U.S. ARMY COMBAT CAPABILITIES DEVELOPMENT COMMAND – ARMAMENTS CENTER

Fuze Conference
Fuze and Power STO
Next Gen Large Cal Setter (NGLCS)

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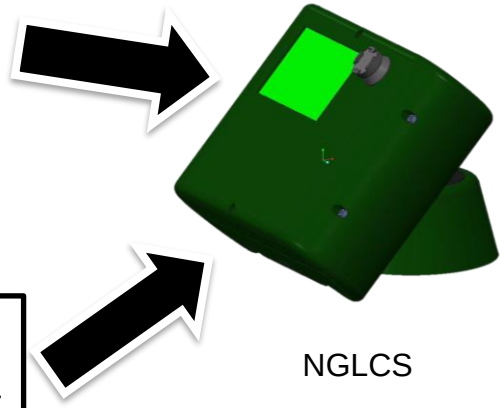
NEXT GENERATION LARGE CALIBER SETTERS (NGLCS)

FUZE AND POWER TECHNOLOGIES FOR MUNITIONS (FY15 STO)

Current EPIAFS



NGLCS

- New SBC
- Direct Set
- Advanced Data Transfer
- Smaller/Lighter
- Hand-held or auto-loader capable

Schedule & Cost

MILESTONES	FY15	FY16	FY17	FY18	FY19
Requirements Development					
Concept Development & Preliminary Design			4		
Engineering Experimentation & Test				5	
System Design & Integration					6

Purpose:

One of four projects under the Fuze and Power Technologies for Munitions STO

- Develop and demonstrate the next generation of smaller and lighter large caliber setters for use in auto-loading cannons and guided mortar applications
- Develop a government designed and owned Single-Board-Computer (SBC) for use with current and next generation programmable fuzes
- Develop new capabilities for direct-set fuze applications and advanced data transfer requirements
- Reduce size and weight of setter system for use with auto-loading systems and reduced warfighter burden (hand-held applications)

Results/Products:

- Smaller and lighter large caliber fuze setter for use in auto-loading cannon systems and guided mortar applications, as well as maintains legacy capabilities
- New SBC that combines the functions of the iPIK/wand/user interface
- New setting capabilities: direct set and advanced data transfer

Payoff(s):

Advanced communication and programming schemes for a large number of current and future applications, all in one system

Reduced warfighter and weapon platform burden

Endorsement(s):

PEO AMMO 27 April 2015

Fires Center of Excellence 28 April 2015

Maneuver Center of Excellence 13 May 2015

TTA DRAFT for HEGM - OCT 2017 - cancelled

Transition(s): ERCA, Long Range PGK (LR-PGK), XM1155, legacy artillery PoRs

REPRESENTATIVE PRECISION GUIDED MUNITION ENGAGEMENT

GPS satellite

Canards Deploy, GPS Acquisition and Track

Canards Steer Projectile

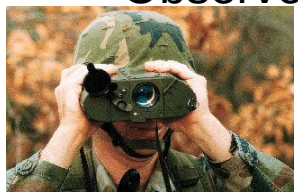
Trajectory Optimization.

Potential GPS denied environment

Target

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

Forward Observer



Targeting info

Mission Data

Advanced Field Artillery Tactical Data System (AFATDS)

Platform / Fire Control

FIELDED PRECISION GPS GUIDED MUNITION AND FUZES

Excalibur Precision Guided Munition – M982A1

- Original Development started in the 1990s
- Fully guided 155mm munition
- Raytheon Missile Systems is the contractor
- Artillery launched - precision strike

Precision Guidance Kit (PGK) – M1156

- A course correcting fuze to use with 155mm artillery projectiles
- Northrop Grumman (formerly Orbital ATK) is the contractor

Mortar Guidance Kit (MGK) – XM395

- Leveraged PGK development to add similar capabilities for mortars
- A course correcting fuze for 120mm mortars
- Northrop Grumman (formerly Orbital ATK) is the contractor
- Mortar component of the Advanced Precision Mortar Initiative (APMI)

FUTURE PRECISION GUIDED MUNITION APPLICATIONS

- XM1155 Extended Range Artillery Projectile
- Excalibur Hit to Kill
- Long Range PGK
- Image based guided munitions

