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Ineco renews its Australia contract through to 2024

The talent of Spanish engineering

ENAIRES: Strong measures to get off the ground

2030 Agenda / CSR: TEAcompañó mobile application

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EDITORIAL

Projects that improve people's quality of life

We glimpse a new stage after a long period of pandemic that we are beginning to overcome thanks to the effort, resilience and exemplary behaviour that we have shown as a society, expressing our special thanks to all those who form part of Ineco.

In this context of a gradual return to normality, we are continuing our roadmap with the aim of making an effective contribution to improving people's quality of life. Against this background, in this new edition we take an in-depth look at four recent works carried out in our country that are firmly committed to making further progress towards this goal. The new maritime station of Ceuta, designed by our architectural and engineering teams, is an efficient technical and architectural solution that significantly improves the comfort and functionality of the building, organises traffic flows and reinforces its security. This is clearly a major benefit for the more than two million people who use these facilities every year.

In the aerospace field, we learn about the main developments at ENAIRE from its General Director, Ángel Luis Arias, who provides us with highly relevant information on the company's new strategy, in which social, environmental, safety and technological aspects are becoming increasingly important.

From a transport and land mobility perspective, Josep Vicent Boira, Government Commissioner for the Mediterranean Corridor, provides interesting data on the development of the Cartographic Viewer of the Mediterranean Corridor, a cutting-edge tool that is extremely useful for monitoring the progress of this infrastructure, a key connection with Europe. We also report on the work to adapt the tunnels of the Directorate-General for Roads of the Ministry of Transport, Mobility and the Urban Agenda to European regulations.

On the international front, we focus on Africa, Europe, Latin America and Oceania. Aeronautical solutions on two Cape Verde islands, field work for our client Rail Baltica in Latvia, the latest studies carried out for Aerocivil de Colombia at El Dorado airport, as well as the ongoing railway signalling work in Australia, highlight the important role played by Ineco equipment throughout the world.

The commitment to Spanish engineering talent, through the promotion and transmission of knowledge provided by the company's training programmes; the promotion of social and innovative action with tools such as the TEAcompañó mobile application –which improves accessibility to air transport for children with ASD– and the commitment to environmental sustainability, led by our team specialising in noise pollution, round up the contents of this edition, which we share with all our readers.



“We glimpse a new stage after a long period of pandemic that we are beginning to overcome thanks to the effort, resilience and exemplary behaviour that we have shown as a society”

CARMEN LIBRERO
President of Ineco

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Editor-in-Chief: BÁRBARA JIMÉNEZ-ALFARO - barbara.jimenez@ineco.com **Editorial Staff:** LIDIA AMIGO - lidia.amigo@ineco.com

Editorial Board: LIDIA AMIGO, JOSÉ M^a BERDOY, JORGE DE SAN JOSÉ, NATALIA DÍAZ, JUAN RAMÓN HERNÁNDEZ, BÁRBARA JIMÉNEZ-ALFARO, DANIEL LATORRE, MÓNICA LAUDA, ADRIÁN LÓPEZ, TATIANA MANCEÑIDO, ALBERTO MILANÉS, ANA PELÁEZ, PATRICIA REY, CELESTINO RODRÍGUEZ, JARA VALBUENA

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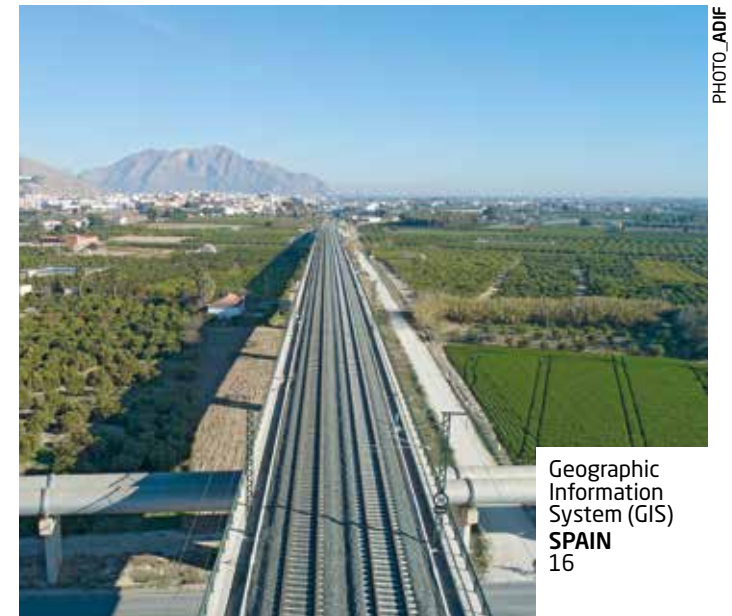
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MASTER PLAN FOR KINGSTON AIRPORT

Ineco joins a new project in Jamaica with the update of the Master Plan for the Norman Manley Airport in Kingston. The project involves the analysis of air traffic forecasts, the collection of the data necessary to carry out airport planning and the proposed development of existing facilities up to 2040. This work for the concessionaire PAC Kingston Airport Limited, which belongs to Grupo Aeroportuario del

Pacífico (GAP), owned by Aena Internacional, follows the work already carried out for Sangster Airport in Montego Bay and Ian Flemming Airport in Boscombe, in the north of the island. Ineco has updated the master plans for both, as well as managing and projecting various works at Sangster International, where it began working more than a decade ago (see *ITRANSPORTE* 62 and 67).

SPAIN

THE MADRID METRO INAUGURATES THE NEW GRAN VÍA STATION AND SOL PEDESTRIAN TUNNEL



PHOTO_MADRID METRO



PHOTO_INECO / ADIF

The new Gran Vía metro station, in the heart of Madrid, opened in July under the replica of the historic 1920s pavilion designed by the architect Antonio Palacios.

The new station has three levels. In the first, there is a large vestibule that will grow from 900 m² to 2,000 m²; in the second, a museum will be created with the archaeological remains that have come to

light during the works; and in the third, the connection with Metro line 5 and the pedestrian gallery with the Renfe Cercanías in Sol station, which has also entered into service. Ineco has carried out the project and managed the works for Adif. Thanks to this tunnel, 66,000 passengers a day will be able to transfer directly to Gran Vía station without the need to go outside.

MEXICO

NEW GALILEO INFORMATION CENTRE FOR MEXICO, CENTRAL AMERICA AND THE CARIBBEAN

Since 2 June, the European satellite navigation system, Galileo, has had a new Information Centre in Mexico City, located in the facilities of the National Autonomous University of Mexico (UNAM).

The objectives of the centre, similar to others existing in different parts of the world, such as Brazil -in which Ineco is also involved- and Chile, are to promote and disseminate Galileo in its geographical area (Mexico, Central America and the Caribbean), as well as to monitor local initiatives for use in different fields and to provide training in satellite navigation, bringing together industrial, institutional and university/research sectors.

Ineco will support Telespazio, the project coordinator, in tasks related to market analysis and stakeholder identification, as well as in establishing industrial collaborations between European and Latin American partners. The project will run for three years.

This centre contributes to the European Commission's space outreach activities to promote EU Space Programmes and encourage their use in the Latin American market.



PHOTO_UNAM

SPAIN

RADIOELECTRIC STUDIES FOR THE AIRBUS HEADQUARTERS IN GETAFE



PHOTO_ESTUDIO LAMELA

Ineco has carried out various radioelectric and safety studies to ensure that the buildings of Airbus Spain's new 51,200 m² corporate headquarters in Getafe, located next to the air base, do not interfere with airfield operations.

The new Airbus headquarters complex, named 'Futura', was inaugurated on 14 April in the presence of King Felipe VI and Prime Minister Pedro Sánchez.

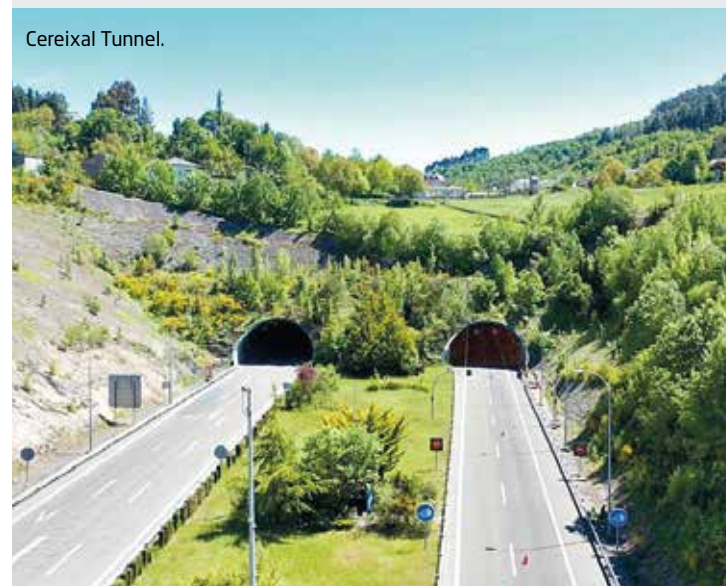
SPAIN

TESTING OF 'SMART TUNNEL' AND ASSISTED DRIVING WITH 5G IN GALICIA

Ineco has participated in an assisted driving test with 5G technology in the Cereixal tunnel on the A-6 in Lugo. The demonstration, which took place in May, is part of the 5G Galicia Pilot project promoted by the Ministry of Economic Affairs and Digital Transformation, which also involves Telefónica, Nokia, Stellantis, CTAG and SICE.

During the test, the vehicle received information from the 'smart' tunnel, which had been equipped with 5G sensors that transmit data and images in real time: accident warnings, congestion, slow traffic, weather conditions outside, etc. Ineco developed the system that integrates and presents the information to the driver.

Cereixal Tunnel.



SPAIN

RAQUEL SÁNCHEZ, NEW MINISTER OF TRANSPORT, MOBILITY AND URBAN AGENDA



Raquel Sánchez Jiménez replaces Jose Luis Ábalos at the head of MITMA. Born in Gavà (Barcelona) in 1975, where she has been mayor of the Socialists' Party of Catalonia (PSC) since 2014, she has a degree in Law from the University of Barcelona and a master's degree in Labor Law and Social Security from the Pompeu-Fabra University. In 2020, she was elected as a representative of the Spanish Federation of Municipalities and Provinces in the National Climate Council.

TAIWAN

THIRD RUNWAY AT TAOYUAN AIRPORT

Ineco will form part of the team responsible for the airport planning tasks associated with the construction of the future third runway at Taoyuan International Airport, the largest and most important airport in Taiwan.

Among the works to be carried out will be the definition of low visibility procedures in the area and an estimate of the capacity in such conditions, the definition of new stop bars and taxi routes and other aeronautical safety studies. An analysis of the construction method of the current end-of-run-

way access taxiway (05L/23R) will also be carried out and the safety of operations will be assessed so that they are not compromised during the execution of the work.

Since the beginning of its aeronautical activity in the mid-1990s, Ineco has participated in the enlargements of major Spanish airports (Madrid, Barcelona, Palma de Mallorca, Alicante, Málaga, etc.), before making use of this experience in other countries such as Abu Dhabi, Kuwait, Peru, Colombia, the USA, the Netherlands and the Ukraine, among others.



