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ORIGINAL ARTICLE

Grounding contingency plan for intact double hull tanker

A.W. Hussein [a,*], U.M. El-Dessouky [b], H.S. El-Kilani [a], E.H. Hegazy [a]

[a] *Dept. of Naval Architecture & Marine Engineering Port Said University, Port-Said, Egypt*
[b] *General Authority of Port-Said Ports, Egypt*

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Abstract Ship grounding is a hazard which requires enormous caution when occurs. No matter how secure a grounded ship may appear, she is in a dangerous position. In most cases, rapid refloating is desirable to remove the ship from a place of danger, to reduce stress on the hull and to decrease the risk of pollution. The usual action taken is reducing the weight of the ship, which requires the help of salvage team and consequently causes high cost. Another alternative is weight transfer from tank to tank until ship refloats; this has to be done with extensive not to cause double loss.

This paper proposes practical support that would help the captain make the right decisions at the moment of the casualty. The plan is summarized in a chart which gives direction to the captain how to refloat the ship by transferring weight from cargo tanks to ballast tanks. Since the ship strength is of major concern, strength check is included in the plan. The proposed Grounding Contingency Plan "***GCP***" for intact double hull tanker is suggested to be prepared in design to facilitate the decision making for the captain and indicates the direction of action to minimize the risk.

1. Introduction

An unexpected incident, such as grounding, can lead to complex technical challenges which require fast and effective response. A stranded ship is in a position not intended by her designers, builders, or operators and is subject to very different forces and conditions than when in normal service. The grounding condition and the environment are the principal sources of forces on a stranded ship. Grounding salvage is time-critical; environmental conditions may improve or worsen with time. A casualty's condition will deteriorate fast unless appropriate action is taken. The longer a casualty is left without professional assistance, the greater the risk to staff, environment, the vessel and its cargo.

Grounding is among one of the most frequent maritime accidents, sometimes with catastrophic consequences for human life and maritime environment such as the Exxon Valdez and Costa Concordia accidents. Consequently, the rapid salvage of the ship is always mandatory and the delay of this decision may subject the ship and the environment to catastrophic consequences. The longer the ship remains in a stranded position, the higher the possibilities for a ship to suffer severe damages and a pollution event to occur.

* Corresponding author.

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If the ship is intact after grounding, there are two options for re-flotation: lightering weight or transfer weight within the ship tanks to free the ship. Weight Lightering is usually the common method to refloat the ship. The salvage team would have to discharge oil from the tanks around the grounding area until the ship is free. While weight transfer within the ship tanks is usually recommended if there are some empty tanks in the ship. This reduces the cost of freeing the ship but requires assuring that the new weight distribution will not affect the ship's stability or strength.

2. Emergency response services and problem definition

Safety at sea has improved considerably in recent decades. Greater transparency on the condition of vessels, more reliable machinery, sophisticated shipboard navigational systems and the mandatory ISM Code have contributed to higher safety standards. Despite such progress, serious accidents still occur. According to current regulations oil tankers must have prompt access to computerized, shore-based damage stability and residual structural strength calculation programs. **MARPOL** Regulation I/37(4), as circulated by Resolution MEPC.117 (52), states that oil tankers of 5000 dwt or more require access to shore-based damage stability and residual structural strength calculations. **MARPOL** 73/78 Annex I, Regulation 26 requires a Shipboard Oil Pollution Emergency Plan (SOPEP) for all tankers of 150 gross tons or more and all other vessels of 400 gross tons or more. While it does not require, it strongly suggests that, when there is excessive damage, consultation with shore-based technical assistance is appropriate before taking any action that may jeopardize the vessel [1].

US Coast Guard requirements of **Oil Pollution Act** OPA 90 in 33 CFR 155.240 for oil tankers and offshore oil barges stated that owners are required to have "prearranged, prompt access to computerized, shore-based damage stability and residual structural strength calculation programs."