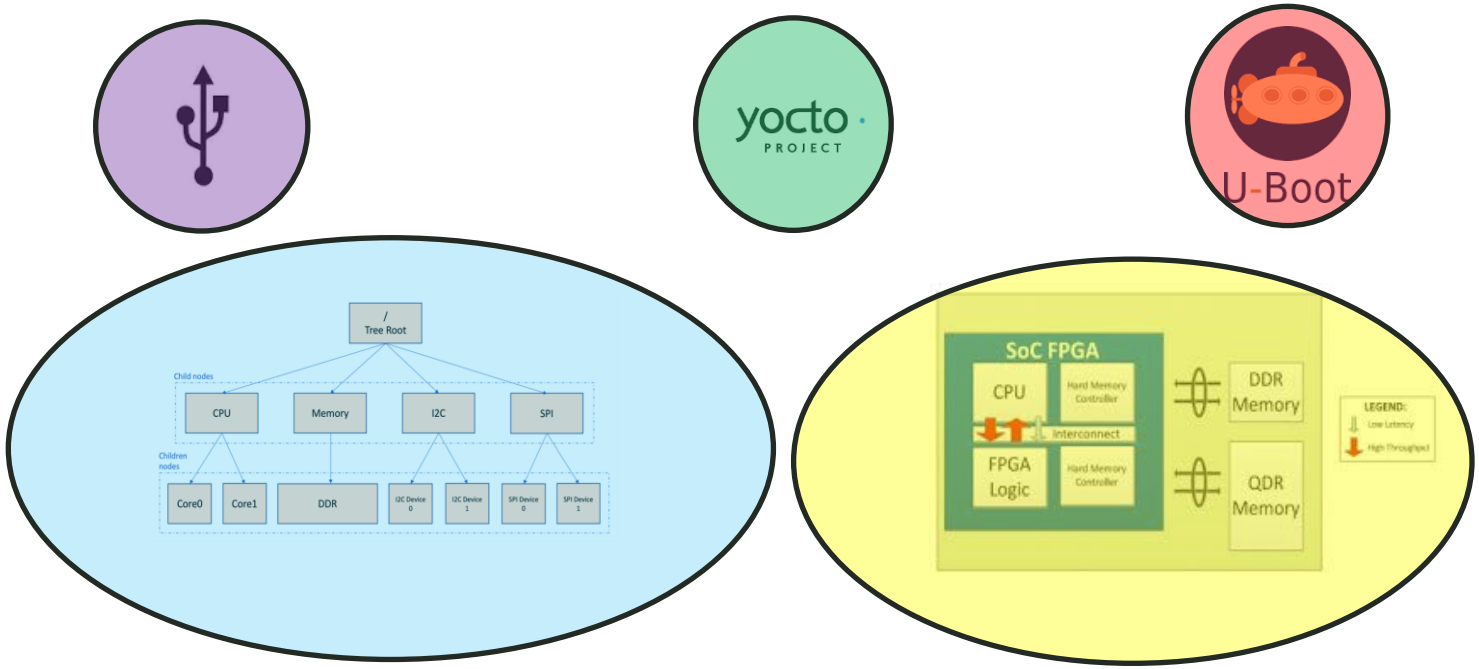
NGLCS can be tailored/augmented to support future munition interfaces.

OVERVIEW OF NGLCS ACCOMPLISHMENTS

- Expanded capability of EPIAFS and condensed all circuitry onto 3 boards - in a single hand held unit
- FPGA designed with significantly more processing power
  - Enables future re-designs for point solutions
  - Enables wireless setting for future development
- Custom Linux operating system
- Maintained compatibility
  - Standard fuze
  - Precision Guided Munitions
- Added capability with interfaces
  - Low speed direct set
  - High speed direct set

GOVERNMENT OWNED IP

- **Government owned design**
- Not tied to proprietary intellectual property
- Capability exists to update system in-house



NGLCS ELECTRONICS

Circuit boards

- **Interface Board**: Connectors, Buttons, LCD
- **Power Board**: Power regulation
- **Logic board**: digital logic, FPGA

Customizable

- May remove/reconfigure LCD, buttons, connectors, inductive coil, GPS antenna, etc
- Circuit board designs are government owned and thus can be reconfigured to suit requirements.
- Allows government freedom to sustain design indefinitely without implications of proprietary data.

