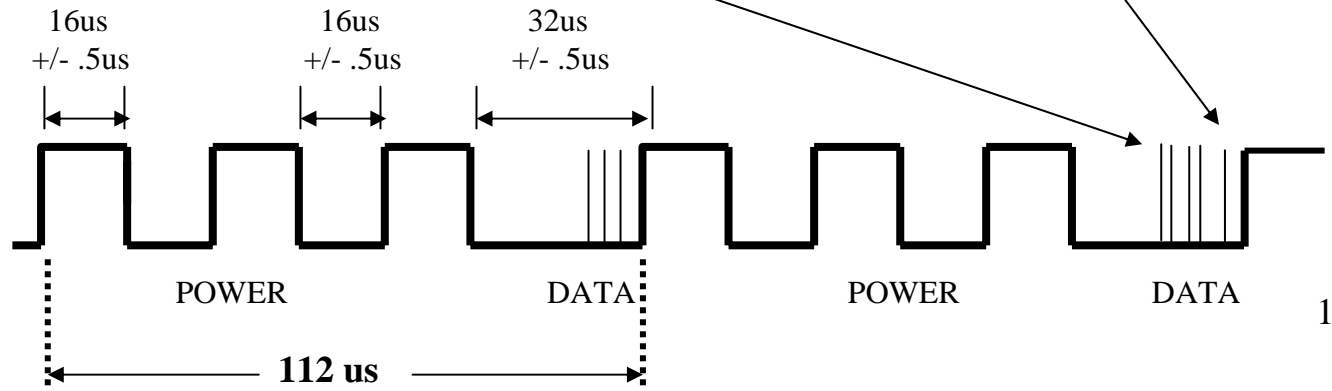
**TX DATA:  
PIK to Setter**



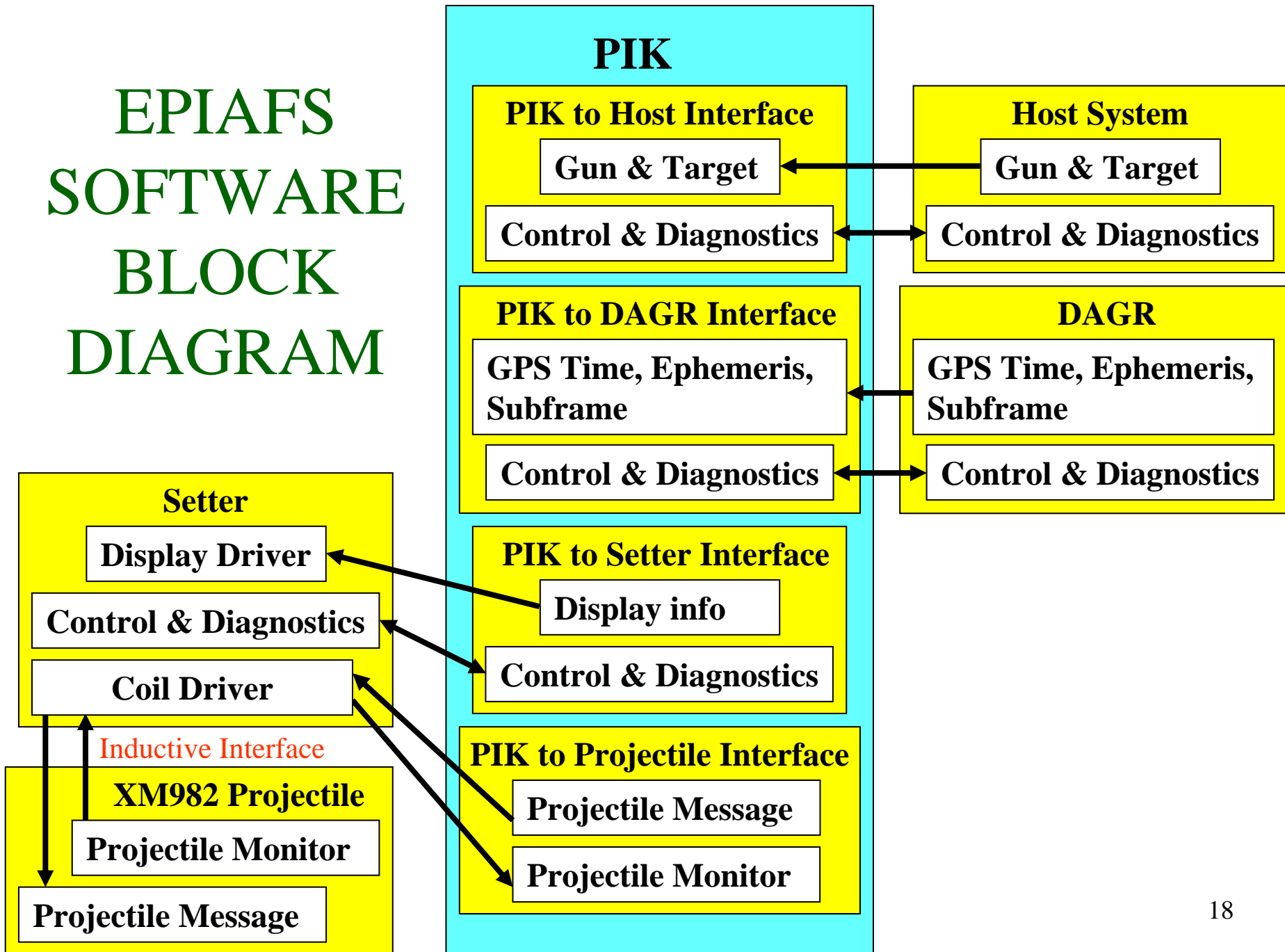
**TX DATA:  
Setter to GNC**



**COIL POWER/TMP  
&DATA**



