



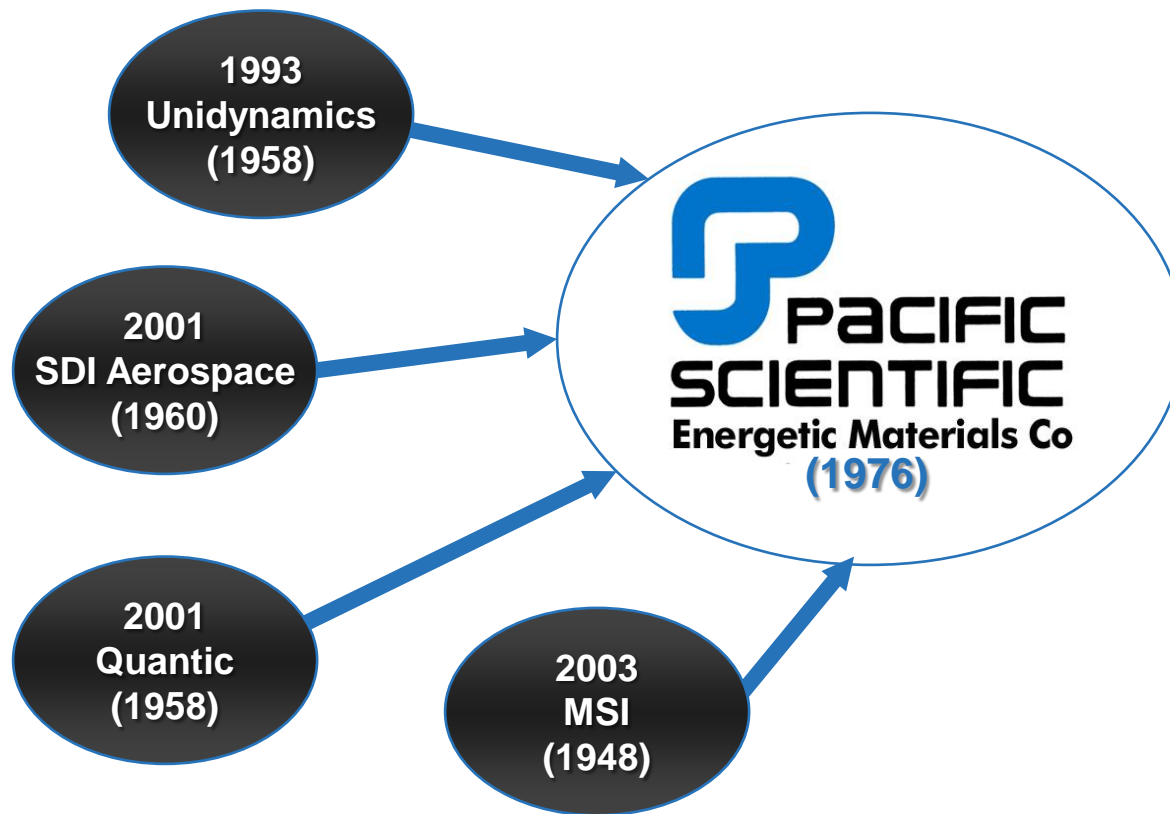
Multi-Point Initiation for a SDACs system

58th Annual NDIA Fuze Conference
July 7-9, 2015
Baltimore, MD

- **Joe Carvalho**
- **Pacific Scientific Energetic Materials Company**
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PSEMC History

PSEMC Has Over 55 Years of Ordnance Industry Experience



PSEMIC Facilities

- **Chandler – 57 Acre Site**

- **250+ Non-Union Associates**
- **100,000+ Square Feet Under Roof**
- **Complete Testing Capability**
- **Core Competencies: Electro/Mechanical Devices (ISD, S&A), Cartridge / Propellant Actuated Devices (CAD / PAD), and Initiators**



Chandler, AZ

- **Valencia**

- **Advanced Technology site**
- **30+ Non-Union Associates**
- **37,000 Square Feet Under Roof**
- **Core Competencies: Smart Energetics Architecture (SEA), Smart Controllers, Detonators and Initiators**



Valencia, CA

- **Hollister – 270 Acre Site**

- **430+ Non-Union Associates**
- **200,000+ Square Feet Under Roof**
- **Complete Testing Capability**
- **Core Competencies: Electronic & Laser Systems, Electronic ISDs/SAFs/AFDs, CAD / PAD, Linear, Ordnance, Propellant Manufacturing, and Specialty Chemical Synthesis**



Hollister, CA

Heritage (continued)

Leveraging past success to drive future innovation.

