



# MADe PHM

MADe PHM is used to design and assess diagnostic / sensor coverage of systems based on FMECA data, enabling verification by analysis and rapid on-screen design trade studies.

## BENEFITS SUMMARY

generates optimal sensor sets for a system design based on FMECA

automatically calculates minimum sensors required for a system design

conducts testability analysis of a system design

provides alternative sensor sets for system design based on coverage requirements

rapid on-screen trade design studies based on coverage and user specified parameters

suitable for new and legacy system designs

automated reporting/compliance with customizable report templates

accommodates design geometry issues

## MADe PHM (Prognostics and Health Management)

The increasing trend towards performance based contracting (PBC) increases the focus on PHM to minimize total ownership costs for complex platforms.

Engineers performing the PHM function require advanced technology tools to assess system monitoring and diagnostic coverage and provide analysis for decision support for design and supportability constraints. It is important to be able to establish and maintain system data for multiple configurations of a platform efficiently and cost effectively.

Key issues in the current PHM process for complex systems that MADe PHM solves include:

- data quality – ensuring that coverage analysis is based on quality FMECA data for the system
- data integrity – ensuring that coverage analysis is consistent across design iterations and variations
- data currency – system data available to PHM engineers concurrently with design process from the initial concept design stage (instead of retrospectively when the design is already locked in)
- data usability – optimising workflows and reducing design costs using a standardised system model that can integrate with other analysis tools and reporting systems

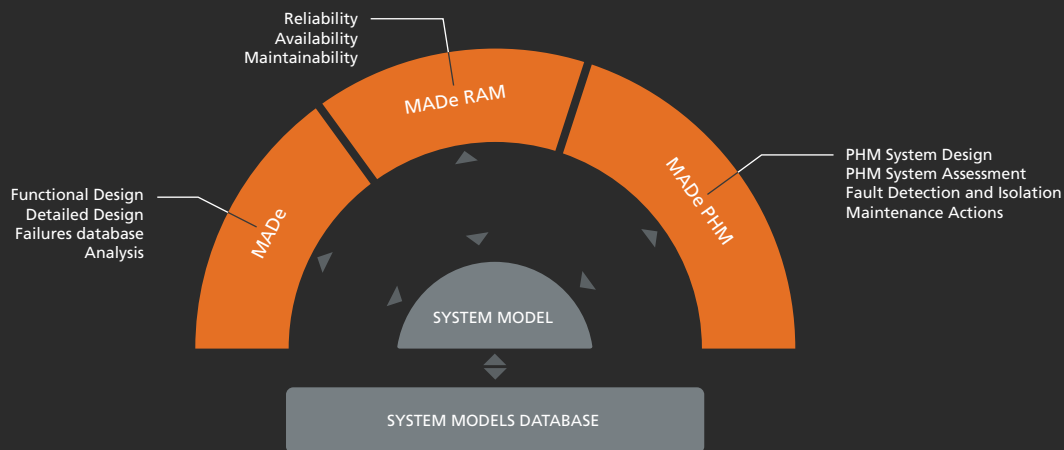
## What is MADe PHM?

MADe PHM offers next generation software tools used for engineers performing or analysing the CBM, HUMS, diagnostic, health management and PHM functions for mission and safety critical systems.

Using MADe system models and failures data, MADe PHM enables the user to design combined sensor sets for new or legacy systems and compare the financial and engineering parameters for each set (e.g. cost, weight, reliability, etc.).

MADe PHM can be used at all stages of the design process (concept, configuration, detail, technology refresh, upgrade) and is optimised for PHM engineers that are using aggregated data to analyse complex, integrated, multi-domain systems (mechanical, hydraulic, electronic).

## The MADe Suite



### Why use MADe PHM?

As mission and safety critical systems become increasingly complex engineers require advanced technology tools to design and assess diagnostic systems and provide analysis for decision support in relation to total ownership costs (TOC).

With the trend towards 'performance based contracting' (or 'contracting for availability') the importance of the PHM function continues to rise. It is important to establish and maintain system data for multiple configurations of a platform efficiently and cost effectively and to ensure quality assessment of the TOC for a system and its variants.

MADe PHM provides the tools to design and assess monitoring and diagnostic (performance) based on system-wide responses to failure modes originating from lower hierarchy levels.

#### Sensor Set Design

MADe PHM uses a model based approach to sensor set design and analysis. The results of failure simulations identify the system-wide responses to each component failure mode.

These 'failure syndromes' are processed by a minimisation algorithm which identifies which syndromes can be used to uniquely distinguish between component failure modes to achieve the required FDI with a minimum of sensors.

#### Testability

MADe PHM enables the user to assess the testability of a system (in terms of percentage failure coverage) by using the signatures of failure within the system, and assessing the ability of a sensor set specified by the user to detect these signatures.

Failure modes that are not covered by a specified sensor set are identified and reported, MADe automatically suggests the additional sensors that can be used to achieve the required coverage and resolve ambiguity groups.

