Revolutionizing Maintenance Through Remote Monitoring via ICAS & Distance Support

OSD Great Ideas Program

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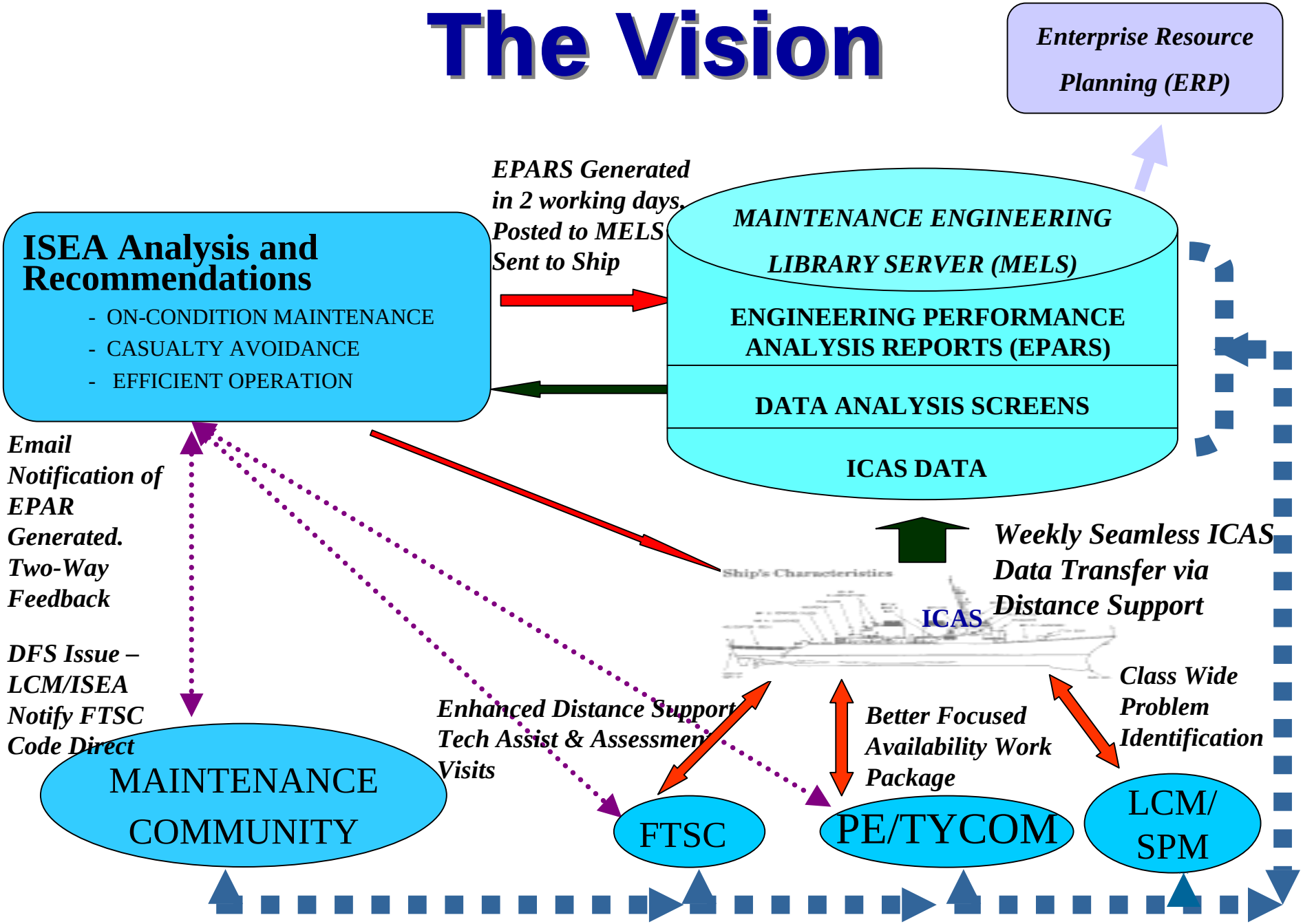
The Vision


Enterprise Resource Planning (ERP)
EPARS Generated in 2 working days, Posted to MELS Sent to Ship
ISEA Analysis and Recommendations
- ON-CONDITION MAINTENANCE
- CASUALTY AVOIDANCE
- EFFICIENT OPERATION
MAINTENANCE ENGINEERING LIBRARY SERVER (MELS)
ENGINEERING PERFORMANCE ANALYSIS REPORTS (EPARS)
DATA ANALYSIS SCREENS
ICAS DATA
Email Notification of EPAR Generated. Two-Way Feedback
DFS Issue – LCM/ISEA Notify FTSC Code Direct
Weekly Seamless ICAS Data Transfer via Distance Support
Ship's Characteristics
ICAS
Enhanced Distance Support Tech Assist & Assessment Visits
Better Focused Availability Work Package
Class Wide Problem Identification
MAINTENANCE COMMUNITY
FTSC
PE/TYCOM
LCM/ SPM
Web Access to MELS

What is ICAS?

