

Intelligent Initiation Systems

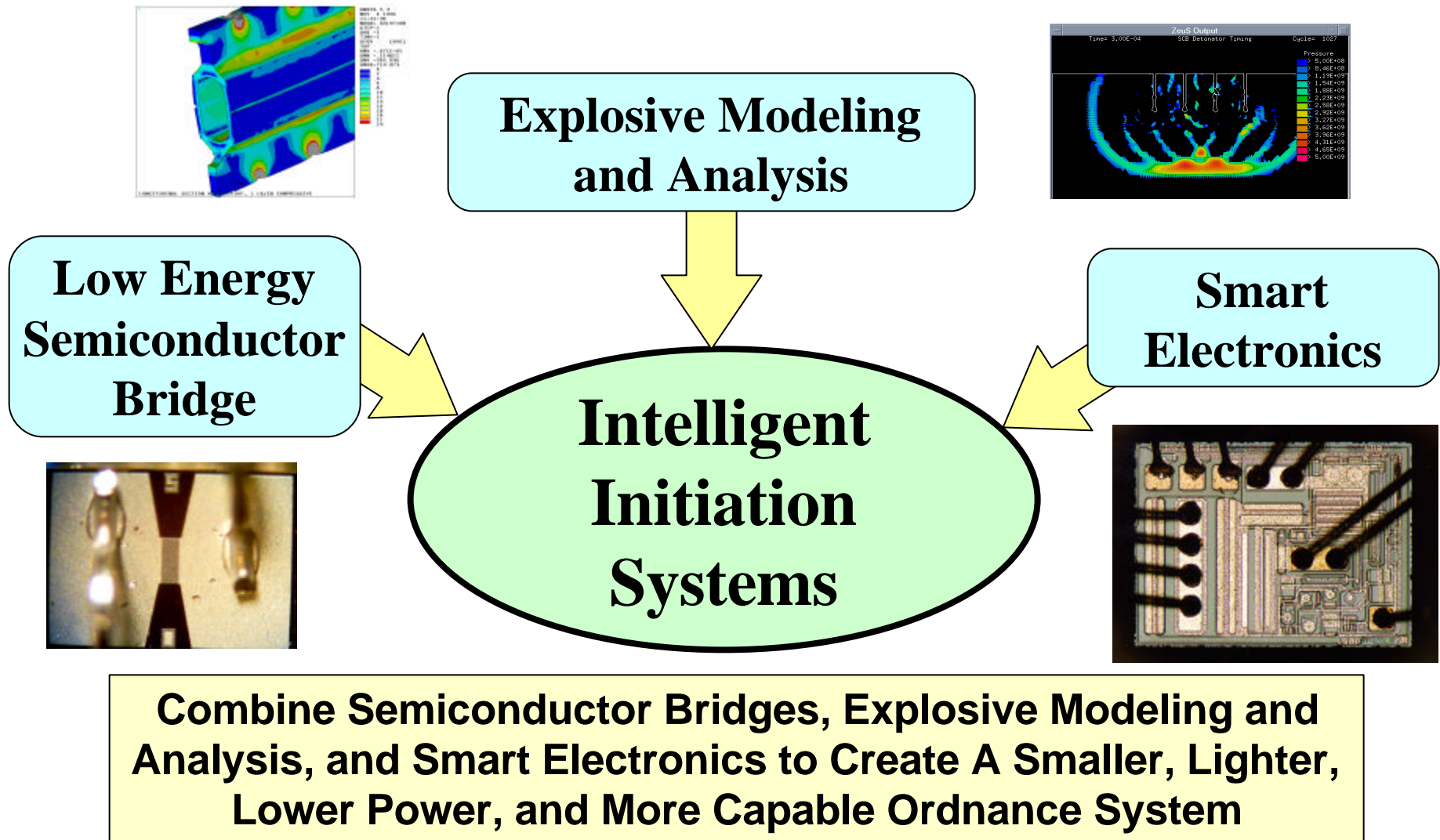
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Report Documentation Page

