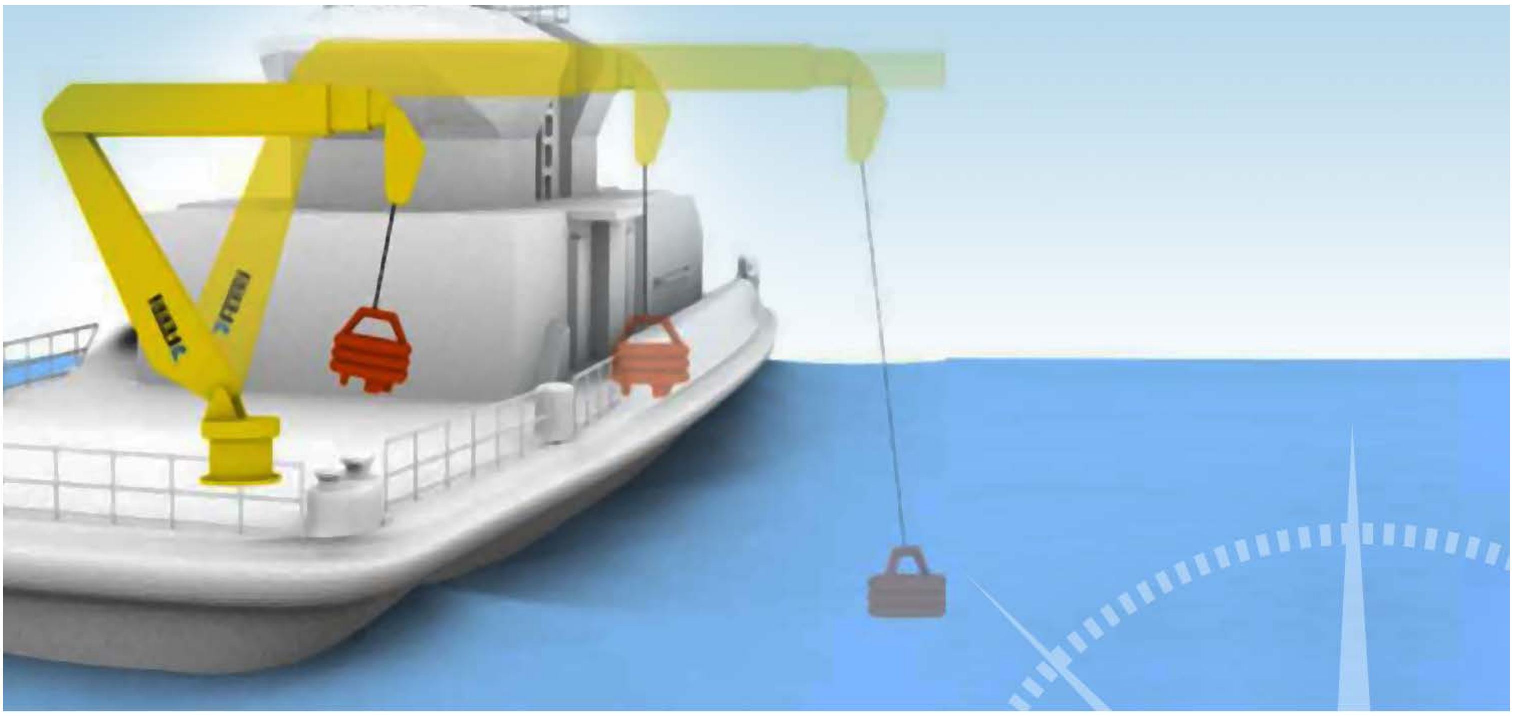

Activity 4 – Sub-Activity 4.2

Platform Recovery

Report on platform recovery tests for OLRS systems

Document No: MONALISA 2.0_D4.2.5

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Document Status

Authors

Name	Organisation
Elia rodríguez rodríguez	Industrias ferri s.a.
Francisco josé ruppen cañás	Industrias ferri s.a.
Enrique pérez prado	Industrias ferri s.a.

Review

Name	Organisation
Patricio fernández goberna	Industrias ferri s.a.

Approval

Name	Organisation	Signature	Date
D4.2.5 report on platform recovery tests for olrs systems	Sasemar		

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Table of contents

1 List of Acronyms

ACO	Air Co-coordinator
AS	Abandon Station
ATM	Air Traffic Management
BLEVE	Boiling Liquid Expanding Vapour Explosion
CEO	Chief Executive Officer
CLIA	Cruise Lines International Association
DNC	Digital Nautical Chart
DNV	Det Norske Veritas
DSC	Digital Selective Call
DVM	Dynamic Voyage Management
EBS	Emergency Breathing System
ECDIS	Electronic Chart Display and Information System
ECTS	European Credit Transfer and Accumulation System
EMSA	European Maritime Safety Agency
EOC	Emergency Operations Centre
EPIRB	Emergency position-indicating radio beacon
EQUASIS	European Quality Shipping Information System
ERCC	Emergency Rescue Co-ordination Centre
ESD	Emergency Shut Down
ETO	Emergency Towing Operation
FAL	The Convention on Facilitation of International Maritime Traffic
FiFi	Fire fighting
GMDSS	Global Maritime Distress Safety System
GPS	Global Positioning System
HMI	Human Machine Interface
HS	Significant Wave Height
HUET	Helicopter Underwater Escape Training
IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities

IAMSAR	International Aeronautical and Maritime Search and Rescue
ICAO	International Civil Aviation Organization
ICS	Incident Command System
ICT	Information and Communications Technology
ILO	International Labour Organization
IMO	International Maritime Organization
IMO NAV	IMO Sub-Committee on Safety of Navigation
IMO MSC	IMO Maritime Safety Committee
JRCC	Joint Rescue Coordination Centre
LNG	Liquefied Natural Gas
LSA	Life Saving Appliance
LT	Local Time
LPG	Liquefied Petroleum Gas
LRIT	Long-Range Identification and Tracking
MARPOL	International Convention for the Prevention of Pollution from Ships
MCC	Mission Coo-ordination Centre
ME	Major Event
MET	Marine Education and Training
ML 2.0	MONALISA 2.0 Project
MOB	Man overboard
MOC	Maritime Operations Centre (Spanish Maritime Safety and Rescue Agency - SASEMAR)
MOR	Means of Rescue
MMSI	Maritime Mobile Service Identity
MRCC	Maritime Rescue Coordination Centre
MRSC	Maritime Rescue Sub-Centre
MRO	Mass Rescue Operation
MSI	Maritime Safety Information
MST	Maritime Safety Training
OBP	Open Bridge Platform
OLRS	On-board life raft recovery systems
OSC	On-Scene Co-ordinator

