

## EXPERIMENTAL INVESTIGATION OF FREE-FALL LIFEBOAT PERFORMANCE

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### ABSTRACT

An investigation into the performance of free-fall lifeboats is reported. The investigation was done using model scale experiments in a test basin. Performance was evaluated using several quantitative and qualitative measures. Tests were done systematically to examine the influence of environmental conditions, as well as changes in evacuation system configuration. The experimental setup is described and key results are presented and discussed in terms of the performance of free-fall lifeboats in a range of weather conditions.

**KEY WORDS:** evacuation; free-fall; lifeboat; performance; experiment; weather.

### INTRODUCTION

Performance capabilities of a variety of evacuation craft have been investigated in an ongoing research program using experiments and numerical models. The experimental campaign includes comprehensive, systematic model tests, complemented by some full-scale trials. The research program encompasses conventional davit launched lifeboats, free-fall lifeboats, and a range of life raft types and sizes. Further, performance has been evaluated in terms of a wide range of environmental conditions, including wind, waves, and ice conditions, as well as for different evacuation system configurations (e.g. Simões Ré *et al.* 2002 & 2004, Raman-Nair *et al.* 2005, Boone *et al.* 2003). The results of the work have practical utility in terms of performance benchmarks to guide decision-making by designers, operators, and regulators. This is particularly important in goal-based regulatory regimes, which appear to be in the ascendant.

The focus of the present paper is on model scale experiments done to evaluate the performance of free-fall evacuation craft. The experimental setup is described in some detail. The basic performance of the model lifeboat is then compared to some predictions of the effects of launching parameters (Nelson & Khandpur 1992) to ensure the validity of the experimental setup. Results are then presented from a large series of tests in which the lifeboat was launched into wind and waves, for a range of weather conditions. The investigation focused exclusively on technical performance and excluded any consideration of human performance and mechanical system reliability.

### EXPERIMENTAL APPROACH

#### Scope of tests

The experimental program for the free-fall lifeboat investigated the influence of environmental factors, as well as system configuration factors. In terms of the full-scale conditions, all the launches were made from the same height (of the centre of gravity of the lifeboat) of 20m from a platform in the test basin. Three different ramp inclinations were used: 25°, 35°, and 45°. Three different nominal ramp lengths were also used, primarily to check that the setup was appropriate. The free-fall boat model was launched perpendicular into oncoming waves, as well as into bow quartering seas at 20° and 40° off the perpendicular. Most of the experiments modeled launches from an intact, undamaged platform, but a series of launches were made in conditions representing a damaged platform. Launches were made using two different lifeboat engine powers. Three different loading configurations were investigated, represented by three different positions of the longitudinal centre of mass. Five different weather conditions were modeled, from calm up to about a Beaufort 8 equivalent. In each case, both wind and waves were modeled. Further, the effects of wave steepness on the lifeboat's performance were also investigated. Tests were done in three wave steepness values – 10, 15, and 20 – to study this effect. Additional experiments were done in irregular waves and in crossed wind and wave environments.

The focus of this paper is on the first series of tests, in which the baseline configuration was used and performance was measured in the five weather conditions. The configuration is described in Table 1. The centre of gravity of the lifeboat was at 4.68m (full scale) ahead of the flat stern, denoted as position **G1** in the table. The platform was in the undamaged condition, denoted by **Lev**. The ramp angle was nominally set at 35° for all launches in this first series, denoted by **L35** in the table. A normal ramp length was used, denoted by **NOR**. A power level **P1**, corresponding to the power required to propel the lifeboat at 6 knots in calm water, was used. All launches in this set of tests were made perpendicular to the oncoming waves, which were regular waves with a nominal steepness of 20, denoted respectively by **D0**, **Reg**, and **S20** in the table. Space limits prohibit including a more thorough presentation of the results from the other test series, but these will be published elsewhere.