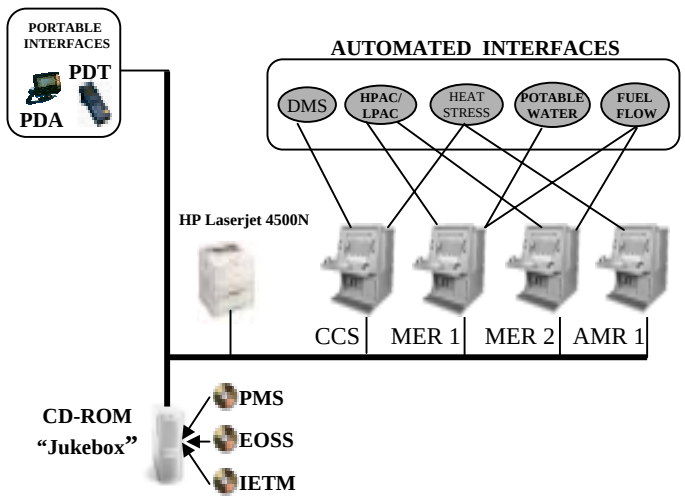
Navy's approved COTS NDI system for on-line automated machinery condition monitoring and assessment supporting Conditioned Based Maintenance (CBM)

ICAS Software

Shelltop
- GUI
- Analysis Engine
- Router

Configuration Data Set (CDS)
- Engineering Knowledge
- List of Equipment
- Alarm Thresholds
- Logsheets
- Expert System
- Event Capture
- Trend definitions

Typical DDG 51 Installation



Currently installed on over 100 Naval vessels and sites

ICAS in DOD

- Navy
  - Currently installed on over 100 vessels and land based sites
  - Endorsed by NAVSEA 08 for monitoring primary and secondary plants on submarines and nuclear aircraft carriers
    - Prototyped aboard USS VIRGINIA, USS NORFOLK and USS MEMPHIS
- Army
  - ICAS prototype installed LCU-2000 Class
  - Continuous dialog with Army Diagnostic Improvement Program (ADIP)
    - ICAS demonstration provided
- Marine Corps
  - AAAV
    - Prototype installed at Allison Transmission plant for evaluation.
- ONR
  - ICAS is installed on Yard Patrol (YP) craft
- FMS
  - ICAS is installed in Spanish Navy Intermediate Maintenance Activity (IMA)
  - ICAS is installed on joint U.S./Australian Fast Ferry

ICAS Navy Program Relationships

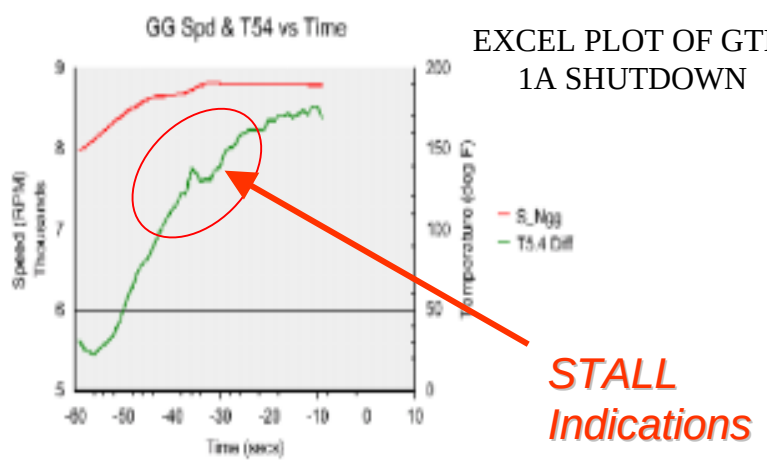
- **Ship Building & Conversion Programs:** CG-47 ISC, Smart Carrier, LPD-17, DDG-51, MCM-1 ISCS
- **Logistics:** EOSS, PMS, Tech Manuals, ERP, OMMS-NG, PMS SKED, SOMS (Tag Out), Distance Support, Sailor to Engineer
- **Programs & Initiatives:** SEMAT, INSURV, Gas Turbine CBM, SURFMER, Newport News Shipbuilding CBM Initiative
- **Activities:** CINC's, Type Commanders, NAVSEA, SUPSHIP, FTSC, ONR, NSWC's, OEMs

ICAS Functionality

" Event Capture / Remote Tech Assist "

Problem: While underway, USS SHILOH (CG-67) experienced a problem with #1A GTM Engine.