PLB	Personal Locator Beacon
Port CDM	Collaborative Decision Making within and in relation to Ports
PPE	Personal Protective Equipment
RCC	Rescue Coordination Centre
RFID	Radio Frequency identification
SAR	Search and Rescue
SASEMAR	Spanish Maritime Safety and Rescue Agency
SCBA	Self Contained Breathing Apparatus
SES	Safe Evacuation System
SMC	SAR Mission Coordinator
SRU	Search and Rescue Unit
STCC	Sea Traffic Coordination Centre
STCW	International Convention on Standards of Training, Certification and Watch keeping for Seafarers
STM	Sea Traffic Management
SVM	Strategic Voyage Management
SWIM	System Wide Information Management
TFEU	Treaty on the Functioning of the European Union
TKPI	Training key performance indicators
VHF	Very High Frequency
VTMIS	Vessel Traffic Maritime Information System
VTS	Vessel Traffic Service

2 Document objective

The objective of this document is to explain the pilot tests and simulations that have been developed during the MONALISA 2.0 project, and to describe all the conclusions that have been obtained.

This document corresponds to the deliverable D4.2.5 whose full title is “Report on platform recovery tests for on board life rafts recovery systems".

3 Executive summary

The overall objective of MONALISA 2.0 is to contribute to the development of Motorways of the Sea (MoS). The aim is to strengthen efficiency, safety and environmental performance of maritime transport, and at the same time reduce the administrative burden of the maritime sector.

This global objective has been broken down into a number of immediate objectives, and the guarantee of operational safety in ports and coastal areas is one of the main challenges. In this context, the proposal of implementing the OLRS system has focused on minimising the number of marine accidents and optimising the response when incidents do occur. The objective of this system is to provide a complementary recovery system to maximise the rescue capacity (i.e. rescues per time unit).

Thereby, in order to validate the system, pilot tests and simulations have been developed and all the conclusions that have been obtained are included in this report.

4 Introduction

OLRS is a system that is capable of recovering life rafts and MOB that are afloat in the water, and place them safely on board the rescue ship. This can be done in a very short time, and it is particularly advantageous in bad weather and cold-water conditions as it minimises the risk that people are exposed to during the recovery operation.
This is in contrast to the usual SOLAS procedure that involves launching a rescue boat, with the added risk to the rescuers that is inherent in launch and recovery operations, and the added risk of hypothermia to the man overboard.

The OLRS system has the capability to extend the boom and recovery hook towards the castaway or the life raft. Hence the rescue vessel in which the equipment is installed does not have to be too close to either castaway or life raft, which can jeopardize the entire operation.

In conclusion, the OLRS system is proposed as an alternative and/or complementary method to existing ones in order to minimise the risk and to maximise the number of rescues per unit of time.

5 Industrias Ferri S.A. and Cimne

The contributions to sub-activity 4.2 related to OLRS system have been developed between Industrias Ferri and Cimne (with the close collaboration of Compass):

- Industrias Ferri, S.A. was founded in 1965, in order to satisfy the growing demand for ancillary deck equipment for the marine sector. Over the years, FERRI has achieved prestige as a leading manufacturing of high quality, reliable equipment as an experienced, innovative company providing solutions to customer requirements.

In fact, FERRI's naval equipment is scattered throughout the world on all types of ships, warships, fishing fleets, tugs, oil platforms, research vessels, cable companies, merchant, luxury cruises and many more.

More and more becomes more important for the company the custom-made equipment, designed and constructed following the strictest demands and regulations so that the equipment can function in the most adverse conditions while meeting requirements from customers in 5 continents.

Industrias Ferri offers a wide range of products to ensure that life on board is both functional and safe. The company is an innovative manufacturer of life-saving appliances, cranes, A-frames and other deck equipment and our goal is to provide our customers with the latest innovative, compact, high quality and safe life/rescue boat davit systems, RHIB recovery installations and marine /offshore cranes. The well-proven product range of Industrias Ferri guarantees the future owner the pleasure of optimum reliability with a minimum of maintenance.

At present, in addition to these activities, we also develop technical assistance and maintenance services for highly specialised mechanical and industrial sectors.

- The International Center for Numerical Methods in Engineering (CIMNE) is a research organization created in 1987 at the heart of the prestigious Technical University of Catalonia (UPC) as a partnership between the Government of Catalonia and UPC. The aim of CIMNE is the development of numerical methods and computational techniques for advancing knowledge and technology in engineering in applied sciences.

CIMNE’s headquarters are located at the heart of the Technical University of Catalonia (UPC) in Barcelona. CIMNE has also premises at different buildings in several campus of the UPC. CIMNE has also offices in Spain in Madrid, Terrassa and Ibiza. In 2005 CIMNE started its international expansion and since then has created the following international branches: CIMNE Latinoamerica (Non-profit

Foundation in Santa Fe, Argentina); CIMNE USA (Non-profit Corporation in Washington DC, USA); CIMNE Singapore (Non-profit Corporation in Singapore) and CIMNE Beijing (China).

CIMNE employs some 200 scientists and engineers who work in the different offices of CIMNE around the world. CIMNE has also established a network of 28 Classrooms and Joint Labs in partnership with Universities in Spain and 10 Latin American countries.

CIMNE’s research and technology development (RTD) activities cover a wide spectrum of topics ranging from classical engineering fields such as civil, mechanic, environmental, naval, marine and offshore, food, telecommunication and bio-medical engineering, computer sciences and applied sciences such as material sciences bio-medicine, computational physics, nature, social and economic sciences and multimedia sciences

6 OLRS validation

In order to validate the effectiveness of the OLRS system, several simulations and pilot tests have been developed and are explained in detail in this chapter.

6.1 OLRS simulations

6.1.1 General issues

Once the rescue operations procedures have been analysed and the main requirements that OLRS system should fulfil have been established (for more details on OLRS technical requirements please go to D4.2.4 “Requirement specifications for on-board life rafts recovery systems"), various simulations in different sea state conditions have been developed in order to know the OLRS behaviour in real conditions. These simulations have been developed as the first stage of system validation.

6.1.2 Simulation assumptions

In order to develop the simulations the rescue vessel “SAR Mesana” (BS-34) has been taken as a reference. This vessel belongs to the Spanish Maritime Safety and Rescue Agency (SASEMAR), the organization in Spain that is responsible for maritime search and rescue services, marine pollution prevention, and maritime traffic control.

