L3 communications
KDI Precision Products, Inc.

KDI Precision Products, Inc.
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HIGH ACCURACY RADAR PROXIMITY SENSOR

48th Annual NDIA Fuze Conference

Presented by Bob Hertlein
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ORDNANCE TECHNOLOGIES

Outline

- Background
- Application
- Features
- Design
- Program Status

Background

HARPS

- Conceived as an updated design to compete with the DSU-33
- KDI bid alternative design to USAF
  - Based on M734A1 technology
- Exportable version developed for FMS in conjunction with Ordnance Technologies (UK) Limited (OTL) and Electronics Development Corp. (EDC)

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Current DSU-33 Prox Sensor

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Application

HARPS

- Fit, Form and Function replacement for existing DSU33
- Air burst capability for standard MK80 series weapons using either FMU139 or FMU152 fuzes and FZU48 and FZU55 initiators.

Features

HARPS

- Improved Height of Burst (HOB) control
- Improved resistance to jamming
- Hermetically sealed sensor electronics
  - Improved reliability
  - Extended shelf life (20yrs)

Design

HARPS

- Objectives
- Signal Processor
- Transceiver
- Antenna
- Interface
- Battery

Design Objectives

HARPS

- Improve Accuracy and Burst Height Control
- Improve ECM resistance
- Improve tolerance to Stick Release
- Improve Reliability
- Improve Storage Life

Design Objectives

HARPS

- HOB: 5 ±1 Metres over following conditions:
- Approach Velocity from 30-500 m/sec
  - Approach Angles from 15° to 90° from horizontal
  - Target surfaces of
    - Soil (Wet and Dry)
    - Concrete (Wet and Dry)
    - Water
    - Dense Foliage
    - Desert Scrub
  - Target Reflectivity range +5dB to -16 dB

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Signal Processor

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- Direction Doppler Ranging (DDR)
  - Original demonstrator units utilized M734A1 Signal Processor
  - Current design uses KDI-100 DDR Signal Processor
    - Fully integrated, single-chip signal processor
    - Doppler passband and reference waveforms tailored to application

Transceiver

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- **First prototypes utilized exportable version of M734A1 transceiver**
  - Fully integrated transmit and receive functions
  - Unacceptable performance variations over the wider temperature range
  - High Cost
- **Current HARPS design utilizes a less integrated transceiver design**
  - Oscillator separate from detector electronics
  - Parameters very stable over temperature
  - Versatile, low cost