Deep Space
Space Vehicles
Launch Vehicles
SmallSats / CubeSats
Earth Observation & Imaging
Space Tourism



Space

*More than 20 critical space initiatives
From Apollo to Atlas V...*

Egress
Actuation
Fire Extinguishment
Payload Deployment
Parachute Deployment
Passenger & Crew Safety



Aircraft

*More than 50 major air initiatives
From SR-71 to F-35...*

Actuation
Motor Ignition & Safety
Payload Deployment
Missile Guidance
MultiPoint Initiation



Defense

*More than 60 major missile initiatives
From Minuteman to THAAD...*

Tubing Conveyed Perforating
Wireline Perforating
Completion Enhancement
Downhole Actuation
Deep Sea Actuation



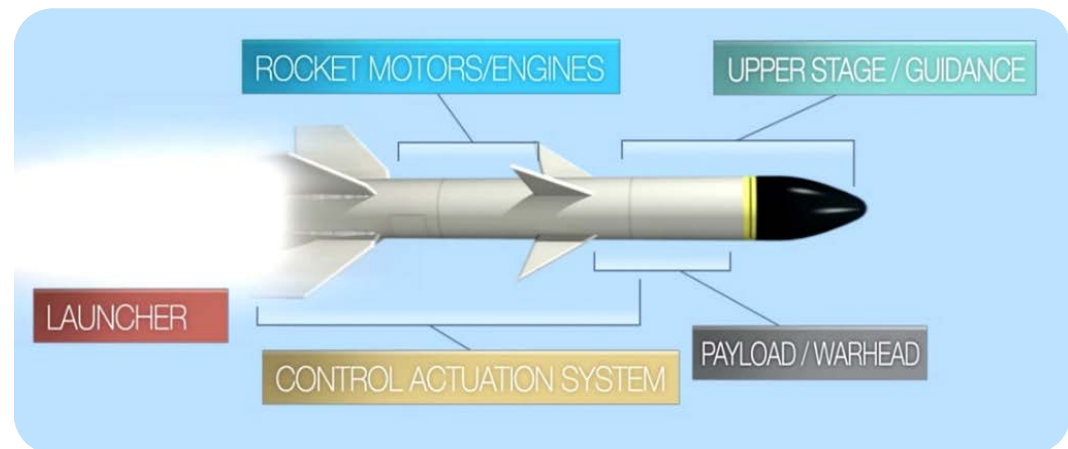
Oil & Gas

*Improving well yields for over 60 years
Innovation driving the shale revolution...*

Missile and Munitions Applications

When you need 100% confidence in mission success.

- CAD / PAD
- Divert Attitude Control Systems (DACs)
- Motor and engine start
- Payload deployment
- Warhead initiation
- Actuation, release and hold down
- Event sequencing
- Flight and thrust termination
- Insensitive munitions



Multi-Point Initiation Project Goal

- Customer needs multiple initiation events
- Each initiation must be MIL-STD-1901A compliant
- Size and weight are critical
- Each event must be accurately timed
- Need a low Risk Solution, utilize proven technology
- Present design architecture to Safety board as early as possible, tech assist, to reduce risks to program

Trade studies were performed to determine the best solution for this application

Trade Study Options

- One Safe and Arm with multiple High Voltage Outputs, high voltage and high current, (Safety approval risk low, but technical risk high)
- One Safe and Arm with multiple high voltage outputs, high voltage low current, (Safety approval risk low, but technical performance risk)
- Multi-Point initiation system with selected Fire. One central safe and arm with environmental detection providing “Unique signals to multiple ISDs”, (Safety approval risk Med, but technical risk low)

Trade Study Results

- The Multi-Point initiation scheme was chosen. This allowed maximum flexibility to the customer, small package at ISDs, and reduced EMI/EMC.
- PSEMC already had a very small ISD package that was qualified and in production for many years. This helped reduce risk to the program.
- A significant portion of the ISD design had already been developed and was available

Heritage

- PSEMC has Qualified and is in Production on a Dual Output MIL-STD-1901A rocket motor ISD
- Included with the ISD is two EFIs with internal TBIs and a mateable high voltage connector



Dual Output ISD



Series 260 ISD

Heritage Technology

- The approach maximized the use of proven qualified components to reduce development risk
- The approach utilized proven electronics packaging approach which met similar environmental requirements
- Early input from safety board critical to reduce program risk

Safety Board Approval

- Having a technical solution is not enough, you need to have a safe solution that the safety boards can approve.
- This application would involve the Navy so a Tech Assist was conducted with the Navy FISTRP at China Lake.
- The FISTRP provided very good feedback on the architecture. One of the key learnings was the need for very “Unique signals” since the inhibits were going to be shared over low voltage signals.

