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Spares Analysis of a Helicopter Fleet

Requirement

To evaluate the effect of two different spares modelling techniques on the fleet availability.

The two modelling techniques were:

- A single item fill rate model
- OPUS

The scenario included both base and deployed aircraft, with four echelons of support.

The target aircraft availability was 80% with a budget constraint.

OPUS was used to:

- **Evaluate the existing modelling approach and the spares allocation**
- **Calculate the optimal cost effective spares allocation**
- **Evaluate the support philosophy**

Benefits Achieved

The evaluation showed the existing approach to be significantly limited with no ability to spare to budget or aircraft availability targets.

The proposed spares allocation cost met the budget constraint, but the aircraft availability was significantly below the target of 80%.

The OPUS calculated spares allocation achieved the target 80% at a lower cost than the budget.

The study enabled the supplier to offer economic support and to be confident of achieving the target aircraft availability.

Logistic Analysis during the Acquisition of an Armoured Fighting Vehicle

Requirement

To analyse the spares and Logistic requirement for a Fleet of armoured fighting vehicles.

The peacetime support structure was fixed; however, the operator required TTW and sustained operations during wartime to be modelled.

Key performance criteria were maximum system availability and minimum life support cost.

OPUS was used to:

- **Evaluate support attenuators**
  - Stocking location
  - Transportation methods
  - Locations of depots, workshops etc
- **Determine repair policy and level of repair**
  - Location of repair.
  - Level of repair.
- **Evaluate peacetime, TTW and wartime scenario**
- **Generate a Life Support Cost**
- **Calculate the optimal cost effective spares.**

Benefits Achieved

OPUS was used extensively to improve the Supportability and Life Support Cost.

The study showed that significant savings of some 20% were achievable in spares.

The study approach provided the operator with visibility of the analysis and enabled understanding of the TTW and sustainability issues.

Spares Analysis of a Harrier GR5 Fleet

Requirement

To evaluate the effect of spares modelling techniques on aircraft fleet availability.

The modelling techniques used were:

- SIM
- OPUS

The support scenario included 4 lines of support with differing levels of repair with aircraft deployed at both fixed basis and remote locations.

OPUS was used to:

- **Evaluate existing modelling approach**
  - Space allocation
  - Ease of use
  - Flexibility
- **Calculate the optimal cost effective spares allocation**

Benefits Achieved

OPUS provided a more user-friendly approach for non-modelling specialists and enabled data and results to be checked.

The OPUS calculated spares allocation was shown to be more effective with savings of 25%.

OPUS was easily used to model ‘what if’ questions providing answers quickly and efficiently.

Logistic Analysis of a Howitzer

Requirement

To evaluate the effect of different spares modelling techniques on Howitzer availability.

The modelling techniques used were:

- A single item fill rate model
- OPUS

The peace time support structure was fixed; however, both TTW and wartime sustained operations were also modelled.

OPUS was used to:

- **Evaluate the existing modelling approach and the spares allocation**
- **Calculate the optimal cost effective spares allocation**
- **Evaluate support alternatives**
- **Evaluate TTW and sustainability requirements**

Benefits Achieved

The evaluation showed that the existing approach could not spare to budget or availability targets.

The OPUS spares allocation achieved target availabilities at significantly lower costs. Savings of some 35% were achieved.

The study enabled the operator to optimise support in peacetime and to be able to react to TTW and sustainability requirements.

Logistic Analysis during the development of a major Military Aircraft Project

Requirement

- To develop logistic support dimensioning scenarios involving various assumptions concerning peacetime operation, alert and wartime conditions.
- To assess various aircraft alternatives including F5, F16 and two versions of F18.
- To provide a basis for Life Cycle Cost based source selection and contracting.
- Various logistic analyses.

OPUS was used to:

- **Evaluate a number of operational scenarios.**
- **Evaluate a large number of system design alternatives.**
- **Evaluate a number of repair alternatives.**

Benefits Achieved

OPUS provided excellent support to the selection process.

OPUS gave crucial support in achieving the contractual Life Support Cost agreement combined with a fixed price.

The customer had access to all data thus permitting own analysis leading to better preparation for negotiations.

Considerable savings.

Since all consortium members had access to OPUS the problem of just and cost-effective distribution of spares contracts was simplified.

Logistic Analysis of a Radar System
During tender submission

Requirement

To analyse the spares and logistic support requirements for a bid submission to an overseas operator with limited logistic resources and long re-supply/pipeline times.

