CLOCKWORK SOLUTIONS

CASE STUDY

Battle Group Thermal Imaging (BGTI) Program Assessment of Vendor Proposals

Introduction

As part of the continuing requirement to ensure that UK Forces are at the forefront of battlefield technology, the UK Ministry of Defence (MoD) asked three well-established defence contractors to offer submissions to provide Battle Group Thermal Imaging (BGTI) equipment for a fleet of 1000 vehicles. The procurement process is intended to transfer risk from MoD to industry by linking contractor payments to successful provision of spares. By guaranteeing the level of spares availability through such a payment mechanism, MoD hopes to achieve a high and predictable level of operational availability.

On behalf of the UK MoD, Clockwork teamed with LSC Group to provide a model for comparing vendor proposals for the BGTI Program.

Model Development

The predictive model had to be capable of calculating the deployment availability in the field at any point in time over a 15-year time period. Furthermore, it had to be able to calculate the probability of having a spare available when requested. The MoD considered both of these measures of effectiveness to be key elements in the tender assessment phase, although not the only outputs to be considered.

Although vendors cannot directly influence spares availability at all levels of storage up to and including first-line stores, the contractors were asked to supply proposals to provide a spares availability service at particular Primary Stocking Points (PSPs). In addition, MoD can request direct delivery to Secondary Stocking Points (SSPs). Closer to the field of operation, vendor direct delivery to SSPs reduces supply time for serviceable LRUs (lowest replaceable units) when compared to a military supply from a PSP.

The model was designed to be flexible enough to incorporate all potential variations to the support structure established by the MoD and to be able to integrate innovative solutions from the proposals by the three competing contractors.

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In addition to these requirements, the BGTI model was built to respect traditional real-life army procedures such as:

- **Prioritization of Support**. A priority state occurs when the number of spares of any type falls below a particular level at any of the common storage facilities. Within a priority state, spares are supplied only to operational deployments.
- **Batching.** Upon failure, equipment may experience an interrupted journey back to the vendor's repair facility. For each storage, location transport may be available only after a specific number of items are available.
- **Surge Period.** A surge store is included at the fourth line of support. These spares will be available only upon a surge trigger. At this trigger, utilization will increase and surge spares will be required.
- **On Request Delivery.** On request, supply is made by direct delivery from the vendor to SSPs bypassing the PSPs. A number of request delivery events will occur every year.

SPAR™, Clockwork Group's advanced simulation technology, was selected to develop the BGTI model. The main advantages of SPAR™ over other simulation packages are:

- A realistic model containing system-level and component-level information, component interaction, system operation through mission profiles, and the support infrastructure can be developed quickly;
- SPAR™ has powerful model creation tools and a fast and comprehensive Monte-Carlo simulation engine. It can handle real-world phenomena such as uncertain or incomplete data, variable demands on the system, component interactions, and variable mission lengths;
- With SPAR™, it is possible to implement time dependencies during the running of the model, for example, component reliabilities, or dealing with life components or aging issues, or variations in support. One can create logic structures that are executed automatically by the simulation engine only under certain conditions;
- Output can be tailored to monitor and display particular measures of effectiveness.

LSC and Clockwork developed a model that contains the MoD support structure and the deployment information for numerous deployments, a combination of operational, training, and non-operational deployments. Once the model was validated, we incorporated the data from each contractor's solution and performed comparison simulations.

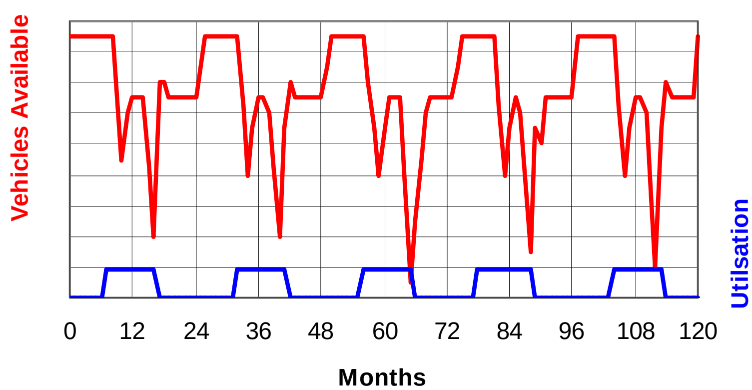
Model Output

Below, we present three examples of the outputs obtained from our SPAR™ model. It should be noted that we provided similar outputs for each vendor proposal and that we provided many more outputs than the ones shown.