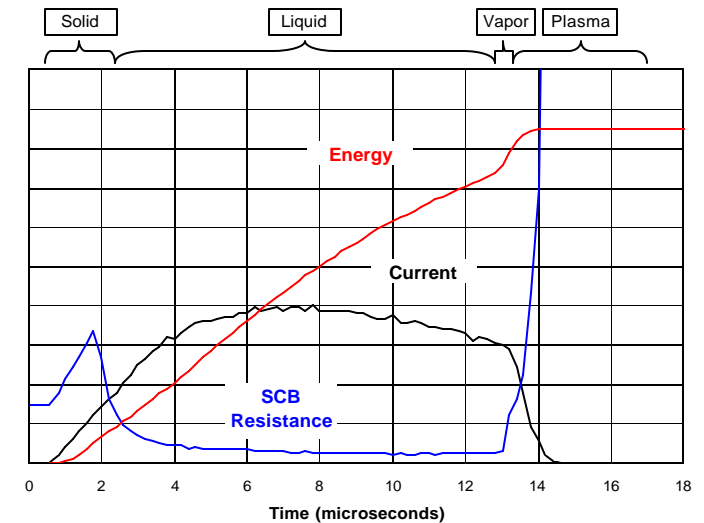
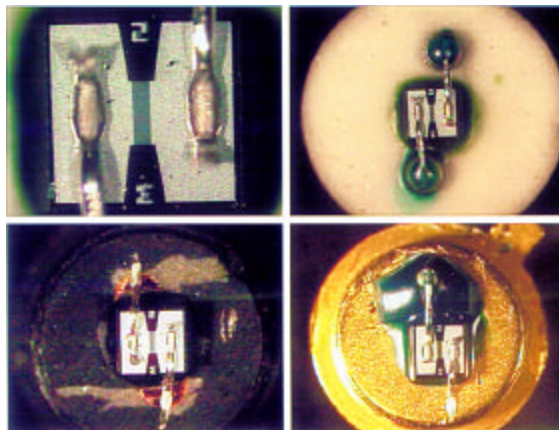
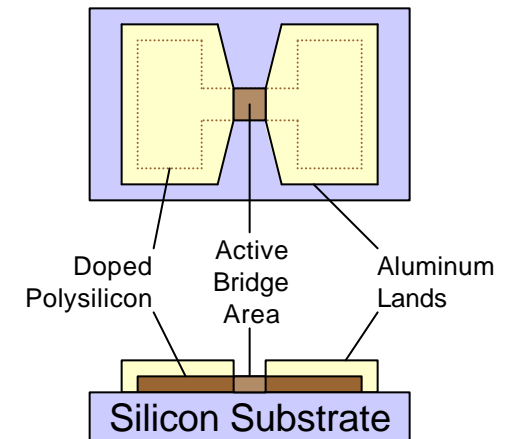
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Intelligent Initiation Systems



Semiconductor Bridges

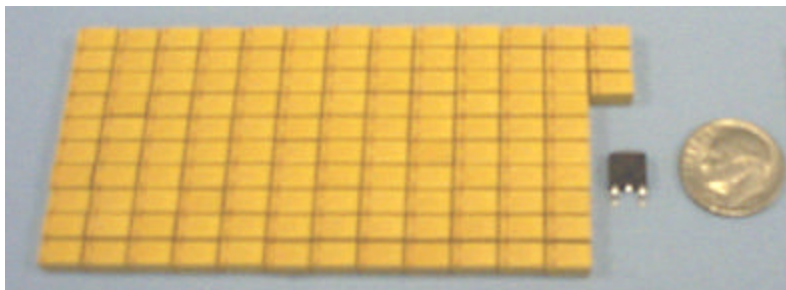
- ◆ Developed By Sandia in 1987
- ◆ Fast, Low Energy Firing (<1.0mJ)
 - ◆ Energy Rate Sensitive
- ◆ Planar Design Provides High No-Fire
- ◆ Enhanced Performance SCBs Developed
 - ◆ Integrated Zener Diodes, RF Voltage Block



