

PORT FORWARD

DIGITAL AND SUSTAINABLE PORTS OF THE FUTURE



Representation of the virtual model of the Port of Magdeburg in the Elbedome of Fraunhofer IFF, Europe's largest 'mixed-reality' laboratory for industrial applications. From left to right: Christian Blobner, Head of International Research Networks, Fraunhofer IFF & Project Manager PortForward, Tobias Kutzler, Senior Researcher, Fraunhofer IFF, Dr. Heiko Maly, Managing Director Transportwerk Magdeburger Hafen, Andreas Höpfner, Senior Researcher, Fraunhofer IFF.



Employing ICT solutions, adopting green technologies and combining different modes of transport – measures of digitalization for more efficiency, cost reduction, and a sustainable port of the future

The PortForward project, led by Fraunhofer IFF, is part of the Horizon2020 "Port of the Future" research and innovation funding program of the European Commission. The objective is to build a competitive and sustainable economy. The PortForward consortium consists of 13 partners, including the ports of Magdeburg, Balearic Islands, Vigo, Livorno, and Naples. The project, funded with a budget of almost five million euros, started on July 1, 2018 and is due to end on December 31, 2021. At the respective ports, digital possibilities are evaluated and researched in use cases. The overall objective of the project is to advance digitalization in small to medium-sized ports.

Christian Blobner, Head of International Research Networks at Fraunhofer IFF, in an interview with *RFID & Wireless IoT Global*.

Challenges Faced by European Ports

Inefficiency and high emissions – the main shortcomings of port infrastructures. Without any further intervention, emissions are expected to increase by 50 to 250 percent by 2050. There is no adequate connection with the hinterland and no real-time monitoring or coordination of cargo flows. In the past, ports have operated autonomously without a collective strategy. The entire maritime industrial cluster of the EU employs 1.5 million people and generates 270 billion euros. For this reason, a new approach will have transnational consequences.

PortForward Provides a Solution

The PortForward project seeks a holistic solution that interconnects a seamless, versatile, and secure IoT network. Christian Blobner explains: "We are investigating to what extent digitalization can push the port infrastructure forward and how concepts from the fields of IoT, logistics, and production can be adapted to port concepts". The project targets a 10 percent reduction in total operating costs. A 10 to 30 percent increase in efficiency in the EU logistics sector would result in annual savings of 100 to 300 billion euros. Furthermore, the consortium estimates that the implementation of the project will lead to a reduction in port emissions of around 10 percent per year.

CONCEPTS	IMPLEMENTATIONS
• Smart logistics platform for ports	• Holistic IoT concept for port facilities (infrastructure, vehicles, freight, personnel, and processes) • Interconnection to a seamless, versatile, and secure IoT network
• Remote management and maintenance platform	• Visualization of infrastructures • Simulations in interdisciplinary models • Remote management and intelligent maintenance tool
• Internet of Things middleware	• Data fusion from multiple IoT sources • Exchange of information with other stakeholders
• Green Scheduler for terminal operations	• Environmental and energy monitoring system • Optimization system based on the innovative concept of Green Yard Scheduling
• Virtual Port Tool for VR- and AR-based visualization	• Virtual Port Tool with central control and alternative visualizations • Augmented Reality (AR) for pilot support and remote assistance for workers/operators • Digital twin of port infrastructures • Increased transparency for all parties involved
• Supply chain related stakeholder engagement	• Support port managers and decision-makers in assessing necessary investments for maintenance and modernization of large infrastructures
• Examination of the socioeconomic effect of port emissions	• Socioeconomic analysis of the port interface with the hinterland and the port city as well as with the rest of the logistical value chain
• PortForward Dashboard for decision support	• Decision support in planning and operating phases • Innovative smart logistics platform with Decision Support System
• Validation in use cases	• Use Case research results of the individual ports



“Every port is determined to make full use of the potential of its infrastructure. The approach of this project is aimed at the digitalization of small to medium-sized ports. Particularly, it is important to adapt and optimize processes and to enhance the use of existing infrastructures. We are investigating how port infrastructures can be used more efficiently through digitalization, how concepts from other industries, e.g. in the fields of IoT, logistics and production, can be projected onto port concepts.”

Christian Blobner, Head of International Research Networks, Fraunhofer IFF

PORT OF MAGDEBURG



The port of Magdeburg is the largest inland harbor in Germany. It has six terminals which are not located in one closed area, but are individual locations that are connected and embedded in a large industrial area.

There are plans for two designated use cases with the technology partner Fraunhofer IFF on-site. On the one hand, the development of a dynamic warehouse management and, on the other hand, the automated identification and recording of warehouse goods and resources. A digital twin is to be developed which supports operational processes by interface connection with IoT devices in real time. As a result, a digital twin of port infrastructures is created – a cross-location system that is networked with external sensors via middleware capacities and cloud services. This enables flexible use and reduces search and coordination costs.



PORT OF VIGO

In Vigo, research efforts focus on the analysis of life cycle data and the development and testing of the so-called Green Yard Scheduler. In this case, the optimization of container management is examined from an environmental point of view. How can management be optimized sustainably? Christian Blobner explains: “Optimizing processes is extremely important because it means that existing infrastructures are also better utilized, which in turn increases capacity for customers”. Technology partners for these use cases include Brunel University London, Leitai, and Imec.