PHOTO_RAY SWI-HYMN (WIKIPEDIA)

PHOTO GRUPO MLN



SPAIN

INAUGURATION OF THE FIGUERUELAS-GALLUR SECTION OF THE A-68 IN ARAGON

The new 14-kilometer section of the A-68 highway between the Zaragoza towns of Figueruelas and Gallur entered service on March 23, with an official act in which the Ministry of Transport, Mobility and Urban Agenda and the government of Aragon participated.

The project, drawn up by Ineco for the Demarcación de Carreteras de Aragón, consisted of doubling the carriageway and upgrading the layout of the N-232 road to

convert it into a high-capacity road. The section accommodates daily traffic of 13,000 vehicles, of which more than 50% are heavy vehicles, and will add to the 28 kilometres of highway already in service between Zaragoza and Figueruelas. When work on the next section, up to Mallén, is completed towards the end of 2022, an axis of more than 80 kilometres of highway will be completed from Zaragoza to Alfaro, in La Rioja.

SPAIN

WORKS ON THE SOUTH DOCK AT EL PRAT AIRPORT HAVE BEEN COMPLETED

Last April, Aena announced the completion of Aena's remodelling work on the South Dock of Terminal T1 at Josep Tarradellas Barcelona-El Prat airport, a project carried out by Ineco in 2018 (see ITRANSPORTE 65).

The works were aimed at increasing the capacity of the Dock to cater for the growing number of wide-body aircraft operations, which now have five new

parking positions. The south wing of T1 has also been remodelled with the construction of four new boarding bridges and the extension of an existing fifth, all equipped with moving walkways for large aircraft.

The interior of the building has been divided into three levels, separating incoming and outgoing passenger flows.



SPAIN



PHOTO INECO

CANALISATION OF THE RIVER ADRA TO PREVENT FLOODING

Ineco will carry out the construction project for flood prevention and adaptation of the Adra riverbed in Almería for the Directorate-General for Water of the Ministry for Ecological Transition and the Demographic Challenge. The works, which have been declared to be of general state interest, include modifications to the road that runs parallel to the river, in an area of difficult terrain.

Among the works planned, the company will be in charge of the project to build a wall perpendicular to the AL-6300 road, which involves raising the road's gradient by 3 metres and

building walls in the area near the riverbed to guarantee that the flow of the overflowing water returns along the right bank of the river.

Declared a Site of Community Interest and a Special Area of Conservation in its last stretch, the channelling of the river Adra is a project that has been long awaited since the 1973 flood caused extensive damage in the municipality, when the river reached a height of more than eight metres in some areas. In the picture, the original wall inaugurated in 1891 during the regency of Maria Christina of Austria.

SPAIN

ENVIRONMENTAL MANAGEMENT FOR THE PORT OF SANTANDER

Ineco is supporting the Santander Port Authority in the maintenance of its integrated quality and environmental management system (IQEMS), whose work includes updating the port's environmental standards.

The company is collaborating in the implementation and certification of the PERS (Port Environmental Review System), a specific methodology for environmental management systems in the port sector, and

EMAS (Eco-Management and Audit Scheme), a voluntary environmental management and audit scheme introduced by the European Union.

Ineco will also carry out maintenance work until 2025, including the annual environmental statement and the biennial PERS report. Ineco will also provide support in the drafting of the Sustainability Report and a Sustainability Plan to be developed during the contract period.



Port of Santander.

PHOTO JUANJOMINOR (FLICKR)

SPECIALIST IN RAILWAY SAFETY, A NEW POSTGRADUATE QUALIFICATION BACKED BY INECO

Ineco's president, Carmen Librero, has announced the launch of the Carlos III University of Madrid's Specialist in Railway Operational Safety degree, promoted by the company, which will provide four of its professionals as lecturers, together with Adif, Adif Alta Velocidad, Renfe and the State Agency for Railway Safety. The programme offers comprehensive training in railway safety and is aimed at bachelor's or master's degree graduates.

The new degree was presented during the Ineco Forum session 'The Future of the Rail', on 22 June, as part of Rail Week held on the occasion of the European Year of Rail. The event was opened by Casimiro Iglesias, General Director of Planning and Evaluation of the Railway Network of the Ministry of Transport, Mobility and Urban Agenda, and was attended by the main players in the sector.



SPAIN

LATIN AMERICA

THE INTER-AMERICAN DEVELOPMENT BANK CONTRACTS INECO TO IMPLEMENT BIM

The Inter-American Development Bank (IDB) has contracted Ineco through a public tender to implement the BIM (Building Information Modeling) methodology in construction projects in Latin America and the Caribbean. This is the company's second BIM contract in the region in recent months, following the recent contract to provide a training course for experts from another multilateral financial institution, CAF (see ITRANSPORTE 71).

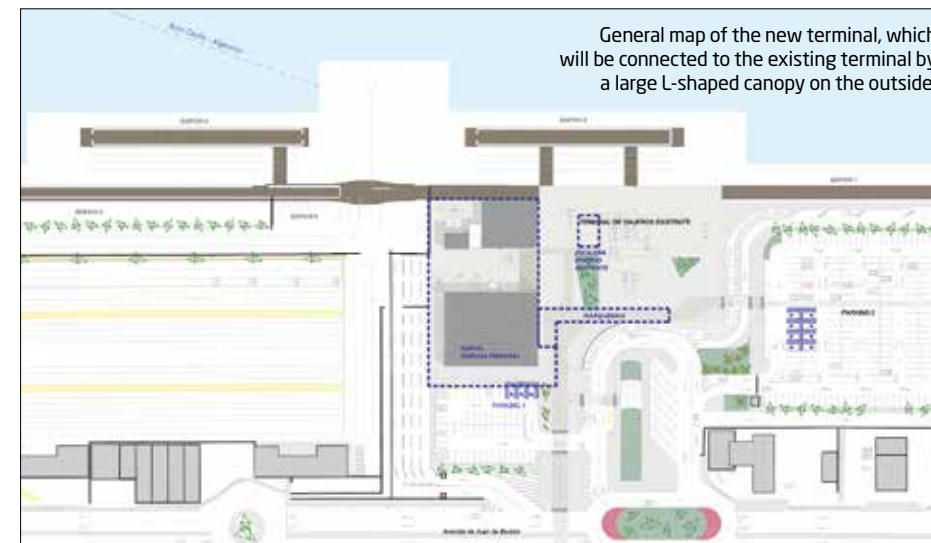
The objective of the consultancy is to generate a methodology to measure the economic, performance and management impacts and results of BIM implementation in construction sector projects. The contract is for a period of five months and includes the implementation of three pilot projects.



THE FUTURE MARITIME STATION
The exterior of the new building plays with volume, with a curtain wall and cladding made from blue ceramic slats that filters light while also acting as a distinctive landmark. On the right, a view of the entrances, and in the image below, the new boarding lounge.



IMAGES_INECO



General map of the new terminal, which will be connected to the existing terminal by a large L-shaped canopy on the outside.

PLAN_INECO

The port of Ceuta, one of the two Spanish autonomous cities, together with Melilla, located in North Africa, is the country's fourth busiest port in terms of regular passenger traffic: 2.1 million passengers and nearly half a million vehicles per year, according to 2019 figures from the Ceuta Port Authority. Due to its peculiar geography –with a surface area of only 19 km² and its location on the Almina peninsula, between the Mediterranean and the Atlantic– the sea provides the primary means of connection with the rest of Spain and supplies for the city, which receives all kinds of goods and basic supplies, such as building materials, fuel and even water. The port is also a transit area for cross-border goods traffic between Morocco and Europe.

Although the city has had a heliport belonging to the Aena network since 2004, where regular flights to Melilla, Algeciras and Málaga operate, the high-speed ferry is the main means of passenger transport. Three shipping companies –Armas, FRS and Balearia– currently offer numerous daily connections for passengers and vehicles between Ceuta and Algeciras.

THE TERMINAL IS THE FIRST AND LAST THING THAT PASSENGERS ARRIVING OR LEAVING BY SEA WILL SEE, WHICH MAKES IT AN EMBLEMATIC BUILDING FOR THE CITY

The port has two breakwaters, measuring 1,500 metres and 500 metres long, known as the Poniente and Levante docks, respectively. Inside the harbour there are two main quays: perpendicular to the coast, the Spain quay, where the control tower is located and where the first passenger terminal was built, and the Cañonero Dato quay, where the maritime station was moved in the 1970s and four ferry berths were built. The port also has a marina and fishing harbour, as well as a dry dock.

A new emblem for Ceuta

Bigger, more modern and more secure: this is what the new passenger building at the port of Ceuta, designed by Ineco, will look like. Every year, more than two million passengers pass through the port, a key infrastructure for the mobility and supply of the city.

By Raquel Alonso, architect, and Antonio Moreno, civil engineer

The terminal is therefore the first and last thing that passengers see when they arrive or leave by sea, which makes it an emblematic building for the city, barely one kilometre from the centre and four kilometres from the Moroccan border. Although various reforms and works have been carried out over the years, the passage of time, the increase in maritime traffic, changes in infrastructure legislation and, above all, the challenge of reinforcing security in the face of global risks such as terrorism, among others, have made it necessary to remodel and expand the facilities.

As a result, in 2017, the Ceuta Port Authority commissioned a feasibility study for the new terminal, which pro-

duced three main conclusions: the need to double the surface area, the need for a new pre-boarding hall and the need to separate the flows of embarking and disembarking passengers –which is not currently the case– for security reasons. In 2019, it contracted Ineco to study the possible alternatives and draft the preliminary design and subsequent construction project for the new maritime station, including car parks and accesses, which was completed in October 2020.

EXISTING FACILITIES

The existing terminal has an estimated maximum traffic capacity of four million passengers and one million vehicles. In addition to the passenger building, it has

four berths for ships, RO-RO ramps for loading and unloading cars and lorries, and an esplanade with a capacity for 900 vehicles, with separate boarding and disembarking areas. Between these two areas are the ticket and police control facilities, and at the end of the disembarking area, the Guardia Civil's tax service checkpoint, which carries out customs inspections.

The existing passenger terminal is a T-shaped building with two floors, each covering approximately 2,500 m². The rear façade faces the quay, where the fixed and mobile boarding bridges (fingers) and the road for vehicles are located, while the main façade gives access to an open space with landscaped areas and parking for coaches. On one side are the taxi stand and a public car park, and on the other, the road for vehicle boarding and a private car park, which will be moved, since the new terminal planned by Ineco will be located on this plot.

THE NEW TERMINAL

The project includes the construction of a new passenger building adjacent to the existing one, improvements to two of the berths and their access galleries (the other two are not included since they have recently been renovated) and the reorganisation and arrangement of car parks and accesses. The estimated completion time for the works is 24 months.

In terms of equipment, modern systems for water and electricity supply, sanitation, fire protection, security and CCTV and telecommunications will be installed.

The building will connect with the existing terminal on the inside at several points, and on the outside, a large canopy more than 46 metres long will be installed to provide aesthetic unity to the complex and give travellers a sheltered route to the taxi stand. From the land

side, the main entrance is located on the southeast façade, near the existing entrance. There will also be three other secondary accesses, for restricted use and for use as emergency exits.

