



The F-110 frigates for the Spanish Navy are multi-purpose escort ships, with anti-aircraft, anti-surface, and anti-submarine capabilities to perform their force protection and naval power projection duties. They will operate in combination with other units, and they are versatile platforms that can also perform functions related to maritime security and support to civilian authorities.

The program valued at 4.325 million euros, was signed in 2019, and includes the construction of five frigates. The first of class will be delivered in 2027 and the follow-on units at one year intervals. The program involves 500 companies from all over Spain, generating 9,000 jobs.

The F110 will represent a qualitative leap from the point of view of the Navy's capabilities and the industrial and technological potential of Navantia and all its collaborating industry. It thus contributes to Spain's strategic autonomy and cutting-edge industrial and technological base, while at the same time opening new export opportunities.

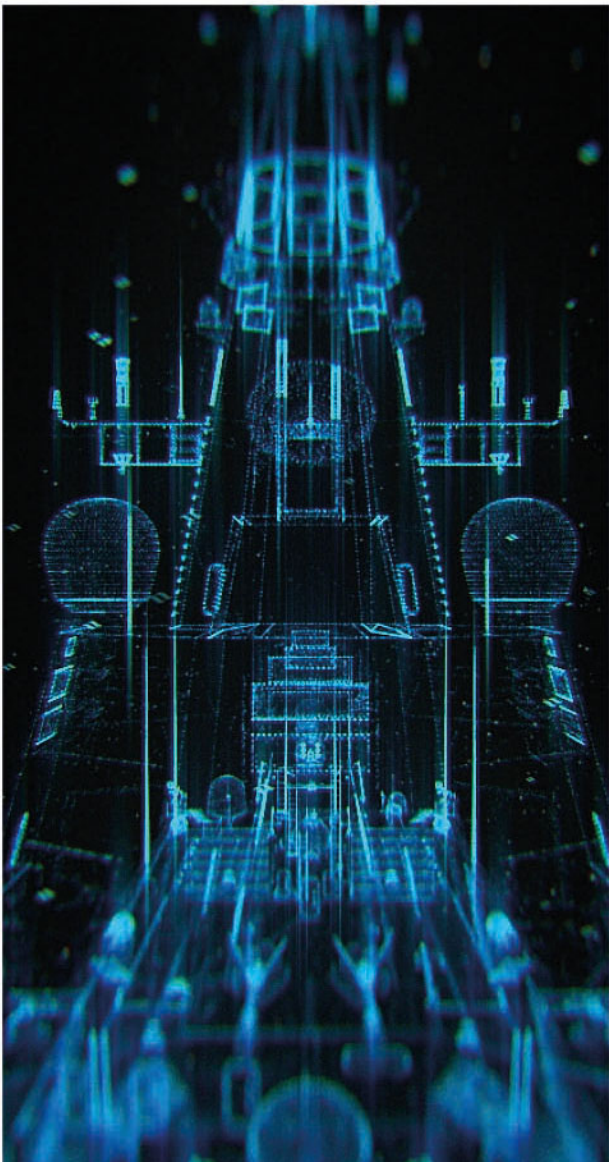
The program is the digital transformation lever for the Navantia shipyard in Ferrol, which will become an international reference in frigates, with innovative concepts such as new digitized factory and Digital Twin Center of Excellence.

# F-110

## The frigate of the future



# A TECHNOLOGICAL LEAP FORWARD



The F110 frigates have a hybrid Combined Diesel-Electric And Gas (CODLAG) propulsion that in its electric mode allows them to operate silently, enhancing their anti-submarine capability, as well as substantially improving the environmental impact thanks to the higher efficiency.

They feature a multi-mission space that increases the flexibility of the vessels' configuration to deploy unmanned vehicles or provide a second helicopter hangar .

They also have an integrated mast deploying state-of-the-art sensors whilst reducing the radar signature.

It is a smart ship designed as part of a digital ecosystem that optimizes design, construction, operation and maintenance activities in a cybersafe environment. Among its new features are:





## ADDITIVE MANUFACTURING

The F110 will carry 3D printers on board in order to print some of its spare parts, thanks to collaboration with Navantia's Center of Excellence for Additive Manufacturing (CEFAN), located in Puerto Real (Cadiz) and the Spanish Navy.