SUPPORTED FUZES

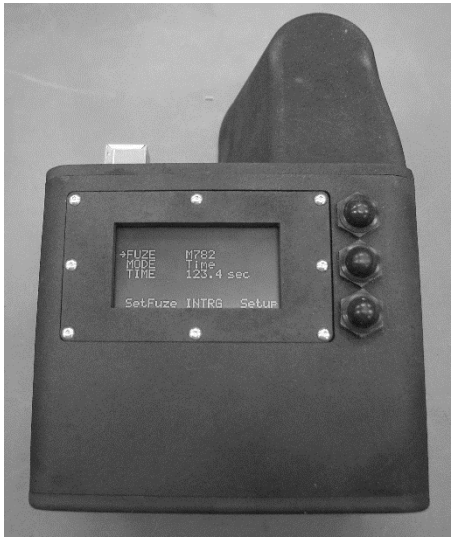
Fuze Name	Type	Country
M762/M762A1	Standard	USA
M767/M767A1	Standard	USA
M782	Standard	USA
C32	Standard	Canada
DM-52	Standard	Germany
DM-74	Standard	Germany
DM-84	Standard	Germany
FUCHSIA	Standard	France
L163A1	Standard	Great Britain
L166A1	Standard	Great Britain
M1156	PGM	USA
XM982	PGM	USA
M982	PGM	USA
M982A1	PGM	USA
XM395	PGM	USA

PICTORIAL OVERVIEW

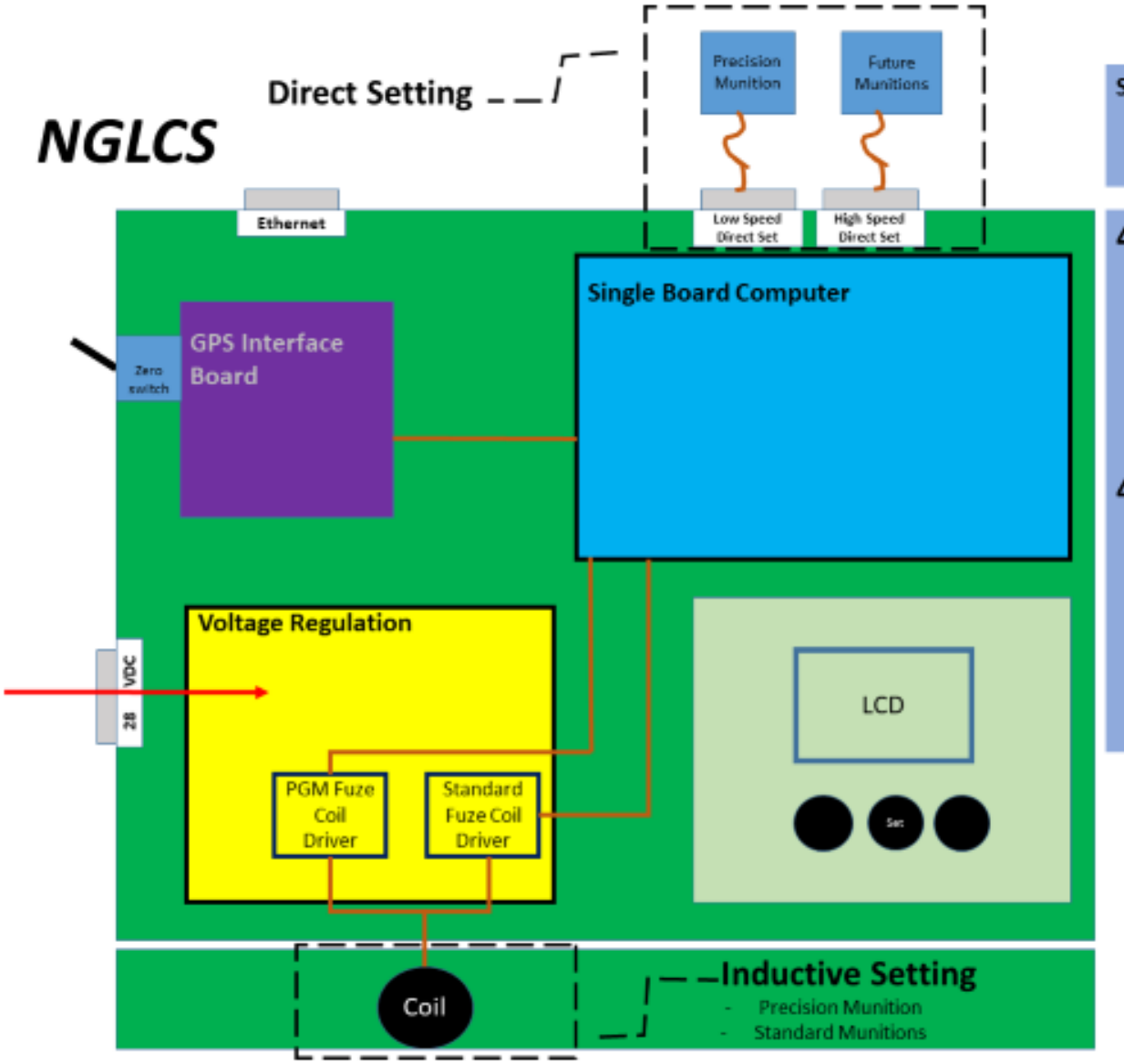
EPIAFS
(Case, Power, PIK, Cables, Wand)