The radar system consisted of some 50 sub-systems deployed at a single site with a support structure consisting of a store and two repair facilities. The individual sub-systems were operated at different utilisation levels.

The operator required the following exacting performance criteria to be met:

- System availability to be a minimum of 99%
- Risk of shortage to be maximum of 5%

OPUS was used to:

- **Evaluate system design alternatives including**
  - Effect of redundancy
  - Reliability growth
- **Evaluate support alternatives including**:
  - Number and location of depots, workshops etc.
  - Stock locations
  - Methods of re-supply
- **Determine repair policy**
  - Where to repair
  - How to repair
  - Repair times
- **Calculate optimal cost effective spares allocation**

Benefits Achieved

The study provided auditable and sustainable evidence that the performance criteria could be met in a cost effective way.

A 25% reduction in investment in spares compared to the projection using the Company's existing spares calculation methods.

The study also showed that although the risk of shortage requirement could be met, it could not be achieved cost effectively. However, if the operator was prepared to accept a higher risk of shortage, significant savings in cost could be made.

Logistic Analysis of a Small Fleet of Ships.

Requirement

To analyse the logistic support and spares requirements for a fleet of 12 ships.

The support structure consisted of 2 bases, 1 in-country depot in the UK. The other preferred a solution that enabled the majority of repairs to be performed and sourced in country. The operator also required spares provisioning to be calculated for both on-board and shore based holdings. Key performance criteria were:

- Ship availability to be minimum of 95%
- Waiting time for spare parts to be 24 hours maximum

Although the support structure was fixed, ie. number of repair facilities, manpower, etc. the operator was interested in any alternative support structures that could be proved to be more cost effective.

The operator also required a demonstration of Level of Repair Analysis and Life Support Cost.

OPUS was used to:

- **Evaluate system design alternatives**
  - Determination of support critical items
  - Categorisation of items as Line Replaceable Units or Ship Replaceable Units
- **Evaluate support alternatives**
  - Methods of re-supply
  - Stocking locations and constraints
  - Types of location; repair facility etc
- **Determine repair policy and level of repair**
  - Where to repair
  - At what level to repair, eg. LRU SRU
  - Repair of discard
- **Generate Life Support Cost for a 20 year period identifying the major cost drivers**
- **Calculate the optimal cost effective spares allocation including on-board stocking.**

Benefits Achieved

This was the first occasion that the supplier had been required to perform a logistic analysis. OPUS provided a pragmatic and easy to implement solution to the problem.

The supplier was the prime contractor/systems integrator with some 50% of the build sourced by sub-contractors. OPUS was used extensively to evaluate sub-contractor submissions.

The study approach provided the operator with visibility of the analysis and re-enforced confidence in the proposed solution.

The study showed that for 95% system availability, the waiting time for spares was greater than 24 hours. A compliant solution was submitted but shown not to be cost effective. An alternative solution was recommended, saving some 20% in spares cost.

Logistic Analysis of a Training System.

Requirement

To analyse the spares and logistic support requirements for a suite of training systems for an experienced operator. The training system consisted of an instructor station, 30 student stations, video players and assorted ancillary equipment. Each station consisted of 10 sub-systems each of which had a different utilisation. The system was defined as available so long as 25 out of the 30 student stations were available.

The operator required a compliant solution against detailed specifications of the support parameters, including the support structure. However, the operator would accept a non-compliant solution if it could be demonstrated to be more cost effective. Key performance criteria were:

- Maximum system availability of 97%
- Maximum risk of shortage of 10%
- Minimum Life Support costs

OPUS was used to:

- **Evaluate system design alternatives**
  - Redundant/parallel sub-systems and items
- **Evaluate support alternatives**
  - Types of location
  - Methods of re-supply
  - Stocking locations
- **Determine repair policy and level of repair**
  - Location of repair
  - Level of repair
  - Repair or discard
- **Generate a Life Support Cost**
- **Calculate the optimal cost effective spares allocation including 'insurance' spares**

Benefits Achieved

OPUS was used extensively to improve the supportability and life cycle cost aspects of the system design.

The use of OPUS encouraged the joint participation of supplier departments, sub-contractors and the operator.

The analysis indicated those significant items with long lead/repair times that effected performance and the supplier was able to either re-design or change the support policy to minimise their impact.

The solution offered to the operator gave savings of some30% on spares and 15% on support costs compared to existing calculation methods used by the supplier.