From a functional point of view, the new maritime station is designed to completely separate incoming and outgoing passenger flows, a key security aspect. This is the case with the layout of the two floors of the building: the ground floor opens onto a large lobby that divides the terminal into two distinct areas: on the one hand, a public space, with a double-height ceiling, which houses the access to the upper floor, the check-in, areas, restrooms and commercial area; and on the other, a large area for restricted use, distributed around an internal courtyard that provides light and ventilation for the space, while remaining out of travellers' sight. This area contains the new premises for the National Police and Guardia Civil, installation rooms and other facilities.

The upper floor connects with the access galleries to the ship berths. It contains the pre-boarding and boarding lounges, which include an authorities' lounge, and between the two, the passenger control area, which is connected to the security forces' offices on the lower floor and is equipped with baggage scanners, document control points and search and X-ray rooms.

Meanwhile, disembarking passengers will have direct access from the gangways to the ground floor concourse (via the shopping area) and from there to the outside. The entire floor is therefore configured in such a way that passenger flows never cross. Three stairwells and two lift shafts are planned, which are distributed so as to allow independent access to the different areas of the terminal.

The construction project also includes improvements to berths and access galleries 3 and 4, which will consist mainly of replacing flooring and suspended ceilings, new lighting, removal of elements that are no longer in use, such as luggage belts and old HVAC equipment, to leave more free space in the corridors, the renovation of enclosures and metal structures and installation of seating and rest areas. Accessibility will also be improved with tactile-visual paving and double handrails with identification plaques in Braille on the ramps connect-

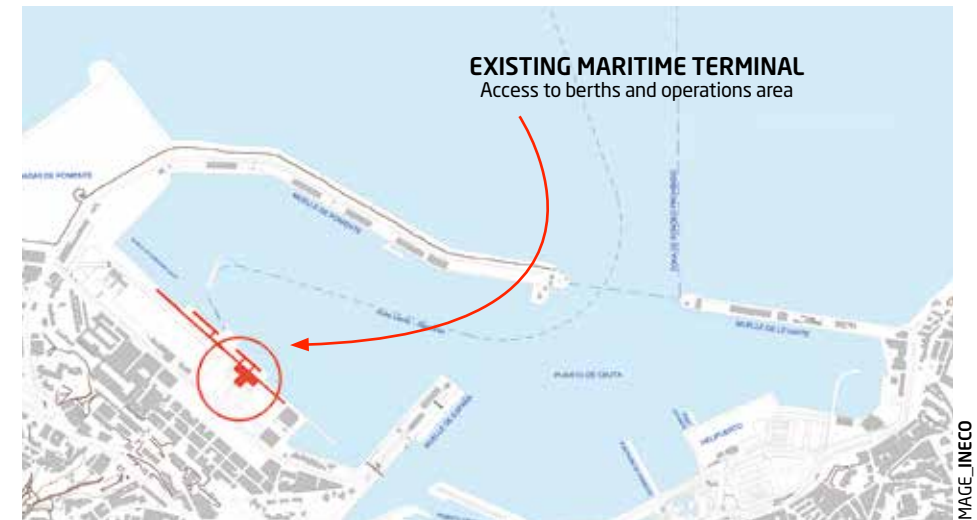


PHOTOS - CEUTA PORT AUTHORITY

Above, aerial photo of the port of Ceuta. Below, from left to right, the existing maritime station, entrance and boarding bridge.

THE NEW MARITIME STATION IS DESIGNED TO COMPLETELY SEPARATE INCOMING AND OUTGOING PASSENGER FLOWS, A KEY SECURITY ASPECT

ing the walkway to the boarding area. In terms of urban development and parking, pedestrian and vehicle flows will be rearranged and prioritised so that there are no intersections. There are two public car parks for about 280 vehicles, drop-off zones and taxi stands for 25 vehicles, seven bus bays, an area for emergency vehicles and an area for loading and unloading. The private car park, with 48 parking spaces, will be located adjacent to the south façade. ■



Location of the maritime terminal of the port of Ceuta and operations area.

IMAGE - INECO



IMAGE - INECO

ARCHITECTURE: INTERACTING VOLUMES

The new Ceuta maritime station has been designed as a volumetric interaction between superimposed boxes that shape the space and the interior layout of the building. The new terminal is spread over two floors covering approximately 3,200 m², separating public/private flows and needs, with the visuals between the two floors playing an important role, allowing a 360° view of the interior of the terminal.

Its structural layout replicates the modular grid of the existing building, adapting to the needs of large numbers of travellers and large, unobstructed spaces. The building is set on a base of ceramic slabs, thus blending in with the existing terminal. Above the base, a lantern-like volume stands out as a visual landmark, created by a curtain wall façade and a second skin of blue ceramic slats, which acts as a focal point that regulates the light that enters the building. The play of protruding volumes and the vandal-proof design of the façade make the building more secure.



PHOTO_KAINITA-FUCKR (WIKIPEDIA)

CEUTA'S ECONOMY

Based on the tertiary sector and fishing, the region is characterised by its small territory. It has free port status and certain tax advantages. Tourist attractions include the medieval royal walls with their navigable moat, the Cathedral of St Mary of the Assumption, several museums, the picturesque Casa de los Dragones (1905), pictured here, and a Neolithic site discovered in 2001, which is open to visitors. Visitors also have at their disposal the Maritime Park, an urban leisure complex with three artificial salt lakes which opened in 1995, a marina and 21 kilometres of coastline with several beaches and coves.



PHOTO_DIEGO DELSO (WIKIPEDIA)

THE CITY OF SEVEN HILLS

The origins of the city go back almost 250,000 years BC. Phoenicians, Carthaginians and Romans have left their mark on this enclave of great strategic and commercial importance since ancient times.

A profitable project for society

Ineco has carried out an assessment to determine the socio-economic benefits of the new maritime terminal

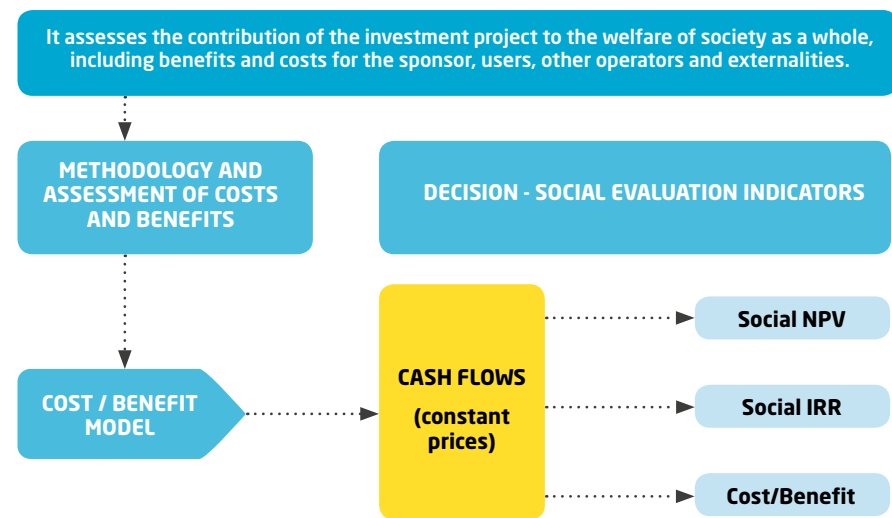
By Carmen Araújo, bachelor in Economic Sciences (Ineco)

The cost-benefit analysis or socio-economic evaluation is a technique that enables the net contribution of the project to the overall welfare of society as a whole to be measured in monetary terms. In order to determine the net social benefit of the new maritime terminal in the port of Ceuta, the flow of benefits and costs generated over a period of analysis has been compared with a baseline situation (without the project), which is taken as the basis for the analysis.

With the increased capacity and floor space of the new building, both the functionality and security of the terminal are expected to be improved. Although the project aims to increase the port of Ceuta's passenger handling capacity, it is not expected to have a significant effect in terms of attracting or generating traffic. Therefore, one of the main assumptions is that the main people who will be affected by the project are the users of the port, mainly the passengers on the Ceuta-Algeciras line.

The results obtained indicate positive final results for the socio-economic

SOCIO-ECONOMIC PROFITABILITY



Methodology: Cost-Benefit Analysis

evaluation, even if they are based on conservative assumptions. The benefits resulting from the time savings in boarding are high enough to offset the increased operating costs and pay for the initial investment required. From a socio-economic

point of view, an IRR (Internal Rate of Return) higher than the discount rate of 3.0% has been obtained, therefore, it offers a positive NPV (Net Present Value), which ensures the profitability of the project and confirms its timing. ■



CARLOS DELGADO
Civil engineer (Ineco)

THE PORT: THE LUNGS OF CEUTA

The port of Ceuta plays an essential role in guaranteeing passenger mobility and goods supplies for the autonomous city. In particular, the more than 2.1 million passengers that the port facilities handled in 2019 make it the fourth largest volume of passengers in terms of transport in the state-owned port system as a whole. Additionally, the Ceuta Port Authority handles almost 450,000 vehicles in transport regime and more than 1.7 million tonnes (excluding fishing, provisioning and inland traffic).

Focussing on passenger mobility, nearly all the passengers handled by the port of Ceuta are travelling between

the autonomous city and the port of Algeciras. This shipping line, which is one of the 13 cabotage shipping lines designated as being of public interest, is operated by three shipping companies (Balearia, Transmediterránea/Armas and FRS) with a combined service of approximately 18 daily crossings, generally using HSC (high-speed craft, colloquially known as fast ferries).

It is also worth highlighting the strong seasonal component of passenger demand during the summer months, largely due to Operation Crossing the Strait. The large influx of citizens of North African origin residing in Europe who take advantage of their holidays to visit their countries of origin in North Africa, means that the total monthly demand on the line triples during the months of July and August for the Algeciras-Ceuta direction and in August and September for the opposite direction. Furthermore, this phenomenon also changes the distribution between Ceuta resident passengers (who receive a discount on the ticket price) and non-residents, as non-resident passengers went from being approximately 50% in the non-summer months to registering an average participation of close to 70% in July, August and September.

The importance of the Port of Ceuta in the mobility, accessibility and territorial cohesion of the autonomous city plays an even greater role since it is the main alternative for connection with the Spanish mainland. Although Ceuta has had a heliport belonging to the Aena network since 2004, the volume of passengers transported was approximately 33,000 people in 2019 (with services connecting Ceuta with the cities of Algeciras and Málaga), which barely represents 1.6% of the total number of passengers transported by sea.

On the other hand, of the 1.7 million tonnes managed by the Port Authority of Ceuta, approximately 355,000 tonnes (more than 20%) are transported on the public interest shipping line that connects the autonomous city with Algeciras. The seasonal component that can be observed in passenger transport is not evident in the freight segment, although flows are usually quite unbalanced as loaded lorries arrive in Ceuta and return empty.

To conclude, Ineco's experience in carrying out transport demand studies in all modes of transport (road, railway, air and maritime) makes it a leading company when it comes to undertaking this type of analysis.