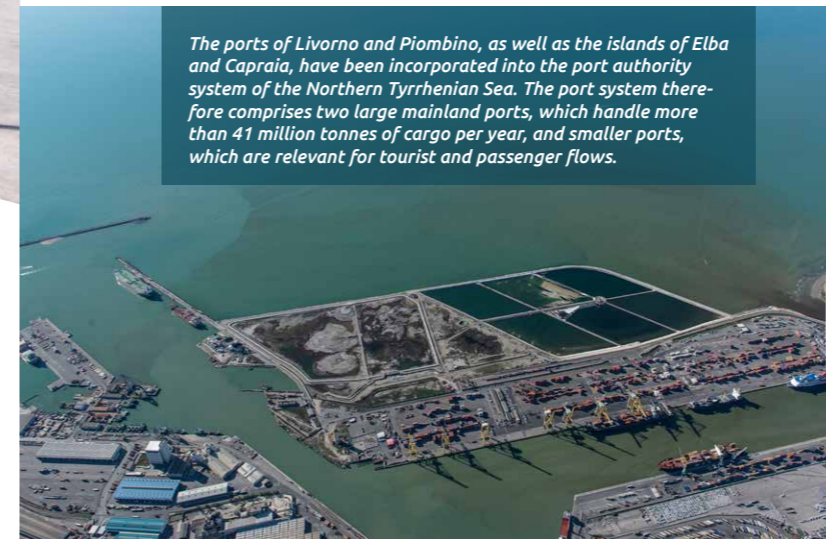
The port of Vigo (APV) is the largest container port on the Spanish Atlantic coast. It is a natural port located in the northwest of the Iberian Peninsula. The port authorities provide a public area with basic infrastructure, while the rendering of port services is left to private companies.

The ports of Livorno and Piombino, as well as the islands of Elba and Capraia, have been incorporated into the port authority system of the Northern Tyrrhenian Sea. The port system therefore comprises two large mainland ports, which handle more than 41 million tonnes of cargo per year, and smaller ports, which are relevant for tourist and passenger flows.

PORTS OF LIVORNO AND PIOMBINO



The port system is highly specialized in ro/ro-traffic, which means that the port facilities, access roads, and the environment are consequently heavily polluted. The port’s research objectives include AR-based navigation and remote maintenance. The first use case addresses pilot assistance during ship maneuvers in port waters. The second use case focuses on support for custom controls and inspections within port boundaries. In both applications Ubimax from Germany provides support with smart glasses solutions on-site.



PORTS OF NAPLES AND SALERNO

At present, the ports are lagging behind in terms of infrastructure, seabed maintenance, cargo handling capacity, technological services, and competitiveness. The quay facilities are not able to meet the market demands in light of the development within the next years. The main areas of research are intelligent logistics and socioeconomic studies. The use case addresses the monitoring of port performance in different port areas using the PortForward Dashboard for decision support in planning and operational phases. The project partner is MAR.TE from Italy.



The Naples-Salerno system is one of the three most important port systems in southern Italy. In fact, this system is regarded as a single large multi-purpose port system based on a large demographic agglomeration with a high population density. The two ports are active, both in the container market and in the automobile sector.

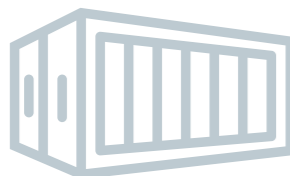
European Commission: Measures of Digitalization for Ports

The PortForward project is embedded in the following two affiliated projects. One of which is Corealis (Capacity with a positive environmental and societal footprint: Ports in the future era) and the other, Pixel (Port IoT for Environmental Leverage). Both projects started on May 1, 2018 and will run until April 30, 2021. The ports of Valencia, Piraeus, Antwerp, Livorno, and Haminakotka are participating in the Corealis project with a cumulative budget of more than 5.1 million euros. The objective: to increase efficiency, to optimize land use, to enhance the urban environment, and to be financially viable. With a combined budget of almost 4.9 million euros, the ports of Bordeaux, Monfalcone, Thessaloniki, and Piraeus are participating in the Pixel project. Their objectives are: the mutual cooperation between ports, to enable multi-modal means of transportation and cities, the optimal use of resources, reduction of environmental impacts, and sustainable economic growth.

The Balearic Islands are an archipelago of Spain in the western Mediterranean Sea, near the east coast of the Iberian Peninsula. The archipelago consists of four large islands: Mallorca, Menorca, Ibiza, and Formentera; and smaller islands, including Cabrera, Dragonera, and S’Espalmador.



THE PORTS OF PALMA, ALCÚDIA-MAHÓN, IBIZA, AND LA SAVINA ON THE BALEARIC ISLANDS



On the Balearic Islands, the project focuses on intelligent maintenance and logistics. There are a total of three use cases. The first, ship loading, ro/ro terminal handling (roll-on/roll-off) and the optimization of logistical services are being examined. The Spanish partners Acciona and Leitai, as well as the Belgian research institute Imec, are on board for this purpose. Second, the optimization of the central monitoring and management of heterogeneous port systems will be optimized with the

help of Acciona, Imec, Leitai, and Fraunhofer. In the third use case, movements between city and port are examined with regard to increasing safety and improving passenger transport for tourism activities. Christian Blobner explains, “Here, existing information is used to optimize visitor management and to provide value-added information for the port and the municipality of Palma de Mallorca.” Leitai and Acciona support this use case as technology partners.