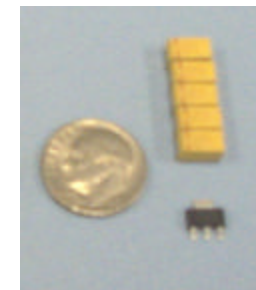
SCB Performance Data

- ◆ SCBs Provide:
 - ◆ Comparable No-Fire and ESD Performance
 - ◆ Significantly Reduced All-Fire Energy and Function Time

| Bridge | No-Fire | ESD | All-Fire Energy | Function Time |
|--------------------------------|---------|------------------|-----------------|---------------|
| HBW | 1.1A | 25kV, 500pF, 5k | 30mJ | 3ms |
| 1 st Generation SCB | 1.4A | 25kV, 500pF, 5k | 3mJ | 60μs |
| 2 nd Generation SCB | 0.7A | 25kV, 500pF, 150 | 0.3mJ | 30μs |
| 3 rd Generation SCB | 140V | 25kV, 500pF, 5k | 3mJ | 30μs |
| Small SCB | - | - | 200μJ | 1.5μs |



1A/1W Conventional Bridgewire Firing Capacitor Bank and Fire Switch



1A/1W SCB Firing Capacitor Bank and Fire Switch

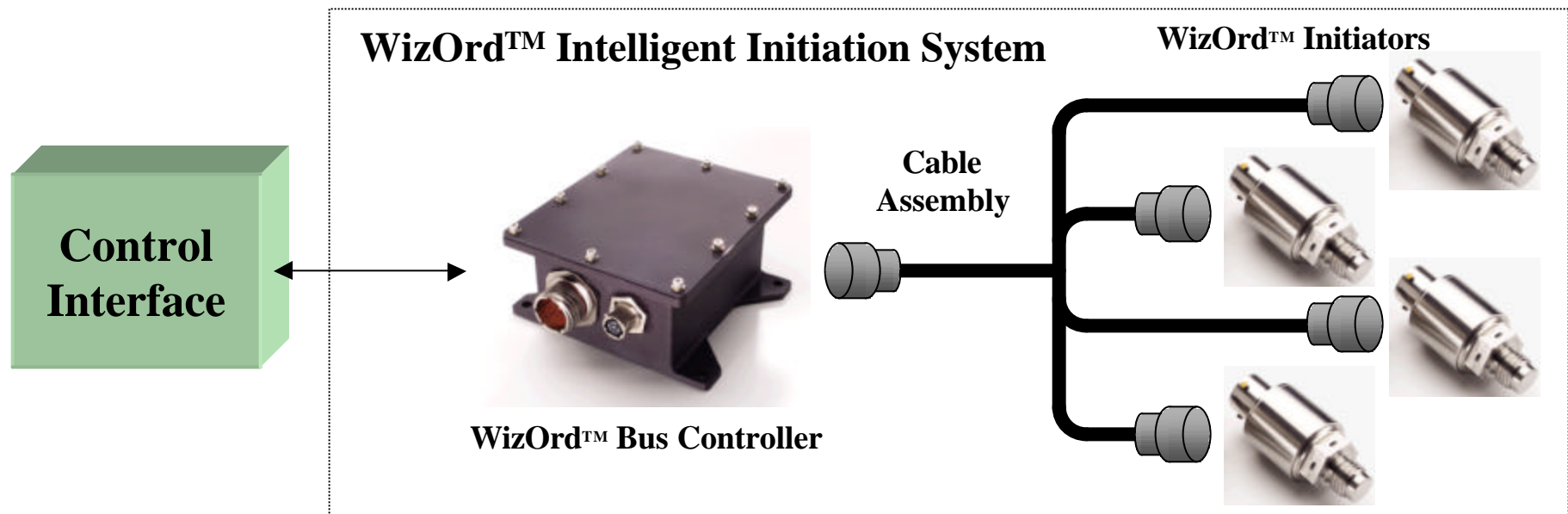
WizOrd™ Intelligent Initiation System

- ◆ *WizOrd™ Intelligent Initiation System*
 - ◆ A New Paradigm in Ordnance Initiation Systems
- ◆ *WizOrd™ Utilizes Smart Miniaturized Electronics to Create an Addressable Initiation System that is:*
 - ◆ Smaller
 - ◆ Lighter
 - ◆ Lower Power
 - ◆ Flexible
 - ◆ More Capable



WizOrd™ System Overview

- ◆ WizOrd™ is an Addressable Party Line Initiation System
 - ◆ One Bus Controller - Multiple Initiators
 - ◆ Individually Addressable Initiators
 - ◆ Two-Way Digitally Coded Communications
 - ◆ Initiators Contain Arming and Firing Circuits
 - ◆ Simple Control Interface
 - ◆ 28VDC Power
 - ◆ 28V Discrete Arm Enable Command and Serial Control Interface