Operational Capability: Using the *ICAS Event Capture* feature, Ships Force plotted the unexplained engine shutdown. Ships Force then utilized the *ICAS Data Download* function to export the data (plots) into a Comma Separated Value (CSV) format. The CSV file was imported into a Microsoft Excel Spread Sheet for review. The graph in the lower left represents the file from USS SHILOH (CG-67) which was emailed to FTSCPAC for a *Remote Tech Assist*. FTSCPAC Tech Rep was able to detect an engine stall based on the this data.



EXCEL PLOT OF GTM 1A SHUTDOWN

Figure 2c - Rising difference between actual $T_{5.4}$ and estimated $T_{5.4}$ for stall #2

Plot taken from a FTSCPAC report on USS SHILOH STALL 6/21/00

Benefits:

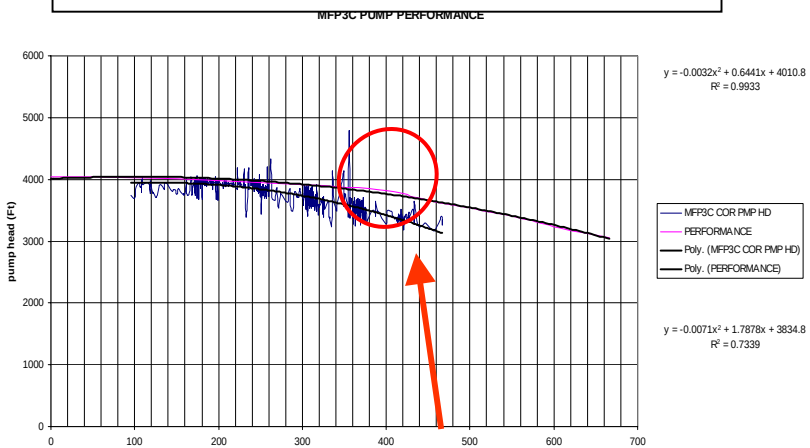
- ***Increased Mission Readiness/ Ao*** - GTM downtime minimized.
- ***Decreased Maintenance/Workload*** - SF was able to identify issue, FTSC was able to use ICAS data to identify problem.
- ***Decreased Tech Assist Cost/Remote Troubleshooting*** - Tech Rep was able to use captured data to analyze problem. Data is emailed from ship (No travel cost). Reduces need for test equipment.

ICAS Functionality
"Trending"

Problem: Ships Force aboard USS KITTY HAWK indicated that #3C Main Feed Pump performing poorly. Unit was included into the Ships Work Package for Depot Level maintenance action (overhaul).

Operational Capability: Ships Force identified #3C MFP for overhaul based on poor performance. During Work Package Development the Type Commander requested validation of the recommendation based on ICAS data. Tech Reps utilized ***ICAS Trending*** feature to plot Head vs. Flow. Initial indications were worn impeller or wear rings, as suspected by ships force. However, unit is turbine driven. Tech Reps also plotted control air vs. turbine speed (lower left). This indicated control air vs. turbine speed setting was incorrect. Turbine control setting was adjusted and unit removed from work package.