#### Trade studies & what-if analysis

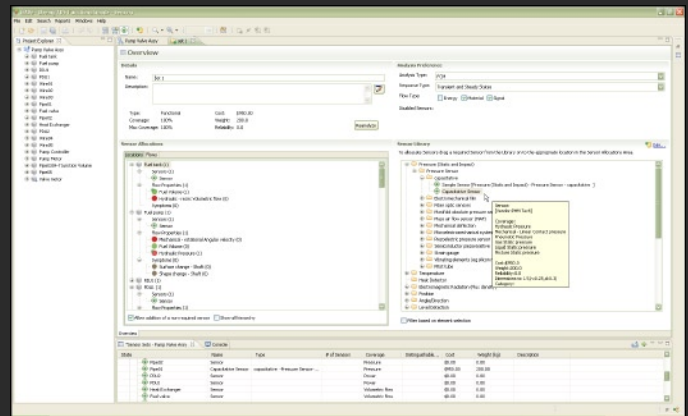
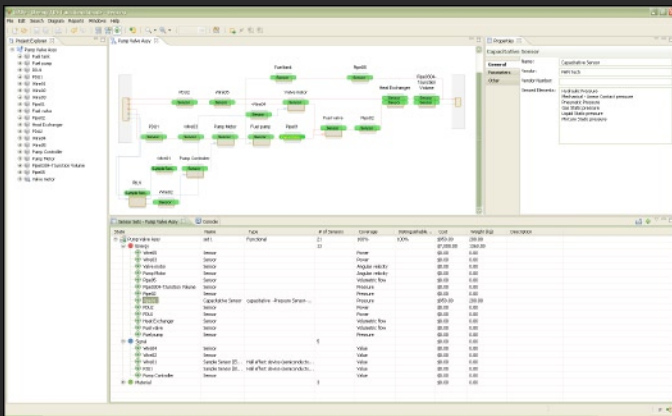
MADe PHM enables the user to conduct rapid on-screen 'what if' analysis for a specific sensor set based on user specified parameters (eg. aggregated cost, weight, reliability of each sensor in the diagnostic set).

MADe PHM also enables the user to identify the failure modes that are not covered by a legacy sensor set and automatically specify additional sensors that can be used to achieve required coverage levels and resolve ambiguity groups.

#### Sensor Library

MADe PHM provides the user with a library of sensor types as the basis for allocating specific sensors to a system. The library automatically filters the available sensor types for the user to review (and allocate) based on the system responses that are to be monitored.

The MADe Sensor Library is rapidly populated based on vendor provided specifications and can be customised for a specific organisation, project, platform or model variant of a system.



### Benefit Summary

Key benefits of MADE PHM include:

- sensor coverage calculated based on system FMECA data for a system design
- automatically calculates minimum sensors required for a system design
- conducts testability analysis of a system design
- provides alternative sensor sets
- accommodates design geometry issues (e.g. user can preclude a location within the system from having a sensor if it is difficult to access)
- rapid on-screen design trade studies based on coverage and user nominated parameters (e.g. weight, cost, reliability, etc.)
- suitable for new and legacy system designs
- automated reporting with customizable report templates

### Feature Summary

Key features of MADE PHM include:

- generates diagnostic sets that can be used in other applications (e.g. as the input for a Model Based Reasoner).
- sensor library that can be customised by the user to include only sensors from 'approved' vendors
- uses existing MADE system models to generate analysis
- automated export protocols for failures data (XML, CSV) to other analysis & decision support tools
- detailed failures databases optimised for PHM function based on parts, components, assemblies and systems
- extensible & reusable library of parts, components and systems

### MAde PHM (Enterprise version)

MAde PHM can be customised to meet the specific internal processes of a client, including configuration management, design approvals, knowledge management, PLM and QA.

Customisable features include user access rights (e.g. design authority), data segmentation (internally or from the supply chain) and reporting formats.

For enterprise implementations, specific application program interfaces can also be developed or provided to facilitate automated legacy data capture (e.g. CAD data), ensuring that the data MADE PHM generates integrates with the organisation tool suite of other engineering tools.



### MADe software

PHM Technology provides data generation and decision support tools that enable designers and discipline specific engineers to achieve concurrent engineering.

The Maintenance Aware Design environment ('MADe') is an integrated suite of software tools designed to meet the practical engineering requirements of design, RAM and PHM.

The other modules that make up the MADe suite are:

- MADe is used to model and analyse system behaviour in response to potential failures – provides a system model that can be used to generate FMEA and FMECA data for design, RAM and PHM
- MADe RAM (Reliability Availability and Maintainability) is used to generate and analyse system reliability, availability and maintainability assessments

MADe offers significant engineering, productivity and process improvements over existing customer solutions, and can be implemented on a single user, network or supply chain basis.

### PHM Technology Services

PHM Technology provides value-added support and integrated services to ensure that the implementation of MADe for projects, programs and organisations is successful and that customer goals are met.

The services provided by PHM Technology and its technical partners include:

- Project Management
- Data Migration
- Training
- Technology Consulting
- Solutions Delivery
- Customer Support

### Company Overview

PHM Technology (est. 2006) is an advanced engineering technology company that has developed a range of decision support tools for complex engineering systems that are mission / safety critical.

While MADe is a stand-alone application, enterprise versions can be customised to meet the specific process requirements and protocols of OEMs and their supply chains.

The first customer for MADe was the Joint Project Office of the JSF program.

MADe has users in the EU, UK and US.

### Quality Products and Services

PHM Technology understands that its customers require reliable long term software solutions to support complex business and engineering needs.

PHM Technology is committed to delivering high quality software products and services to its customers.



#### Head Office:

Level 1 / 15 Pickering Road  
Mulgrave, Victoria 3170 Australia

#### Phone

Australia - (03) 9561 0700  
International - (+61) 9561 0700

#### Fax:

Australia - (03) 9561 0199  
International - (+61) 9561 0199

[www.phmtechnology.com](http://www.phmtechnology.com)