WizOrd™ Advantages

- ◆ Reduced Weight/Size
 - ◆ Bus Controller Smaller than Typical Firing Box
 - ◆ Fewer Cables
 - ◆ Power System Reduction
- ◆ Reduced Power Consumption
 - ◆ No Ordnance Firing Current Loads
- ◆ Enhanced Testability
 - ◆ Two Way Communication Bus Allows More Testability
 - ◆ Extensive Testing can be Performed in the Flight Configuration
- ◆ Flexibility
 - ◆ Initiators are Easily Added or Removed with No Controller Requal
 - ◆ Unlimited Communications - Any Initiator at Any Time
 - ◆ Intelligent Initiators Provide Flexible Protocol
- ◆ Expandable Functions
 - ◆ Bus Architecture Could Accommodate Sensors

WizOrd™ Performance Data

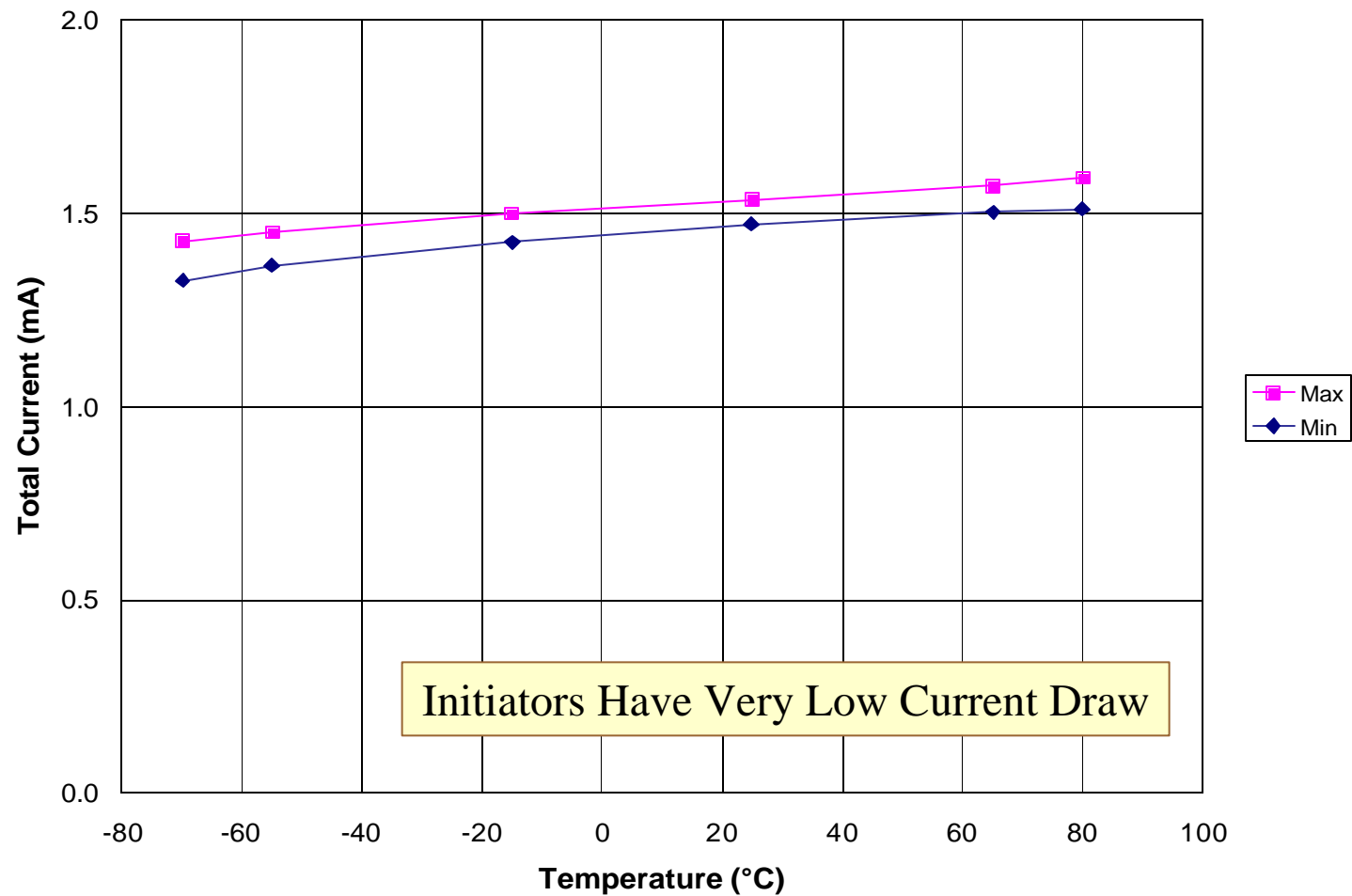
- ◆ WizOrd™ is Designed to Meet the Requirements of:
 - ◆ MIL-STD-1512
 - ◆ MIL-STD-1576
 - ◆ MIL-I-23659
- ◆ On-Going Design Validation Test Program
 - ◆ Maximum Performance Limits Currently Being Identified
 - ◆ Stated Performance Data Represents Testing Performed to Date
- ◆ Planned System Improvements Are In Development
 - ◆ Improved Data Bus Speed
 - ◆ Detonation Output
 - ◆ Sensors
- ◆ The WizOrd™ Intelligent Initiation System Can Be Tailored for Many Applications Without Compromising Safety or Reliability

