

CHAPTER 31

HUMAN IMPACT ON R&M

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1. INTRODUCTION

Human error is a principal cause of serious failures and accidents, and the likelihood of such errors can be influenced by features of the equipment's design. The equipment designer's goal should always be to achieve the lowest possible level of human error.

2. SCOPE

Human reliability analysis is a method of reviewing an equipment to identify areas where the design could be improved to eliminate or reduce sources of human error. Defence Standard 00-250 covers human reliability engineering in detail and includes a comprehensive check list for designers.

3. HUMAN RELIABILITY ANALYSIS

Human reliability analysis comprises three main steps:

- a) Hierarchical task analysis
- b) Human error identification
- c) Error reduction

3.1 Hierarchical Task Analysis

Starting with a rigorous definition of the equipment objectives, the analyst identifies all human tasks required at successively lower levels down to individual task steps, e.g. power up system, check fluid level etc. Each task step is analysed in detail and the data is recorded in a tabular format such as:

- a) Stimulus - indicator lamp.
- b) Response/action - actuation control.
- c) Feedback - change of status lamp.

3.2 Human Error Identification

3.2.1 Each task step should be considered in the context of the ergonomic aspects eg:

- a) Information presentation - BITE message.
- b) Communication - intercom quality.
- c) Control layout - control type and sense i.e. light switches, up for 'off' and down for 'on.'
- d) Environment - lighting, motion, vibration.
- e) Human resources - skill levels, fatigue/stress, mental and physical.

3.2.2 Those human errors which are both credible, i.e. likely to occur, and have severe consequences should be highlighted. It may be possible in some instances to estimate the probability of human error, but data and methods on which to base such estimates are not readily available outside the nuclear and process industries. In some complex systems it may also be necessary to consider the recovery action which may follow the initial error.

3.3 Error Reduction

3.3.1 The remedial action taken to eliminate or substantially reduce the occurrence of credible errors of significant consequences, through:

- a) Changes to design - safety interlocks.
- b) Improved ergonomics - improved displays, control layouts.
- c) Improved procedures - checklists.
- d) Improved training - simulators.

3.3.2 Human reliability analysis should be carried out by the contractor during the design phase of the project. It is at its most effective when carried out by a team including human factors specialists and representatives of the operators and maintainers. The results are used to make improvements to design and training; particularly where an error rate is considered to be too high.

4. MAINTAINABILITY

Defence Standard 00-250 provides anthropometric data and other useful information which can be used to ensure that the equipment is designed to be maintained by 5th and 95th percentile males and females wearing Arctic and NBC clothing if required. The capability of the maintainer to physically perform the maintenance task should be considered at an early stage.