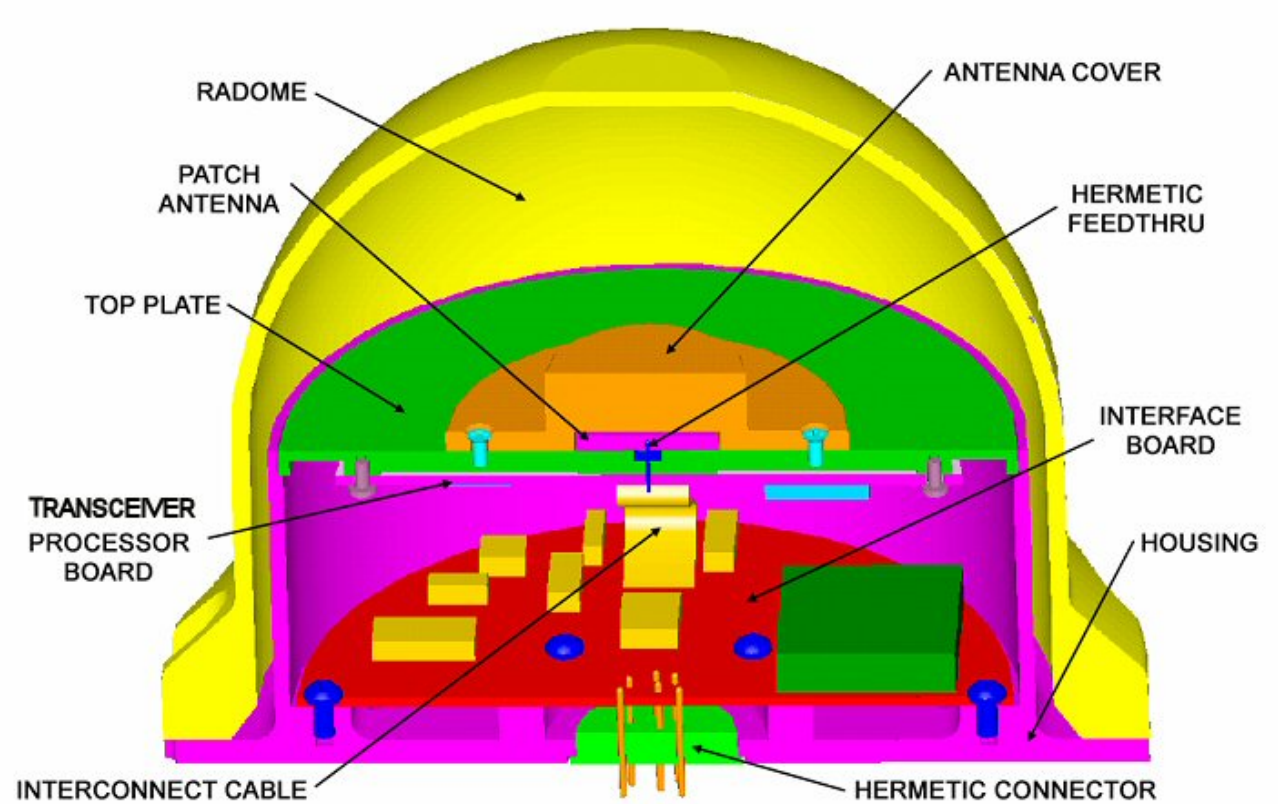
Antenna

HARPS

- Circular patch mounted on extended ground plane
- Fed via hermetic feedthrough
  - Glass-to-metal seal welded to housing
- Extremely rugged

Sensor Cutaway View

HARPS



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Interface

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- Interface PWB Supplied by OTL
- Interfaces to Initiator, battery, fuze
  - Inititiator Interface
    - +32 to +150V at 2.5mA max for 1.2 sec (FZU48 & FZU55) or
    - +195 volts or -195 volts (±4%) at <25mA for 15 - 500 ms (FFCS)

Interface

HARPS

- Firing Signal Interface
  - 30mA (min) into 470Ω for >100μsec
  - 33,000 ergs into 4Ω within 200μsec
  - Compatible with FMU152A/B, FMU55A/B, FMU139A/B, FMU139B/B & FMU139C/B
- Electrical Connection
  - Interfaces directly with FZU as per existing Mk80 weapon system designs.
- Mechanical Interface
  - Screw fit to Mk80 front fuze pocket.