1. Deployment Availability

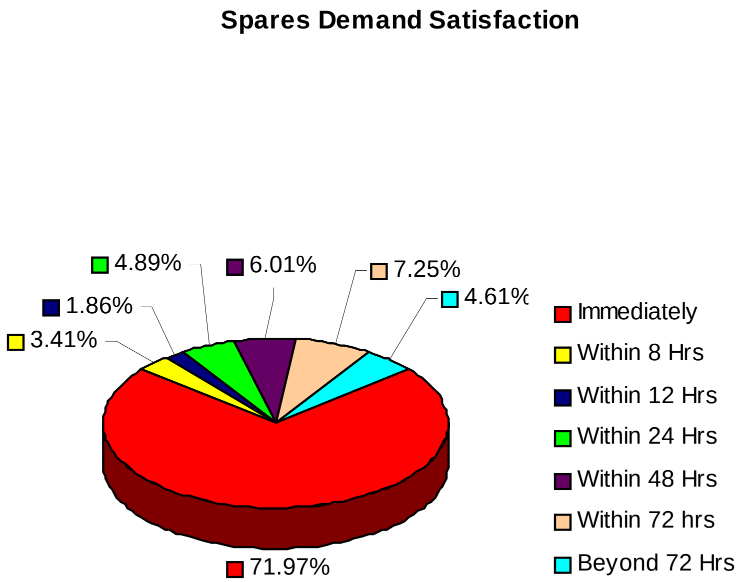
The core measurement of the BGTI model is the number of vehicles available in each of the deployments at any point in time.

The following graph shows the availability of a particular deployment. It is interesting to note that even if a similar pattern is repeated throughout the year, the deployment availability does not reach a steady state within the first ten years of in-service time. This is due to the interaction between all the deployments sharing a common fourth-line support stocking point. This interaction between brigades clearly influences the spares redistribution between deployments and is a typical real-life phenomenon which could be analyzed only with a complex simulation model like the one we built with SPAR™.



2. Spares Demand Satisfaction

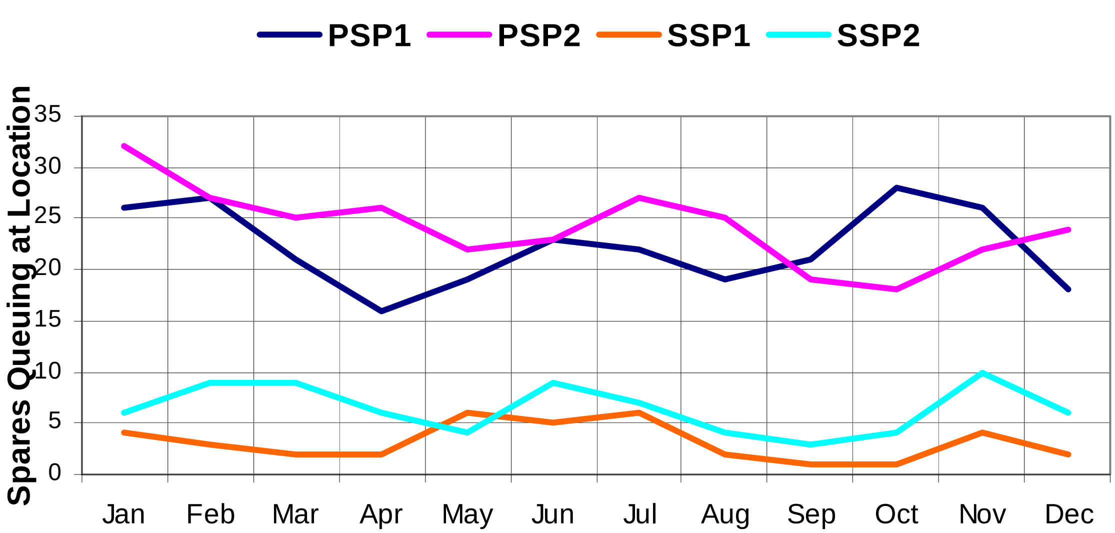
Spares demand satisfaction is used as a performance measure in the tender assessment activity. It allows the MoD to measure the total number of spares demanded and the proportion of those demands that are fulfilled within given delivery times (8 hours, 12 hours, 24 hours, etc.) at up to 20 stocking points. This key output provides a clear picture of the contractor's ability to meet MoD requirements and provides a good indicator for the payment mechanism to be set up. Spares demand satisfaction is measured on a monthly basis and therefore can point to bottlenecks in the spares flow over the service period.



