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Industry Insight: Condition Monitoring & Condition Based Maintenance

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Presented by





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John Hathaway

Director, Product Management

I joined ABS in 2007 from an NS customer to influence the direction of our products. Product is my passion – continuously improving our fleet management suite to solve the key business needs of our customer

Condition Monitoring & Condition Based Maintenance

Overview

Recent Enhancements & Key Features

API

Demo New Features

Condition Monitoring & Condition Based Maintenance

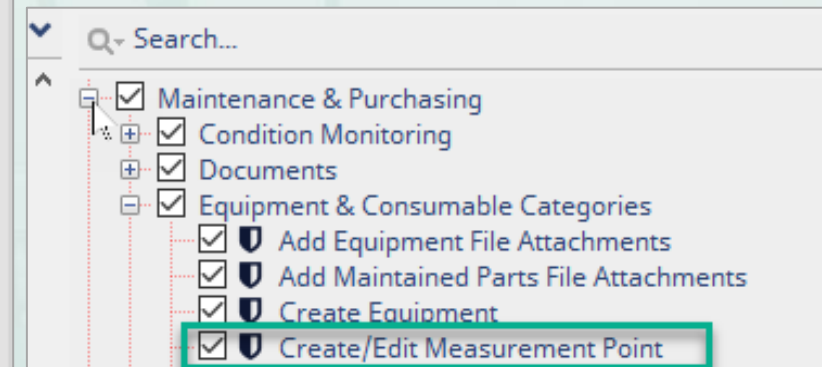
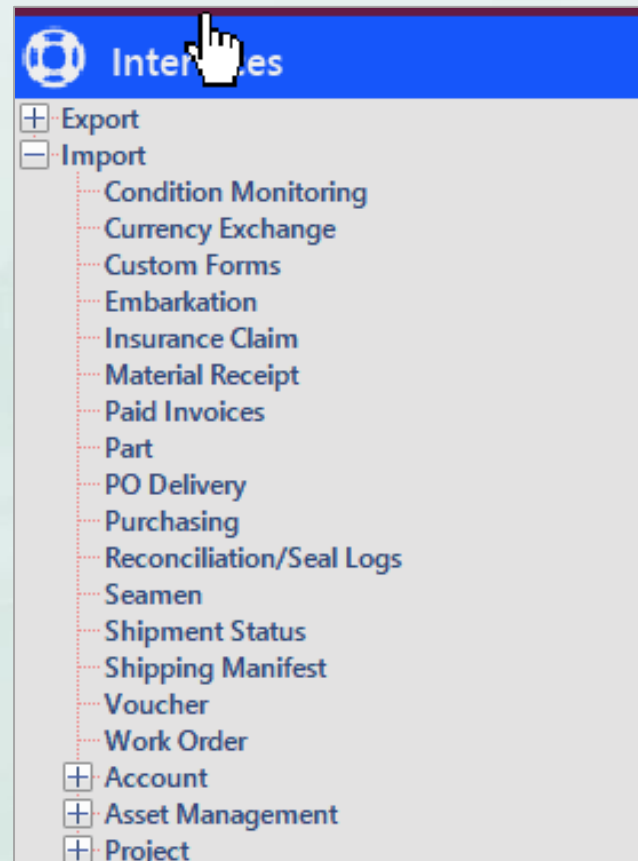


Condition Monitoring

- Condition Monitoring (CM) and Condition Based Maintenance (CBM) are practices used to track Machinery Health and running efficiency of equipment which in turn can influence maintenance schedules and condition-based maintenance/repair work.
- Manage condition monitoring types like Vibration Monitoring, Oil Analysis, Megger Readings, Infrared Thermography, etc
- Define status as reported by vendor or as defined by your organization (ie Poor, Good)
- Optionally – define measurement points for readings per equipment (vs 6.5.27)
- Configure your equipment to automate action based on condition
- Record condition
 - via condition report –provided by vendor as a summary of equipment health
 - via planned job – you capture reading and system interpret the condition and proposes action

