

briefing

A new fleet management tool for the Royal Navy

The Royal Navy plays an essential role safeguarding the UK's security and promoting its prosperity. To fulfil this role effectively, the Navy must manage its technologically sophisticated fleet in a highly efficient manner. This is no easy task, given the competing demands of operational availability and the need to update capabilities, conduct maintenance, and make necessary amendments and alterations over the lifetime of the vessels while in service.

Through KT-Box, a government-funded programme that takes leading-edge research from a consortium of UK universities, Clive Kerr and Simon Ford from the University of Cambridge's Centre for Technology Management (CTM) at the Institute for Manufacturing, have worked with the MOD to produce a software tool that helps to meet this challenge. Their focus was on the maintenance and use planning for the 13 strong fleet of Type 23 Duke class frigates - the backbone of the Royal Navy.

The fleet management challenge

Keeping a large fleet of assets in service over many years, while at the same time keeping that fleet performing optimally, is a considerable challenge. It is a challenge faced by many at the MOD, including Lt Cdr Mark James, T23 Requirements Manager. The Type 23 fleet will be in service until 2035. A lot can change over the 20 years or so time period. Gaps or shortfalls in capability may arise. Obsolescence will be a factor. New functionality may be required due to advances in technology. Routine maintenance work must also take place.

"Imagine through the ship's life, there is a certain amount of time when it is out on the ocean, and then time when we have to bring it back into port," says Mark. "Those periods are when we will often upgrade or update equipment. We have to look ahead



Image: Royal Navy Photographers

through the whole life of a ship. Look at what the ship is doing, and how we take all the different projects and enhance our capability, replace older equipment with new equipment, and how that all fits together."

The fleet, therefore, needs to be well managed in order to balance the operational demands on availability, wherever that is in the world, with the scheduling of non-fleet time, and the upkeep or maintenance cycle, when a vessel is in port to have work done on it.

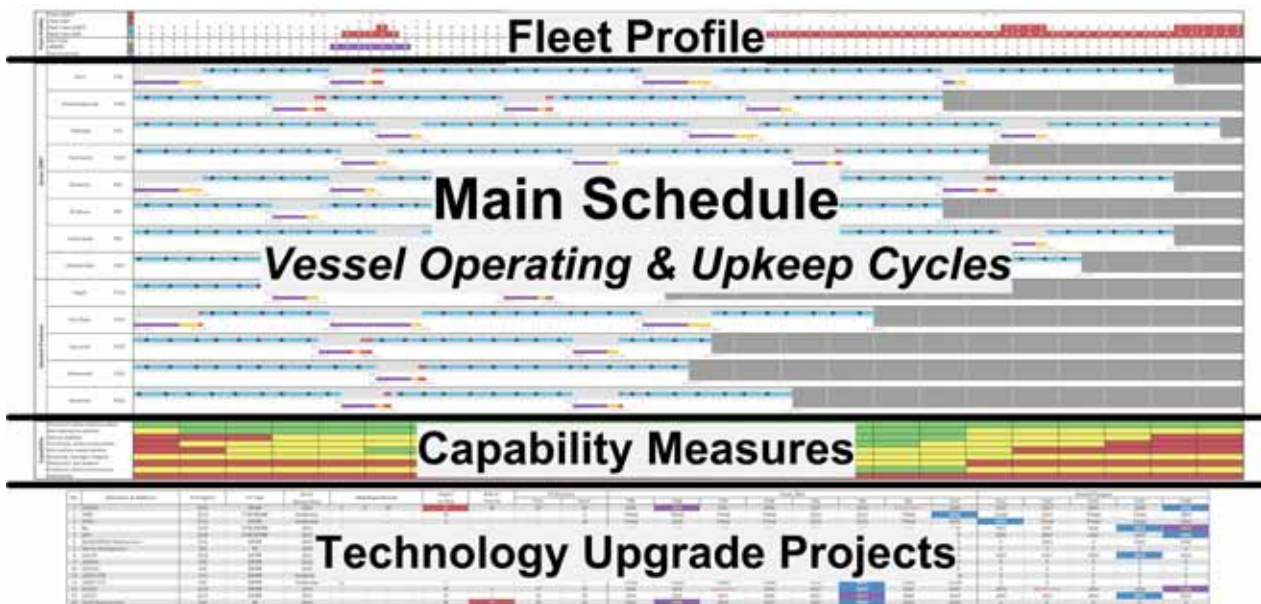
What happens when a vessel is in port has to be very carefully planned. "There is a hard window of opportunity, with a deadline attached, to install the technologies required over the next few years," says Clive. "There is always a risk that there's an attempt to do too much in that limited period. To try and implement too many technologies, for example. This in turn might lead to overrunning the time allotted for sea trials after installation."