**ACCESSIBLE AND DETAILED
MONITORING OF THE ENTIRE CORRIDOR**

The Cartographic Portal includes information on the current and future state of the Mediterranean Corridor and on accesses to ports and railway terminals. It also includes specific layers on the metropolitan and suburban lines of the main urban centres, as well as the major transport networks: the route of the European Mediterranean Corridor (TEN-T), the Trans-Maghreb Corridor and the maritime connection between Palma de Mallorca, Barcelona and Valencia. In the picture, a section of the Corridor in the province of Alicante.



In-depth mapping for the Mediterranean Corridor

Adif, through the Office of the Spanish Government Commissioner for the Mediterranean Corridor and with the support of Ineco, has created an interactive map viewer, which compiles and details all the information on the Corridor, including the latest development along more than 5,000 kilometres.

By **Matteo Berzi**, PhD in Geography and Head of GIS at the Office of the Spanish Government Commissioner for the Mediterranean Corridor

On 24 March 2021, Adif unveiled the new Geographic Information System (GIS) of the Mediterranean Corridor to celebrate the European Year of Railway. The need to develop a GIS arose in response to requests received by the Commissioner's Office from institutional, economic and social actors: an official, accessible and user friendly, but at the same time technically and graphically detailed means of consultation.

There are interesting and pioneering examples of GIS applications to trans-European corridors, such as the European Commission's TENtec interactive map of the 9 trans-European corridors or the CIS (Corridor Information System) of the Rhine-Alpine Corridor. However, neither case manages to combine the precision and quantity of information, the speed of consultation and the ease of use that today's information society demands. For this reason, Adif has emphasised that the Mediterranean Corridor GIS should set four fundamental objectives: providing up-to-date information on its development; displaying its complexity, identifying



Future scheme of Mediterranean Corridor (Map Viewer).

all the connection nodes; showing its cross-border and European scope; and visualising the work of the Office and the monitoring of the works. The materialisation of these objectives in the form of this interactive portal has attracted attention in the EU, where the tool has been received with interest. Its excellent reception, which exceeded 10,000 visits in the first month, has prompted Adif to plan the development of a GIS for the Atlantic Corridor as well.

In order to achieve the aforementioned objectives, a specific working methodology has been developed

and articulated in several phases under the direction of the Office of the Mediterranean Corridor. Firstly, it has been necessary to design *ad hoc* databases to catalogue and process the information related to the Mediterranean Corridor: the technical, socio-economic and geographical aspects of the railway infrastructure, urban nodes, ports and terminals, among others, have been structured and codified in an integrated and coherent manner. This has been very important in order to achieve a geo-spatial architecture that is both flexible, i.e. allowing

periodic reviews, and at the same time rigid, in the sense that no structural modifications are needed and that it is well adapted to other European corridors or other transport networks.

Secondly, all the necessary data and cartographic bases have been collected. This step has relied upon the collaboration of many institutions and companies. Adif's role in providing geospatial information and very specific data on the railway infrastructure and freight operations, and Ineco's role in numerous works, studies and projects of the Mediterranean Corridor, both stand out. SNCF

Réseau and the Occitania Region were involved in the profiling of the cross-border sector and the French sections. Much data has also been collected from the websites of port authorities, intermodal terminals and private companies websites.

Thirdly, mapping has been carried out to provide the databases with spatial information. The real challenge has been to harmonise the sectioning of the railway network and the nodes in order to make the sections implemented in the Geographic Information Systems of Adif (IdeADIF) and the European Commission (TENtec) compatible and at the same time coherent with the planning of the works and ongoing studies.

As a result, the network is made up of almost 700 sections between the Network of General Interest and the accesses to terminals and ports, represented in four situations: sections currently in service; in execution; in the study and construction project phase; and, finally, future sections, i.e., when all the actions in progress have been completed.

Nodes, on the other hand, total more than 270 elements. Overall, more than 1,000 elements have been processed, each with its associated geometries and information, with a total of 45,000 attributes. The amount of information to be processed is considerable and continuous revisions (last phase) have been

necessary in order to achieve a very high level of accuracy and detail.

In order to show how the Corridor fits in at local and regional level, the layers of the metropolitan and suburban lines of the main urban centres have been incorporated, as well as the major transport networks at 'Euro-Mediterranean' level: the route of the European Mediterranean Corridor (to the north), the Trans-Maghreb Corridor (to the south), the maritime connection between Palma de Mallorca and Barcelona/Valencia (to the east) and lastly, Adif's railway network (to the west).

Finally, a set of socio-economic and environmental indicators have been incorporated in order to understand the Mediterranean Corridor as an axis

THE VIEWER HAS A BASE MAP TO CONSULT ALL THE PLANNED SECTIONS UNDER CONSTRUCTION AND IN SERVICE AND A STATISTICAL MAP WITH DYNAMIC GRAPHS THAT SUMMARISE THE MOST RELEVANT TECHNICAL AND SOCIO-ECONOMIC ASPECTS

of territorial structuring, a lever for a more sustainable, resilient and better connected territory. This data will be updated on a regular basis, in line with the progress of the works and ongoing studies. After the data had been validated by Adif, a map viewer was developed in Esri environment that is highly innovative in terms of its structure, content and visualisation. It is available in two different modes: a base map that allows users to consult the information mentioned above, and a statistical map with dynamic graphics that summarise the most relevant technical and socio-economic aspects.

The viewer is hosted on the Hub-GIS of the Office of the Spanish Government Commissioner for the Mediterranean Corridor, where it is possible to consult additional documentation on the Office (reports, annual reports, photos of works in progress, infographics, etc.) and links to related websites. The Hub-GIS is accessible to the public from Adif's main website and the following link <https://corredor-mediterraneo-ADIF.hub.arcgis.com>. A searchable user guide has been produced to make it easier to consult and use the viewer.

Using a practical example, it is possible to consult the current status of the mixed-use line between the French border and Barcelona, the type of electrification (25kv), the maximum axle



PROGRESS ON THE CONNECTION WITH FRANCE AT VILA-SECA AND THE MARTORELL TUNNEL
The works to adapt the Martorell tunnel to standard gauge and the installation of a third track between Martorell and the Vila-seca junction are essential for freight trains to be able to run on standard gauge between Tarragona and Barcelona. The completion of these works will link the road to the area's factories, such as the SEAT factory.

THE CARTOGRAPHIC PORTAL



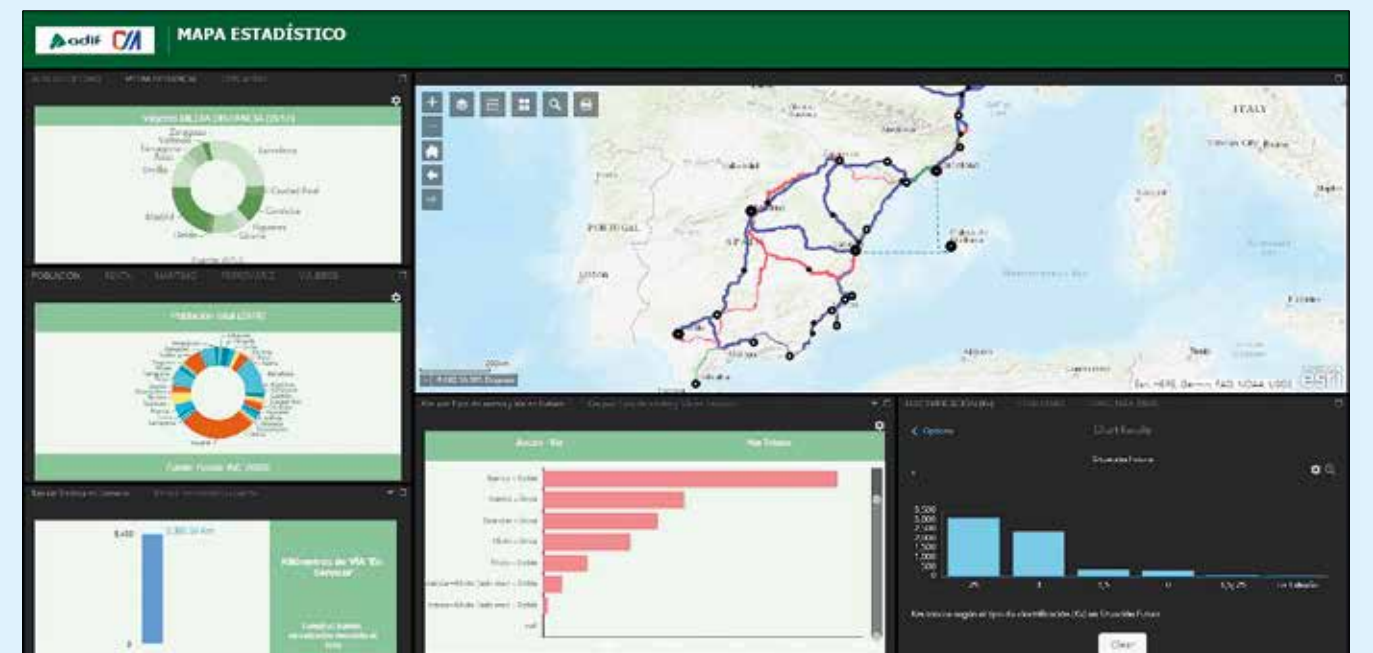
PURPOSE OF THE VIEWER:

- **To provide economic agents and citizens with information** on the development of the Corridor, i.e. to show its current situation, the state of works and projects in progress, and finally the future situation (foreseen according to the current planning of the Ministry of Transport, Mobility and Urban Agenda, MITMA).
- **To display its depth and complexity**, identifying and characterising the main nodes connected and to be connected to the Corridor: cities, freight terminals, factories, passenger stations, ports and airports.
- **To highlight its European nature**. To understand the potential of the Corridor, it is necessary to look beyond state borders because the Mediterranean Corridor is a European project that connects six Member States (Spain, France, Italy, Slovenia, Croatia and Hungary, up to the border with Ukraine) and has a clear cross-border nature.
- **To streamline the monitoring of works and improve the visualisation** of the work of the Office of the Spanish Government Commissioner for the Mediterranean Corridor.

SIMPLE AND INTUITIVE NAVIGATION:

- **The technical characteristics of the current and future Corridor**. Through specific layers on the status of works and ongoing studies. It also includes the future situation, a vision of the Corridor once the planned projects have been completed, meeting the requirements of railway interoperability and intermodality for freight and passenger transport, as well as Regulation 1315/2013.

- **Railway accesses and the internal railway network** of Adif's main terminals, ports, logistics centres and factories, specifying current technical characteristics, possible works and studies in progress, and their future situation.
- **Freight terminals and passenger stations** listed in Regulation 1315/2013, as well as those relevant in the state and regional context.
- **The zoning of port terminals**.
- **The main urban nodes**, as well as the medium-sized cities that the Mediterranean Corridor crosses.
- **Regional and local transport networks** (Commuter hubs and metropolitan lines).
- **The characterisation of the railway infrastructure**, nodes and terminals in the south of France (Occitania region), in line with the cross-border vision of the Office of the Commissioner.
- **Other transport networks** that give continuity and complement the Corridor in a 'Euro-Mediterranean' sense, i.e. the Palma de Mallorca maritime connection with Barcelona and Valencia, the Trans-European Mediterranean Corridor (up to the Hungarian-Ukrainian border), the Adif railway network and the Trans-Maghreb Corridor.
- **Socio-economic and environmental indicators** to understand the Corridor as a territorial structuring project that brings benefits in terms of local, regional and national socio-economic growth in a sustainable and resilient manner.