The International Safety Management Code (ISM Code), Section 8, requires the company to establish procedures to respond to potential emergency shipboard situations, including the use of drills and exercises to prepare for those emergencies. The **ABS RRDA** program can be a valuable resource augmenting a company's emergency preparedness program.

Now the question is: "Who is prepared to assess the stability and residual strength of a damaged ship with the required accuracy and speed?". Some Classification societies had already offered a solution. American Bureau of Shipping **ABS** provided **Rapid Response Damage Assessment** (RRDA) program which gives the ship owner and operator with the essential technical support needed in the critical hours after a vessel is involved in a casualty [2]. A team of naval architects, marine engineers, master mariners and support staff provides the ship owner access to the professional resources needed to conduct the essential structural and stability calculations in the event of an incident that could result in the loss of the vessel, loss of all or part of its cargo or lead to pollution of the marine environment.

The **Det Norske Veritas – Germanischer Lloyd** provided the **Emergency Response Service** (ERS™). It helps in making the right decisions in case of collision, fire, grounding or other damage scenarios. It gives the technical advice: Buoyancy, damage stability, residual strength, grounding aspects, potential oil outflow, lightering sequence [3].

The Nippon Kaiji Kyokai **ClassNK** provided **PrimeShip-Emergency Technical Assistance Service** (ETAS). PrimeShip-ETAS is an emergency service designed to help ship owners and operators ensure ship safety and prevent or minimize the effect of marine pollution in the event of a serious ship casualty such as stranding, collision or explosion. Working closely with the owner and salvage team, the ClassNK ETAS team is often the brains behind the brawn, making sure that salvage operations do not make the situation worse, while minimizing environmental impact. The ClassNK ETAS team can swiftly calculate stability at damage condition and residual longitudinal strength [4].

Early in 1985, Clay [5], used a software called "Ship Hull Characteristics Program" (SHCP) to evaluate the likelihood of exceeding longitudinal strength of stranded tankers in wave. The author modeled ground reaction for hull strength calculations. The authors addressed the need to apply microcomputer technology to salvage as this would increase hull survivability and decrease the chance of pollution. It was proposed that new technologies can augment a salvor's feel for the dynamics involved in salvage engineering.

The Oil Pollution Act of 1990 (OPA 90) established standards for the prevention and removal of, and liability for, oil pollution to the marine environment. It set strict requirements for any tanker trading in the U.S. waters, including the requirement of maintaining a Vessel Response Plan (VRP). The VRP specifies pollution prevention and removal procedures and identifies Qualified Individuals, salvors, and resources to assess damaged stability and residual strength. Treglia et al. [6] reported a tanker casualty and highlighted the cooperative response effort of the responders, the role of the Qualified Individual, and the importance of accessibility to a pre-arranged stability and strength assessment program.

Picolo and Vasconcellos [7], highlighted the main technical aspects related to salvage operations as inspection of the casualty, including cargo and flooding, inspection of the site, including weather conditions, availability of material and equipment, stability and strength calculations, grounding reaction calculation, cargo transshipment or jettisoning, patching and dewatering, pulling with usage of beach gear or tugboats and dewatering and assisted refloating. Examples and case studies were included and new research areas were indicated.

Varsami et al. [8] performed several simulations using TransasNavi Trainer 5000 Simulator. They tried to analyze the possibility of refloating a ship by using her own means of propulsion, namely her main engine, in combination with ballasting and de-ballasting the stern tanks and the ones on the portside and starboard side.

El-Dessouky et al. [9] discussed the possible hazards related to hull girder bending during refloating of stranded intact double hull tankers. The authors used the commercial software HECSALV to analyze a number of hypothetical scenarios in order to identify the hazards related to hull girder bending due to the refloating of a stranded intact double hull tanker. The scenarios are generated according to different loading conditions, pinnacle positions, tide and wave heights.

El-Dessouky et al. [10] studied the refloating scenarios of an intact-grounded tanker. Many scenarios were assumed, using the commercial software HECSALV™, varying the