

## **CHAPTER 4**

### **TRADE-OFF STUDIES**

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## 1. INTRODUCTION

Trade-off studies are carried out to optimize a system with respect to technical and economic factors. R&M are of equal importance to other parameters (e.g. cost, time, performance) and should not be sacrificed for short term gain. Trade-off studies are particularly valuable in the feasibility phase of a project as an aid to decision making and play a primary role in design reviews, but may be conducted at any phase of a system's development.

## 2. SCOPE OF R&M TRADE-OFF STUDIES

R&M Trade-off Studies can be regarded as:

- a) Analysis.
- b) Results and presentation.

### 2.1 Analysis

**2.1.1** In order to perform a trade-off study it is desirable to model the system, or sub-system, using as much real data as possible. At least two parameters should be considered and care should be exercised in the selection of the model to ensure that results are both compatible and consistent.

**2.1.2** Reliability can be modelled in various ways such as Reliability Block Diagrams (RBD) (PtCCh30), Monte-Carlo Simulations (PtDCh4) and Fault Tree Analysis (FTA) (PtCCh29), depending upon the nature of the trade-off and data available.

**2.1.3** Maintainability requirements will be governed by maintenance times, repair policy and the operational environment. These factors will influence the model selected. Models range from the simple specified repair times for the user through to complex Life Cycle Cost models. Consequently care should be exercised in choosing and tailoring a model to suit a given study.

**2.1.4** In the case when different models have to be used, for example when data exists on one option but the other is still at the concept or design stage, confidence limits or error bounds shall be stated for the results of any analysis or modelling in order to help in the comparison.

### 2.2 Results and Presentation

**2.2.1** As two or more situations are being compared, the results of the study should be presented in a way that allows for ease of comparison. The conclusions should be clearly stated, with the reasons and references to the text to allow the conclusions to be validated.

**2.2.2** When reliability is being traded-off against a parameter which is not directly comparable, for example if reliability is being traded-off against firepower, it is important that the comparative importance of the two parameters is clearly stated. For example, just what degradation in reliability is acceptable for a given improvement in firepower? The Project

Manager cannot make a rational decision unless he knows the equivalent value of the two parameters.

**2.2.3** It is also essential that the following are clearly stated in the report:

- a) The models used, and the reasons for choosing them should they be commercially available software packages or some form of comparison matrix produced in-house. Remember, there may be the need to compare 'apples' with 'pears' particularly when there is usage data for one solution but not for another when only predictions are available or need to be derived.
- b) The assumptions of the models. There may be the need to compare and trade off the attributes of a mature solution with that of a prototype of an alternative which perhaps has the potential of providing an improved capability or satisfies other constraints such as cost and time. In these instances the trade-off may be governed more by project consideration than those of R&M.
- c) The data sources, to enable future validation and audit. There may also be the need to support contract negotiations, bidder debriefing etc.