STATION REMODELLING

The incorporation of European or standard gauge has made the adaptation of tracks and the remodelling and creation of new stations. In the pictures, the Elche and Orihuela High Speed Station.



PHOTOS: ADIF

load permitted (22.5t), the gradients in the north and south directions, the total length of the section, etc. We could also visualise the works in progress on the Castellbisbal-Martorell section (mixed gauge installation), known as the 'Gateway to Europe' due to its strategic importance for the entire Mediterranean Corridor. The viewer also allows us to visualise the accesses now under construction to the SEAT-Martorell factory, or the remodelling of the Ford factory in Valencia, the new access branches to the ports of Castellón and Sagunto, as well as the dozens of freight terminals and intermodal centres.

After reviewing the number of trains handled at a specific terminal (e.g. San Roque freight, on the Algeciras-Bobadilla section), a web link redirects to the functional diagram in Adif's catalogue of logistics facilities. If, on the other hand, we are interested in knowing where the planned route for the new Murcia-Almería line runs, the corresponding layer would

THE FUTURE SITUATION SHOWS WHAT THE MEDITERRANEAN CORRIDOR WILL LOOK LIKE ONCE COMPLETED AND FULLY INTEROPERABLE

be activated, informing us that the Los Arejos-Vera section has a finished platform, while works are already underway on the adjacent sections. The satellite base map shows the exact location of the project. Finally, the future situation shows how the corridor will look once it is finished, fully interoperable and with passenger stations, freight terminals and urban nodes connected in an intermodal system. In order to understand the Corridor in terms of a territorial project, it is possible to activate some of the economic indicators included in the viewer, such as

population per municipality, income per capita at municipal level, tonnes of goods unloaded per province or the level of PM10 and Nitrogen Dioxide (NO_x) pollution.

Ineco has been implementing Geographic Information Systems (GIS) for years to respond to the needs of ever more demanding clients in the field of virtual technologies, BIM, Big Data, etc. However, due to its complexity and novelty, this project marks a milestone for the company and for the Office of the Spanish Government Commissioner for the Mediterranean Corridor, which is coordinated by Prof. Josep Vicent Boira.

The collaboration between Ineco and Adif personnel working at the Office is also noteworthy in terms of compiling and reviewing a large volume of data, as well as providing the advice and technical knowledge of their respective railway experts. Meanwhile, UTE TAG-Esteyco has been responsible for the first phase of the processing of technical and cartographic information. ■

JUNCTIONS

The Ministry of Transport, Mobility and Urban Agenda (MITMA) is enhancing freight transport on the Mediterranean Corridor to connect with the Trans-European Transport Network (TEN-T). Among other actions, new mixed junctions have been installed on third rail and standard gauge tracks at different points of the network. In the images, mixed junctions and new PAET in the provinces of Castellón and Tarragona.



PHOTOS: ADIF



JOSEP VICENT BOIRA

Government Commissioner for the Mediterranean Corridor

THE MEDITERRANEAN CORRIDOR IN 2021: THREE ANNIVERSARIES THAT SHAPE THE FUTURE

Anniversaries are a good time to understand where we have come from and where we are going. This year, 2021, we have three reasons to celebrate in the Mediterranean Corridor. The first is that this year has been declared the 'European Year of Railway' and because our work is aimed at a mode of transport that is set to play a strategic role in the coming decades, we feel a part of this celebration. The European Union is turning its attention to trains, both passenger and freight. The United States is also doing the same, with a president, Joseph R. Biden, who has not only given his name to a station (Wilmington station, for the reason that as a senator for Delaware, he used it every day to commute to Washington), but is already beginning to be known as 'Amtrack Joe' because of his enthusiasm for railway travel. In Europe, this year could be an excellent opportunity to talk about full European interoperability, to abolish the costs of different gauges, to finally achieve full freedom of movement within a single European railway system.

Two further anniversaries are of interest to us in 2021. First of all, it's our 10th anniversary. The Mediterranean Corridor was declared part of the Trans-European Transport Network (TEN-T) in October 2011, when Commissioner Siim Kallas reformulated the plans for priority European

infrastructure projects to include lines, such as ours, which had mysteriously been left out of previous plans. This marks the beginning of a real network that is due to be completed by 2030 and which will play an important role in the urgent European challenge of achieving climate neutrality through the decarbonisation of transport. If other EU partners should be running towards this goal, in Spain (due to the disproportionate share still held by road freight transport) we should be flying, not like aeroplanes, but like the high-speed trains that are the future of internal and external transport. This is not a question of attacking road transport, but of moving towards rail, as society as a whole is already doing.

Finally, in 2021, it is also worth looking back at where we have come from. This year we are celebrating 160 years since the Valencia-Tarragona route was approved by Royal Order on 21 March 1861. This section was the link that made it possible to connect the railway developments that were already taking place in the north and south of the Mediterranean axis. On one side, the Sociedad de Ferrocarriles de Almansa a Valencia y Tarragona (AVT), created with the support of the Sociedad Valenciana de Fomento, worked in the Valencian area, while the Catalana General de Crédito worked in Catalonia. In 1861, authorisation was given to link the two local networks in order to continue the project towards France. The progress of the line was remarkable: on 20 April 1862 the Valencia-Sagunto section was inaugurated, by 21 August the train had reached Nules and on 26 December it reached Castellón. On 21 June 1868, shortly after the inauguration of the bridge over the River Ebro, the first train travelled the new route with great expectations among agricultural exporters as it allowed access to France thanks to the Catalan network, which was completed in 1878, when, after the necessary changeover due to the different gauge, the border link of Portbou with the French company of the Midi was established.

1861, 2011 and 2021 are milestones in a process that must go on. New technologies have meant that this year we now have access to an open and freely accessible Geographic Information System for the Mediterranean Corridor, which will soon be followed by another for the Atlantic Corridor. The European coordinator of the Mediterranean Corridor of the TEN-T Network has congratulated us and expressed the hope that one day the entire route of the Corridor, from Algeciras to Záhony, in Hungary, will be equipped with a tool like this. However, technological progress and the effort to make public works transparent is useless if we do not know where we have come from and where we want to go. We are heirs to those old steam and coal trains that first roared across the land more than 150 years ago for a more prosperous society and we as citizens of the European Union are part of the generation that is laying the foundations for cleaner, more sustainable and safer transport and trade. 2021 will, therefore, be a year to remember.

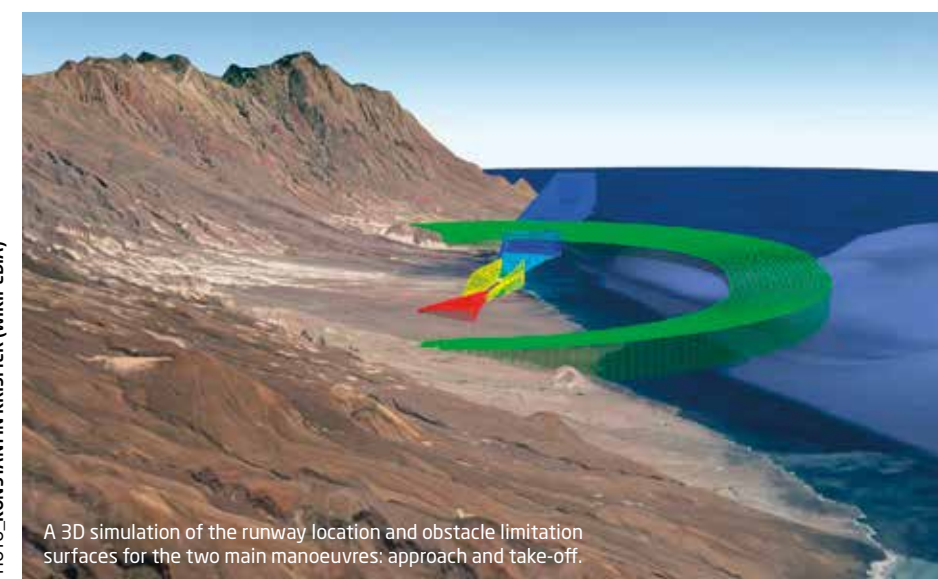


The characteristic mountainous landscape of the island of Santo Antão, a magnet for nature tourism, but a challenge for air navigation.



Agostinho Neto Airport, in Santo Antão, which was closed in 2003.

PHOTO_GIMBOAKIMBO (FLICKR)



A 3D simulation of the runway location and obstacle limitation surfaces for the two main manoeuvres: approach and take-off.

PHOTO_KONSTANTIN KRISMER (WIKIPEDIA)

INFOGRAPHIC_INECO/ASA

Ineco has returned to Cape Verde for the study of a new international airport on the island of Santo Antão and the possibility of night flights at the São Filipe aerodrome on the island of Fogo. The archipelago continues its commitment to improving its air connectivity to boost tourism, an objective in which the company has been collaborating for almost 20 years.

By Miguel de Bernardo, Andrés Manzanas, Marta Martínez and Eva G. Moreno, aeronautical engineers

Cape Verde, airports with *morabeza*

A four-hour flight from Europe, the Cape Verde archipelago offers visitors mountainous volcanic landscapes, golden beaches, marine wildlife sanctuaries and its rich *crioula* (creole) a blend of its Portuguese past and African

roots. The dry, warm climate means that the attractions of these Atlantic islands that together form Africa's most westerly country can be enjoyed all year round. In 2019, Cape Verde welcomed 758,000 tourists with its traditional *morabeza* (a creole

term meaning hospitality, friendliness), a figure that has steadily increased over the past two decades from 28,000 visitors in 1995, and has established itself as a destination for sustainable and nature-based tourism.

To meet this growing demand, several years ago the country began to expand and modernise its airports. Ineco first started working in the archipelago in 2003 and since then has continued to provide services to the national company Aeroportos e Segurança Aérea, ASA (see ITRANSPORTE 7,50 and 61). Currently, the network consists of four international airports –Sal, Praia, São Vicente and Boavista– and three airports for domestic traffic, São Nicolau, Maio and Fogo. For the São Filipe aerodrome, Ineco is carrying out a study of flight procedures for the implementation of night operations.

In early March 2021, it also presented the technical feasibility study prepared for ASA on a new international airport on the island of Santo Antão, at an event held in the capital, Porto Novo, attended by the country’s top officials.



CAPE VERDE AIRPORTS

The current network consists of four international airports –Sal, Praia, São Vicente and Boavista– and three domestic airports, São Nicolau, Maio and Fogo.