Length	39.7 m
Breadth	12.5 m
Draft	4,2 m
Propulsion	2 diesel motors abc 8dzc-1000-175
Power	5090 hp
Speed	13 knots
Autonomy	6000 mn
Crew	10+2 people
Omi number	9429091
Mmsi	224631000
Callsign	Ebrd

Fig. 1 - SAR Vessel Mesana

Once the vessel to perform the simulations of the OLRS system has been selected, all the boundary conditions have been set: boom length (up to 12 meters), boom position (two cases to be studied, one oriented towards the side of the ship and the other oriented to the aft of it), three Sea States, Beaufort 4, Beaufort 6 and Beaufort 8.

Within these boundary conditions, and assuming the OLRS system is installed on board the SAR Mesana vessel, the variables to be measured were established: the vertical component of velocity, and maximum acceleration.

In order to develop these simulations, a piece of software called SeaFem has been used. SeaFem is a suite of tools for the computational analysis of the effect of waves, wind and currents on naval and offshore structures, as well as for manoeuvring studies. This software has been developed in collaboration with the International Center for Numerical Methods in Engineering, and is completely integrated in the comprehensive simulation environment, Tdyn, developed by Compass.

With the simulations of the OLRS system, the final objective was to obtain all the necessary inputs of pressure and speed in the hydraulic system, in order to design the winch and spooling of the rope device. These inputs were for the two boom positions mentioned above, and the values of the vertical components of speed and maximum acceleration.

6.1.3 Simulation data and results

As mentioned above, all necessary simulations have been performed in collaboration with CIMNE (International Center for Numerical Methods in Engineering) and Compass (Compass Ingeniería y Sistemas, SA).

Firstly, all required data of the OLRS and SAR Mesana have been introduced. Then, the natural results of an analysis of RAOs (Response Amplitude Operator) have been obtained by SeaFEM. That is, the response of the vessel (i.e., the movement of its centre of gravity). To get this information a sea coming forward has been hypothesized (0º).

Then, the response of the hull in a defined range of frequencies (periods), for a dimensionless amplitude, has been analysed. In this case, a range of frequencies between 4 seconds and about 14 seconds have been analysed and a result for the six degrees of freedom of the vessel (Surge, Sway, Heave, Roll, Pitch and Yaw) has been obtained.

A_w [m]	1,95						
		Surge	Sway	Heave	Roll	Pitch	Yaw
w [rad/s]	T [s]	A_su/A_w	A_sw/A_w	A_hv/A_w	A_ro/A_w	A_pi/A_w	A_ya/A_w
1,59835598	3,93103	0,0320584	0,000271449	0,178072	0,00012776	0,0291403	0,00021916
1,54323796	4,07143	0,0409518	0,000411908	0,180827	4,46E-05	3,26E-02	1,06E-04
1,48812362	4,22222	0,0477169	0,000178481	0,202163	6,65E-05	3,74E-02	7,41E-05
1,43300567	4,38462	0,0738871	0,000290166	0,273286	5,41E-05	3,92E-02	7,54E-05
1,37789151	4,56	0,132068	0,000303273	0,279256	5,77E-05	5,79E-02	7,81E-05
1,32277585	4,75	0,180898	0,000220177	0,316837	3,04E-05	7,44E-02	8,77E-05
1,26766064	4,95652	0,220412	0,000269367	0,390177	4,04E-05	7,75E-02	7,19E-05
1,21254411	5,18182	0,306865	0,000133378	0,429198	2,41E-05	9,08E-02	6,79E-05
1,15742918	5,42857	0,400608	0,000294626	0,521091	2,59E-05	1,03E-01	4,29E-05
1,10231321	5,7	0,453513	0,00031617	0,613159	4,15E-05	9,94E-02	2,16E-05
1,04719755	6	0,500603	0,000160233	0,655671	2,05E-05	9,36E-02	2,03E-05
0,99208241	6,33333	0,554571	3,14E-05	6,92E-01	3,03E-05	8,79E-02	1,71E-05
0,93696656	6,70588	0,60994	5,40E-05	7,48E-01	6,76E-05	8,21E-02	1,14E-05
0,88185057	7,125	0,654711	2,55E-05	8,14E-01	1,32E-05	7,47E-02	9,22E-06
0,82673491	7,6	0,695068	2,81E-05	8,63E-01	9,40E-05	6,69E-02	1,92E-05
0,77161898	8,14286	0,732002	6,73E-06	8,95E-01	0,00023155	0,05927	3,07E-05
0,71650365	8,76923	0,765126	6,08E-05	9,23E-01	0,00058532	0,0517978	4,22E-05
0,66138793	9,5	0,794199	3,58E-05	9,44E-01	0,00031677	0,0445196	1,51E-05
0,60627439	10,3636	0,820273	1,36E-05	9,61E-01	7,36E-05	3,78E-02	6,95E-06
0,55115661	11,4	0,844193	5,02E-06	9,74E-01	6,59E-05	3,14E-02	8,64E-06
0,49603964	12,6667	0,869341	6,36E-06	9,84E-01	6,65E-05	2,58E-02	4,12E-06

