A shockproof hull made of foam:
a useful project for operations on uneven ice

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ABSTRACT

The aim of this paper is to describe an innovative composite structure called SoftHull developed for marine and amphibious vehicles capable of deforming without breaking under external actions. It is composed by a hull made of elastic and lightweight foam, supported by a rigid frame and protected by a flexible “skin” so that it can absorb shocks and withstand to most of the unpredictable lacerations that can occur during operations. The peculiar structure of SoftHull is constituted by a bulky volume of closed cells foam tracing the shape of the hull, which warrants the buoyancy in every condition. This part is protected by an external rigid skin made by a thin layer of a resistant but deformable material. The framework sustains the superstructures and absorbs the small loads transmitted by the elastic hull. The two parts are connected in such a way that the soft-hull results resiliently linked to the upper rigid part.

KEY WORDS

Hovercraft;ACV Air Cushion Vehicle;MACP Multipurpose Air-Cushion Platform; Flexible; HDPE Foam Hull; SoftHull; Polyethylene.

INTRODUCTION

In these last years we record a continuously increasing interest in the development of vehicles for access in shallow and inaccessible waters. These areas represent a wide part of the Earth: rivers, streams, marshes, swamps, lagoons, coastal areas, icy and polar regions. They all are zones of great interest for the most disparate reasons:
- icy and polar scientific research (that requires vehicles appropriate to a very hostile ambient),
- fish food and wildlife
- the preservation of wetlands like marshes and swamps, which provides many benefits including water quality improvements flood and shoreline erosion control

The access to these zones is complicated by the presence of many difficulties. Among the others, protruding obstacles, mixed terrains and a continuously changing ground are the most affecting for the vehicle’s integrity. For these reasons only a strict number of vehicles, which are not always adequate for the needs, can approach such areas.

Moreover it has to be taken into consideration that the increasing number of flooded regions due to climate changes as well as the necessity of demining or fighting the Oil Spill which are other situations that require vehicles with the same characteristics.

The operators need to be equipped by a very reliable vehicle that does not represent a limit for the activities to perform. An important example is the case of flood emergency when the operators must look after the people to rescue and not to the integrity of the vehicle.

This project created new technologies for these vehicles which provide the possibility of an easy and fast access to critical areas. The main result of the Hoverspill project is the innovative, compact and professional hovercraft named “MACP”, the Multipurpose Air Cushion Platform described by Odetti and Mastrangeli (2015b). MACP is characterized by diesel engine, compact size, wide cargo space and modularity which provide several utilization, both for research development and for working purposes (e.g. oil Spill, bathymetric surveys, search and rescue).

Hovercrafts have a high potential for what concerns access to difficult zones: they are light and fast and can operate both in speed and in stationary conditions on land, water, mud, ice and other surfaces also in presence of strong currents. But the widespread of these vehicles has been limited by several implementation problems as described in Odetti and Mastrangeli (2015b) and Odetti and Mastrangeli (2015a).

The main improvement of this project is the flexible hull made by a huge amount of foam named SoftHull, that grants to MACP the required properties. In fact it avoids the serious problem of deterioration of the structure of vehicles trying to access in difficult areas and so allows a good behaviour at high speed and a safe driving.

Further the lightness of this structure due to the foam allows the hull to be disassembled, cut, and decoupled for container transport without affecting performances. Though developed for MACP, SoftHull is also suitable for different applications: for example we constructed boats...