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LARSC: LAunch and Recovery Smart Crane for naval ROV handling

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Abstract

The subject of this paper is describing the ADAMS simulation of LARSC, a product of Calzoni S.p.A., a software controlled crane for putting in the water and retrieving from it a Remotely Operated Vehicle (ROV, typically used for minehunting), even when the sea state is up to 2 or 3, while the ship and the ROV itself are moving with the waves. The automatic crane, already used by the Italian Navy, augments considerably the operating limits of such vehicles, eases the operator intervention, and minimises risk of damages and crew injuries. ADAMS is being used for design investigations of the future generation of this product, based on the "modification" of a standard commercially available naval crane, instead of a completely in-house built device.

Introduction

The need for a dedicated and reliable handling system for on-board ROV/AUVs (Remotely Operated Vehicle/ Autonomous Underwater Vehicle) has been felt since long. The conduct of operations at sea requiring outboard handling of shipborne equipment has represented, in general, a difficult task when in presence of rough environmental conditions, endangering both the ship crew and the equipment being deployed.

Launch and recovery systems designed for underwater vehicle handling can be divided in two main categories, in relation to the vehicle to be handled:

1. tethered vehicles fitted with cables of large cross section, able to withstand the towing and lifting of the vehicle itself (e.g. large ROVs, powered from the mother ship);

2. tethered ROVs connected to the ship only through a thin coaxial or fibre optic cable link, or fully AUV;

Launch and recovery of vehicles of type "1" takes place in many different ways, based in every case on the permanent strong link connecting ship and vehicle.

Calzoni S.p.A. addressed some years ago the problem posed by type "2" vehicles, with its LARSC product: LAunch and Recovery Smart Crane ([1], [2]).

The vehicles belonging to the second category, very often employed in military applications (seabed surveillance, mine identification and destruction), are ranging from 0.5 to 1.5 tons, and can be handled, without excessive risks, up to sea state 2, with the standard onboard crane.

The crane hook, when in calm water, can be inserted in the AUV/ROV top eyebolt from the ship with the help of a stem, but must be inserted manually, sending people at sea on a boat, as soon as sea waves are showing. When the sea state grows up to 2 or 3, relative motions between the crane hook, the floating ROV, and the boat with people, become so ample to make the operation increasingly difficult and dangerous.

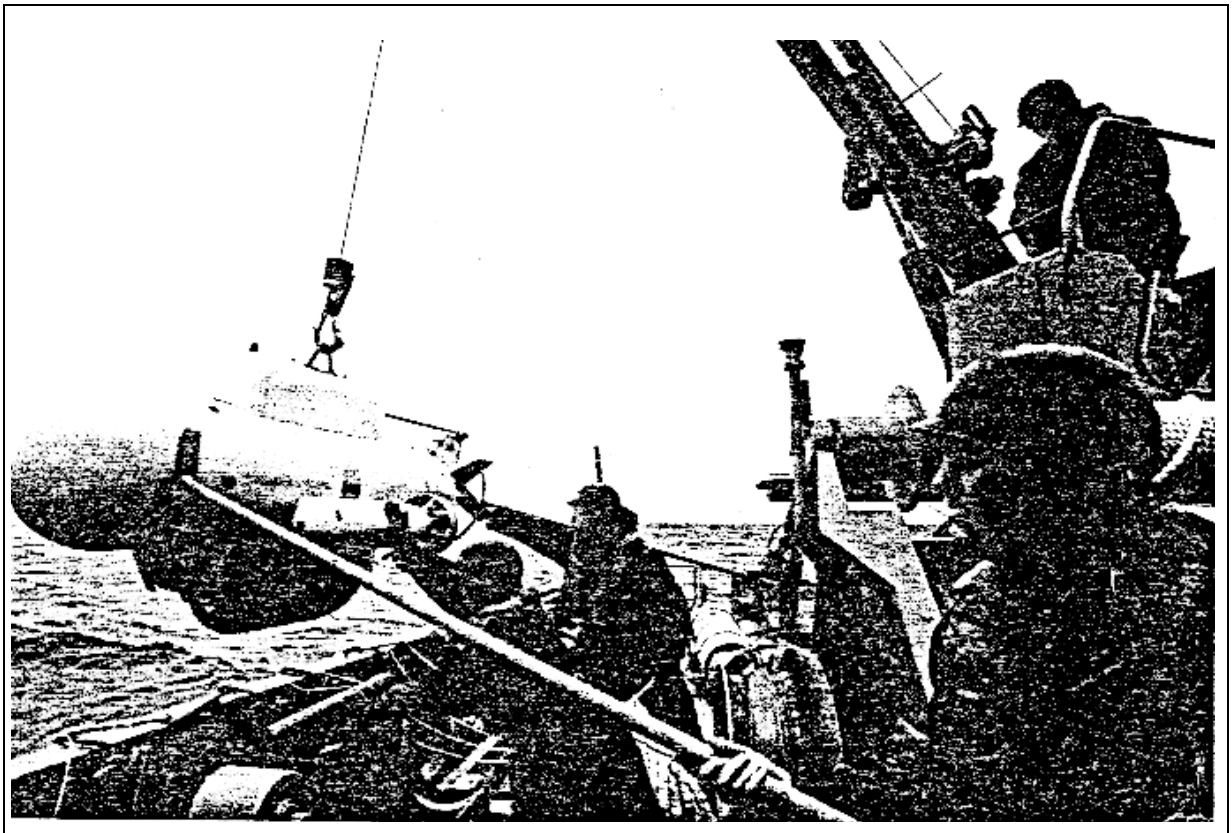

Fig.1: Launching can be a critical and people intensive activity

Strangely enough, both ship and ROV are designed to operate up to sea state 4, but due to the handling requirement this operation can take place only in condition equivalent to a sea state 2.

The Calzoni LARSC crane, a purpose built mechanical and hydraulic modification of the existing on-board crane, featuring a 2000 Kg maximum load at 10 m range, completely software controlled by a portable console, can be used in normal "Crane Mode" for any operation (using its software, for example, to avoid operator mistakes, taking continuously into account interdicted areas due to ship superstructures), or in "ROV Handling Mode", in which case the operations are carried out in a fixed sequence of programmed "high level" logical steps (e.g. automatic crane positioning onto the vehicle, vehicle lifting and outboard positioning, vehicle immersion, ... and so on).

LARSC is already in use by the Italian Navy: the Calzoni company is now thinking about the design of an evolution of the product, called provisory LARSC Kit, and we have been asked to create an ADAMS model enabling us to investigate the many different aspects of its mechanical behaviour. The work is at its initial stage, so this paper will simply try to share with the reader the problems we are finding and the ways that we are devising in order to solve them.