EPIAFS➡NGLCS
Reduced Size
Single handheld unit
Added functionality

NGLCS



NGLCS BLOCK DIAGRAM



Signal and Data Overview

4 Boards

- SBC
- GPS
- Voltage Regulation
- LCD

4 Setting Modes

- High Speed Direct
- Low Speed Direct
- Standard Inductive
- Precision Inductive

NGLCS HIGH SPEED DIRECT SET

Challenge: Future image based fuzes will require much larger size of initialization data and faster communication link to set fuze.

Communication Link	Data Rate	Small Data Size 80 to 8500 bytes	Large Data Size 20 MB
Inductive Set (72 KB/sec)	72 KB/s	< 1 sec.	278 sec
Low Speed Direct Set RS422 (1 Mbps)	1 Mbps	< 1 sec.	20 sec.
High Speed Direct Set USB 2.0 (35 MB/s)	35 MB/s	< 1 sec.	0.57 sec.

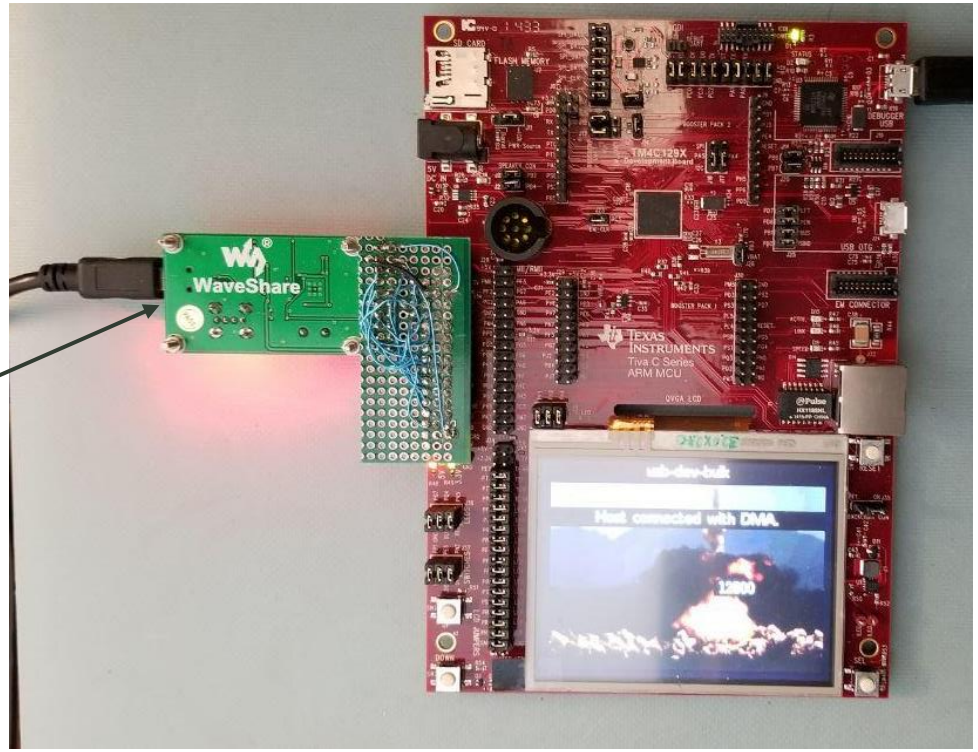
Inductive Set – currently used by fielded EPIAFS
Direct Set – Communication is via direct electrical connection

NGLCS HIGH SPEED DIRECT SET

- Direct Set – Communication link is through direct electrical connection.
- NGLCS system supports USB 2.0 High Speed protocol
- NGLCS PIK application can send initialization data via USB link at effective data rate up to 35 MB/sec.
- NGLCS sends data at a rate compatible with USB capable fuzes