Implementation/Configuration

- Maintenance Manager Authorizations > System Administration
- Standard Job creation with work instructions
- CM Vendors (Companies)
- Company Type
- CM Equipment Creation
- Reserved Document Numbers
- Notifications (email & internal)
- Master Data to include:
 - Measurement point
 - Condition monitoring status
 - Condition monitoring type
- Optional CM Interface



Configuration – Measurement Points

Configuration Close

OIL ANALYSIS

Monitoring Type : **Manual**

Ext. Condition Monitoring: **EXT MONITORING ID**

CM Vendor: **AMO**

Ext. Equipment Id: **10.200.31.10**

Unit of Measurement: **LT**

Condition	Ext Condition	N	Action	PM Job	Interval	Unit
MARGINAL	fair	<input checked="" type="checkbox"/>	Increase CM Frequency	OIL ANALYSIS - 1 MONTHS	20 Days	
SATISFACTORY	good	<input type="checkbox"/>	No Action			
UNSATISFACTORY	poor	<input type="checkbox"/>	Schedule Overhaul Job			

Measurement Point	Ext. Measurement Point	Condition	From	To
TOP SIDE	MP 1	MARGINAL	15.000000	20.000000
		SATISFACTORY	10.000000	15.000000
		UNSATISFACTORY	20.000000	0.000000
MID SIDE	MP 2	MARGINAL	10.000000	15.000000
		SATISFACTORY	5.000000	10.000000
		UNSATISFACTORY	13.000000	0.000000
BOTTOM SIDE	MP 3	MARGINAL	5.000000	10.000000
		SATISFACTORY	1.000000	5.000000
		UNSATISFACTORY	10.000000	0.000000

- Released in vs 6.5.27
- General Data > The measurement points are available under Machinery Measurement Point
- Measurement point can be associated with one or many CM Type
- Manual or automated collection of data based on measurement points

Work Order

Work Order - New

File Process Reports Help Condition Monitoring

Created Completed Closed

Ship: MV NORTHERN BAY Perform By: WO/Crew Priority: D ☐ SI Replaced ☐ Failure ☐ Condition Based **PM Job**

WO/SR No.: AUTOGEN Title: OIL ANALYSIS

Scheduled: 03/01/2022 Due: Equipment: F.O. VISCOTHERM

Completed: Ext: Counter: ☒ Event ☐ Drydock

Questionnaire: Identifier: ☐ Findings Required ☐ Table Entries Required ☐ Further Action Required

CM Type: OIL ANALYSIS

Description JSA/Work Permit Work Certificates Findings Questionnaire Observation Admin Info **CM Readings** Materials Certificates Resour

Equipment	Condition Monitoring Type	Measurement Point	Unit	Readings
F.O. VISCOTHERM	OIL ANALYSIS	TOP SIDE	LT	15.0000
		MID SIDE	LT	5.0000
		BOTTOM SIDE	LT	1.0000

- Condition Monitoring WOs from the Standard Jobs or Adhoc Condition Monitoring Work Orders can record the measurements and generate the actions required from the measuring points.
- This could be to Increase PM Frequency, Create CBM Work Orders, or No Action.

Actions Based on Status

Workspace | **Maintenance & Purchasing** | Crew & Payroll | HSQE | DMS | Drydock | On Demand Reporting | Replication | I

Navigator

★ Favorites

Maintenance

- Budgets
- Equipment Explorer
- Find Equipment
- Find Part
- Maintenance Plan
- Service Explorer
- Vessel Certificate
- Class Information
- Condition Monitoring
 - Equipment Status
 - Update
- Documents
- Create
 - Findings
 - Invoice
 - Job Safety Analysis
 - Landing Order
 - Management of Change
 - Permit to Work
 - Project
 - Purchase Order
 - Request For Quotation

[21] Equipment Explorer

File Open Find View Help

Configuration

Vibration Monitoring

Monitoring Type : Manual

External CMType Id:

CM Vendor: Antares Ship Yards

Ext. Equipment Id:

Unit of Measurement:

Condition	Ext Condition	N	Action	PM
Marginal		<input checked="" type="checkbox"/>	No Action	
Satisfactory		<input checked="" type="checkbox"/>	No Action	
Unsatisfactory		<input checked="" type="checkbox"/>	Increase CM Frequency	
			Generate CBM WO	
			Schedule Overhaul Job	

