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CASE STUDY

Smart Port System

Optimisation of port operations at the San Nicolás dock (Peru) through an **ocean-meteorological monitoring station**

Project background

The company **Shougang Hierro Perú S.A.A.**[1] operates and manages the **Special Port Facility "San Nicolás"** in the Marcona district, located approximately 530 km along the Peruvian coast south of Lima. The dock extends about 330 meters and has the **capacity to accommodate large-tonnage ships due to the depth of its waters**. This port holds more than eight international certifications, providing security and reliability to all its clients.

At the start of the project in 2022, the San Nicolás dock did not have a comprehensive real-time system for measuring meteorological and oceanographic parameters affecting navigation, although it did have an anemometer and a tide gauge on land. As a result, the dock relied on the Port Authority's instructions for the opening and closing of port operations, based on conditions measured at other points along the coast or predictive models issued by relevant authorities. This situation led to mismatches between the actual conditions in Marcona and the conditions used to determine the port's closure or reopening, causing unnecessary closures or delays in reopening.

This project, implemented at the San Nicolás dock, is the result of collaboration among various national organizations to enable more efficient management of ports along the Peruvian coast, as well as the transmission of relevant data to the competent authorities to support a national database. The project is led by the **Directorate of Hydrography and Navigation of the Peruvian Navy**[2] together with the **National Port Authority**[3], with the collaboration of the **Port Authorities**[4] and the companies managing the port facilities, such as **Shougang Hierro Perú S.A.A.** in this case. The ocean-meteorological monitoring system for the opening and closing of ports at the San Nicolás dock is the first to be developed and implemented within this framework.

[1]https://www.shougang.com.pe
[2]https://www.dhn.mil.pe/portal/
[3]https://www.gob.pe/apn
[4]https://www.dicapi.mil.pe/

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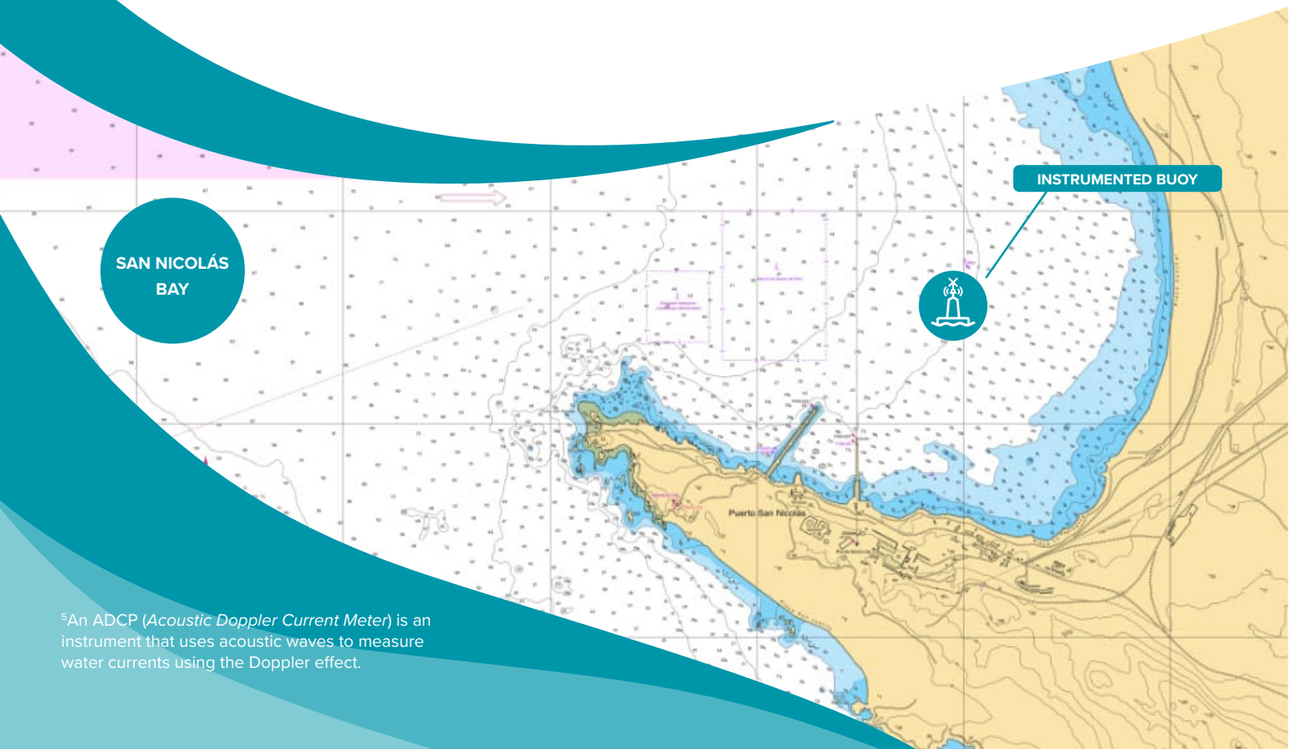
Design of the technical solution

