

EVALUATION OF HUMAN AND ORGANIZATION FACTORS IN DESIGN OF MARINE STRUCTURES: APPROACHES & APPLICATIONS

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ABSTRACT

This paper addresses evaluation of human and organization factors in design, reliability, and quality of marine structures. Complimentary approaches to develop such evaluations are discussed. Sources of quantifications in performing probabilistic evaluations of human and organization factors are summarized.

An example is developed to illustrate application of qualitative and quantitative analyses to one portion of the design of a ship structures: Finite Element Analyses (FEA) of Critical Structural Details. Based on recent experience with FEA of CSD in ship structures, typical sources of errors in such analyses are defined and discussed. The effects of improvements in the human and organization aspects of FEA of CSD are discussed and illustrated.

APPROACHES

There are three alternative approaches that can be used to help develop evaluations of Human and Organization Factors (HOF) effects on the quality of marine structures: 1) *qualitative*, 2) *quantitative*, and 3) *mixed qualitative - quantitative*.

It is important to stress that these three approaches are complimentary. They should be used in different stages and parts of the HOE evaluation process.

In this paper, quality is defined as an acceptable and desirable combination of serviceability, safety, durability, and compatibility; a system is the combination of the individuals (humans), organizations, procedures (software), environments (internal,

external), and structure - equipment (hardware); failure is an unanticipated compromise in the desired or acceptable quality of a system; error is the unanticipated and undesired action or inaction that results in a compromise in quality; reliability is the probability that quality is equal to or greater than desired or acceptable (Bea, 1995).

At the outset, it is important to stress that the fundamental objective of evaluations of HOF effects is not the traditional engineering objective of "prediction." Rather, the objective is assessment of engineered systems to identify potential "critical flaws and situations" and identify how best to rectify the critical flaws and situations before they result in undesirable compromises in quality.

Qualitative - Subjective

The first approach can be identified as *subjective* or *qualitative*. Experience with evaluations of HOF in reliability of marine structures indicates that this approach should be the starting point for the evaluation and assessment processes (Bea, 1994a). In many cases, this approach can prove to be sufficient to achieve and assure the desired level of quality in a marine structure. This approach uses 'soft' linguistic variables to describe systems and procedures. Integration of the evaluations generally is subjective. This approach may or may not involve detailed structuring of systems and the related HOF EDA (Events, Decisions, Actions) that may influence the quality of these systems.