Measurement Point	Applicable	Ext. Measurement Point	Condition	From
Top Side	<input type="checkbox"/>		Marginal	
			Satisfactory	
			Unsatisfactory	

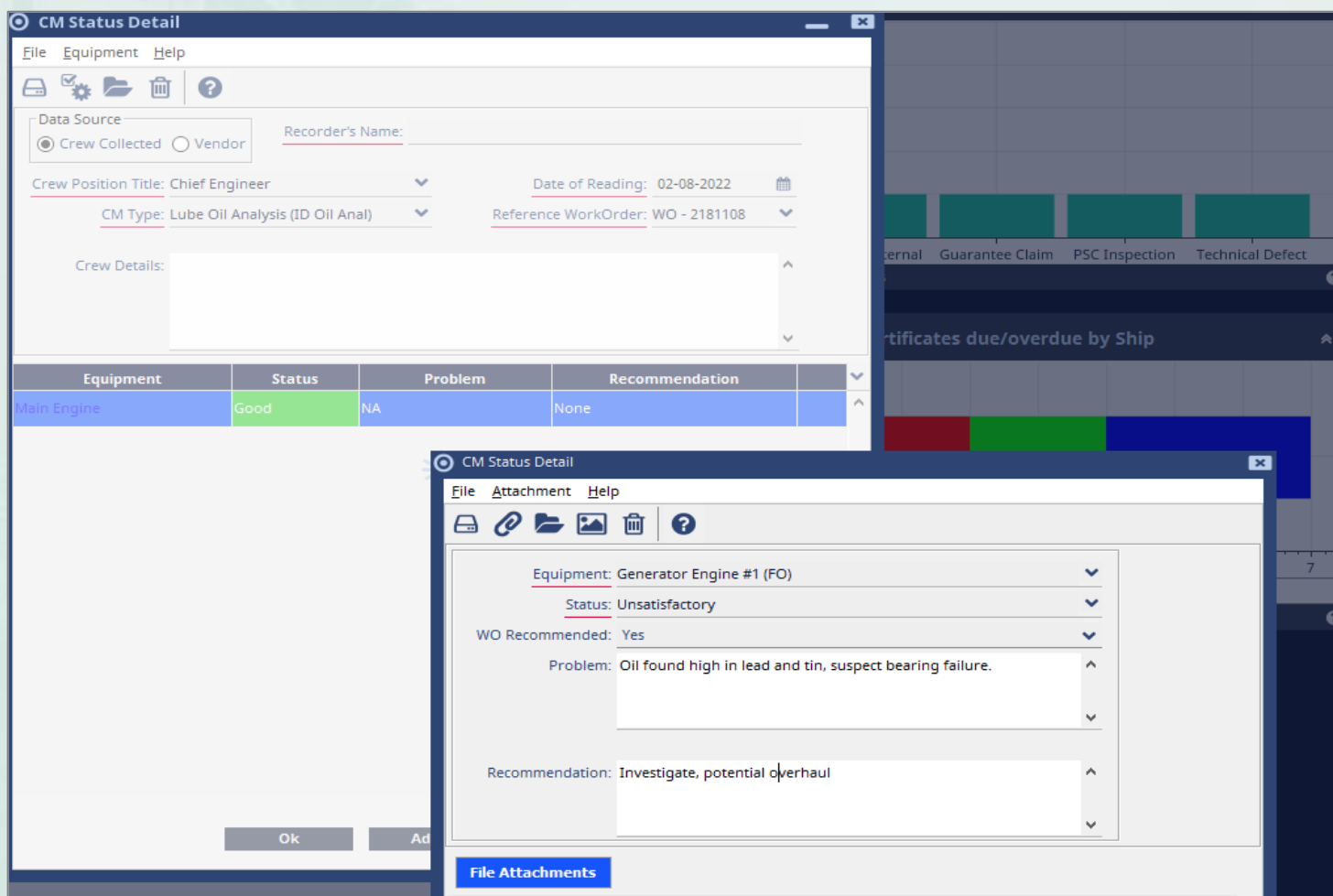
- Condition & Action based on Status
 - No Action
 - Increase CM Frequency
 - Generate CBM WO
 - Schedule Overhaul Job
- From the condition information, the maintenance schedules could be increased or decreased, and repair work can be initiated

