

# MADe Maintenance Effectiveness Review (MER)

## Analyse and improve your maintenance program.

### Key benefits

- ▶ Conduct trade studies– ‘Is there a better way (faster / cheaper) to maintain this component?’
- ▶ Model-based approach enables a continual improvement process
- ▶ Risk mitigation for critical and catastrophic failures
- ▶ Knowledge capture / management for the sustainment organisation

### Key features

- ▶ Automated identification of critical items based on a reliability threshold
- ▶ Adaptability (configurable to integrate with an organisation’s engineering processes)
- ▶ Configurable library of maintenance actions
- ▶ Structured reporting / charting of proposed vs. existing maintenance

**The Problem:** When it comes to maintenance and failure management, the key is to possess the “right information in the right time and act accordingly”. The optimal maintenance strategy seeks to eliminate unnecessary maintenance and refine maintenance frequency – thereby reducing the cost of sustainment. It is difficult to identify the most efficient maintenance strategy for a platform in design, as changes in operating modes or environments can have a material effect. The optimal approach is to collect and use operational data to continually refine the maintenance, to constantly improve the maintenance and continually decrease costs.

**The Solution:** The initial determination of maintenance periodicity is based on expected inherent reliability, which should be updated using operational failure rates as the data becomes available. Maintenance Effectiveness Review (MER) using a Back-fit RCM methodology enables the maintainer to identify and prioritize unreliable items and optimise their maintenance in a configuration managed process. MER offers potential cost, schedule and technical benefits to the sustainment of complex platforms.

### Identify poor performing components and optimise the current maintenance

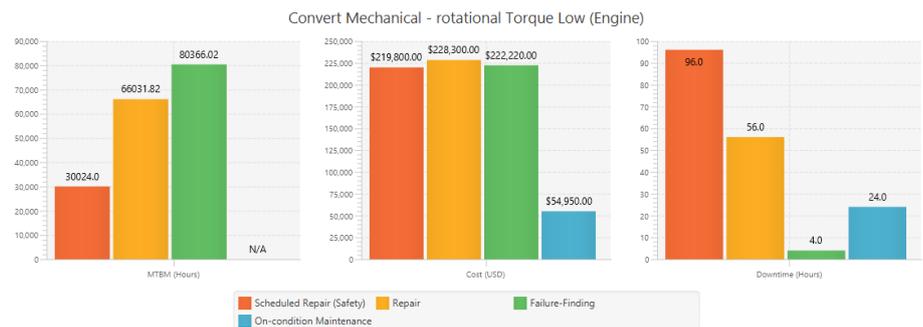


Figure 1: Comparison of existing maintenance to a revised approaches

### Why use MADe for MER?

MADe is a model-based integrated analysis tool set that enables informed Back-fit RCM decisions and maintenance trade studies to identify the most cost-effective maintenance approach for an asset based on its operating profile / environment. The MADe Back-fit RCM workflow is based on the Back-fit process defined by NAVSEA.

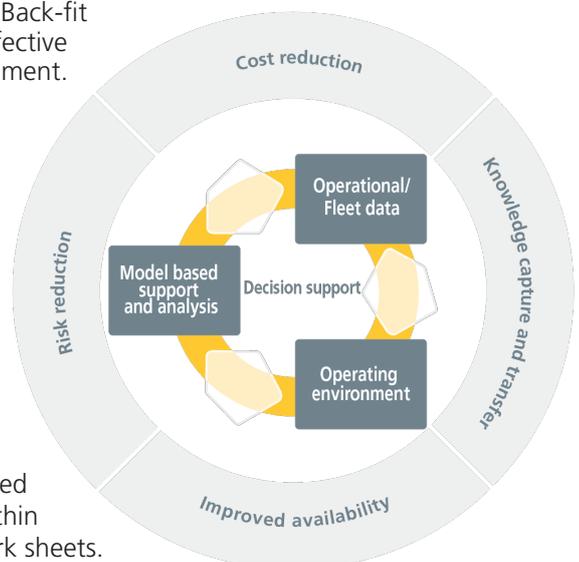
### What does MADe MER offer?

Using MADe to improve / optimise a maintenance program can:

- ▶ ensure efficient and cost effective maintenance optimisation
- ▶ optimize overall platform / system availability and reliability
- ▶ mitigate the potential technical and capability risk of unscheduled outages
- ▶ focus maintenance analysis efforts on critical / non-performing systems / components

### How does MADe MER optimise maintenance?

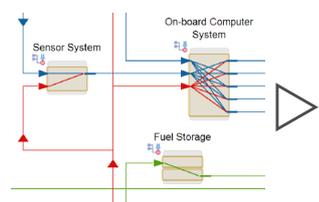
MADe facilitates a Maintenance Effectiveness Review through the structured Backfit-RCM process. Failure, Reliability, and Criticality data is captured within the MADe system model and used to auto-fill portions of the BF-RCM work sheets. MADe leverages automation and currency of data inherent to the model-based software platform to rapidly produce up to date assessment and optimisation of maintenance actions.