w [rad/s]	T [s]	A_su [m]	A_sw [m]	A_hv [m]	A_ro [rad]	A_pi [rad]	A_ya [rad]
1,59835598	3,93103	0,06251388	0,000529326	0,3472404	2,49E-04	5,68E-02	4,27E-04
1,54323796	4,07143	0,07985601	0,000803221	0,35261265	8,70E-05	6,36E-02	2,07E-04
1,48812362	4,22222	0,09304796	0,000348038	0,39421785	1,30E-04	7,29E-02	1,44E-04
1,43300567	4,38462	0,14407985	0,000565824	0,5329077	1,05E-04	7,63E-02	1,47E-04
1,37789151	4,56	0,2575326	0,000591382	0,5445492	1,12E-04	1,13E-01	1,52E-04
1,32277585	4,75	0,3527511	0,000429345	0,61783215	5,93E-05	1,45E-01	1,71E-04
1,26766064	4,95652	0,4298034	0,000525266	0,76084515	7,87E-05	1,51E-01	1,40E-04
1,21254411	5,18182	0,59838675	0,000260087	0,8369361	4,70E-05	1,77E-01	1,32E-04
1,15742918	5,42857	0,7811856	0,000574521	1,01612745	5,06E-05	2,01E-01	8,36E-05
1,10231321	5,7	0,88435035	0,000616532	1,19566005	8,09E-05	1,94E-01	4,21E-05
1,04719755	6	0,97617585	0,000312454	1,27855845	4,00E-05	1,82E-01	3,97E-05
0,99208241	6,33333	1,08141345	6,12126E-05	1,34976855	5,91E-05	1,71E-01	3,34E-05
0,93696656	6,70588	1,189383	0,000105211	1,45940925	1,32E-04	1,60E-01	2,22E-05
0,88185057	7,125	1,27668645	4,97369E-05	1,5881814	2,57E-05	1,46E-01	1,80E-05
0,82673491	7,6	1,3553826	5,48336E-05	1,68260235	1,83E-04	1,30E-01	3,74E-05
0,77161898	8,14286	1,4274039	1,31303E-05	1,74471375	4,52E-04	1,16E-01	5,98E-05
0,71650365	8,76923	1,4919957	0,000118522	1,79927475	1,14E-03	1,01E-01	8,23E-05
0,66138793	9,5	1,54868805	6,97133E-05	1,83983865	6,18E-04	8,68E-02	2,95E-05
0,60627439	10,3636	1,59953235	2,65689E-05	1,8733455	1,44E-04	7,37E-02	1,36E-05
0,55115661	11,4	1,64617635	9,78726E-06	1,8993975	1,29E-04	6,13E-02	1,68E-05
0,49603964	12,6667	1,69521495	1,24013E-05	1,91803365	1,30E-04	5,02E-02	8,04E-06

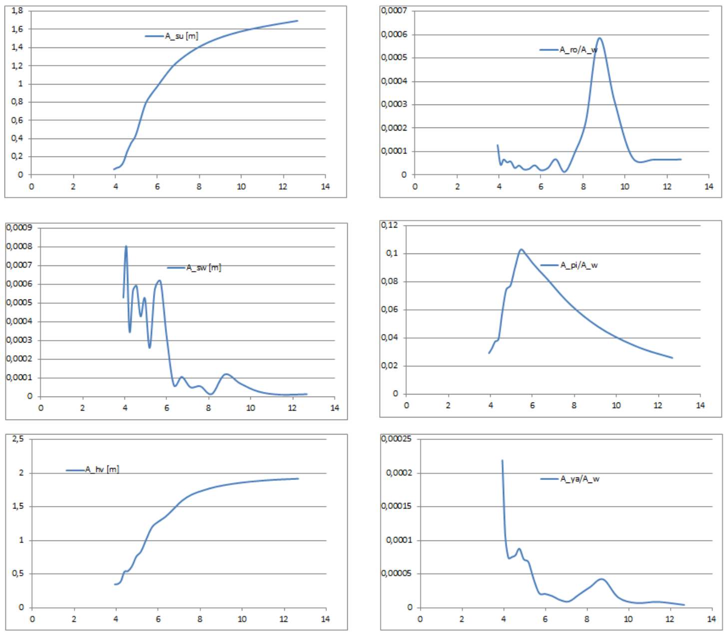


Fig. 2 - RAOs analysis of SAR Mesana for Beaufort 4

In the figure above, there are two tables and six graphs. The second table is similar to the first one that has been explained above but with the difference that the values are affected by the amplitude (A_w [m]) data. In this figure, the values obtained for a wave amplitude of 3.9m (ie, H/2 of 1.95 m), equivalent to Beaufort 4 conditions, are shown as an example.

Once all RAOs data of the COG of the vessel have been obtained and analysed the accelerations and velocities at the end of the boom of the OLRS system have been studied. These values of accelerations and velocities are given for a set point, the one to be related to the COG of the ship, which is taken as origin. This point, which is the object of study, is called P_x, P_y, P_z in the figure below.

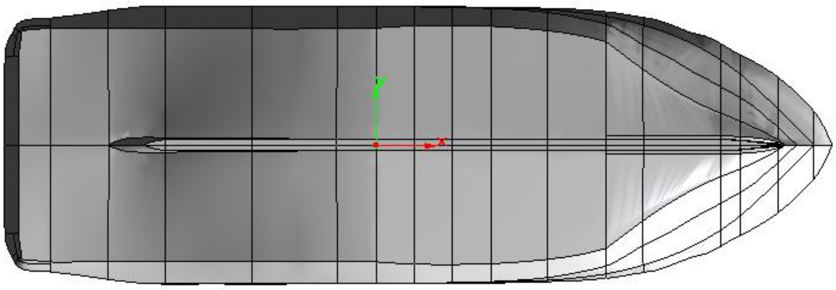


Fig. 3 - COG of SAR Mesana

The above processes have been studied for different sea conditions and positions and extensions of the boom of the OLRS system. In order to provide an example for this report of representative values of velocities and accelerations of the end of the boom ("P" point), its coordinates have been defined as follows: Px =-3m, Py=-14m and Pz=8m, for Beaufort 4 conditions.

The abscissa of the figure that is shown below corresponds to the period, and the ordinates of those graphs are the curves of the accelerations and velocities in the three axes. The maximum values of the vertical component of acceleration and speeds are of particular interest as they are the inputs to be used for the design of the prototype.

P_x [m]	P_y [m]	P_z [m]
-3	-14	8
cdg_x [m]	cdg_y [m]	cdg_z [m]
0	0	1,4

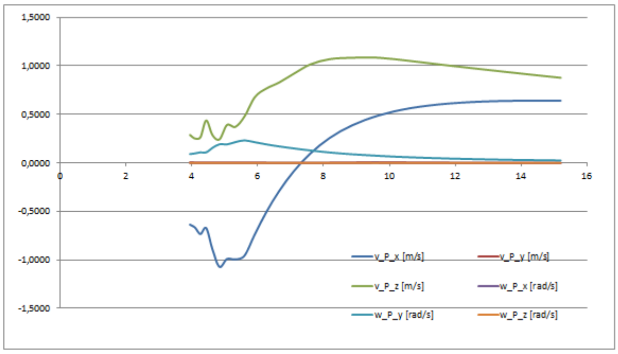
Velocities and accelerations of point P

V_P

V_P_x = v_G_x + (r_y*w_z - r_z*w_y
V_P_y = v_G_y + (r_z*w_x - r_x*w_z
V_P_z = v_G_z + (r_x*w_y - r_y*w_x

