ICAS
(Enterprise Remote Monitoring)

DoD Maintenance Symposium

13 Nov 2007

Statement A: Approved for Public Release; Distribution is unlimited.

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Integrated Condition Assessment System

Navy’s CBM/ RM Challenge

Platforms

Surface Combats

Amphibious

Mid Life

Carriers

Subs

Mine sweeps

Platforms

New acquisition

Mid Life

New acquisition

Platforms

Automation

Data Acquisition

Functionality

Handheld PDAs (Palm Pilots)

Hybrid System (Combination of Handhelds & Automated Readings)

Fully Sensorized Automated Readings

No CBM
No RM

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OnStar Vehicle Diagnostics

Subscribers receive monthly e-mail updates on the condition of the vehicle’s key operating systems. Condition and time-based maintenance recommendations are included.

Approximately every 30 days, the vehicle automatically transmits diagnostic data on the following systems:

- Emissions Systems
- Air Induction System
- Fuel Management System
- Engine Cooling System
- Throttle Control System
- Variable Valve Timing System
- Ignition System including Misfire Detection
- Active Fuel Management™/Displacement on Demand
- Engine Electrical System
- Transmission Control System
- Antilock Braking System
- Traction Control System and StabiliTrak® (where applicable)
- Supplemental Restraint System including Airbag Deployment Mechanisms and related sensors
- OnStar System

Integrated Condition Assessment System

ICAS Capabilities - Afloat

• CBM implementation tool
  – Machinery Data Trending
  – Rules based expert system
  – Vibration Analysis
• Troubleshooting Aid
  – Rules based expert system
  – Event capture
• Operational Assessment
  – Material Assessment
  – Plant Situational Awareness
  – Assessment Visit Support
    (Availability Planning)
• A tool to enable reduced manning
• ILS
  – Access and linkage to PMS, EOSS and IETMs
• Electronic Logsheets

ICAS Expert System:
• performs a continuous analysis of machinery data.
• automatically generates maintenance advisory

Data Logging / Situational Awareness

Continuous Analysis
"ICAS has the information that Distance Support needs."
– VADM Sullivan, NAVSEA 00
"The right maintenance, at the right time, at the right cost."
Integrated Condition Assessment System

Enterprise Performance Analysis Report

“Fleet wide view of a system”
• **IPAR Summary**
  
  **Sep 06 – Aug 07**
  
  – 12 System IPARs complete
    • MPDE, GTM, GTG, AC, HPAC, LPAC, EVAP, RO, Refer, etc
  
  – 2871 Ship data submittals
    • High Month: Aug 07: 361
  
  – 81 Separate Ships
    • 91% ICAS Surf Ships
    • High Month: Jun 07: 45
  
  – 554 IPARs were released
    • High Month: Aug 07: 101

• **Business Rules**
  
  – Currently optimizing process via SWE
  
  – Process Metrics presented to SWE BOD

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Remote Monitoring is an Integral Part of the Surface Warfare Enterprise
Integrated Condition Assessment System

CNSF GTG Metric Study

Two-Year 1B4B Cost Averages

• ICAS Average Per-Ship Cost = $90k per year
• Non-ICAS Average Per-Ship Cost = $154.5k per year

Maintenance Savings Can Be Realized Using The ICAS System
The Integrated Condition Assessment System (ICAS) is the poster child for Fleet Commonality:

- Surface Combatants (60/100)
- Amphib & Minesweeps (24/34)
- Carriers (6/11)

The same ICAS software is utilized on all installations:

- Enterprise class based system training
- Shared logistics costs
- Shared system support costs
- Shared implementation costs
Integrated Condition Assessment System

A Cross Platform, Common Solution

Various Sources of Requirements

Legacy Fleet
- Log Sheets
- Trends
- Events.

DDG Mod
- Client Sever
- Thin Client

SEA 08
- Relational Database
- 10,000 Sensors

DDG 1000
- TSCEI
- Diagnostics

LCS
- Data Qualification
- Remote Monitoring

Enterprise Remote Monitoring (eRM)
- Commonality
- Reduced Life Cycle Costs
- Shared/Reduced Development Costs
- Reduced Installation Costs
- Reduced In Service Costs

Legacy Fleet

DDG Mod

SEA 08

DDG 1000

LCS

Enterprise Remote Monitoring (eRM)
Integrated Condition Assessment System

Enterprise Remote Monitoring
“The Path to the Vision”

 Fully Autonomous Enterprise Remote Monitoring

IPAR Virtual Subject Matter Expert
2 Hour IPAR Turn Around
IPAR Case Based Reasoning
Dedicated eRM Response Center
Remote Real-Time Tech Assist

PMS Identified & Scheduled Remotely
IPAR Standard Statements
Remote Monitored 2 Kilos Generated
Shore Side uploaded Shipboard
IPARs Delivered to Ship via Web Service
Electronic Data Submittals
Integrated Performance Analysis Reports (IPARs)

Shipboard Automated Diagnostics
Shipboard Data Storage
Shipboard Monitoring & Alarming

Shipboard Generated IPAR’s (w/ rec’s)
Tiered Remote Monitoring Team
(Upside Down Pyramid of Support)

High Security Firewall – Multi Level Network Card
Machinery Control System LAN Secure Interface
Interface with ISNS LAN

Manual Data Submittals
Shipboard data qualification
(trends, events, transient analysis, alarms)

Status
Further Planning Required
Planned & Estimated
Under Development
Development Complete, Deployment Underway
Integrated Condition Assessment System

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Fully Sensorized Automated Readings
Backup Slides
**Problem Description**
- High Startup Vibes on GTG#1
- Identified During RDS event 4 March 2005
- This is the first data offload and first RDS event for ship

**Analysis performed**
- High vibes compared to DDG80 GTG high vibe problem that resulted in engine replacement due to 4th Stage turbine blade damage
- Vibe signature matched and suspected 4th stage turbine damage on GTG#1

**Action Taken**
- Ship notified (in POM period) and begins troubleshooting
- MARMC visits ship after water wash and troubleshooting complete
- MARMC performs borescope inspection during connection of independent vibration gear

**Results\Benefits**
- Borescope revealed, (as suspected), 4th stage turbine blade damage
- MARMC recommended engine replacement based on damage and ship schedule

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**Reverse Distance Support Timeline**
- First ICAS data offload received
- First RDS Event for Ship
- ICAS Install
- Feb 5, 2005
- March 4, 2005
- Time: + 1 day
- Time: + 3 days
- Time: + 11 days
- Time: +11 days

- Ship contacted and begins troubleshooting
  (waterwash, transducer inspection, etc)
- MARMC SME performed borescope inspection. Damage found on 4th stage blade
- MARMC SME and SME Performance review complete
- Data Verified by SME and compared to failure library
- Recommendations documented in pdf
- MARMC Change out request
- 13 Nov 07