## INTEGRATED SERVICES SYSTEM

The Integrated Services System (ISS) is an initiative in collaboration with the Universities of Vigo and Coruña to develop an architecture based on the ship's 2,000 light points, a neural network that provides a significant reduction in the ship's wiring volume, while supporting the incorporation of the 4.0 technologies mentioned above. It currently integrates functionalities such as lighting, public address, monitoring, TV cameras, secure wireless access services and diverse sensorization into a single system, also allowing interaction with crew members.

## DIGITAL TWIN

It is the great project in terms of technological innovation applied to the naval industry. The Digital Twin, designed in close collaboration with the Spanish Navy and the Directorate General of Armament and Material (DGAM) of the Ministry of Defense, is a virtual replica of the ship that constantly receives information from the vessel, data permanently supplied by a network of sensors distributed throughout the ship, constituting a cyber-physical system that through the use of behavioral models and technologies such as Cloud Computing, Machine Learning and the Internet of Things (IoT) allows to support its maintenance and operation even thousands of miles away through the Digital Twin deployed ashore.

The Digital Twin will:

- Provide decision support
- Obtain in real time behavioral patterns, usage conditions, lubricant status, temperatures, thermographs, vibrations and corrosions, to make effective reliability-based maintenance.
- Through this new interactive digital environment, enhance the capacity for instruction and training of personnel.

Complemented with the Integrated Services System (ISS), it will improve quality of life at sea.







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# INDUSTRIAL AND ECONOMIC IMPACT

Some 500 companies from all over Spain are participating in the program. The high degree of nationalization stands out, since almost 65 percent of the orders placed up to January 2022 are with Spanish suppliers.

Navantia's Systems division is a supplier of numerous systems, including the: Integrated Platform Control System, Cybersecurity System, Integrated Bridge and Navigation System, Integrated internal and external Communications System, and the SCOMBA combat system. These developments performed by a Spanish company reinforces strategic sovereignty.

This nationalization of equipment reflects the maturity of various technologies - of a dual nature - that has been taking place in Spain. Thus, almost two thirds of the F110's equipment is Spanish, all of it integrated in a frigate that is at the highest level of technological excellence among escort ships worldwide in this first half of the 21st century. This driving role of Navantia among the collaborating industry also means that these companies grow in international competitiveness and opens doors to new business opportunities in different countries.

The F110 program will generate around 9,000 jobs between Navantia's own workforce and auxiliary direct employment, with further indirect jobs.

437 million euros per year of direct contribution to GDP. The impact on aggregate demand is estimated at 1300 million euros per year. Each euro of Navantia's turnover generates 1 euro of GDP.

The F110 offers new export possibilities: in the case of the F100, export contracts were generated for the same amount as the program's budget. The modularity of the F110, as well as the automation of processes, make this frigate a very competitive product.





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# DIGITAL TRANSFORMATION

The F110 is being the lever of Navantia's Digital Transformation Plan at the Ferrol shipyard, driving a new digital ecosystem. The shipyard, which is already in the process of becoming a "zero paper" production center, will have a new Block Factory that will involve an investment of 100 million euros.

It is a fully digitalized, automated and robotized factory, including advanced technology machinery, which guarantees the optimization of the product, its versatility and the reduction of delivery times. In this new manufacturing line, the traditional welding process is replaced by hybrid laser technology, substantially improving performance and minimizing distortions.

In Ferrol, Navantia will also locate its Digital Twin Center of Excellence, one of the centers of excellence of the network that Navantia is implementing in all its shipyards. The center of excellence will act as a strategic meeting point, generating innovation opportunities in the Ferrol region.

It will also provide service to all Navantia's centers, monitoring the performance of all the ships designed and manufactured by the company. Both innovations use the key technologies that enable the digital transformation commonly known as 4.0 in the field of Industry.

The aim of the project is to optimize operations, facilitating the development of new products and services thanks to the use of interoperable technologies such as Artificial Intelligence, Modeling and Simulation, Big Data, Internet of Things (IoT), Industrial Robotics, 3D Printing, Cloud, Virtual and Augmented Reality, New Digital Platforms, Cybersecurity,... a total of 14 enabling technologies so that physical assets and people are connected to their digital twins in an intelligent way. The digital twin is the key to this model, which has laid the foundations for new concepts such as "smart ship", "smart plant" and "smart support services".