Equipment Health Status

Machinery Health								
<div> <div>File View Documents Help</div> <div> <div> <div>Ship Filter</div> <div> <input checked="" type="checkbox"/> All <input type="checkbox"/> Choose Ship Ship: <input type="text"/> </div> </div> <div> <div>Equipment Filter</div> <div> <input checked="" type="checkbox"/> All <input type="checkbox"/> Choose Equipment Equipment: <input type="text"/> </div> </div> <div> <div>Date Filter</div> <div> <input checked="" type="checkbox"/> All <input type="checkbox"/> Last Year <input type="checkbox"/> Last Report <input type="checkbox"/> Range Start Date: <input type="text"/> End Date: <input type="text"/> </div> </div> <div> <div>Source Filter</div> <div> <input checked="" type="checkbox"/> All <input type="checkbox"/> Vendor <input type="checkbox"/> Crew </div> </div> <div> <div>Status Filter</div> <div> <input checked="" type="checkbox"/> Select All Status: <input type="text"/> </div> </div> </div> </div>								
Ship	Equipment	CM Type	Status	Source	Date	Problem	Recommendation	WO Nos.
Universe Portugal	Main Engine	Lube Oil Analysis	Unsatisfactory	Crew	28-03-2012	Excessive metal found in sample	examine engine main bearings	MULTIPLE
Universe Portugal	Generator Engine #1 (FO)	Vibration Monitoring	Fair	Vendor	01-04-2012	Vibration occasionally crossing con...	Monitor closely for deterioration	
Universe Portugal	Generator Engine #2 (FI)	Lube Oil Analysis	Good	Crew	10-04-2012	No Problem Found	No action required	
Universe Portugal	Generator Engine #3 (AO)	Lube Oil Analysis	Good	Crew	28-03-2012	No problem found	No action required	
Universe Portugal	HFO Purifier #1 (F)	Lube Oil Analysis	Good	Crew	01-04-2012			

- Machinery Health can be viewed from the Equipment Status screen or the Equipment Hierarchy
- At either Ship or Fleet Level the CM Equipment Status will show the Machinery Health which reflects the:
 - Ship (If at Fleet Level)
 - Equipment
 - CM Type
 - Status
 - Source – of the report,
 - Date
 - Problem – if found
 - Recommendation
 - Work Orders

Condition Report



The screenshot displays the 'CM Status Detail' window with the following fields and data:

- Data Source:** ☒ Crew Collected ☐ Vendor
- Recorder's Name:** (Empty field)
- Crew Position Title:** Chief Engineer
- Date of Reading:** 02-08-2022
- CM Type:** Lube Oil Analysis (ID Oil Anal)
- Reference WorkOrder:** WO - 2181108
- Crew Details:** (Empty text area)

Equipment	Status	Problem	Recommendation
Main Engine	Good	NA	None

A secondary window titled 'CM Status Detail' is overlaid, showing a detailed report for 'Generator Engine #1 (FO)':

- Equipment:** Generator Engine #1 (FO)
- Status:** Unsatisfactory
- WO Recommended:** Yes
- Problem:** Oil found high in lead and tin, suspect bearing failure.
- Recommendation:** Investigate, potential overhaul

Buttons at the bottom include 'Ok', 'Ad', and 'File Attachments'.