# EPIAFS SOFTWARE BLOCK DIAGRAM



# EPIAFS Software Status

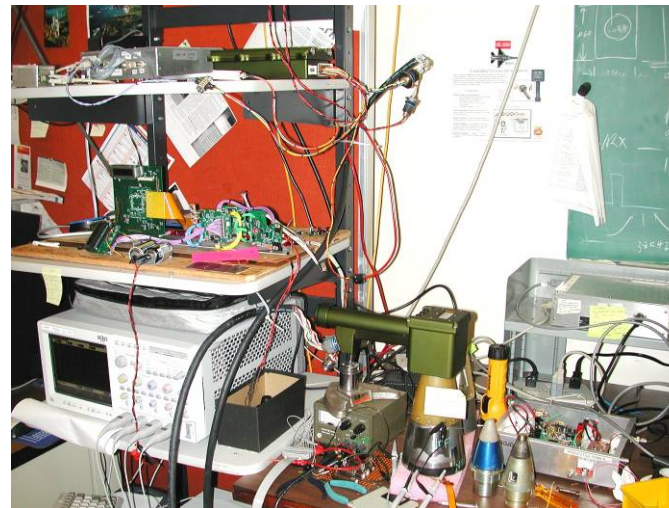
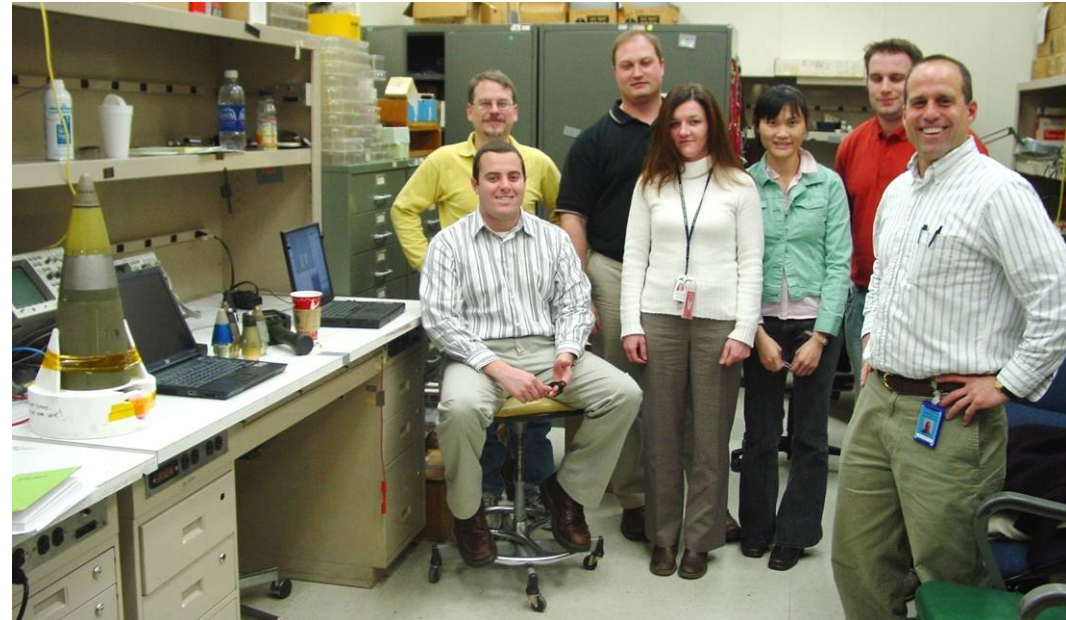
- PIK