WizOrd™ Specifications

| Parameter | Specification | Comments |
|----------------------------------|---|---|
| Bus Controller Operating Voltage | 22VDC to 34VDC | Can Be Re-Designed To Meet Specific Needs |
| Bus Controller Current Draw | 60mA + 4mA per Initiator | Typically 40mA + 3mA per Initiator |
| Maximum Number of Initiators | 124 | Set By Communication Address Length |
| All-Fire | Minimum 2X All-Fire Energy | 0.999 All-fire @ 95% Confidence Level at -65°F |
| No-Fire | No-Fire less than Operate Power Voltage | 0.999 No-fire @ 95% Confidence Level at +160°F |
| EMI | Designed to MIL-STD-461 | Testing in process |
| Charging Time | 0.5 Seconds | Resistively Limited - Could Be Reduced To Meet Specific Needs |
| Firing Delay | 4ms ± 0.25ms | Improved Bus Speed (2X) is in Development |
| Cable Length | Greater than 100 feet | Minimum 2X Firing Energy Margin Independent of Cable Length |
| Operating Temperature Range | -65°F to 165°F | Tested -90°F to 170°F |
| Vibration | Designed to meet typical aerospace vibration environments | Testing in process |
| Shock | Designed to meet typical aerospace shock environments | Testing in process |
| Initiator Output | NSI Equivalent (118mg ZPP) | Detonation or Other Squib Outputs Easily Accomodated |
| Size and Mass | | |
| Initiator | 0.8 in. dia x 1.8 in., 1.25 oz. | Can Be Re-Packaged To Meet Specific Needs |
| Space Bus Controller | 4.5 in. x 4.0 in. 2.5 in., 1.75 lb | |
| Tactical Bus Controller | 4.5 in. x 2.5 in. x 1.25 in., 0.5 lb | |