Condition Reports can be created/updated manually by the crew or via interface

CM Report Detail:

- Data Source
- Recorder's Name
- Crew position Title
- Date of Reading
- CM Type (One per CM Report)
- Reference Work Order (WO), this is a requirement, multiple WOs can be selected
- Crew Details if needed
- Add Equipment, multiple Equipment can be linked

Condition Report via API

```
{
  "CmReport": {
    "VendorID": 10000012,
    "VendorCode": "CM1000",
    "CompanyCode": "",
    "AddressCode": "",
    "VendorReportID": 10000012,
    "Company": "CM",
    "ShipId": 10000012,
    "ShipCode": "M",
    "ShipNo": "S00",
    "DateOfVisit": "2022-08-29",
    "ShipSpeed": 4,
    "SeaState": 12,
    "ForwardDraft": 12,
    "MidShipDraft": 12,
    "AftDraft": 50,
    "EquipmentDtl": {
      "Equipment": "Generator Engine #2 (FI)",
      "Equipment": "Generator Engine #1 (FO)",
      "ImageFile": "Generator Engine #2 (FI).jpg",
      "Performance": "Marginal",
      "Status": "Marginal"
    }
  }
}
```

Machinery Health - Universe Portugal

File View Reports Help

Equipment View **Report View**

Date Filter: Start Date: 30-08-2021 End Date: 30-08-2022

Source: ☒ All ☐ Vendor ☐ Crew

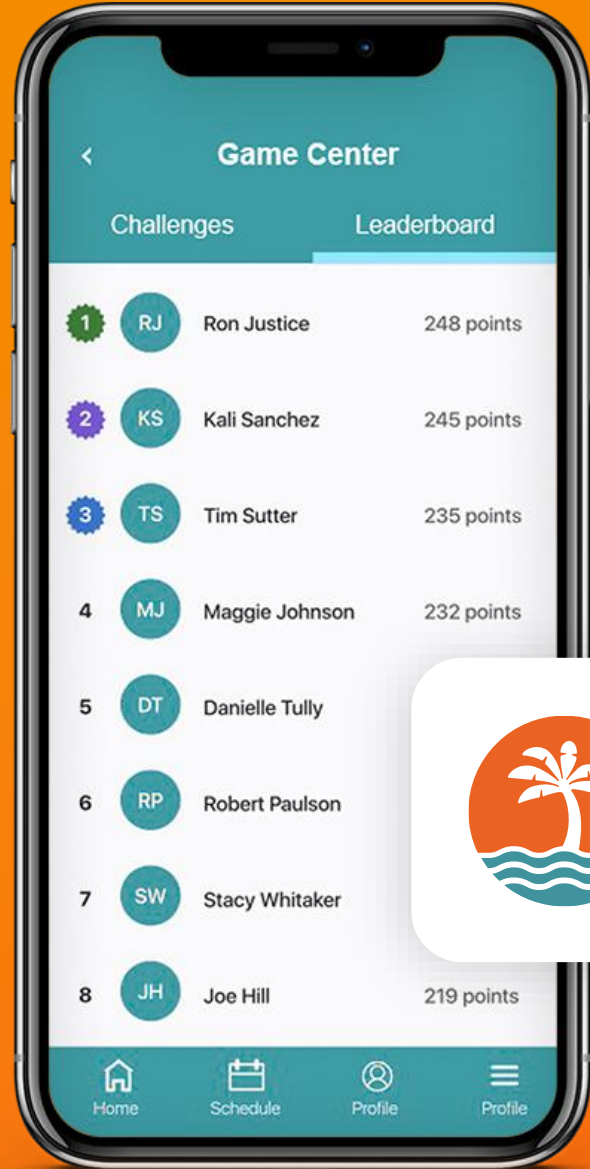
Filter By Index: ☒ All CM Type: ☐

Company	Joe4-C/E	DK-SUP	Mr X-SUP	DK-SUP
Date	2022-08-29	2022-08-29	2022-08-26	2022-08-26
CM Type	Lube Oil Analysis (ID Oil Anal)	Lube Oil Analysis (ID Oil Anal)	Lube Oil Analysis (ID Oil Anal)	Lube Oil Analysis (ID Oil Anal)
Source	Crew	Crew	Crew	Crew
Report ID	C/E-2000019	SUP-2000015	SUP-2000012	SUP-2000013
Equipment	Status	Status	Status	Status
Generator Engine #2 (FI)	Marginal			
Generator Engine #1 (FO)			Satisfactory/Good	
Main Engine		Unsatisfactory		Marginal

- Reports are fed into the system either manually or interfaced (xml)
- Images associated with the file are added if they have been placed in the same location

Demonstration





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THANK YOU

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