a_P_x = a_G_x + w_y*(V_P_z - V_G_z) - w_z*(V_P_y - V_G_y)
a_P_y = a_G_y+ w_z*(V_P_x - V_G_x) - w_x*(V_P_z - V_G_z)
a_P_z = a_G_z + w_x*(V_P_y - V_G_y) - w_y*(V_P_x - V_G_x)

w [rad/s]	T [s]	v_P_x [m/s]	v_P_y [m/s]	v_P_z [m/s]	w_P_x [rad/s]	w_P_y [rad/s]	w_P_z [rad/s]	a_P_x [m/s2]	a_P_y [m/s2]	a_P_z [m/s2]	aph_P_x [rad/s2]	aph_P_y [rad/s2	aph_P_z [rad/s2]
1,5944176	3,94074	-0,6362	0,0061	0,2881	3,98E-04	0,090824317	0,000683067	0,13546239	0,000955721	0,953972662	6,36E-04	0,14516959	0,001091785
1,535364	4,09231	-0,6662	0,0033	0,2517	0,000134323	0,098123799	0,000319634	0,16148278	0,001699885	0,917242034	2,07E-04	0,151428371	0,000493272
1,4763123	4,256	-0,7327	0,0027	0,2638	0,000193073	0,108523052	0,000214915	0,17101692	0,000645838	0,967545093	2,87E-04	0,161495717	0,000319821
1,4172609	4,43333	-0,6717	0,0027	0,4376	0,000151166	0,109404265	0,000210582	0,26019198	0,001026288	1,190405918	2,17E-04	0,156776932	0,000301765
1,3582065	4,62609	-0,8933	0,0027	0,2855	0,000154985	0,155655478	0,000209805	0,416599	0,000932952	1,228159472	2,14E-04	0,214476363	0,000289088
1,2991558	4,83636	-1,0708	0,0019	0,2430	7,83809E-05	0,191785025	0,000226265	0,50708695	0,000448381	1,375902719	1,04E-04	0,2536886	0,000299298
1,2401015	5,06667	-0,9897	0,0020	0,3914	9,97514E-05	0,191504764	0,000177848	0,58092335	0,000628339	1,516519932	1,26E-04	0,242763051	0,000225451
1,1810499	5,32	-0,9943	0,0013	0,3715	5,70199E-05	0,214706301	0,000160475	0,74166088	0,000143079	1,599789146	6,91E-05	0,26034086	0,000194582
1,1219974	5,6	-0,9541	0,0014	0,4806	5,85363E-05	0,232110789	9,67575E-05	0,88507316	0,000630566	1,792565125	6,78E-05	0,2686518	0,00011199
1,0629451	5,91111	-0,7343	0,0015	0,6786	8,92073E-05	0,213562707	4,6369E-05	0,93800876	0,000726935	1,817850805	9,83E-05	0,235412994	5,11132E-05
1,003893	6,25882	-0,5072	0,0008	0,7662	4,18823E-05	0,191107542	4,15281E-05	0,96104237	0,000303117	1,694384103	4,39E-05	0,20012735	4,34881E-05
0,9448399	6,65	-0,2886	0,0006	0,8295	5,86493E-05	0,170122173	3,31367E-05	0,97767188	4,5018E-05	1,56009073	5,82E-05	0,168775216	3,28743E-05
0,8857878	7,09333	-0,0855	0,0011	0,9193	0,000123587	0,149955426	2,08421E-05	0,97696641	0,00012274	1,461161546	1,16E-04	0,14050322	1,95284E-05
0,8267349	7,6	0,0978	0,0003	1,0154	2,26211E-05	0,12847643	1,58553E-05	0,94335063	3,10903E-05	1,367143894	1,99E-05	0,113297013	1,3982E-05
0,767682	8,18462	0,2576	0,0014	1,0697	0,000151482	0,107814301	3,09428E-05	0,89174812	5,94509E-05	1,243081197	1,25E-04	0,089133846	2,55815E-05
0,7086297	8,86667	0,3873	0,0029	1,0836	0,000348406	0,089181021	4,61587E-05	0,82644545	6,63704E-05	1,102480006	2,69E-04	0,068813768	3,56169E-05
0,6495772	9,67273	0,4892	0,0068	1,0835	0,0008178	0,07237096	5,90003E-05	0,75107252	0,00019483	0,96567286	5,86E-04	0,051854057	4,2274E-05
0,5905249	10,64	0,5647	0,0034	1,0503	0,000408538	0,057417216	1,9528E-05	0,66788692	8,95543E-05	0,831198911	2,70E-04	0,037975053	1,29156E-05
0,5314734	11,8222	0,6121	0,0007	1,0029	8,70041E-05	0,044693569	8,22016E-06	0,58199982	1,83855E-05	0,704568386	5,27E-05	0,027096567	4,98367E-06
0,4724199	13,3	0,6369	0,0006	0,9465	7,08531E-05	0,033785795	9,28436E-06	0,49667399	7,57368E-06	0,586123098	3,91E-05	0,018621264	5,11714E-06
0,4133675	15,2	0,6415	0,0005	0,8776	6,43401E-05	0,024919288	3,98698E-06	0,4152762	7,00833E-06	0,476911584	3,19E-05	0,012360955	1,9777E-06



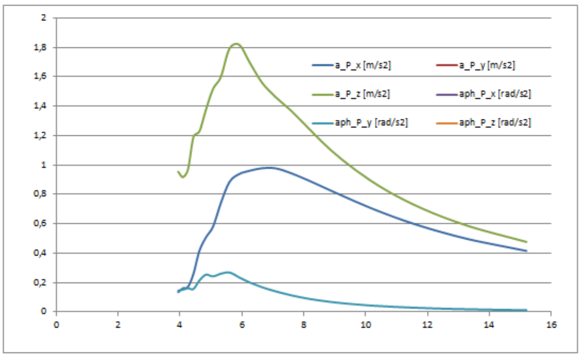


Fig. 4 - Accelerations and Velocities of the end of the boom of the OLRS

6.2 Pilot tests

6.2.1 General issues

Once the simulations have been done, and the inputs to the design of the prototype have been defined, the design drawings have been developed. Then, all needed components have been manufactured and the prototype has been assembled and tested.

Pilot tests were performed at SASEMAR's facilities at the Jovellanos Training Center in Gijon (northern Spain) last June of 2015. Those pilot tests have been developed at Beaufort 4 equivalent conditions in a swimming pool with waves of 1.5m of Hs (Significant Wave Heigh) and swinging the boom of the crane at the same time.