In the case of the San Nicolás dock, the following parameters of interest were established for the analysis of navigation conditions in approaching the port

WIND: Speed and direction **WIND GUSTS:** Speed and direction	**ANEMOMETER**
WAVE: Hight, directions and period	**WAVE SENSOR**
SURFACE CURRENT & VERTICAL CURRENT: Speed and direction	**CURRENT METER OR ADCP**[5]

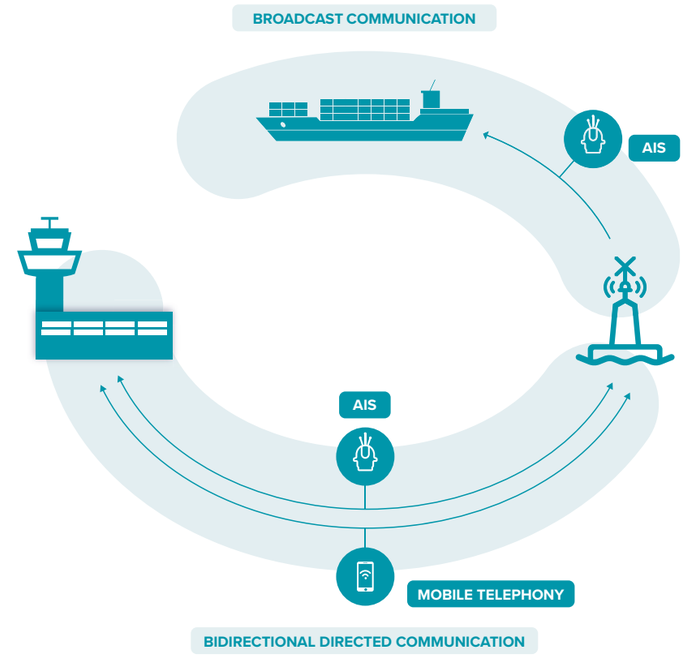
Therefore, it was decided **to place an instrumented buoy in San Nicolás Bay**, where the port is located, to measure these data appropriately for the objective.



[5]An ADCP (*Acoustic Doppler Current Meter*) is an instrument that uses acoustic waves to measure water currents using the Doppler effect.

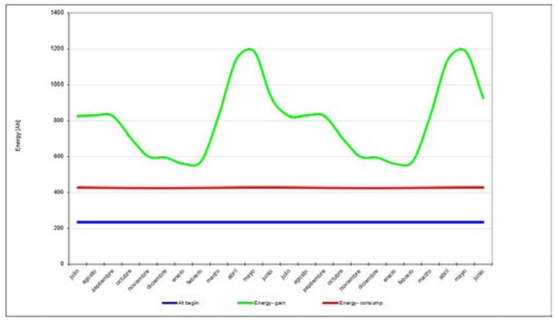
Regarding the communication strategy, a dual strategy was decided:

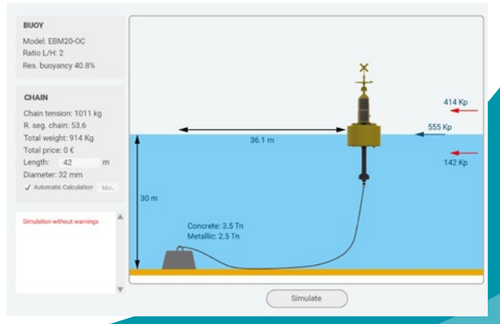
- **Bidirectional directed communication:** for Shougang's Control Center to receive meteorological and oceanographic data and operational data from the buoy (status and alarms), as well as for operational control remote commands of the buoy through AIS communications with redundancy via mobile telephony.
- **Broadcast communication:** For vessels in the area with AIS #8 Message for meteorological and oceanographic data.