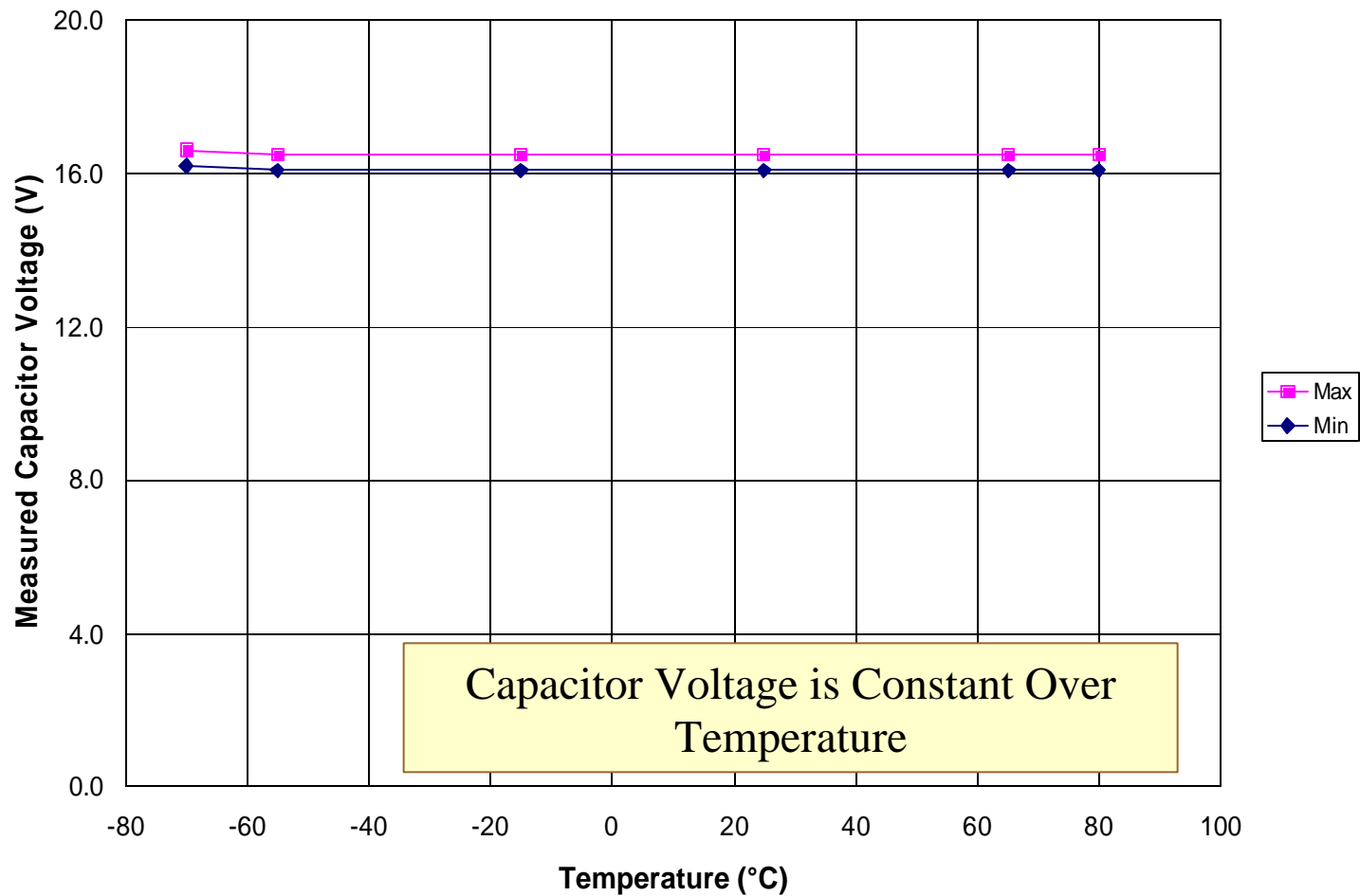
WizOrd™ Measured Data

Total Current per Initiator, Safe and Armed State



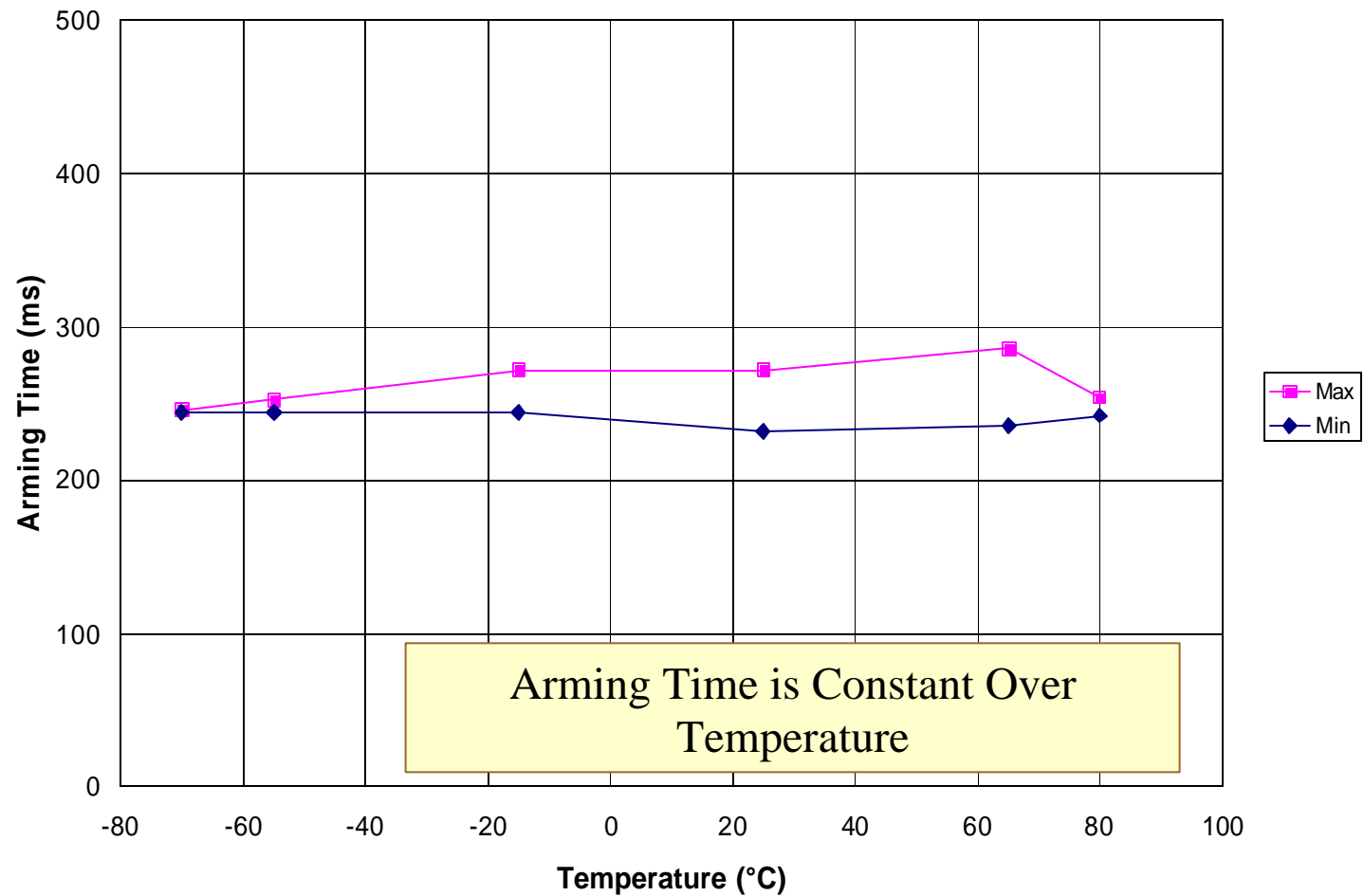
WizOrd™ Measured Data

Capacitor Voltage, Arming Voltage = 18.0V



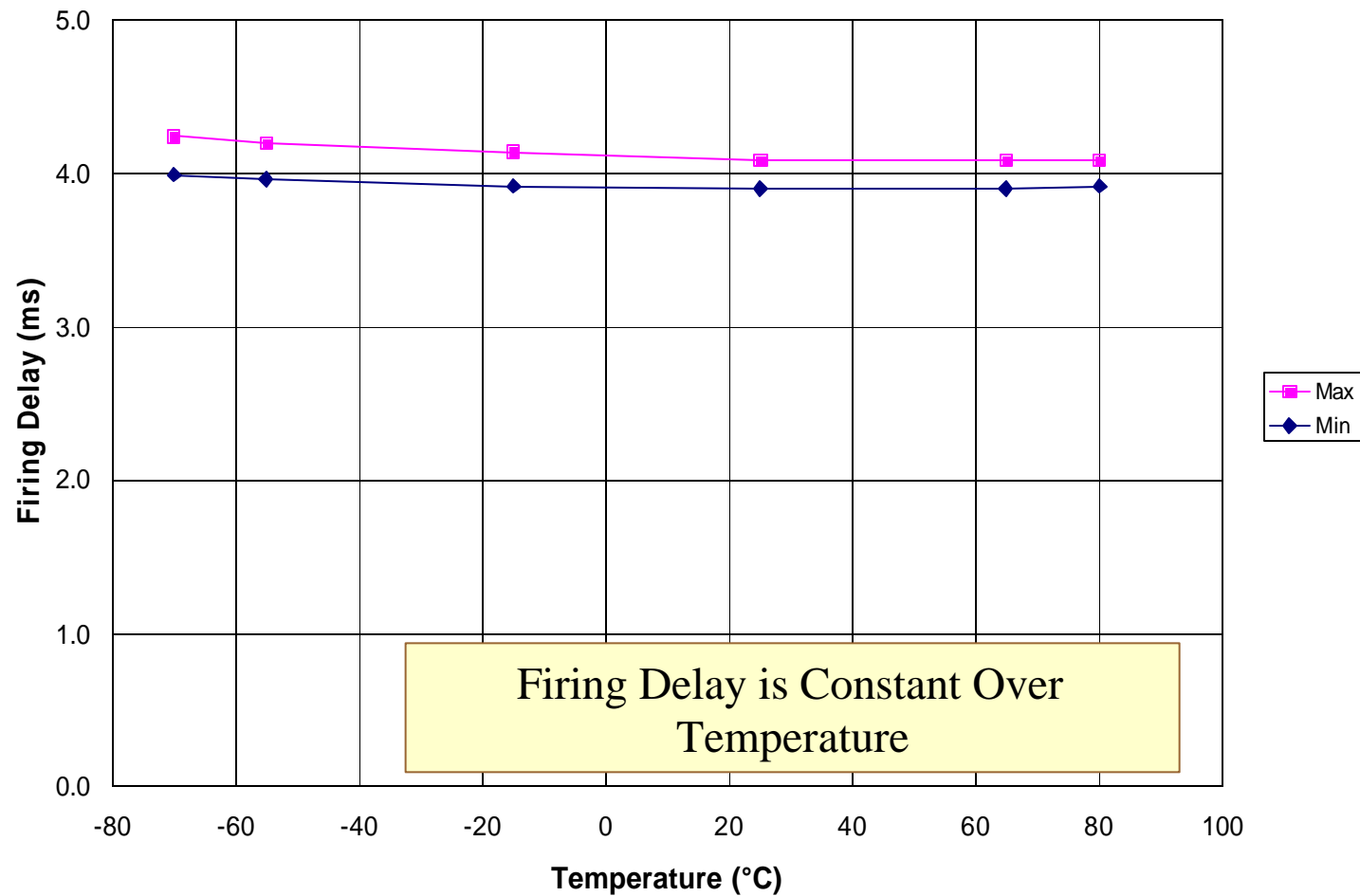
WizOrd™ Measured Data

Arming Time



WizOrd™ Measured Data

Firing Delay



WizOrd™ Program Status

- ◆ Prototype System Delivered to NASA
 - ◆ One Prototype Bus Controller with PC Based Control Software