Fig. 5 – Jovellanos Training Center

6.2.2 Pilot development

After defining all resources available/needed for the testing phase of activity 4, it was decided that the OLRS pilot tests were to be performed at the Jovellanos Training Center (SASEMAR's facilities).

For this reason, and in order to test the system under real conditions, the following resources have been used:

- Telescopic boom crane with an outreach up to 12 meters.
- Pool with capacity to generate waves of Hs = 1.5 meters (Significant wave height).
- Hydraulic winch with enough speed and load capacity to test the OLRS, both lowering and hoisting a rescuer and also hoisting and lowering a life raft. This hydraulic winch should have a negative brake, design safety factors for operators and softness in the transition between wave compensation mode to lifting / lowering mode.
- Spooling out rope/wire device. This consists of an additional cable pulley that hauls down cable to maintain a constant tension between the load sheave and the winch reel. With this, we avoid using a large counterweight that can provoke dangerous situations for people (swinging weight), and ensure that the coiling of the loading cable into the drum is done correctly.
- Hydraulic Power Unit (HPU) with enough hydraulic capacity

- Dummy (as a rescuer)
- Life raft

Once all that is necessary to develop the prototype for the real tests is known, all calculations and drawings for the assembly of the prototype have been carried out. In order to show this assembly, the most significant drawings are provided below:

- General Arrangement of the whole prototype
- Hydraulic Diagram
- Hydraulic Winch
- Spooling rope/wire device