3. Event Counters

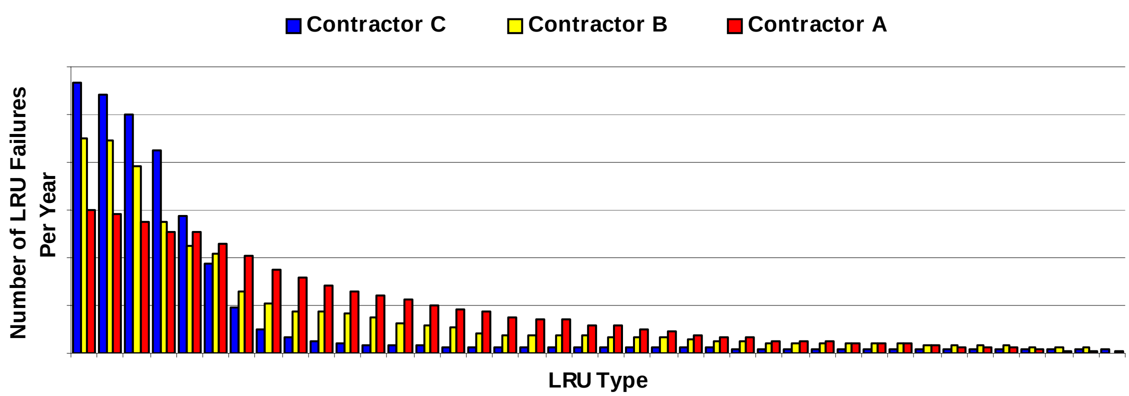
For life cycle costs, on each simulation, the model records a great number of event counters such as:

- Total number of transportations between each storage location;
- Total number of repairs per LRU type at contractor level;
- Total number of *on request* deliveries;
- Total number of spares queuing at each stocking point.



4. LRU Failures

In order to determine the specific cost of repairs across all LRU types, as well as to investigate the sustainability of each contractor proposal, the number of failures per LRU was plotted for comparison as displayed below.



From the graph, it is clear that the reliability of the system proposed by Contractor C is highly dependent on a relatively few number of LRU types – only five LRU types in their proposal are responsible for over two-thirds of the failures. In the event of an initial spares reduction or an increase in the pipeline or repair time, this would have a dramatic effect on the vehicle availability in the field. Instead, one could consider Contractor A. Although their solution might appear more expensive, the number of failures is more widely spread across LRU types making their system more robust than their competitors.

Conclusion

SPAR™ is a valuable tool in assessing the merits of logistics solutions. It provides a large variety of output parameters that allow for thorough comparison of the advantages and disadvantages of each contractor's proposal.

The kind of analyses presented in this case study could only be performed using a model that integrates the different aspects of a real life situation. It must allow for *what if* scenarios in order to enable full investigation of all aspects of a project within a reasonable time frame. SPAR™ achieves this capability through its inherent rich feature menu, flexibility, and adaptability, and through the formidable power of its simulation engine.

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