THE INECO REPORT CONCLUDES THAT THE CONSTRUCTION OF A NEW AIRPORT IN SANTO ANTÃO IS FEASIBLE AND PROPOSES THAT IT BE LOCATED IN PONTA DO MORRO PRETO, SEVEN KILOMETRES FROM PORTO NOVO

THE FIFTH INTERNATIONAL AIRPORT, IN SANTO ANTÃO

In total, the Cape Verdean territory, with just over 530,000 inhabitants, is made up of 15 islands and islets: 10 large ones (one of which, Santa Luzia, is uninhabited) and five smaller ones. All of them have at least one seaport and ferry lines, which together with domestic flights provide internal mobility. International airports are the main gateway for foreign tourism, which in 2019 contributed 28.6% of gross domestic product.

The second largest island by area, after Santiago (where Praia airport is located), is Santo Antão, which is 779 km² and the third most populated island, with more than 40,000 inhabitants. In 2003, the island’s only aerodrome, located in the north with a small runway of less than 600 metres, ceased operating for operational and safety reasons, meaning that its connections are now limited to the ferry line to neighbouring São Vicente. Despite this, its spectacular mountain scenery attracted more than

42,000 tourists in 2019, according to Cape Verde’s Directorate General of Tourism, a 20% increase on the previous year.

In 2016, the government, through ASA, launched preliminary studies for the construction of a new airport near Porto Novo, the island’s capital and home to a quarter of the population. On 5 March, the city hosted the presentation of the conclusions of the technical feasibility study prepared by Ineco, which was attended by the Prime Minister, Ulisses Correia e Silva, the Minister of Tourism, Carlos Santos, and other Cape Verdean authorities and public and private entities.

After mapping the area and analysing four possible locations, the winds, as well as taking into account the mountainous terrain of the island and the obstacles to aircraft operations, the Ineco report concludes that the construction of the airport is feasible. After considering several criteria, the proposed location is the Ponta do Morro Preto area, seven kilometres from Porto Novo. This area was selected as the most suitable because of its proximity to the city, which would make it more convenient for future passengers, and because it would require less earthworks than the other options, making construction cheaper and easier.

The runway is expected to be 1,400 metres long, which could be extended to 2,000 metres, suitable for the medium-sized aircraft that make up the fleet of the airlines that will operate at the new airport. In order to determine the runway orientation, which is essential



NIGHT OPERATIONS ON THE ISLAND OF FOGO

The 2,829-metre-high Pico de Fogo is an active volcano that dominates the island that shares the same name, as well as being the island’s main tourist attraction. The aerodrome, which handled more than 66,400 passengers in 2019 and is the fifth busiest in Cape Verde, is located about two kilometres southeast of the town of São Filipe. It has a runway 1,350 metres long and 30 metres wide, which allows small ATR type aircraft to operate, with a capacity for between 42 and 50 passengers.

ASA has asked Ineco to carry out a study to determine how to improve operations at São Filipe aerodrome, especially in difficult visibility conditions such as night operations. In order to achieve the desired objective, an analysis is being carried out to determine the best mode of operation based on the physical characteristics of the aerodrome, the required navigation aids and the type of flight procedure to be implemented.



São Filipe aerodrome was opened in 1997 and only handles domestic flights.

In the foreground, Cape Verde Airlines ATR 42-500 aircraft at São Filipe aerodrome, Fogo Island.



On the right, São Filipe aerodrome tower on the island of Fogo.



The technical feasibility study prepared by Ineco was presented in Porto Novo on 5 March 2021. In the photo, Marta Martínez and Miguel de Bernardo, on either side, with Moisés Monteiro and Nuno Santos, ASA administrators.

PHOTO: MINISTRY OF TOURISM AND TRANSPORT

PHOTO: INECO

PHOTO: JI ELLÉ (WIKIPEDIA)

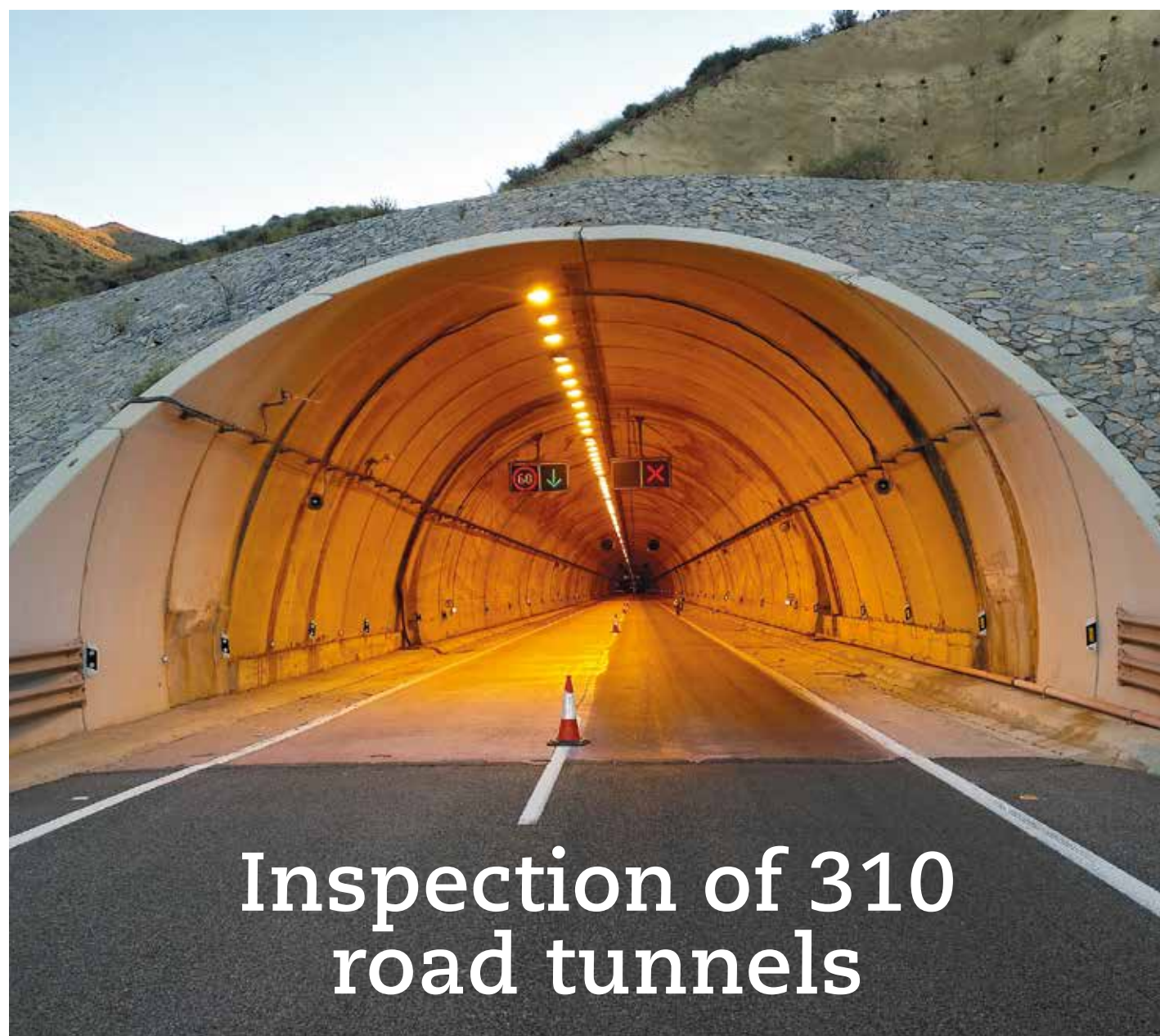
PHOTO: INECO/ASA

to ensure safe operations, a detailed analysis of the data collected over the last four years by the weather station, which was installed in the area in 2017, has been carried out. In this way, it has been established that the predominant winds are east-southeast, which dictates the orientation of the runway for the ap-

proach maneuvers, the most delicate, and the take-off.

The Ineco study also includes an analysis of the tourist demand that the new airport would generate, using the Spanish islands of La Gomera and El Hierro as a benchmark. Following the confirmation of the technical feasibility of the project,

a ‘road map’ of the next steps was presented: the completion of a preliminary flight procedures study, the preparation of a Master Plan including location alternatives, a demand study and a cost-benefit analysis, a Strategic Environmental Assessment, and finally, construction and operation authorisations. ■



Inspection of 310 road tunnels

PHOTOS: INECO

Two decades ago, two serious accidents in the Montblanc and St. Gotthard border tunnels prompted the European Commission to introduce mandatory safety regulations for tunnels throughout the trans-European network. In Spain, Ineco has drawn up the Tunnel Adaptation Plan for the 310 tunnels of the Directorate-General for Roads.

By Arturo Muñiz, mining engineer

On 24 March 1999, at around 11 a.m., a refrigerated lorry carrying 9 tonnes of margarine and 12 tonnes of flour began to burn inside the Montblanc tunnel. About 2 kilometres from the Italian entrance, when the smoke was already thick, the driver stops the lorry in the central area of the

tunnel, approximately 6 kilometres from the Italian entrance and 6 kilometres from the French entrance. Within seconds, the lorry explodes. Because it's a bi-directional tunnel, a queue of vehicles forms on both sides of the burning vehicle. Alarms are activated and the tunnel is closed to traffic in both direc-

tions, but 25 vehicles with 39 people inside are already stopped or driving towards the burning lorry from the French side. The smoke is heading towards the French entrance. In barely half an hour, the smoke travelled the 6 km distance and exited through the French entrance, partly aided by the mechanical ventilation that was activated by workers on the Italian side.

Several rescue attempts are made, but all are unsuccessful. The fire lasts for 53 hours. Once the blaze had been put out, firefighters entered the tunnel and, sadly, found 39 victims. All had died in the first stages of the fire due to smoke inhalation.

Two years later, on 24 October 2001, there was a collision between two lorries inside the Gotthard Tunnel, which links Italy and Switzerland beneath the Alps. A few minutes after the collision, a large fire breaks out and temperatures inside the tunnel exceed 1,000°C. The fire burns for 20 hours and causes part of the tunnel to collapse. When rescue services enter, they find 11 victims.

SAFETY REQUIREMENTS IN SPAIN

Following these accidents, the European Commission decided to draft legislation on safety measures in road tunnels for all its Member States. Therefore, on 29 April 2004, the European Parliament and the Council adopted *Directive 2004/54/EC on minimum safety requirements for tunnels in the Trans-European Road Network*.

Although this directive applies only to tunnels located on the trans-European road network, when transposed into Spanish law by *Royal Decree 635/2006, of 26 May, on minimum safety requirements in State road tunnels*, no distinction was made between tunnels located on the trans-European network and other tunnels, in the belief that they should all have a similar level of safety. The royal decree also increases European safety requirements, so that all tunnels currently operating on Spanish roads are affected by the regulation in one way or another.

In 2016, the Directorate-General for Roads entrusted Ineco with the drafting of the first projects, which included the development of the Tunnel Adaptation Plan as the first assignment. There are a total of 354 tunnels on Spanish roads, of which 41 are on the toll road network and another three belong to the first-generation highways, all of which are managed under concession contracts. The remaining 310 belong to the network managed directly by the Directorate-General for Roads.

Following an analysis of the equipment of these 310 underground tunnels, it was concluded that 118 already meet the minimum safety requirements set out in the Royal Decree, and therefore the remaining 192 tunnels require attention. Of these, 90 are located on the Trans-European Network and 102 on other state roads.

