DEVELOPMENT A PRESSURE DIFERENCE ANCHOR SYSTEM IN A ROV

Pablo Alvarez[1], Ignacio Gonzalez[1], Christian Simoes[2], Ana Almécija[2], Pablo Izquierdo[2], Miguel Castro[2] , José Antonio Vilán[2] , and Silvia Torres[1]

(1) Unidad de Tecnologías Marinas (UTMAR), Fundación CETMAR (Centro Tecnológico del Mar), C/Eduardo Cabello s/n 36208 Vigo (Pontevedra)

E-mail: igonzalez@cetmar.org

Tel:(+34) 986 247047

(2) Escola de Enxeñería Industrial, Universidade de Vigo, Rúa Maxwell, s/n. Campus Universitario Lagoas-Marcosende 36310 Vigo (Pontevedra)

Abstract –A differential pressure anchor system has been designed and implemented in order to improve the capacity of an autonomous underwater platform to temporarily anchor to any structure, regardless of its material or shape . This project has been developed in the framework of the A-TEMPO initiative promoted by the University of A Coruña and the European Regional Development Fund (ERDF).

Keywords – ROV, Thruster, CFD, Sucker, Anchor

I. INTRODUCTION

The aim of this project was to develop an anchor solution to be mounted on an underwater platform in order to improve the inspection tasks during maintenance of offshore structures. The underwater platform is a modular solution which works in an autonomous or cabled mode. It can accommodate or integrate specific modules for inspection and maintenance.

This underwater inspection platform has the ability to reach any point of the structure as well as temporarily anchor to the surface to be inspected regardless of its material or shape. With this goal in mind, a differential pressure anchor system was designed.

II. DESING AND CONSTRUCTION

This device is a continuous coupling system which works through differential pressure. The device has a set of suction cups which produces a continuous suction system with the aim of generating a differential pressure that, together with a hovering system, keeps a platform static.

This temporary fixing system is suitable for any type of structure or submerged surface, regardless of its material: concrete, composite or stainless steel. It can also be fixed to structures with different shapes (structural beams, flat areas, curved areas, etc) instead of using specific devices for specific shapes. This device can also be conveniently fixed to submerged elements affected by "fouling", i.e., accumulation of organic material which normally impedes anchoring.

When compared with a magnetic fastening, which has been widely used and tested in the marine environment, our device has the advantage of being used with any type of structural material: Wood, steel, stainless steel, composites, concrete, etc. Unlike a traditional grip, this device allows clamping on flat surfaces. Furthermore, occurrence of fouling in the structure does not prevent the use of this system, although its effectiveness may decrease.

This device can be mounted directly on the vehicle structure, pointing its suction cup to the side to be fixed. It is not limited to a single suction unit; in fact, it can be used both as a large single unit or as a small-sized set of suction cups placed in the vehicle structure so that a greater grip stability is ensured, although the energy consumption may also increase. (See Figure 1 for a detail of nozzle assembly)

The suction system is controlled by a magnetic coupling motor allowing the uncoupling between the engine and the propeller, in case of gear breakage or engine overheating.

The engine control can adjust the gripping power of the device, thereby reducing the energy consumption depending on the differential pressure to manage the coupling between the cup and the structure.

One of the limitations posed by this design is that the use of a propeller turbine entails a high energy consumption, approximately 50-100W, but this consumption is essential to maintain a negative pressure in a water leakage area. Nevertheless, the better the first ring fits within the device, the less energy it uses. (Table 1 shows the relationship between Power and Thrust)

Finally, it is important to note that for the total stabilization of the vehicle, both this device and the dynamic positioning system of the vehicle should be used.

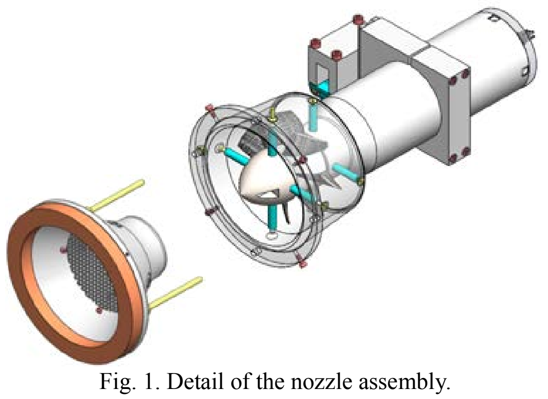

Fig. 1. Detail of the nozzle assembly.

III. CONCLUSION

This device can be easily adapted to different gripping levels and shapes while keeping the same design. A larger number of grippers may be installed, and the size of the device may be modified so that the clamping force is suitable for a specific work environment (e.g. the varying power of ocean currents).

Power(W)	Thrust open[Kg]	Thrust closed [Kg]
49,10	0,6	1,98
58,80	1,32	3,6
78,08	1,32	4,94
92,64	1,56	5,56
116,59	1,72	6,24
130,52	1,78	6,36

Table. 1. Test on smooth surface.

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[6] Ali Can Takinacı, Advanced Propulsion System GEM 423E. The Faculty of Naval Architecture and Ocean Engineering 34469 Maslak – Istanbul – Turkey