Case Study

Information exploitation for operational advantage

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Overview

In the era of digitally enabled modern platforms, BAE Systems provides capabilities that deliver information to operators, maintainers, support staff and industry to allow for better informed decisions.

By capturing and analysing real-world asset data, we enhance engineering knowledge, to support the adoption of asset management and maintenance regimes that increase availability, reduce operational and support costs, and enhance mission effectiveness.

BAE SYSTEMS

To enable this, BAE Systems offers has a number of core capabilities including:

Systems Information Exploitation (SIE)

Systems Information Exploitation (SIE) is an on ship data hub that has been developed by BAE Systems to enable the acquisition, processing, analysis, storage and transfer of data from ship to shore; all within an environment that can meet strict security requirements. It can operate in real-time and has been designed to handle the typical high-volume, high-frequency, multiple-channel data sources that feature on modern platforms.

The adoption of open and industry standards allows SIE to acquire data from a wide spectrum of sources including ship systems, machinery control & health systems, and raw sensor data. These sources can be expanded over time to enrich the currently available data sets.

This approach allows SIE to act as a data hub allowing for the deployment of additional services, including the current BAE Systems capabilities described in this document, future capabilities and those from third parties.

BAE Systems offers expertise in the integration of SIE into platforms and guidance on what sensors and systems should be connected to maximise its benefits.

Cost and Availability Modelling

We have developed a cost and availability model to help clients assess the impact of platform availability and operating costs from changes to maintenance plans and policy. This allows clients to explore and optimise their approach to maintenance, and to quantify the potential benefits of moving to a more condition-based approach to maintenance.

Prognostics & Health Management (PHM)

BAE Systems uses cutting-edge data science techniques to analyse equipment data. Working with engineering subject matter experts we have developed Prognostics and Health Management (PHM) algorithms that derive system health scores, detect and predict the development of faults, and help to optimise when maintenance should be performed. This analysis can be conducted both onboard in the SIE environment or ashore.

Independent of the SIE solution, we offer our expertise to clients, enabling them to analyse system data sets and communicate key outputs to answer client questions or objectives.

Ship Energy Assessment System (SEAS)

The Ship Energy Assessment System (SEAS) provides vessel performance optimisation and monitoring advice to ship operators. SEAS calculates and tracks hull performance/fouling, propulsive power through different sea states, engine running configurations, and trim and displacement. This allows ship operators to reduce their fuel spend by informing them of their ship performance and facilitating more efficient planning and operation. This capability is delivered through the SIE data hub.

Previous Examples

Working with the Royal Navy, we have demonstrated how our platform knowledge, data science and analytics expertise coupled with our engineering know-how provides a high-value service which has helped to improve ship performance, reliability and most importantly availability to the fleet.

A number of active SIE trials have been installed across several Royal Navy vessels, including: Type 45 Destroyers, an Offshore Patrol Vessel (OPV), and a hydrographic survey ship.

1. During one of these trials, SIE detected a fault with an alarm on a sensor, which was causing unexpected engine shutdown and power loss on the ship. This resulted in a new sensor being designed and subsequently installed across the class of ships. This change reduces the exposure of the engine to high temperature running which may increase the lifespan of the equipment. It also provides the crew with key information to manage their ship appropriately, improving their lived experience and enhancing the reliability of the class.
2. SIE has also been used to find alternative solutions to engineering challenges. A six-week lead-time on a new OEM part for the power system of a platform would have resulted in the ship missing its return to service date and significant cost overruns. The SIE project team performed an analysis of historical data, and modelled the behaviour and performance of the component in various scenarios. With the support of this data, a short-term solution was put in place to enable the ship to safely and confidently begin its testing programme, reducing the delay by two weeks and saving substantial overrun costs.
3. Working collaboratively with the Royal Navy, SIE has been used to detect anomalies in the system performance of platforms, and has provided insights into the material state of ships during overseas deployments.

Outcomes

Providing real-time material state data to help predict and avoid faults and alert the crew of any future risks presents a huge opportunity to reduce spend on materials and labour, improve long-term planning capabilities and increase ship availability.

SIE and PHM can help to reduce the volume of unplanned maintenance. For example, over the lifetime of a platform, data from 16 systems indicates that failure avoidance could result in substantial cost savings, and task automation could amount to significant time savings for the maintainer.

Key Benefits

Through these capabilities, we provide the technology and services to:

- Enable the move **to condition-based maintenance regimes;** informing decisions and providing evidence to justify the concessions or changes to planned maintenance activities
- **Enable supply chain optimisation** in relation to material and parts requirements through predictions of remaining useful life and the changes to maintenance planning
- Provide a **live assessment of the material state** of an asset, its systems and equipment
- **More efficient utilisation of available manpower** through automation and analysis previously dependent on manual inspections and interventions.
- Use machine learning to **provide early warnings for failures** to enable interventions that avoid costly repairs
- Use machine learning to derive equipment health status and **prioritise maintenance activities**
- Provide the raw data and processed information to the owners, operators, maintainers and partners to enable **access to insights where and when it is needed**
- **Present data and information** in a way that is easy to read and understand for users across a range of technical/non-technical backgrounds
- **Increase the levels of autonomy** possible on board platforms to enable more complex systems and lower crew levels
- Develop Digital Twins that allow for decisions to be made and actioned that **optimise the operational performance** of deployed platforms
- **Enhance training management** using feedback from ship operation informs training decisions
- Improve energy management reducing fuel consumption and optimising loading of equipment to **reduce fuel costs and environmental impact**

Conclusion

Ultimately, our capability helps deliver cost savings realised through improvements to ship performance, reliability and availability.

Deployed appropriately, these capabilities can help to inform future information requirements, provide greater decision support and timely material state awareness to optimise on-condition maintenance and the provision of continuous engineering and deployed support.

This results in:

1. Better availability and performance of platforms;
2. Reduction of operating and maintenance costs; and
3. Reduction of environmental impact.

How we can help

BAE Systems can work with potential clients in a number of ways. We have previously worked under the following arrangements, but would be happy to discuss a combination of these approaches or new options:

- Provision of the capabilities directly into client platforms.
- Licencing options for the capabilities to enable clients to directly control the output and grow their capabilities.
- Lending of subject matter experts time to assist clients in developing their own solutions.

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