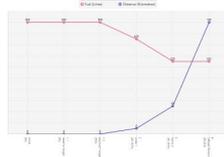
# How does MADE support the Backfit RCM approach?

## What is the expected (inherent) reliability of the system?

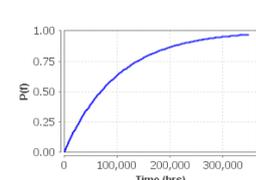
**Functional Model**



**Operational Usage**



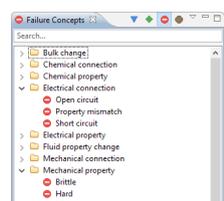
**Reliability Editor**



- 1) Functional identification: based on functional dependencies within the asset.
- 2) Operational usage: Evaluate system given assumed usage profile/environment.
- 3) Reliability editor: Enter failure rates for items with design data.

## What is the actual (operational) reliability of the system?

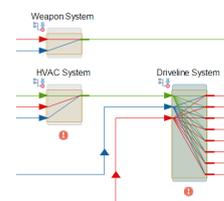
**Defect Reports**



**Reliability Analysis**

BD / RBD	Reliability	MTTF (hr)
APC Platform	0.5100080	493,705.2
Diesel Engine	0.8754612	2,091,175
Driveline System	0.8187936	1,734,605
Electrical System	0.9837929	21,255,98
Fire-Suppression System	0.8004459	1,575,299
Fuel Storage	0.9442827	6,116,207
HVAC System	0.9922112	40,020,07
On-board Computer System	0.9837929	21,255,98
Sensor System	0.9922112	40,020,07
Weapon System	0.9879065	27,921,38

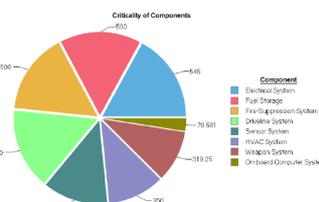
**'Poor Performers'**



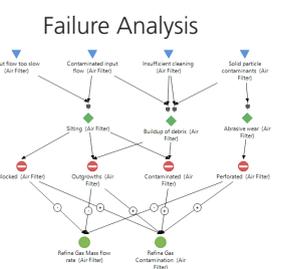
- 1) Defect Analysis: Operational failures are captured in the model.
- 2) Reliability Analysis: Re-assess reliability with operational data.
- 3) Poor Performers: Identify critical items based on acceptable limits.

## What are the failure causes for the poor performers?

**Critical Items**



**Failure Analysis**



- 1) Identify critical items in the model for failure analysis prior to Backfit RCM.
- 2) Understand the causes, mechanisms, faults and symptoms of the failures.

### What maintenance already exists?

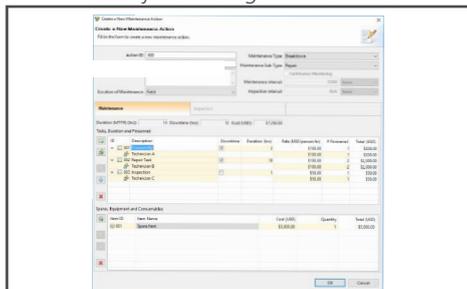
Analyse existing maintenance

### Can the maintenance be improved?

Analyse potential improvements

### What is the outcome?

Maintenance Optimisation



Detail the current maintenance action/s for the item. If none exists, a maintenance task will need to be created

Applicability of Existing Maintenance Action

**Is the Existing Maintenance Action applicable?**

Classified Maintenance Type: TIME-DIRECTED (TD)

Select the Existing Maintenance Action that applies to this failure

Time-directed Maintenance Actions are applicable only if:

- The item exhibits an increased probability of failure at some age.
- A large proportion of the population survives to that age.
- A potential failure point does not exist or cannot be measured.

Is the Existing Maintenance Action applicable?

YES The Existing Maintenance Action satisfies all of the applicability rules for the classified Maintenance Type.

NO The Existing Maintenance Action does not satisfy all of the applicability rules. Evaluate whether the task can be modified to create an applicable Maintenance Action.

Explain why the Existing Maintenance Action is applicable

Abnormal wear is linear and can be tracked in a time-directed manner.

Can the Maintenance Activity be modified to meet the applicability rules?

YES A modified task can be created to meet the applicability rules for the classified Maintenance Type.

NO It is not possible to modify the Maintenance Action to meet the applicability rules. The Proposed Maintenance Action will be set to No Maintenance Action.

Optimise the recommended maintenance task (e.g. change periodicity, procedures, remove if unnecessary)

Current Action	Proposed Action	Duration...	Downtime...	Cost delt...
002 - Scheduled replace (tyre)	004 - Condition based replace...	+605.57	-108.72	-\$17,096.11
001 - Scheduled replace (wheel)	No change proposed	0	0	\$0.00
002 - Scheduled replace (tyre)	004 - Condition based replace...	+605.57	-108.72	-\$17,096.11
002 - Scheduled replace (tyre)	004 - Condition based replace...	+605.57	-108.72	-\$17,096.11
003 - Maintenance Action	No Maintenance Action	-793.65	-793.65	-\$515,873.02

Compare recommended and existing maintenance actions based on potential cost / availability benefits.