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Management of Human and Organizational Error
in Operational Reliability of Marine Structures

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ABSTRACT

Due to the high risks associated with the operation of offshore drilling and production platforms, the potential for catastrophic accidents are substantial. Over 80% of high consequence marine accidents are the result of compounded human and organizational error (HOE), and 80% of these accidents occur during operations. There are currently no structured quantitative analysis methods by which engineers can examine alternatives to better manage HOE in operating offshore platforms. Such methods could assist designers, operators and regulators in developing human error tolerant systems and identifying low tolerance critical paths which potentially result in catastrophic accidents. Through formal reliability analyses, the impacts of HOE and HOE management alternatives can be examined to determine how checks and balances can be assigned to reduce the incidence of HOE, and to take advantage of "early warning signs" to interrupt catastrophic compounding of these errors.

INTRODUCTION

The sources of a majority (generally more than 80%) of high-consequence offshore platform accidents can be attributed to compounded human and organizational errors (HOE) [1, 2]. These errors can occur in design, construction, and operations phases. HOE that occurs during the operations phase accounts for approximately 80% of the major incidents. Recent examples include the *Occidental Piper Alpha* North Sea platform explosions and fire (167 workers killed), and the *Odeco Ocean Ranger* capsizing off Newfoundland (84 workers killed).

Traditional engineering of marine systems has focused primarily on the structure and equipment aspects, ensuring the proper amount of structural materials is in place, suitable functioning equipment is provided, and the structure is constructible and serviceable for its intended purposes. Given that something in excess of 80% of failures of these systems are the result of human errors (Figure 1), it is timely for engineers and regulators to begin to formally engineer people and organizational considerations into design, construction, and operation of structures.

At the present time, there is no structured quantitative method to assist engineers in identification and evaluation of effective strategies to either design human error tolerant systems or include consideration of the potentials for human and organizational errors as an integral part of reliability assessments. Those critical of the use of reliability based methods in engineering structures cite the omission of consideration of the "human aspects" as a primary obstacle to meaningful applications of reliability methods [3].

This paper discusses the impact of human and organizational error on operational reliability of offshore platforms. It examine how probabilistic risk analysis (PRA) is used as a tool to evaluate the impact of HOE and HOE management alternatives. In addition, PRA modeling is a valuable tool in learning how to take advantage of "early warning signs" to interrupt catastrophic compounding through formal reliability modeling [4-6].