Among other works, Ineco has drafted 22 adaptation projects, which include a wide variety of actions: road signalling, the installation of traffic lights, variable messaging panels, road surface improvement treatment, ventilation, upgrading of SCADA, CCTV and DAI, environmental control systems, fire protection systems, radio communications, public address systems, electrical installation, toxic liquid drainage, new emergency galleries, waterproofing and soundproofing improvements.

THE COMPANY HAS ALSO CARRIED OUT OTHER WORK SUCH AS RISK ASSESSMENTS FOR 42 TUNNELS LOCATED ON THE TRANS-EUROPEAN NETWORK

A further 21 projects were awarded in three lots to different consultancy firms. Ineco also provides support to the MITMA (Ministry of Transport, Mobility and Urban Agenda) in the drafting of tender specifications, bid evaluation and the preparation and review of study orders and subsequent modifications. As the Adaptation Plan progresses, some projects are being sub-divided in order to accelerate the tendering of tunnels falling within the scope of *European Directive 2004/54/EC* (tunnels longer than 500 metres located in the Trans-European Network).

In April 2021, Ineco began a new project to bring the Xeresa and Mascarat tunnels into line with the royal decree. Of the 53 tunnel projects on the road network managed directly by the State, Ineco is in charge of 32, involving a total of 104 tunnels.

The company has also carried out other work over the years, such as risk assessments for 42 of these Trans-European Network infrastructures. The objective was to assess, in accordance with the Ministry's Risk Analysis Methodology, whether these tunnels could be classified as safe, or whether any additional measures were required. Once the improvements have been implemented, all of these can now be considered safe, on the basis of this methodology.

Two new tasks have been added to Ineco's activities in the Tunnel Plan, which is scheduled to last until November 2022. Firstly, the control and monitoring of some of the works and secondly, the drafting of a plan to improve energy efficiency in the lighting of tunnels on the state network.

The work to upgrade the 192 tunnels is expected to be completed in 2026, after a major investment of more than 500 million euros. Once completed, the time may be right for a new plan, with the aim of converting the tunnels into smart infrastructures, thanks to new technologies and materials, connecting them to future autonomous vehicles, which, together with 5G, will become a reality in the next few years. ■



Work on the 192 tunnels, which are being brought into line with European regulations, is expected to be completed in 2026.

Good signals: more accurate software for flight trajectories

An Ineco software development for the NavTools suite is improving the safety of air operations by providing more precise studies in the face of growing urban and industrial development in airport environments.

By **Carolina Ajates**, telecommunications engineer, and **Francisco Fernández de Liger**, aeronautical engineer

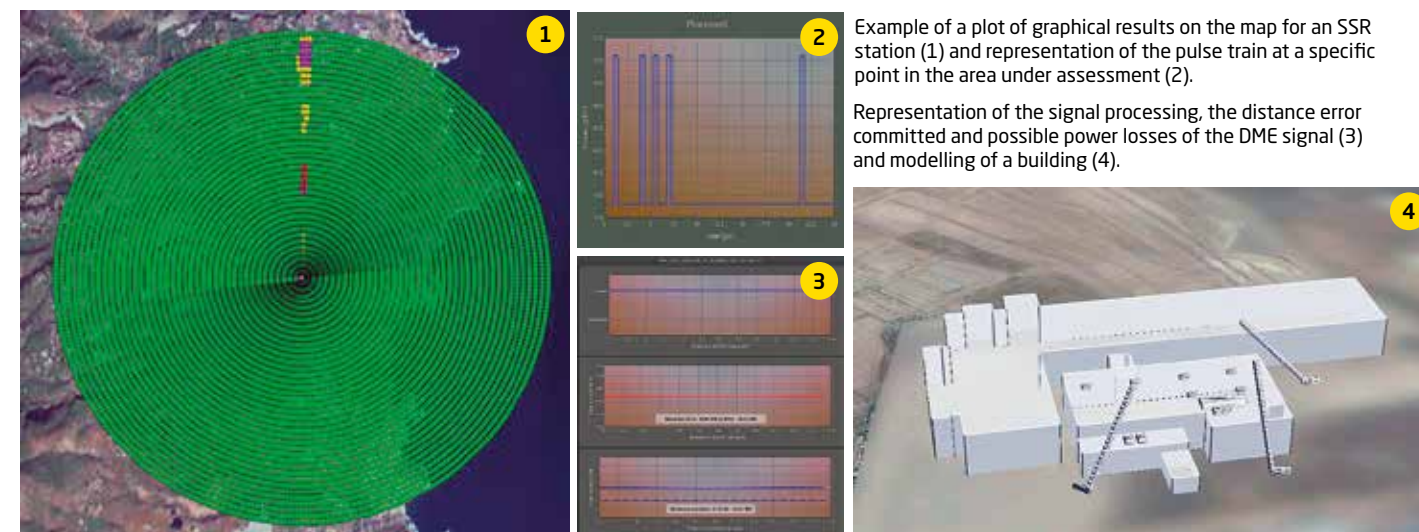
Nowadays, air traffic controllers and pilots need to send and receive accurate and reliable information in order to operate safely. To do so, they use communication, navigation and surveillance (CNS) systems. These systems work by transmitting and receiving suitably modulated radio frequency signals that propagate by spatial wave, that is, by direct line of sight between transmitter and receiver, in order to track the position of aircraft and to guide or direct their movement from one point to another

in a safe, smooth and efficient manner. The information provided by these systems is therefore essential for the design of flight procedures, which establish the trajectory that aircraft must follow in order to avoid collision with each other or with any element in the environment.

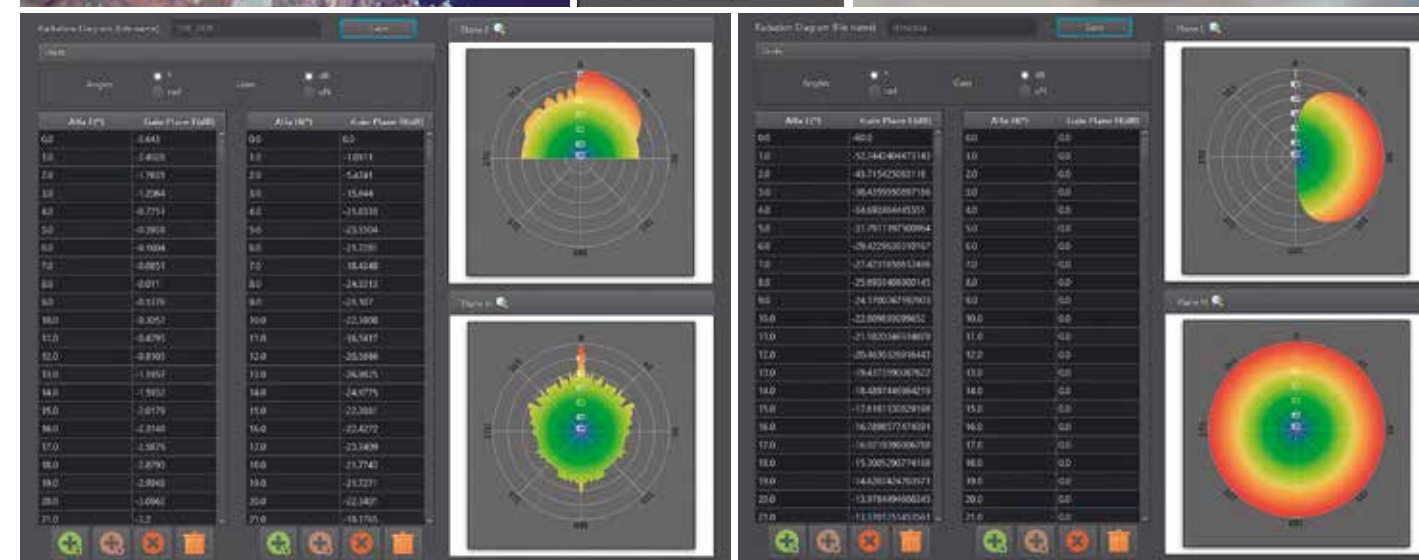
However, the presence of obstacles on the ground in the vicinity of such equipment can cause signal fading or amplification, and, in general, overlaps and distortions in the information transmitted. In recent decades, these effects

are becoming more pronounced, as increasing urban and industrial development is taking place in airport environments, leading to the emergence of high obstacle densities in the vicinity of CNS systems.

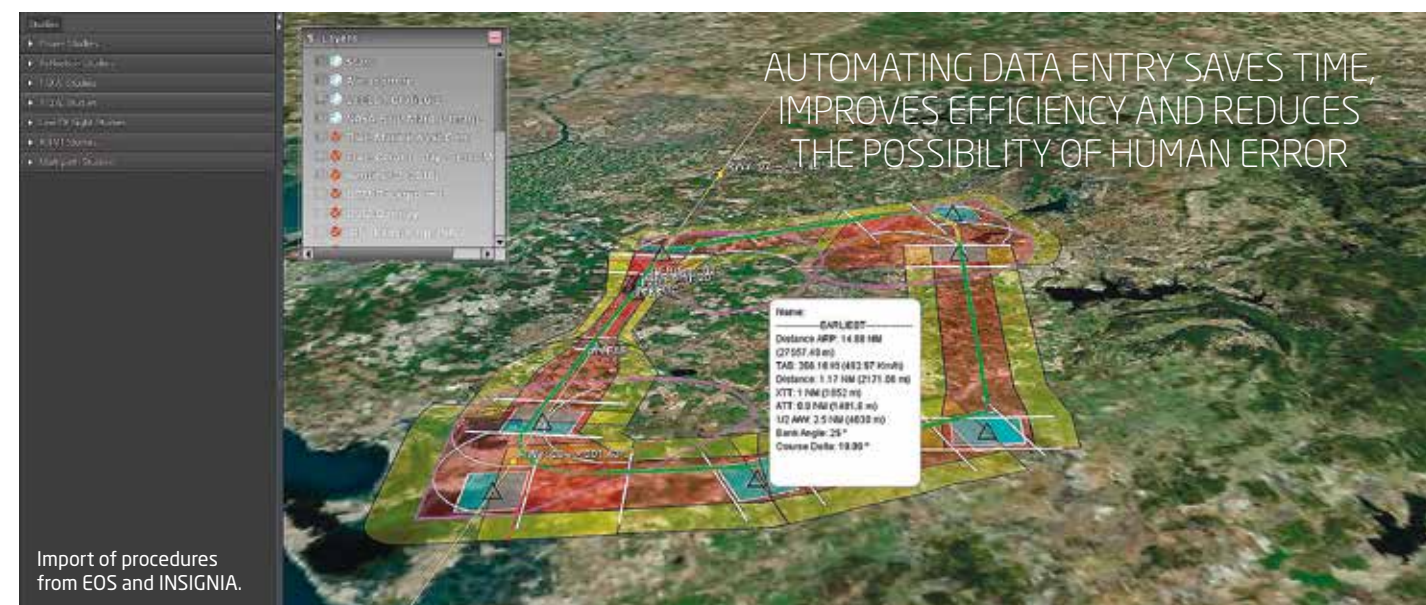
Simulation studies to assess impact on radio systems analyse the disturbances that physical obstacles can cause in radio wave transmission. Their analyses are vital for air navigation because they enable identification of those that are incompatible with the proper functioning and/or performance of the



Example of a plot of graphical results on the map for an SSR station (1) and representation of the pulse train at a specific point in the area under assessment (2). Representation of the signal processing, the distance error committed and possible power losses of the DME signal (3) and modelling of a building (4).