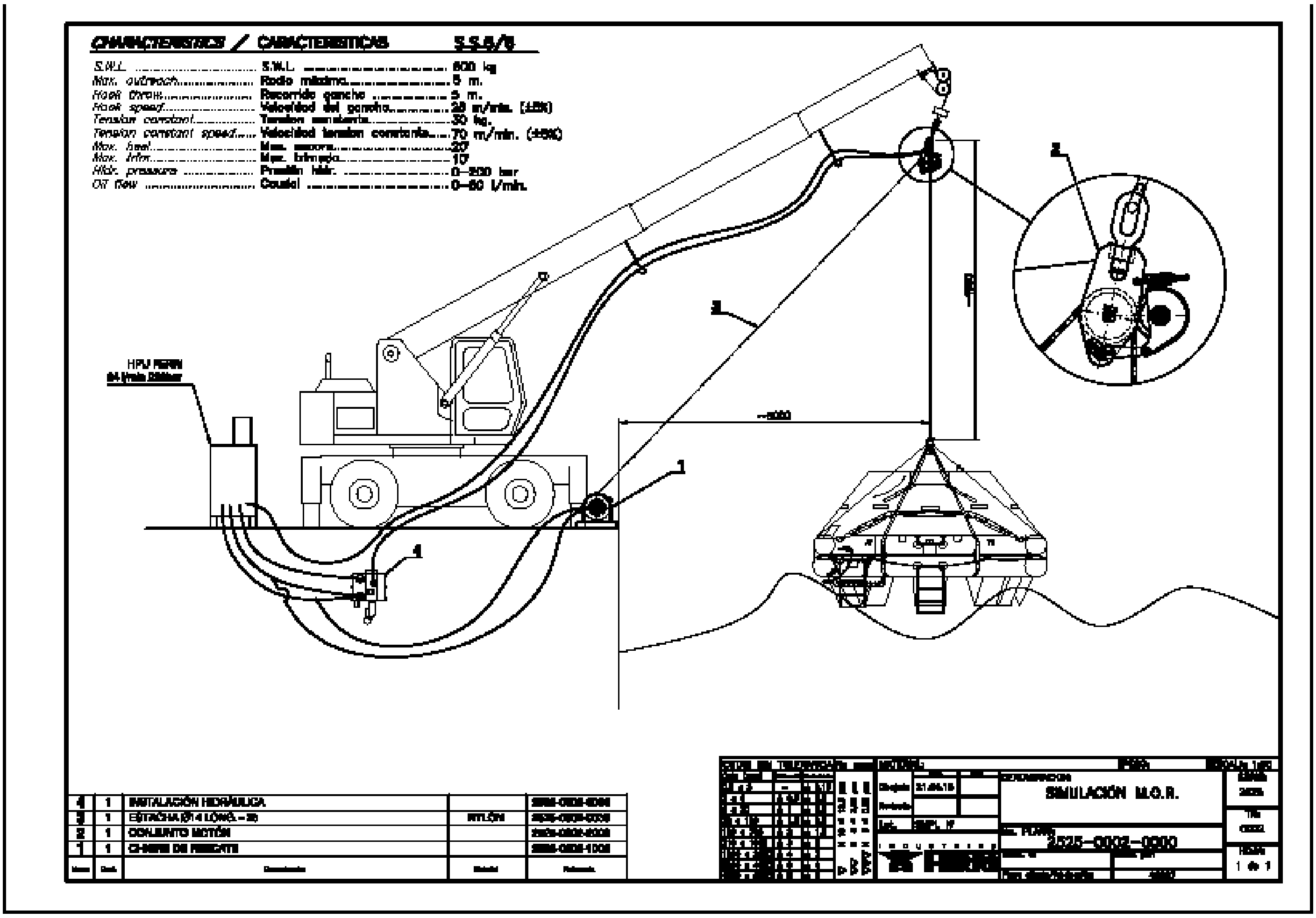


Fig. 6 - General Arrangement

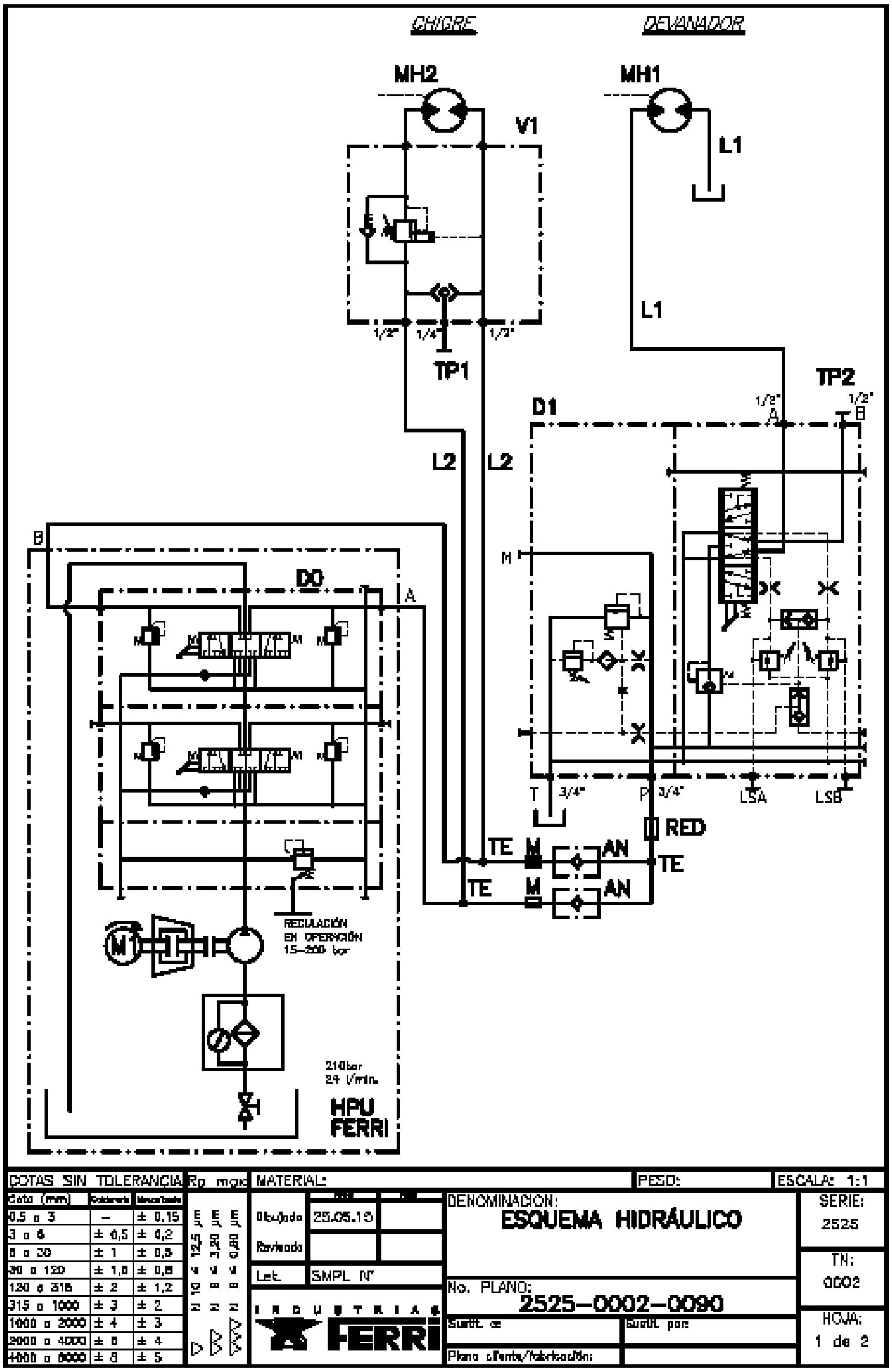


Fig. 7 - Hydraulic Diagram

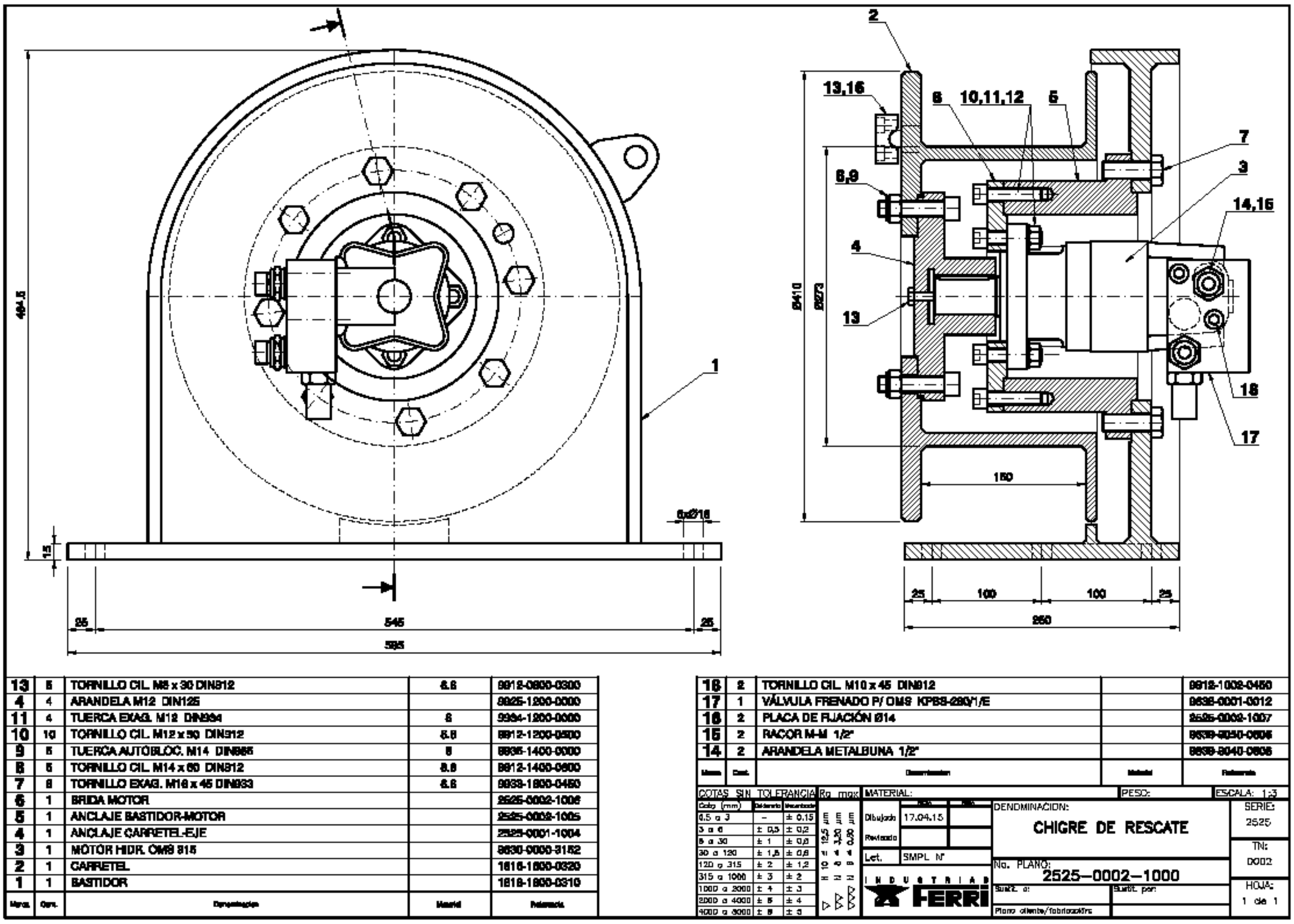


Fig. 8 - Hydraulic Winch

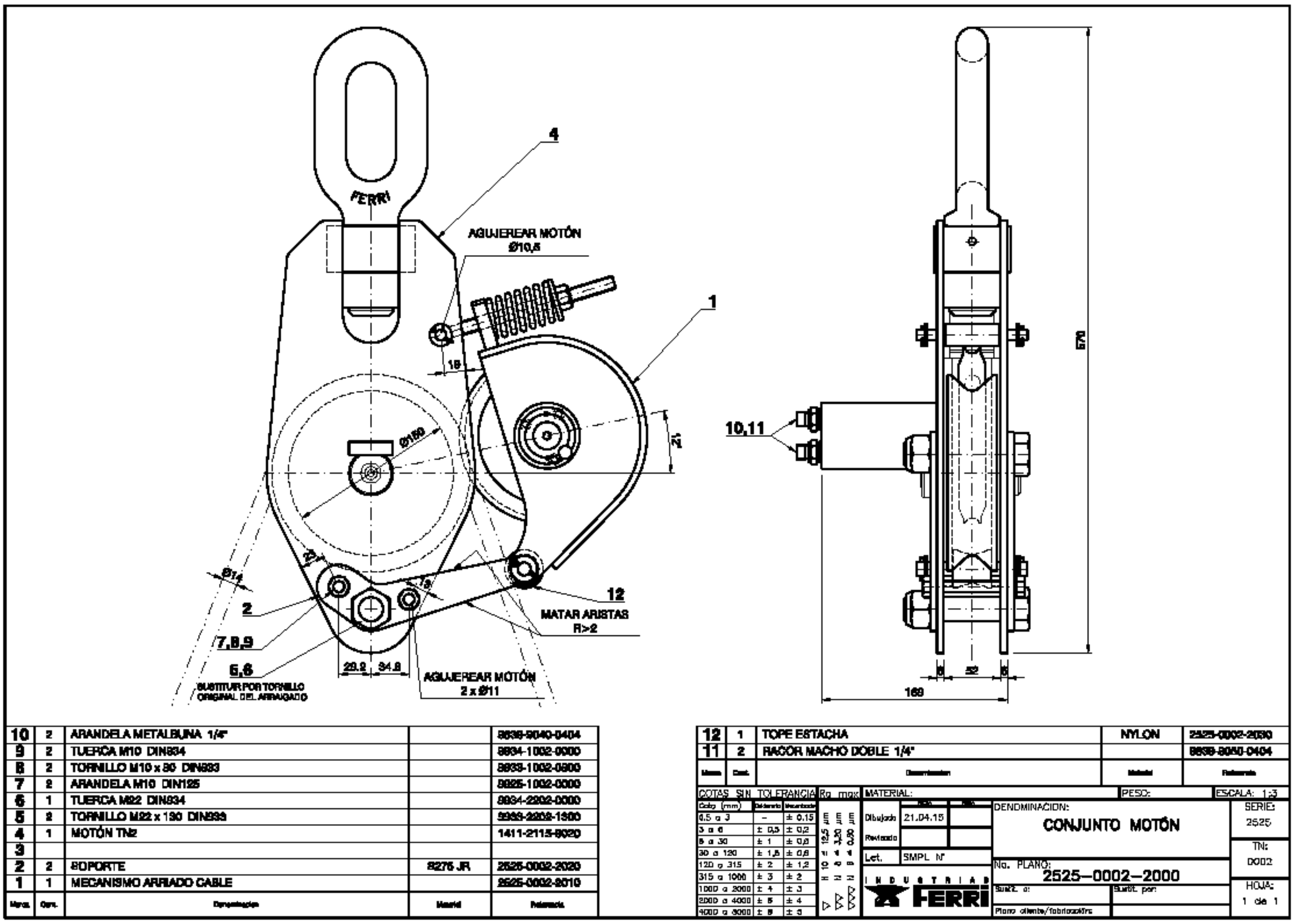


Fig. 9 - Spooling rope/wire device

6.2.3 Pilot test results

The tests carried out last June at the Jovellanos Training Centre were satisfactory. In fact, very useful conclusions were reached:

- The design of the hydraulic system should be developed to be effective when it is used to lower and hoist a rescuer (one rescuer to recover one survivor), when it is used to lower and hoist a MOR (with two rescuers to recover one survivor) and when it is used to recover a launchable life raft with 20 survivors on board, for example. The hydraulic system should have enough precision to avoid any brusqueness, be easy to manoeuvre during MOB recovery, and minimise risk.
- Similarly, the wave compensation system has to be designed / regulated very precisely. At this point, the case with the lighter weight which involves only one rescuer who is being lowered to recover a survivor should be studied. Take into account that the difference between the minimum tensions needed to keep the rope taut, and the maximum tension possible to keep the rescuer afloat while he is trying to grab the survivor is very subtle, so the compensation system should be very precise to prevent sudden pulls.
- The velocity measures both for the waves and for the boom of the crane used in the tests were equivalent to those used in the simulation for SeaFEM for Beaufort 4 conditions, so it has been concluded that the results for those tests are comparable and representative for those sea conditions.
- The correct operation pay out device has been validated in conditions as close as possible to real life conditions.

It was concluded that the tests were representative of the operation of the system in real life conditions and the response of the system to them was reliable and secure.

7 Conclusions – System Validation

The contribution provided by Industrias Ferri to the MONALISA 2.0 project, in terms of improving the operational safety in ports and coastal areas, has focused on the implementation of the proposed system whose testing and validation has been described in this report.

Once the OLRS system has been validated, thanks to the simulations and real tests performed at Jovellanos Centre, it is time to think about the following steps, i.e. how to place the OLRS system on the market, taking advantage of the fact that this development is a part of the MONALISA Project (TEN-T Project). Related to this, an important issue to be considered is the patenting of the system to protect the technical development that has been made.

As has been previously discussed, the OLRS system can easily be implemented in existing systems. However, in each case both the existing lifting appliance and the stability of the vessel in which it is installed should be studied in order to define the manoeuvres (with rescuer, with MOR and with launchable life raft) and the sea conditions in which it could operate in compliance with the safety factors for man riding in offshore conditions.

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