Path to Safety Approval

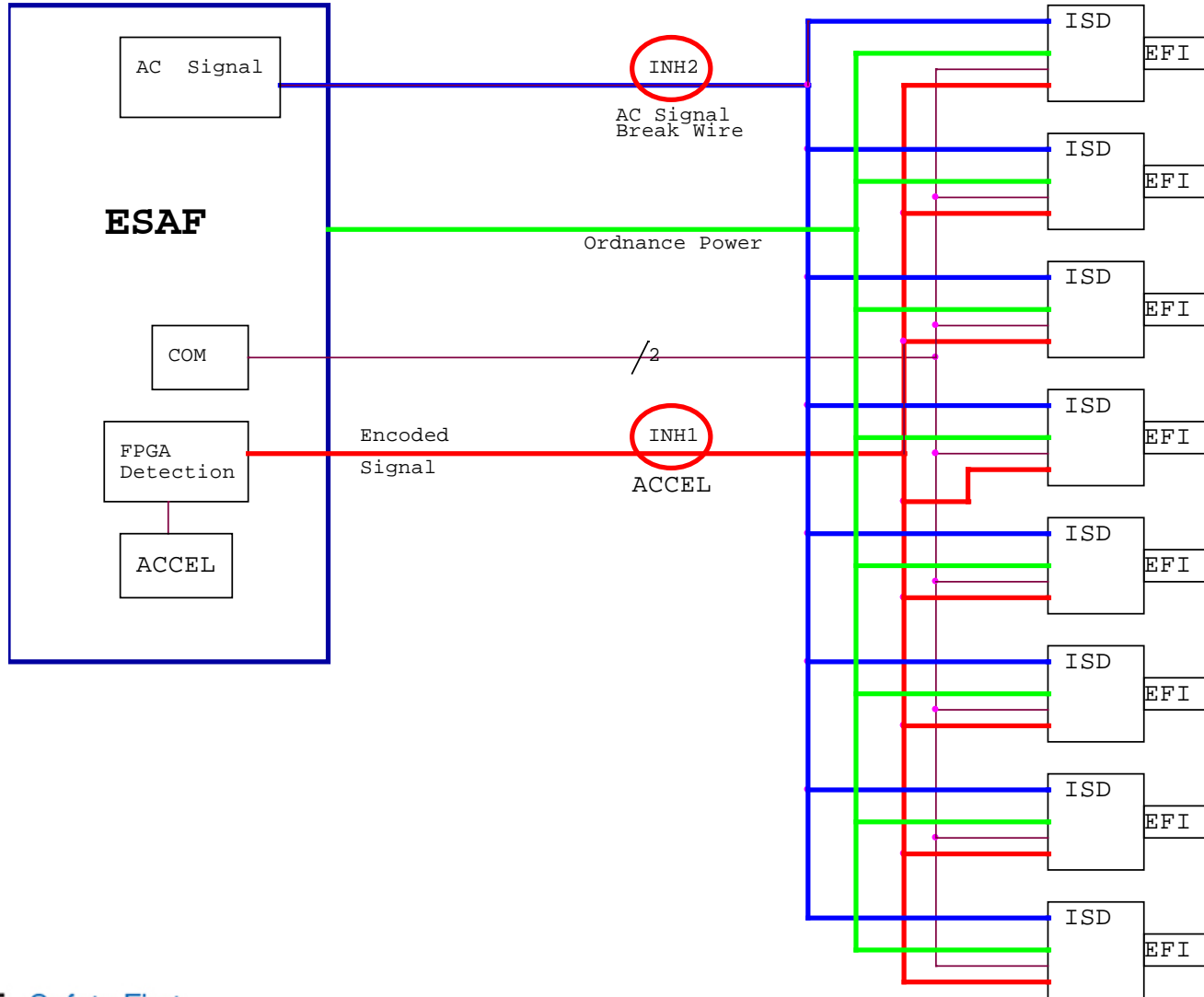
- Mark Etheridge, at AMRDEC, has been developing Multi-Point Fuze architecture that meets the safety requirements.
- Multi-point fuze and multi-point ISD both have the same safety requirements to ensure that the inhibits are safe by making them unique.
- For the SDACs application, the environments include acceleration profile and a break-wire.

Unique Signals

- A couple of options that could work to make the signals unique:
 - An AC signal, analog
 - A digitally encoded signal that would be built up, created not stored.
- These two signals work well because they are different technologies. One is analog AC signal the other is digital, thus less risk of common mode issues.

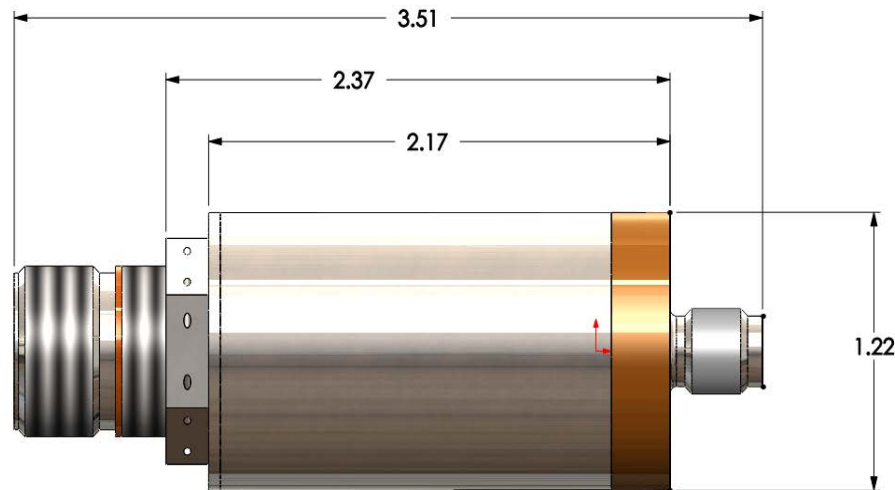
Unique Signals for Multi-Point Ignition

MPI PSEMC



Path Forward

- Two Tech Assist Reviews have been completed.
- Current schedule DVT testing complete in September 2015.



Questions?

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