FIRE HAZARDS AND LIGHTWEIGHT CONSTRUCTIONS AT SEA

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ABSTRACT

The LASS project– Lightweight construction applications at sea (www.lass.nu) – aims at improving the efficiency of marine transport and increasing the competitiveness of the Swedish shipping industry. This will be accomplished through the development and demonstration of techniques for using lightweight materials for ship construction. A major (or even the major) obstacle for lightweight at sea is the increased fire hazard induced by lightweight constructions. Fire safety issues have to be solved before ship builders can utilise other material than steel and fire safety is a central theme for LASS. This article gives a background to the question of construction materials at sea and reports on the accomplishments after two years of this tree year project.

LIGHTWEIGHT CONSTRUCTIONS AT SEA

The purpose of LASS is to develop technical solutions for the construction of ships and offshore using lightweight aluminium and FRP-sandwich composite construction materials. Five different ships and one offshore living quarter module is included in the study. Three of the ships will qualify for classification for international maritime traffic in accordance with the IMO regulations of SOLAS (Safety Of Life At Sea), and the other two will be classified in accordance with the HSC (High Speed Craft) code, which primarily governs high-speed (passenger) ships in coastal traffic. The offshore module has to fulfil in particular the requirements defined by the MODU (Mobile Offshore Drilling Units) code.

Chapter II-2 of the SOLAS functional requirements speaks of "restricted use of combustible materials", while chapter II, rule 11, goes even further: "*The hull, superstructures, structural bulkheads, decks and deckhouses **shall be constructed** of steel or other equivalent material*". This text would render impossible the use of a lightweight material such as sandwich composite. There is, however, since 1 July 2002, a new rule 17 in SOLAS chapter II-2, "Alternative design and arrangements", that in principle allows any construction material, *provided* it can be shown to maintain the same safety level the ship would have if constructed in accordance with the proscriptive demands for non-combustibility. This new rule implies that the proscriptive demands can be replaced by *function-based* demands.

HSC-rated ships have already been built in aluminium, e.g. STENA's HSS ferries, one of the ships included in the LASS project (Figure 1). Composites have not been used in the same way, however, primarily due to fire-rating problems.

Figure 1 Aluminium catamaran

OBSTACLES

Apart from the purely technical obstacles, there are also obstacles of tradition to be overcome on various levels: shipping companies, designers, shipyards and other users. The best way to overcome them is to demonstrate well functioning technology for making lightweight marine constructions. This is the primary goal of LASS.

The main obstacles could in general terms be identified as:

- Technical
  - Solvable. Largest problem is fire safety.
- Tradition
  - Traditions and IMO-regulations+classification rules based on steel hinders lightweight materials.
- Cost
  - Initial cost is higher. LCA/LCC necessary for argumentation

RESULTS SO FAR

Many ships today must carry dead load also when fully loaded and the possibility of exchanging dead load for pay load is obviously very beneficial. The six objects involved in the study have been designed based on lightweight materials and it has been shown that the weight savings are substantial.

However, more advanced materials are also more expensive and a life cycle cost analysis is necessary when arguing for lightweight materials at sea. Such analysis made within LASS indicates that the extra initial cost will be turned into revenue after a few years either due to bunker fuel savings or due to an increased capacity for loading.

A scheme, or a “philosophy”, for demonstrating fire safety when using lightweight materials has been developed based on combining risk analysis with lightweight constructions that fulfils the functional requirements w.r.t. fire safety. This requires tested and certified passive fire protection and knowledge of possible fire behaviour onboard. A number of small and large scale fire tests and fire simulations have therefore been made in order to support the suggested methodology.