

PRODUCT DESCRIPTION

Introduction to SPAR™

Overview

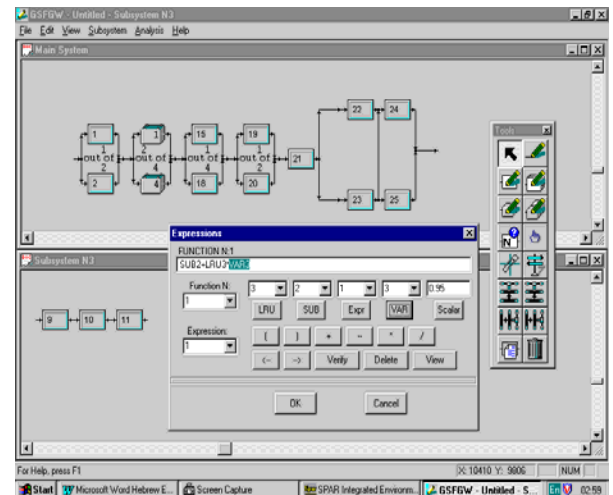
Clockwork Solutions markets, customizes, and provides technical support for SPAR—software that can be used to effectively predict and manage the performance and life cycle costs of complex systems. The user of SPAR can create a realistic model of a system that quantifies the effects of design changes, spare part availability, and preventive maintenance schedules on system performance and cost.

The performance and life cycle costs of a system are affected by several factors. Some factors are known in advance, such as purchase price, while others can vary in time and are therefore more difficult to predict. These include the mix, stock level, and order time of spare parts, repair resources, and the level of preventive maintenance. Because it is difficult to quantify the effects of these variable factors on system performance, they are often simplified or ignored altogether. Yet, it is these variable factors which frequently determine a system's reliability and cost-effectiveness.

How SPAR Works

SPAR™ technology consists of numerous extensions to traditional Monte Carlo techniques implemented in software. These extensions offer a method and tool for describing the fixed and the variable characteristics of a system in one model. SPAR™ then uses the model to predict the system's performance and cost. Variable factors addressed by SPAR models include the following:

- The structure of the system, including redundancy and reconfiguration.
- The objective for the system (throughput, availability, or safety targets).
- The operating policies of the system.
- Qualities of the system's components, such as initial age, aging rate, and repair time.
- External conditions, such as weather or power loss.
- The spare part stocking policies, including supplier lead time and part cost.
- The preventive maintenance schedules, resources required to carry them out, and their effect on the system.



Through simulation, SPAR™ establishes a relationship between these factors and a system's overall performance. A SPAR™ simulation provides a prediction of a system's performance over time, the cost of achieving that

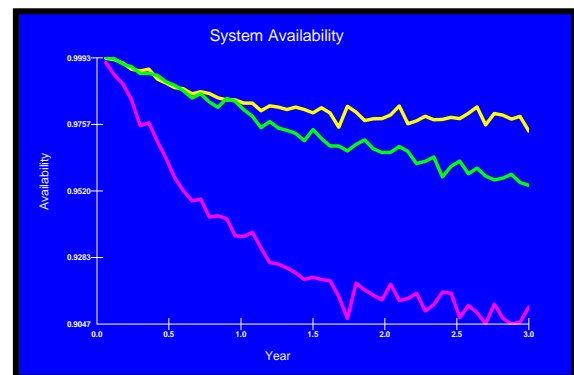
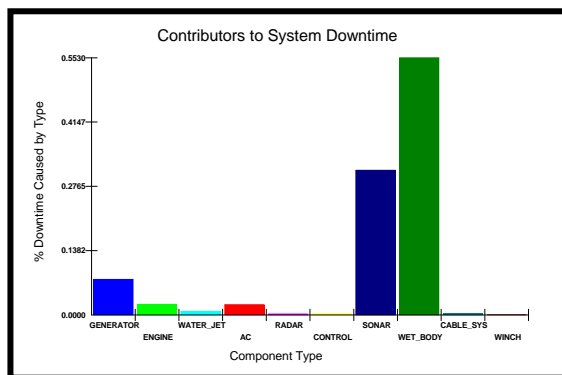
performance, and the sensitivity of the system performance to the variable factors which affect it. Through a continuing process of varying the inputs, one can trade off performance, cost, and risk.

SPAR™'s Applications Include

- **System acquisition:** How do the life cycle costs of candidate systems compare?
- **Spare part planning:** What is the mix and level of spares needed to achieve a performance target given supplier lead time?
- **Maintenance planning:** When should preventive maintenance be done to minimize cost and maximize system life expectancy?
- **Training:** In which areas should operator training be emphasized to minimize system disruptions?
- **Warranties:** What should the warranty level and duration be to assure cost-effective operation of the system?
- **Design improvements:** What is the effect on performance and cost of:
 - Change in the degree of redundancy?
 - Use of a different grade component?
 - Change in the operating policies?
- **Risk assessments:** What is the risk of an event occurrence?

SPAR™ is Unique Because

- **System-level approach:** SPAR™ relates proposed design and operations changes to system performance and cost.
- **Reliability-centered:** The basis for SPAR™'s predictions is the reliability characteristics of the individual components.
- **Monte Carlo solver:** SPAR™ uses a proprietary Monte Carlo simulator to achieve high confidence in a predicted result and to identify drivers of lost system performance.
- **An embedded internal model:** The SPAR™ Monte Carlo engine implements several internal models whose behavior can be customized by the user. This greatly simplifies the model specification.
- **Graphical User Interface:** SPAR™ models are entered graphically. Selecting from the menu of internal models provides much of the input.



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