"One of the greatest problems that we have is that if a ship's programme is affected by a defect or anything else, straight away there is a knock on effect on several other ships," says Mark. "If your ship coming out of a refit

is delayed for any reason, it means that the ship that was supposed to be coming into the refit after it, is delayed. Potentially, a ship that was deployed and supposed to be coming alongside has to stay out. That affects morale."

Clive's work on predictive maintenance and capability enhancement, as part of the EPSRC S4T project, together with research from the CTM's longstanding technology roadmapping programme, appeared to have promising potential application assisting Defence Equipment and Support to provide the Royal Navy with efficient fleet management. In particular, with the strategic technology management challenge, looking at trade-offs between different variables, and then visualising those as a strategic plan.

KT-Box funding made it possible for Clive to work with the MOD, take the generic framework and principles, and productise it as a tool. "What we require is an effective long term planning tool, which easily represents the interdependencies between projects and also ships' programmes," says Mark. "The tool helps us to visualise and understand these interdependencies and relationships, so that, for example, we are not going to suddenly fit a piece



of equipment and find it does not work because we haven't upgraded the electrics."

The tool in practice

There are three types of input into the Excel based software tool. The first is at the ship level, with a sheet for every frigate. Within the frigate input, the tool looks at the relevant maintenance upkeep cycle, operational time in the fleet, the agreed sea trials period, agreed date for handover, and an estimate of the sea trials timescale and whether it exceeds the agreed period.

The second input focuses on what activities need to take place; the alterations and additions. Essentially this is a list of technologies and systems due to be upgraded or replaced. "We list that out, and identify the dependencies with other technologies that have to be fitted first. We look at things such as the potential impact on the ship, how difficult something is to fit, how intrusive, how risky. Then there is an assessment of how long it takes to actually physically fit it on the vessel and integrate it."

Then the third input is an assessment of the capability of the fleet. Once you add new technology, hopefully it improves the overall functionality and capability of the fleet. The tool shows an assessment of capabilities across areas such as the propulsion, weapons, and radar systems.

Once the data is input, the tool maps the data onto two output versions: a complete overview from now and until 2035; and a short term view, of what is going to happen in the next six years.

"Essentially we show a project planner roadmap, detailing when the vessels should be ready for fleet time, versus when they are scheduled to be in port for a refit, and highlighting potential conflict areas, where

something is potentially scheduled in two places at once, or things that are running late," says Clive. "Then, for the capabilities, there is a traffic light system to show how things are either improving or degrading from now out to end of service 2035. While a table of technologies, shows the risks, the fit durations, the dependencies, how many ships are being planned to be fitted, and the progress, how many have already been fitted, when is the first ship to be fitted, when is the last one."

Successful collaboration

The working relationships under the KT-Box funded tool development collaboration appear to have been highly productive. "I had a very good relationship with Clive and Simon. They seemed to quite quickly understand my way of thinking. As well as having a very clear technical view of what they are trying to achieve, they could also understand a lot of the softer issues, the presentational issues," says Mark.

"We were throwing a lot of technical information at them. Once they had got a view of what we were trying to do they came up with some very sound suggestions. On the last iteration, for example, they came back to me and had added another shorter term view to the tool. And they had hit it exactly right with the timescale. That was great."

Now the tool has been successfully prototyped using representative data, how will the full tool be used in practice? It is the first time that a single system, tool or software has combined the range of functions to give a clear, concise, visual "plan on a page" to see where potential conflicts or bottlenecks are that could give rise to problems, and allowing planners to juggle the needs of the fleet, maintenance activity and enhancements, accordingly. As such, Clive suggests one specific application

will be as an input into the through-life capability plans, which are mandated for different military platforms, including the Type 23. The tool can also be used for what-if analysis, when generating fleet management plans.

The tool is currently configured for the Type 23 frigates. Potentially, however, says Clive, the tool could be usefully deployed in any organisation with a combination of a complex product service system, and assets of high value and long life, such as trains, for example.

Convinced of its utility to the Royal Navy, Mark is now conducting a stakeholder consultation exercise, before the tool can be brought into operational use. For his part, Mark is certainly looking forward to using the tool. "If it was solely down to me, I would be using it now. No qualms whatsoever," he says.

What is KT-Box?

KT-Box is a government-funded programme that takes leading-edge research from a consortium of UK universities and turns it into practical tools to support the creation and management of service operations and reduce the potential risks involved.

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