With these elements, **MSM Ocean** conducted the necessary studies to determine the most suitable buoy for the project, selecting the **EBM20-OC elastomer buoy** model:

- Energy balance analysis to achieve a minimum of 14 days of autonomy without solar radiation.
- Mooring system calculation for an estimated design depth of 30 meters.



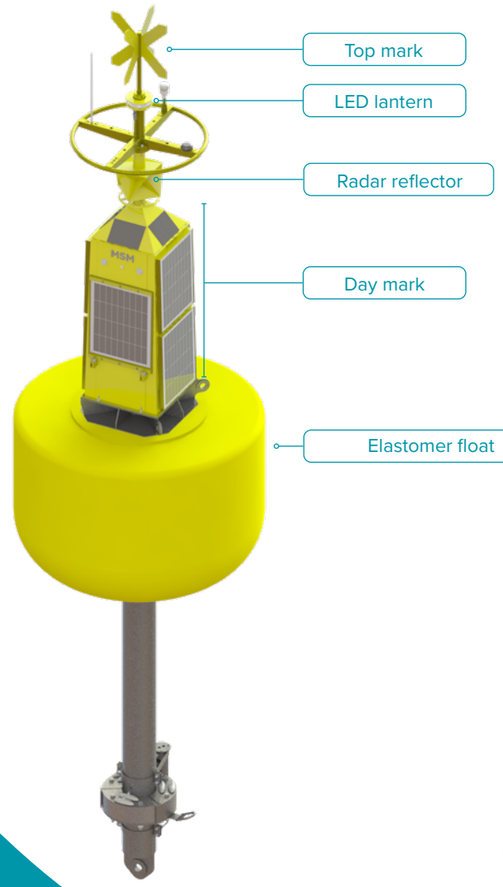


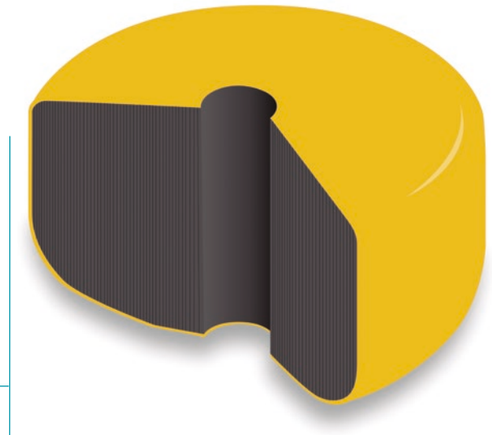
#SMART PORT

System configuration

For the San Nicolás pier project, MSM Ocean configured the following equipment:

EBM20-OC BUOY	• 2.0 m diameter elastomer float • Solar power system with 375 W solar panel and two 130 Ah batteries. • This is a coastal buoy designed according to IALA Recommendations to ensure proper visibility and safety.

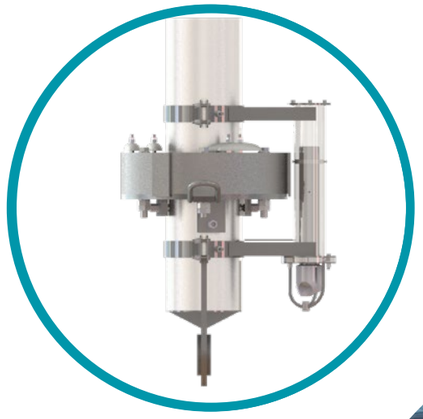




- Good hydrodynamic performance
- High recovery in case of impacts
- Zero water absorption
- High resistance to UV rays and corrosion
- Easy repainting
- Minimum maintenance
- 100% Recyclable

MSM DATALOGGER MMB03	• It **captures sensor measurements, processes them, performs data quality control, and transmits the data** according to the defined communication strategy. • It operates autonomously to **monitor the system onboard the buoy and resolve any detected incidents** through reprogramming or resetting the equipment. • It allows **remote control of the onboard equipment** from the control center.

