Management Sciences Inc.

NAVAIR

A New Engine Monitoring System with Safety Recording for AV-8B

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NAVAIR PMA-257

AV-8B Aircraft

- First Flight 1981
- Current Engine is F402-RR-408
  (Rolls-Royce Pegasus)
- Currently deployed by US Marine Corps
  Also:
  - Italian
  - Spanish
- GR7/9 aircraft operated by UK

AV-8B Engine Monitoring Unit

- Late 80's design
- Hybrid technology with limited processing throughput
- Accurate event detection but limited vibration processing accuracy
- Limited functionality
- Limited upgrade capability
- Obsolescent design

D3 FIR Program

- Digital Data Download with Crash Survivable Memory
- Small Business Innovative Research Grant (FastTrack)
- Phase II awarded in April 2002
- Sponsored by PMA-265 (F/A-18) and PMA-209 (ACE)

D3 FIR Capabilities

- Fully Crash Survivable to ED-112
- Audio, Flight Information, CNS/ATM, and Video (growth) recording
- powerPC, Ethernet, PCI backplane
  - Non-standard form factor to fit F/A-18 CSFIR
- 6 MIL-STD-1553 data buses
- 4 EIA-422/485 serial interfaces
- Options for ARINC 429 and Video
- Advanced Rules Engine for
  - Diagnostics and Prognostics
  - Digital Data Download (data link messaging)

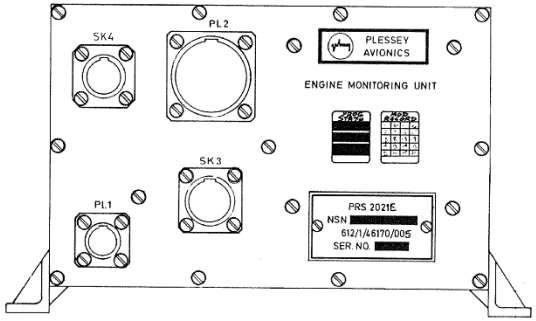
D3 FIR Status

- Safety of Flight qualification completed
  - EMI/EMC – three discrepancies noted
  - Environmental – one discrepancy (test equipment related)
- Full CSFIR and F/A-18 compliance demonstrated at Advanced Weapons Laboratory – NAWC-WD China Lake
- Ready for structural analysis and flight release for Local T&E
- Program halted due to lack of interest at PMA-265
- D3 FIR is currently TRL 6+

AV-8B Needs

- Accurate Engine Monitoring with remaining life prognostics
- Growth to advanced engine performance prognostics
- Improved capability for new event detection
- Safety recording for accident and incident investigation

Merging Concept and Need



EMU + D3 FIR = CSEMS

Crash Survivable Engine Monitoring System

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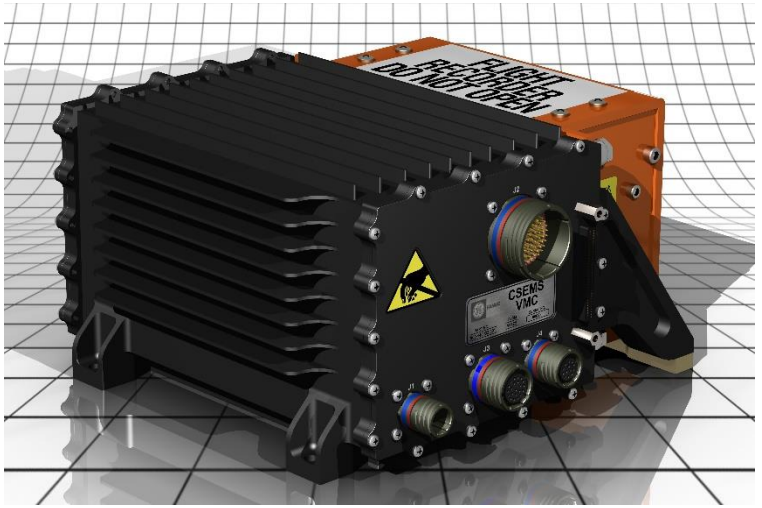

AV-8B CSEMS

Part of D3 FIR Product Line

- Utilizes Crash Survivable Memory Unit
- Modules upgraded to cPCI and PMC
- Same powerPC processing architecture
- Open Architecture Operating System
  - POSIX compliant
- Ethernet download using HTTP protocols
- Advanced Rules Engine for Prognostics
- Extensive reuse of D3 FIR Software

CSEMS Team Members

- Management Sciences, Inc.
  - Prime Contractor, Systems Integration, & Software
- Honeywell International
  - Crash Survivable Memory Unit
- GE Fanuc IP Embedded Systems
  - Chassis, Power Supply, Processor, I/O
- Meggitt Avionics
  - Vibration Processing Module
- Rolls-Royce (Cooperating)
  - Engine Installation of Dual Vibration Transducers

CSEMS Government Team

- PMA-257
  - Program Executive Office and Project Office
- Joint System Support Activity (NAWC-WD)
  - Systems Test and Integration Labs
  - Ground and Flight Test Support
- Fleet Support Team, Cherry Point
  - Engine Maintenance and Fleet Usage
- Others later to include Training and NAVICP

CSEMS Results

- Leveraging SBIR technology to meet current fleet needs
- Streamlined development process using flexible small business
- Teamed with reliable manufacturing
- Completed SRR and preparing for PDR
- Flight Testing in 18 Months
- Production ready in 24 Months

CSEMS – The Future

Several technologies may be added to CSEMS as it is deployed

- Additional prognostic capabilities
  - Data Driven CBM
  - Additional parameter/event recording
- Audio and HUD Video
- Military Flight Operations Quality Assurance (MFOQA)
- Other growth options