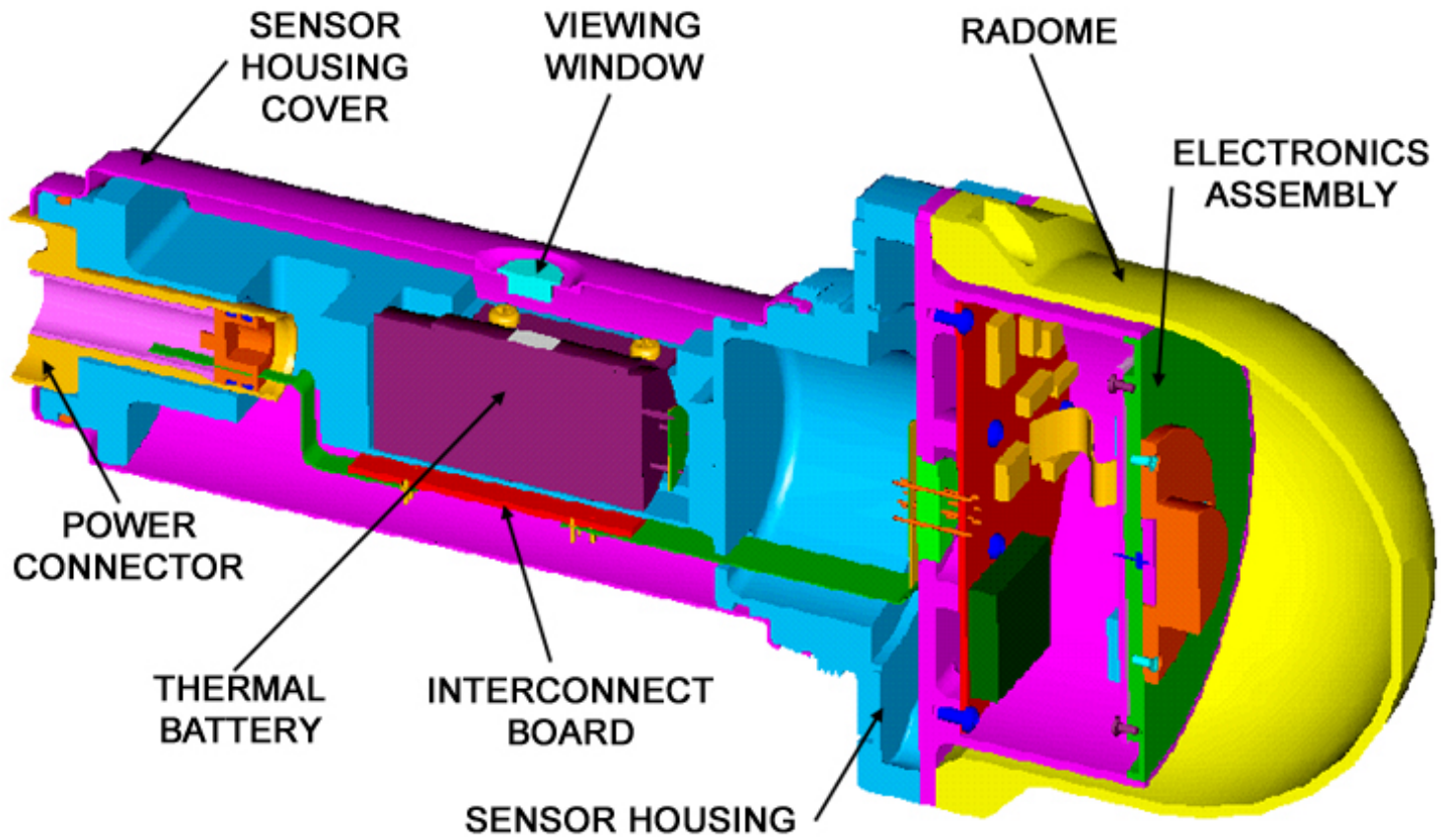
Battery

HARPS

- Thermal Battery
  - Current Design uses same Thermal Battery as DSU-33
  - 32 Volt battery far exceeds power requirements for HARPS
    - Significant power dissipating circuitry required
    - Design has potential to use lower voltage battery
      - Significant cost savings possible