3C MFP TREND FOR HEAD VS FLOW

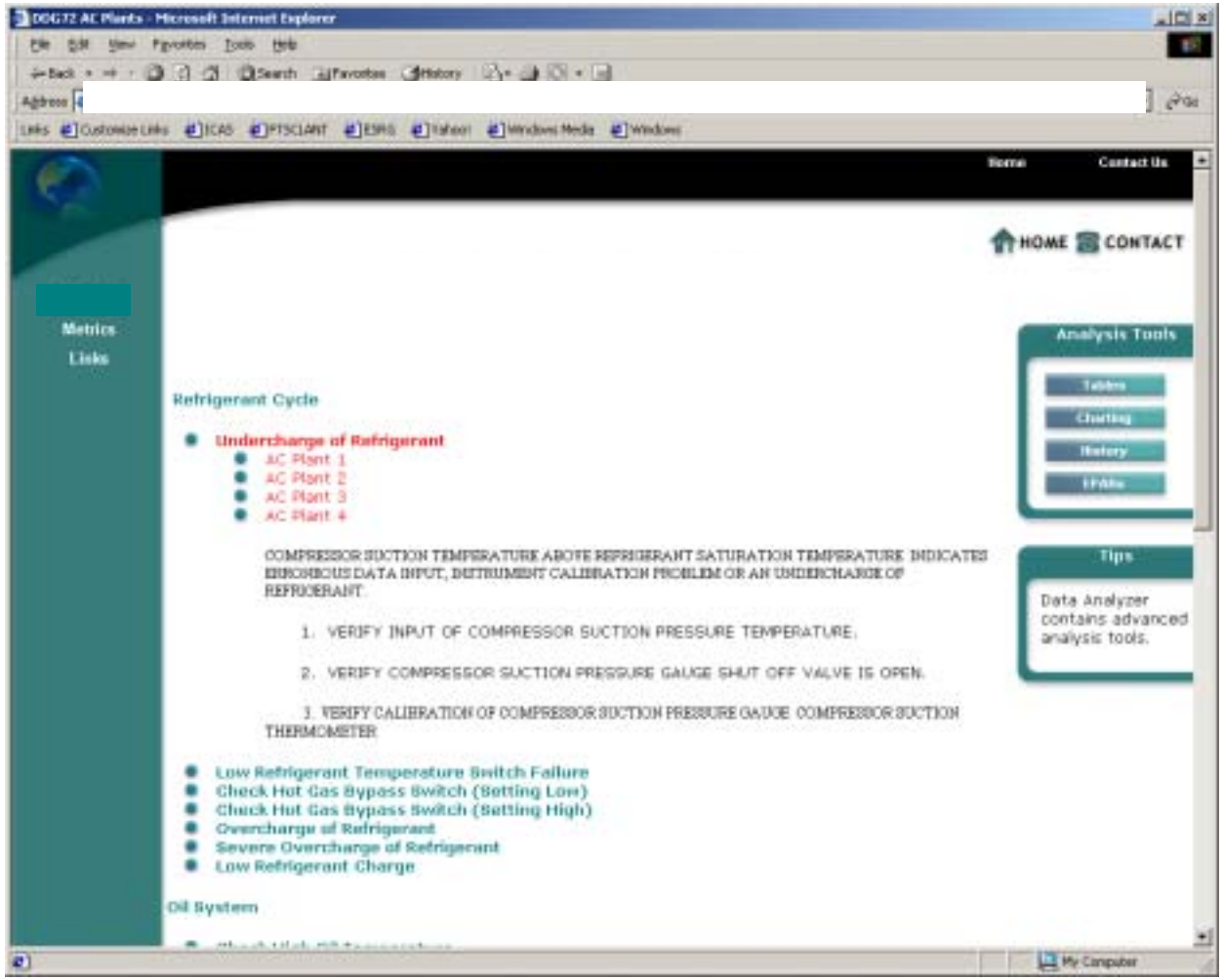


Pump performance starts to drop

Benefits:

- ***Decreased Maintenance Costs*** - A simple adjustment was made vice a costly $250K overhaul.
- ***Increased Capabilities*** - Prior to ICAS Ships Force maintenance recommendations could not be accurately validated without a costly Technical Assist.
- ***Cognizant Maintenance*** - Maintenance is done at the correct time based on condition.