SENSORS	
These sensors have been specifically selected for the project, providing cost-effective measurement precision for the purpose with the necessary quality guarantees:	
WEATHER STATION Brand: Airmar Model: 200WX	• Wind: speed and direction, gusts. • Barometric pressure. • Air temperature. • Relative humidity. *Although the project only requires wind measurement, this weather station provides additional data of interest to the user in a cost-effective way compared to an ultrasonic anemometer.*
WAVE SENSOR Brand: MSM Model: MB Wave 03	It provides real-time information on wave height, period, and direction, as well as statistical data of the measurements as programmed by the user.
ADCP Brand: Nortek Model: Aquadopp 600 khz	For measuring current speed and direction in the water column up to 40 meters deep.



Sensors placed
in the tail of the buoy

EQUIPMENT AND SOFTWARE SUPPLIED FOR THE CONTROL CENTER AND DATA RECEIPTION	
AIS COASTAL STATION Brand: MSM Model: MSS1	• It allows the **reception of AIS Message 8 and AIS Message 6 data**, operating as a link with the server and database for visualization in software applications. • MSM Ocean has developed a **specific Message 6** that not only transmits complete meteorological and oceanographic data, beyond the data collected in Message 8, but **also transmits operational monitoring data from the buoy as well as remote commands from the Control Center**.
WEB APP **OceanCom** Allows full management of the system and its data.	• **Visualization and management of measurement data:** Graphically and in table format, with files available for download and manipulation (.csv, .xls), including summary boxes of the latest received data. • **Operational management of the buoy:** Alarms and status of the main onboard systems (power system, beacon, security systems, etc.), with remote commands to perform corrective or maintenance actions. • **Sensor management:** Monitoring panel and remote control of measurement sensors.
APP **VTS Ocean** Allows the visualization of AIS data on a single screen.	• **Vessels monitoring**. • **Visualization of meteorological and oceanographic data** from AIS Message 8.

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Conclusion and benefits of the project for the client

The buoy was installed in June 2023, and MSM Ocean technicians, along with our representative in Peru, LIBOC S.A.C., supported Shougang Hierro Perú S.A.A. staff in mooring the buoy and configuring the Control Center.

During the installation, training was provided to Shougang Hierro Perú S.A.A. workers who will handle the operation and maintenance of the buoy and the Control Center, as well as to employees of the San Juan de Marcona Port Authority.

The measurements from MSM Ocean's buoy were verified and validated satisfactorily by a team from the Directorate of Hydrography and Navigation (DHN) following its installation.

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Testimonial

“The port of Shougang Hierro Perú S.A.A. is located in San Nicolás Bay in San Juan de Marcona. This bay is uniquely protected from wave action, especially from the south, which predominantly affects the Peruvian coasts. Due to such wave conditions and the lack of equipment to provide objective oceanographic-meteorological data, the authorities, in their role of safeguarding life and port operations, would decide to close operations throughout the San Juan de Marcona area. This restriction affected the continuity of operations at our terminal and caused ships to wait in the bay until conditions improved.

The technology applied to daily operations has repeatedly demonstrated significant advantages in optimising available resources. Thanks to the installation of MSM’s monitoring buoy at our terminal, real-time oceanographic-meteorological data is collected and shared with port operators, vessels operating in the area, and the competent authorities, allowing them to verify if conditions are within the parameters established by the maneuvering study and if the port can continue operating.

In this way, Shougang Hierro Perú SAS has not only optimised its operations in terms of resources but also added significant value to the safety of port operations and contributed to decision-making authorities by including this data in their national network.”

Leo Mansilla
Superintendent of Shipping Services and Maritime Operations
Shougang Hierro Perú S.A.A.

“Shougang Hierro Perú SAS Port has not only optimised its operations in terms of resources but also added significant value to the safety of port operations”

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