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Source Selection for a major Life Cycle Cost Based Acquisition of Rapid Trains

Requirement

To determine the cost effective spares allocation and support organisation for the acquisition of Rapid Trains.

OPUS was used to:

- **Evaluate system design alternatives**
- **Evaluate support alternatives**
- **Calculate the optimal cost effective spares allocation**

Benefits Achieved

OPUS was used extensively to improve the supportability and Life Cycle Costs of the Rapid Trains. A simple reallocation of existing spares increased Train availability by some 50%.

Available Reference Material

"Front End Availability and Reliability Analysis for Rapid Trains"
5th International Logistics Congress, London, UK
April 5 – 6 1989

Authors: Lars Palsson, SJ
Jan Karlsson, Systecon AB

Initial Logistic Support Analysis for the Budgeting of Spares Funding for A Complete Offshore Oil Production Platform

Requirement

To determine the cost effective availability performance of the platform including maintenance costs and costs associated with production loss.

OPUS was used to:

- **Evaluate support alternatives including alternative mixtures of onboard and shore-based spares holding and/or repair**
- **Study the impact of variations in life of certain items, internal rate of interest, cost for stores and transportation alternatives**

Benefits Achieved

The analysis proved a major contribution to forming the decision basis for optimising field design and operations.

A saving of some 20% in spares investment was achieved compared to the traditional methods of analysis.

Savings of some $1m in Life Support Costs were obtained.

Studies and Analysis for the Viggen Aircraft Project

Requirement

Classified

OPUS was used to:

- **Evaluate system design alternatives**
- **Evaluate support alternatives**
- **Perform special studies related to engine support and overhaul**
- **Perform spares optimisation assortment and allocation analyses for batched contracting and production**

Benefits Achieved

The analysis showed significant improvement in cost and RAM factors. The optimal logistic support organisation was determined and the best utilisation of maintenance resources at a reasonable Life Cycle cost. Significant savings were obtained in spares investment.

Available Reference Material

Viggen Aircraft Maintainability – Maintainability Evaluation of the Engine Installation for the Viggen Aircraft
Proceedings 1975 Annual Reliability and Maintainability Symposium, Washington DC, USA

Authors L-E Dahlberg, Systecon AB
S-E Westlund, Volvo Flygmotor AB

Support to the Selection of a Major Air Traffic Control System for Norway

Requirement

To analyse the risk due to loss of critical functions. This risk should be negligible and was translated into criteria related to:

- Redundancy
- Common Parts
- Fault Detection Capability
- Regular Switch-over
- Logistic Waiting Times

OPUS was used to:

- **Evaluate Systems Design and System Configuration alternatives including:**
  - Redundancies
  - Impact of computer alternatives including special standard solutions
- **Evaluate a multitude of Logistic Support Alternatives involving**:
  - Supplier/3rd Party/Customer repair both at site and workshop
- **Create a procedure, used both by Contractor and Customer, to Support Life Cycle Cost based contracting.**

Benefits Achieved

The studies showed significant improvements due to system design and configuration changes as well as selection of the optimum logistic support approach could be achieved. Improvements of approximately £2m in Life Cycle Costs were achieved.

The experience gained during the studies laid the foundation for future procurement programs.

Available Reference Material

"Control Your Future Costs – Life Cycle Cost Evaluation of an Air Traffic Control Centre" presented at the 7th International Congress; Paris, France; April 1991.

Authors: Olof Waak et al

Logistic Support Analysis and Spares Dimensioning for a Remote Control System for Hydro Power Stations in a South American Country during Tender Phase

Requirement

To analyse the spares and logistic support requirements for a Remote Control Terminal Unit (RTU). The RTUs consist of 15 – 20 components in different configurations. A total of 40 unique RTUs are used in dispersed geographic locations.

The key performance criteria was a maximum of 48 hours downtime per year for the RTUs.

OPUS was used to:

Determine optimum spares holdings and perform sensitivity analyses related to failure rates and logistic times. Further studies involved:

- **Repair/discard analysis**
- **Different support alternatives**

Benefits Achieved

OPUS was used extensively to improve the supportability of RTU.

The analysis indicated the major cost drivers in the support policy and where possible design changes should be made or the support policy altered.

The analysis also highlighted that the initial assumptions were extremely optimistic.

Available Reference Material

"Logistics Support Analysis Effectiveness Measures – Practical Examples" presented at the 8th International Congress, Madrid, Spain; April 1 – 3 1992.

Authors: Olof Waak, Systecon AB
Tor G Isdal, Systecon AB