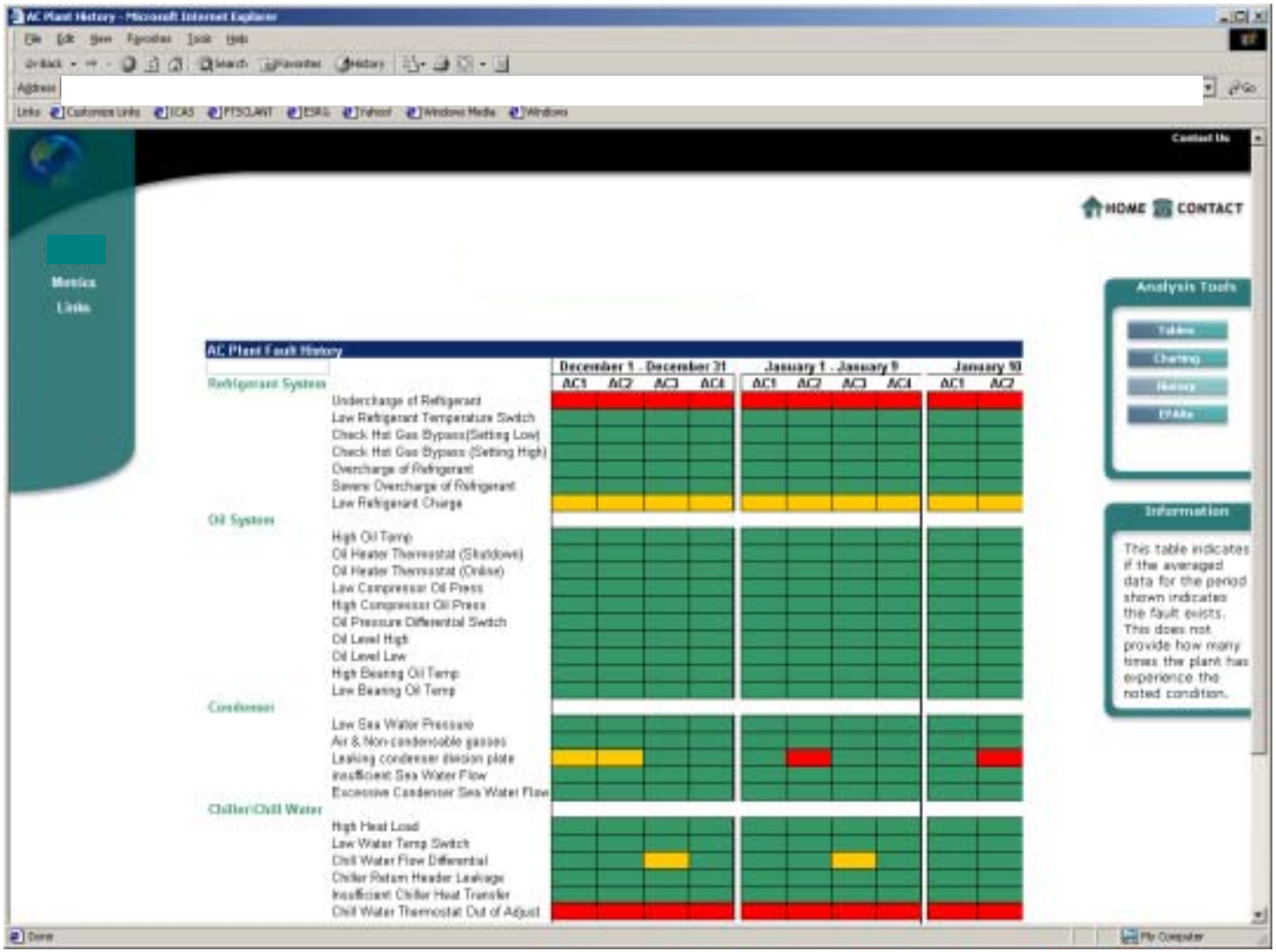
DDG-51 CLASS SEMAT II Visit



The AC Plant faults are accessible on this page. In addition to current fault status, the advisory actions are displayed for each fault which allows for the ship's crew and SEMAT inspectors to communicate necessary preparations prior to the visit.

Analysis tools containing all available data are on the right. As details are needed, they can be accessed on the same summary page.

DDG-51 CLASS SEMAT II Visit



A running history of faults identified through data analysis enables inspectors to have an easily accessible condition history of their equipment. Based on the data history, the probability of there being a problem developing\existing with a leaking divider plate on AC Plant #2 exists and the inspector will take a closer look during the visits

CG-47 Class Summary

Shipboard Maintenance/Operations Costs

	ICAS	non-ICAS
• O-Level Maintenance*	$736K	$888K / yr / ship
• Fuel Usage	$2.9M	$3.0M / yr / ship
• Logsheet Man-hours	30,200	41,700 hrs / yr / ship

* Based on 3-M data of 10 ICAS monitored systems for the period of Jan 1999 through Mar 2002.

Shipboard Savings

• O-Level Maintenance:	$152K / yr / ship
• Fuel Usage:	$ 90K / yr / ship
• Logsheet Manhours:	$230K / yr / ship

$472K Savings / yr / ship

1998 CNA Report: Trimming Ship Operating and Support Costs: An Economic Analysis of the Integrated Condition Assessment System (ICAS)

CG -47 Projected Savings: $517 K

Projected ROI: 1+ years

Projected Class Wide Savings:

Current Savings (13 ships): $6.1M / yr

Unrealized Savings (14 ships): $6.6M / yr

Projected Annual Savings: $12.7M