- Written in C++
- 25,000 lines of code
- Software FQT Ver 2.6

- Setter

- Written in C
- 12,000 lines of code
- Software FQT Ver 2.1

FQT Team

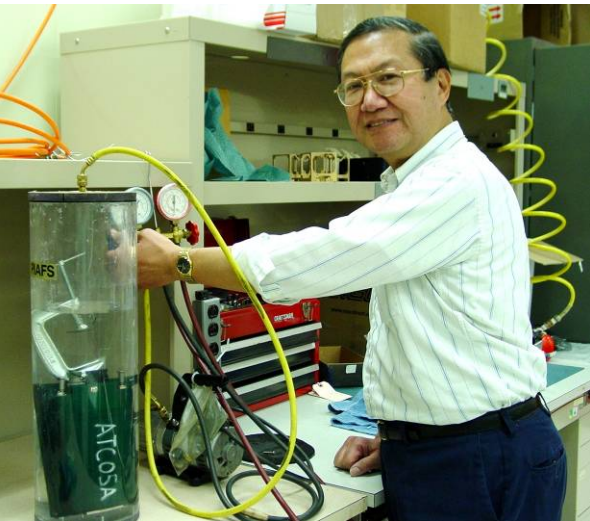
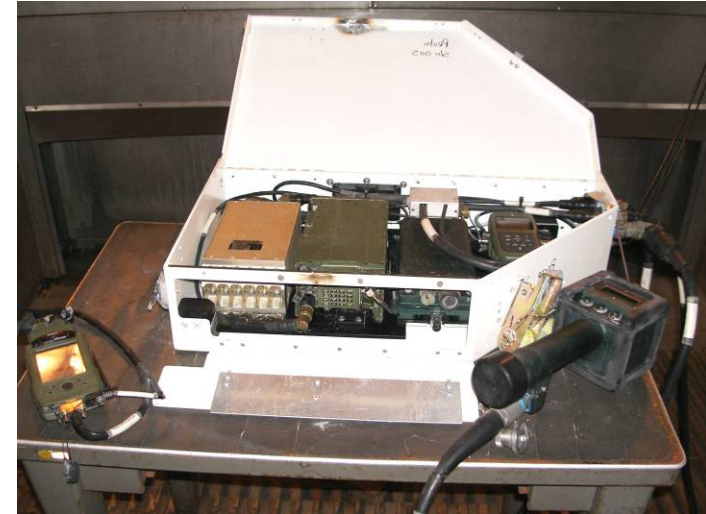
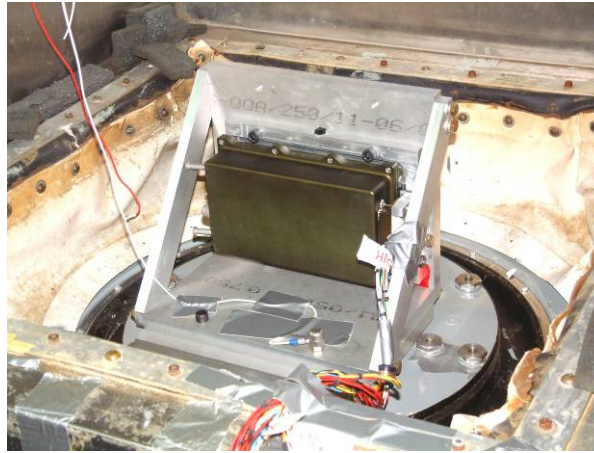
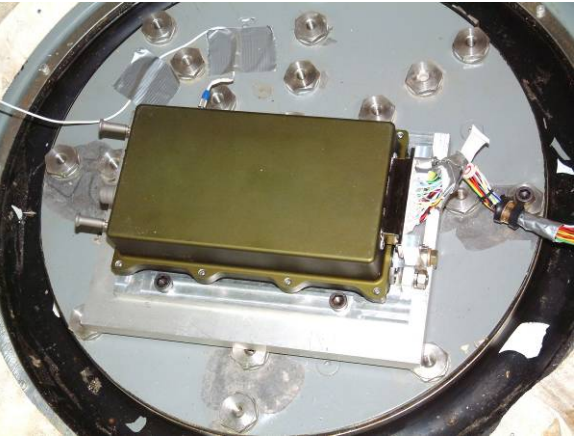


# EPIAFS Fabrication



# EPIAFS Lab Testing

## Shock/vibration



## Leak

## Temperature

# EPIAFS Field Testing

## Paladin



## Excalibur



## Setting Excalibur before firing



## Yuma Proving Ground



## EPIAFS Laptop Host FCS

# EPIAFS ACCOMPLISHMENTS FY06

- Supported development of EPIAFS-Excalibur interface
- Received EPIAFS CONOPS approval for Black Keys from NSA
- Delivered Prototype EPIAFS to PM-CAS
- On-site support at Raytheon of EPIAFS integration
- Delivered laptop based Host Fire Control System to allow early Field testing
- On-site support of Excalibur test firings at YPG
- Supported integration of EPIAFS into Portable Excalibur Fire Control System (PEFCS)
- Delivered Qualification EPIAFS to PM-CAS
- Passed EPIAFS Software Formal Qualification Testing (FQT)
- Supported PEFCS FQT
- Passed DITSCAP
- Authored documents including: Detail specs, Software specs, test plans, system drawing tree, ICD's, CONOPS
- Supported Excalibur, JLW, EPIAFS, and PEFCS E3 testing at WSMR
- Implemented Setter casting to reduce EPIAFS UPC

# PLANS

- Complete EPIAFS Qualification Build & Test
- Field units to PEFCS to support Excalibur Early Fielding
- Update EPIAFS TDP
- Support EPIAFS integration into JLW-155 and Paladin
- Support EPIAFS functional integration into NLOS-C
- Support Contractor First Article Build