HARPS Cutaway View

HARPS



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HARPS Photo

HARPS

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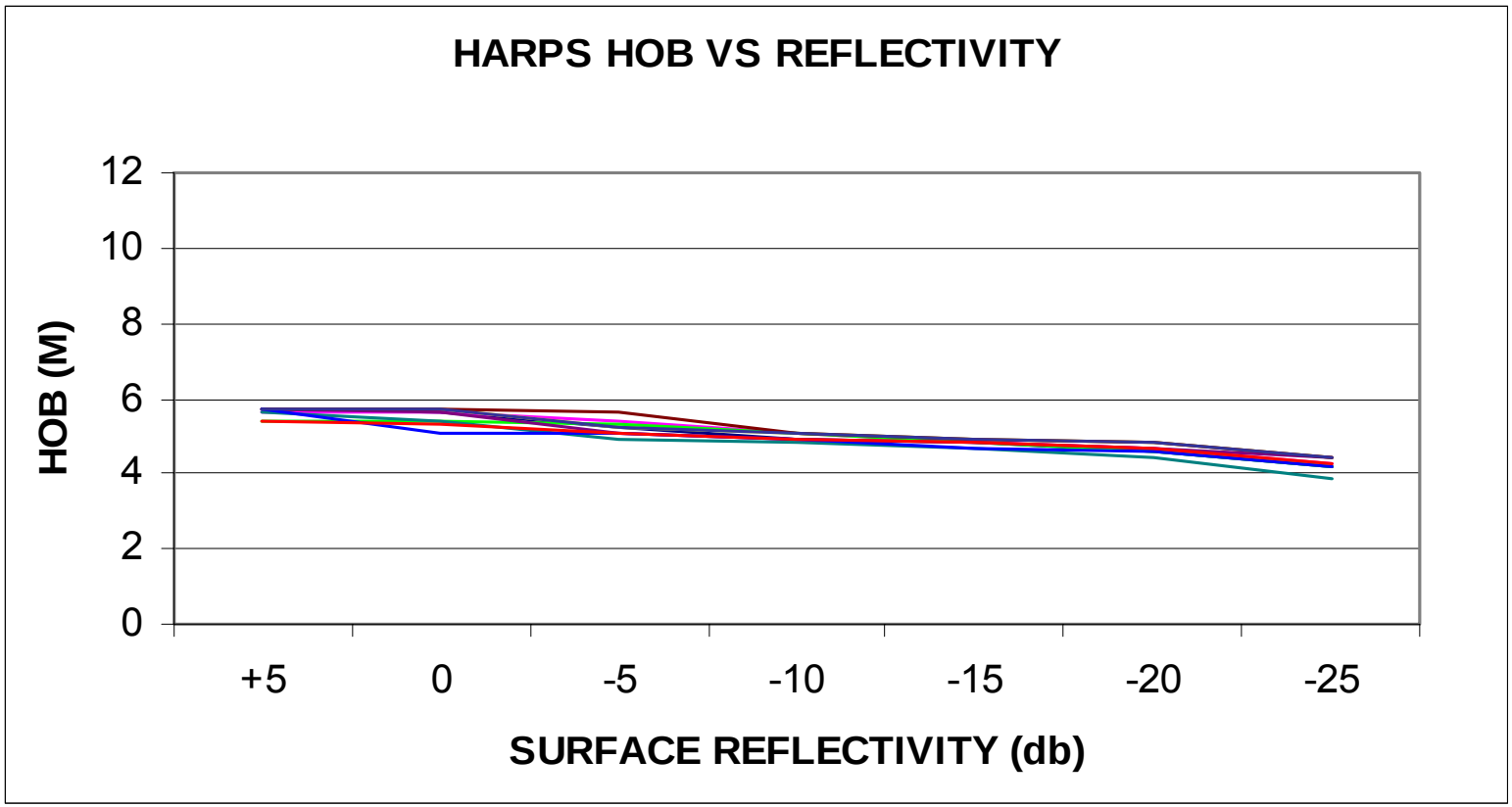
HOB Test Data

HARPS



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Program Status

HARPS

- 5 Units recently shipped to French DGA
  - Trials to take place early summer
    - Ground test
      - System test with Pyrotechnic Indicator
    - Flight Testing (Mk82 Bomb system)
      - Captive Carriage
      - Inert release with Pyrotechnic Indicator
      - Live release with FMU-139B/B
- Additional International opportunities

Conclusion

HARPS

- Form, Fit, Functional DSU-33 replacement
- Enhanced Performance
  - Tighter HOB
  - Jam Resistant
- High Reliability
- Extended Storage Life
- Low Cost

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