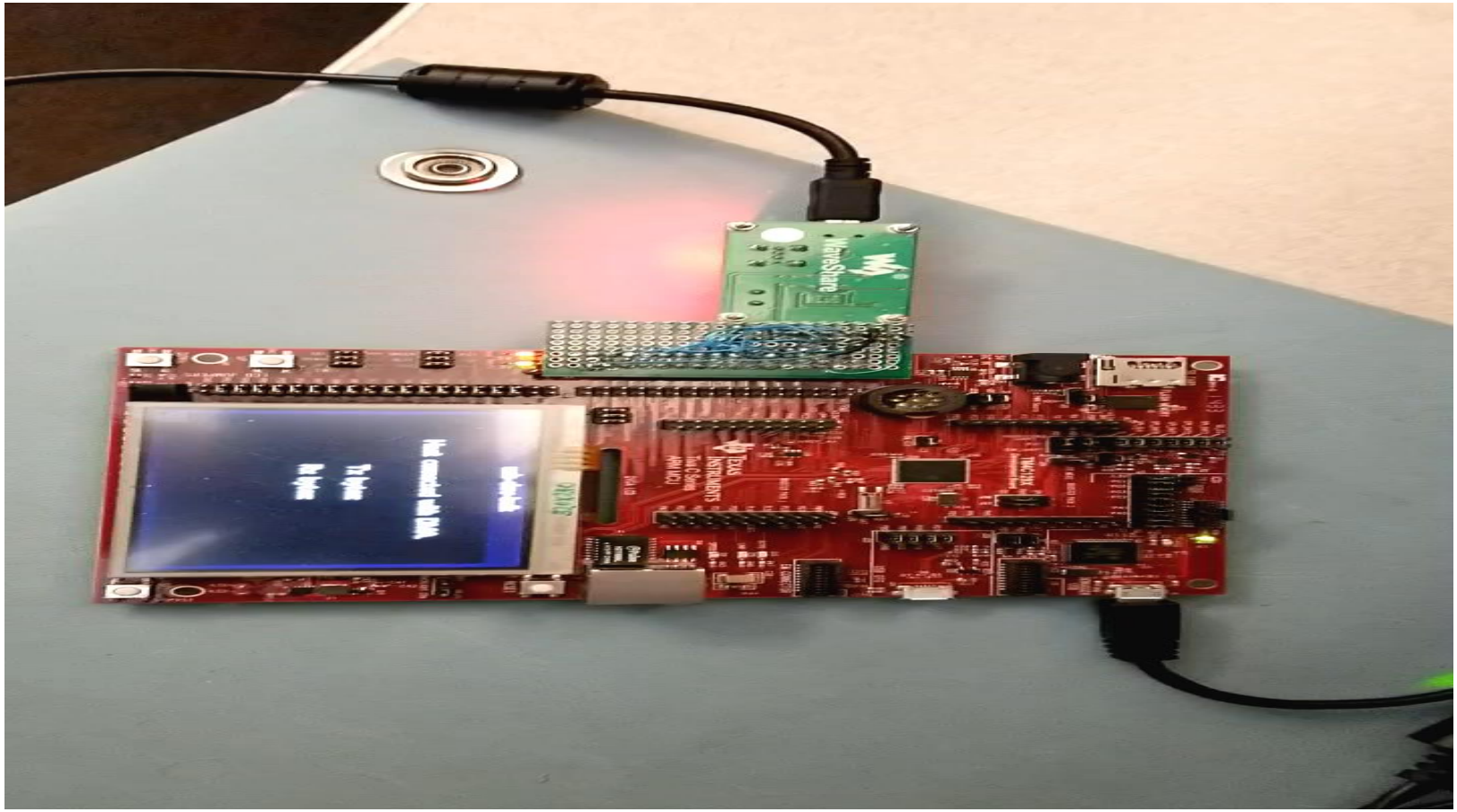
NGLCS HIGH SPEED DIRECT SET

- There is no existing high speed direct set capable fuze. Emulation board was built to demonstrate high speed direct set capability.
- Developed firmware that can receive a series of image data at 35 MB/s, and display them in sequence on a color LCD screen.

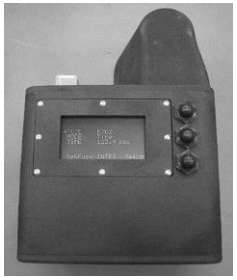


HIGH SPEED DIRECT SET DEMONSTRATION

NGLCS sends 70 frames of video image (80KB per frame) to emulation board via High Speed USB 2.0 link at 35 MB/s.



SUMMARY AND PATH FORWARD



- The Next Gen Large Cal Setter developed under the Fuze and Power Science and Technology Objective exceeded size and weight objectives
- Handheld setter replicates all capabilities of existing EPIAFS while adding both high and low speed direct set capability.
- Verified inductive interface on existing Precision Guided fuzes
- Developed direct set interface to demonstrate high speed setting of 70 frames of video/80KB per frame over USB 2.0 interface at 35MB/sec
- Anticipate supporting ERCA autoloader to facilitate rate of fire goals

  (*Munition interface was not addressed under this program)