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<th>Title and Subtitle</th>
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<td>The Evolving Nature of Value Added Fuzing</td>
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<tr>
<th>Author(s)</th>
<th>Grant Number</th>
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<tr>
<td>Lewis, Ted</td>
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<th>Performing Organization Name(s) and Address(es)</th>
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<td>KDI Precision Products, Inc.</td>
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<th>Sponsoring/Monitoring Agency Name(s) and Address(es)</th>
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<td>NDIA (National Defense Industrial Association) 211 Wilson BLvd., Ste. 400 Arlington, VA 22201-3061</td>
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GUIDED MLRS USA AND FOREIGN PARTNERS

LOCKHEED MARTIN - PRIME CONTRACTOR
U. S. ARMY
GERMANY - DIEHL
ITALY - FIAT
ENGLAND - MATRA BAE
FRANCE - AEROSPATIALE
KDI PROGRAM TEAM

- Mike Buckhanan - Program Manager
- Ted Lewis - Electrical Project Engineer
- Cory Hatch - Electrical Engineer
- Tony Zucker - Mechanical Project Engineer
- Mike Sowder - Test Equipment Electrical Engineer
- Steve Gemperline - Quality Engineer, CQE
- Bob Garrett - Reliability Engineer
- Tom Moore - Manufacturing Engineer
- Bob Butts - Configuration Management

www.kdi-ppi.com
GMLRS ROCKET

- The GMLRS Rocket Is Nominally a Ballistic Round
- The Maximum Off-axis Shot Is 4° Degrees
- The Canards Are Used Only for Trimming the Trajectory During the Flight
HOUSING

• Material: 304L Stainless Steel

• Function
  – Interfaces to LEEFI Adapter Assembly
  – Interfaces With Rocket
  – Alignment Feature Incorporated
  – Hermetic Environment
  – Supports Printed Wiring Board (PWB)
SEALING

• The ESAD Will Be Hermetically Sealed and Tested to Meet a Leak Rate of 1 X 10^-6 cc/sec He/Mass Spectrometer at 1 Atmosphere Pressure Differential

• Laser Welding Will Be Used to Seal the Housing, Similar to the Other Qualified Programs at KDI

• The GMLRS ESAD Will Be Back-filled With Nitrogen With A Trace Of Helium Through A Fill Plug
LEEFI ADAPTER ASSEMBLY
GMLRS ESAD WITH LEEFI ADAPTER ASSEMBLY
TIMING DIAGRAM

Note 1: Arm/Fire Warhead Commands Are Rejected Until Arm Delay Timer Expires.
SERIAL INTERFACE

• 442 Drivers/Receivers
• SDLC Message Formats

Guidance to ESAD Message
- 48 BITS
  - 8 BIT Start Word
  - 8 BIT Command Word
  - 8 BIT Delay Time
  - 16 BIT CRC
  - 8 BIT Stop Word

ESAD to Guidance Message
- 64 BITS
  - 8 BIT Start Word
  - 20 BIT Command Word
  - 4 BIT Delay Time
  - 8 BIT Timer Status
  - 16 BIT CRC
  - 8 BIT Stop Word
ACCELERATION PROCESSING

• Motorola MMA1201P Analog Accelerometer
  – ± 40g Capacitive, Micromachined Accelerometer
  – Output Sensitivity = 50 ± 2.5 mV/g
• Accelerometer Readings Are Taken Every 340µS
• Accelerometer Output Level Checked During BIT
• Accelerometer Output Level “Nulled” When Battery Power is Applied
• Specification Requirements:
  – 1st Motion = 5.08g for 6 msec Within 0.5s From Umbilical Disconnect
  – Safe Separation = 5.08g for 5.7 ± 0.1 Seconds
LEEIFI ASSEMBLY

• Designed in Unison by China Lake, Reynolds Systems and Silicon Designs
• The LEEIFI Has Been Qualified by China Lake IAW MIL-STD-331, Test G1
• Specific Tests Designed to Demonstrate the Initiator Meets a Reliability of 0.99 at a 95% Confidence Level Were Performed
MCT SEMICONDUCTOR DISCHARGE SWITCH

• N-Type MOS-Controlled Thyristor
• 1400 Volt
• 4ka Surge Current
• Silicon Power Corporation
• Tested in KDI IRAD Program – > 20,000 Discharges
PROGRAM STATUS / SCHEDULE

• Initial AFSRB Presentation - Completed 19 Dec 2000
• PDR - Completed 1-2 Feb 2001
• Engineering Tests - 15 Nov 2000 To 31 Mar 2001
• CDR - 27-28 Mar 2001
• Qualification - 30 May 2001 To 17 Jul 2001
• Flight Hardware Delivery 1 June - 28 Sept 2001
QUALIFICATION TESTING

• Twenty ESADS Will Be Subjected to Qualification Testing
• The Qualification Test Environments Will Consist Of:
  – Thermal Shock
  – Tactical Vibration
  – Launch Shock
  – High Temperature Operation
  – Low Temperature Operation
  – Acoustic Noise and Flight Simulation
• Electromagnetic Environment