 - ◆ 10 Initiators
- ◆ Validation Test System Delivered to NASA
 - ◆ Two Flight Bus Controllers
 - ◆ 20 Initiators
 - ◆ Validation Test Baseline
 - ◆ Thermal Cycle
 - ◆ Vibration
 - ◆ Shock
 - ◆ Thermal Vacuum
 - ◆ EMI
 - ◆ Salt Fog



WizOrd™ Program Status

- ◆ EBA&D Validation Testing
 - ◆ Thermal Cycle (-65°F to +165°F)
 - ◆ Extended Temperature Testing (-90°F to +170°F)
 - ◆ All Performance Characteristics Measured
 - ◆ All-Fire at -65°F
 - ◆ No-Fire at +160°F
 - ◆ Preliminary Conducted EMI (CS101)
 - ◆ Fault Simulation
 - ◆ Controller Faults
 - ◆ Initiator Faults
 - ◆ Bus Faults



WizOrd™ Summary

- ◆ WizOrd™ Intelligent Initiation System
 - ◆ Smaller
 - ◆ Lighter
 - ◆ Lower Power
 - ◆ Flexible
 - ◆ More Capable
- ◆ Simple Control Interface
- ◆ Squib or Detonation Output
- ◆ Two Bus Controller Configurations Presently Available
- ◆ Extensive Testing Has Been Performed
- ◆ Development System Available



WizOrd™ - Enabling Advanced Ordnance Systems