Examples of radiation pattern implementations of an SSR station (left) and a DME station (right).



Import of procedures from EOS and INSIGNIA.

IMAGE_INECO

systems, ensuring that aircraft take-off, flight and landing operations are carried out correctly. Ineco boasts a long list of national and international simulation projects to assess effects on CNS radio systems, with more than three thousand studies done.

It is from within this context that the main motivation for this innovation project, developed in 2020, arises. Engineering specialists need software tools to assess the impact of obstacles and terrain on the performance of these systems in a quantitative manner that is as close to reality as possible, enabling them to evaluate key aspects of the design of flight procedures, such as the coverage and signal quality of CNS equipment.

In particular, to assess the impact on pulsed systems, Ineco developed the

Impulse tool (currently integrated into Navtools), which, as a first approach to this problem, was capable of carrying out a qualitative analysis of the impact on primary and secondary surveillance radars, and DME equipment.

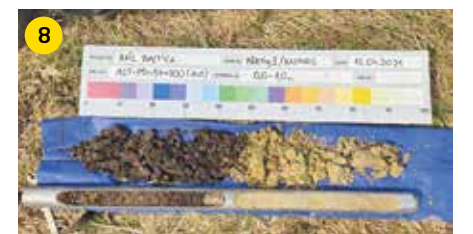
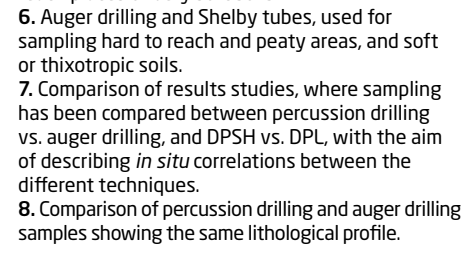
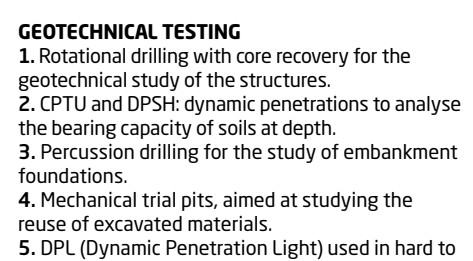
In the new innovation project developed at Ineco, which will have a final version from the first quarter of 2021, a major step forward has been taken by replacing the initial qualitative studies with quantitative studies modelling the real signals emitted by equipment and aircraft for primary and secondary surveillance radars and for DME (Distance Measuring Equipment). In this way, by considering real radiation patterns, encoding and decoding the pulses and taking into account multipath effects caused by terrain and obstacles in the

environment, it is possible to carry out much more precise and detailed studies than those carried out so far (qualitative analysis only). New functionalities have also been incorporated in DME stations, such as the calculation of the distance error committed, power losses, system decoupling, etc. The implementation of all these new functionalities makes it possible to address studies that until now could not be undertaken analytically and were resolved qualitatively or by expert judgement. Likewise, having such a powerful tool in air navigation for the study of pulsed systems strongly positions Ineco both in the national and international market when carrying out aeronautical safety studies, radioelectric impact studies or procedure design. ■

IMAGES_INECO



PHOTOS_INECO



GEOTECHNICAL TESTING

1. Rotational drilling with core recovery for the geotechnical study of the structures.
2. CPTU and DPSH: dynamic penetrations to analyse the bearing capacity of soils at depth.
3. Percussion drilling for the study of embankment foundations.
4. Mechanical trial pits, aimed at studying the reuse of excavated materials.
5. DPL (Dynamic Penetration Light) used in hard to reach places or very soft soils.
6. Auger drilling and Shelby tubes, used for sampling hard to reach and peaty areas, and soft or thixotropic soils.
7. Comparison of results studies, where sampling has been compared between percussion drilling vs. auger drilling, and DPSH vs. DPL, with the aim of describing *in situ* correlations between the different techniques.
8. Comparison of percussion drilling and auger drilling samples showing the same lithological profile.

Beneath the soil of Northern Latvia

Ineco has completed the first phase of the geotechnical site investigations prior to the beginning of works on the 94-kilometre section of the future Rail Baltica line known as Latvia North. The project will run until 2022.

By Israel González, geologist, Alberto Ortega and Carles Viader, civil engineers

Rail Baltica is a rail transport infrastructure project, the largest in the region during the last century, which will integrate the Baltic States into the Trans-European Transport Network (TEN-T) by means of an 870-kilometre conventional and electrified, international gauge, high-speed line. The EU-funded project will connect Lithuania, Latvia and Estonia with the rest of Europe via Poland and, through an indirect connection by ferry from Tallinn to Helsinki, also with Finland, at a maximum speed of 249 km/h for passengers and 120 km/h for freight.

Since 2019, Ineco has entered into four contracts for the line, in consortium with two Spanish engineering companies: the first, with Ardanuy, for the study of the energy subsystem of the entire line. Another contract, in consortium with the same firm, is for the study of the location and development of the maintenance depots and Railheads for the construction of the entire railway line, along with maintenance strategies. The third, in consortium with Idom, is the design of the 56-kilometre stretch through the Latvian capital, known as the Riga Ring.

The fourth, led by Ineco and in consortium with Ardanuy, was signed in April 2020 and comprises the design and design supervision during the execution of works on the 94-kilometre section known as Latvia North, which runs in a north-south direction from the Latvian-Estonian border to the city of Vangazi, northwest of Riga. The scope of the works is divided into two phases: the design stage, with an expected duration of 30 months, and the construction supervision phase, with an estimated duration of five years. The contract



QUARRIES

To build the Rail Baltica line, 8 million m³ of mineral materials will be needed. Therefore, around 100 active quarries are being inventoried within a radius of 60 kilometres around the route.

includes the development of the entire railway, the complete design of the roads and all geotechnical works, which started in March 2020 and will last until the end of 2022. The works are divided into three phases, the first of which was completed in July 2021.

The analysis of the geological characteristics and the load-bearing capacity of the ground is essential for the proper design of the foundations of the future railway line's platform, embankments and all bridges, viaducts and drainage works, as well as roads.

The ground investigation work, both subsoil and surface, includes the geotechnical campaign, the location of deposits for the supply of construction materials, the BIM integration of the geological model into the project, the creation of an inventory of buildings for the design of acoustic barriers, the investigation of unique construction features and the coordination and obtaining of construction permits. The company currently has an office in the central district of Riga with a team of railway, road and geotechnical engineers and a geologist to carry out the work.

GEOTECHNICAL SITE INVESTIGATIONS

The project area is located on glacial, subglacial, fluvial and coastal lands of Quaternary origin and geomorphology. A detailed study is required between every 100 and 300 metres with different types of follow-up investigations to study the geotechnical behaviour of the ground and the existing hydrogeological model. For this reason, during the two-year duration of the project, about 1,500 geotechnical investigations will be carried out, completing more than 350 investigations that have already

been done, as well as other historical investigations by the Latvian Geological Institute. In total, nine geotechnical campaigns will be done almost simultaneously.

Due to the peculiarities of the region and its accessibility characteristics, the following types of research are being carried out:

► **A survey of old unexploded ordnance (UXO Analysis, Unexploded Ordnance):** before beginning any geotechnical investigation, a preliminary geophysical investigation with magnetometric methods is required to detect possible unexploded ordnance, remnants of World War II. This research is carried out by military experts approved by the Latvian Ministry of Defence.

► **Core drilling boreholes with core recovery:** oriented towards the analysis of the foundations of structures, these are boreholes 25 to 50 metres depth that analyse the substratum, taking lithological samples of soils and rocks and analysing their geomechanical behaviour in the laboratory.

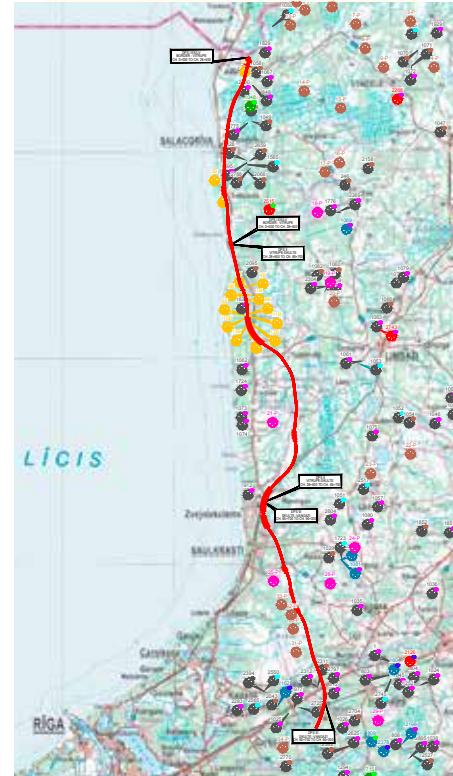
► **Small diameter percussion gouge drilling:** this is a technique commonly used in the Baltic countries, which is not common in Spain. This consists of 'mini-drilling' at a maximum depth of 6 to 10 metres, which allows a quick, versatile, convenient and economical study of the influence area on the ground for the foundations of embankments. The big advantage is that these drills can be transported almost anywhere, due to their small size.

► **Mechanical trial pits:** the collection of soil samples using trial pits



INVENTORY OF BUILDINGS

Nikita Grismanovskis making an inventory of houses for the noise survey.



THE LATVIA NORTH SECTION, THROUGH FORESTS AND RIVERS

The section has been divided into three sections: section I, from the Estonian-Latvian border to Vitrupe, 25.8 km; section II, from Vitrupe to Skulte, 39.9 km, which is mostly in forest; and section III, from Skulte to Vangazi, 29.3 km, which is considered the most complex. The largest viaduct on the entire line will be built here, over the Gauja River, with a total length of approximately 1.5 kilometres and a span of more than 150 metres. In total, the section will require, according to preliminary estimates, the construction of some 50 structures, including 16 railway bridges, 36 road viaducts and 6 eco-ducts.

Although the route crosses important population centres such as Salacgriva, Skulte, Seja, Adazi and Vangazi, the majority of it runs through large forests, which cover more than 70% of the country's surface area. Numerous rivers intersect the route, including the Salaca at Salacgriva and the Gauja River near Vangazi, as well as the Zakupite, Liepupe, Vitrupe, Tora and Svetupe. The route abandons its straight course to avoid the large area of natural peat bogs known as Dzelves Purvs, consisting of up to six metres of soft organic soils.

makes it possible to study its behaviour with a view to reusing it for embankment fills, given the high demand for such material.

► **Dynamic Penetration Tests:** although in Spain the use of DPSH (Dynamic Probing Super Heavy) and SPT (Standard Penetration Test) in boreholes are widely used as in situ tests to measure soil strength and bearing capacity, in the Baltic countries, and specifically in Latvia, where there is a large amount of soft soils and peat areas, it is necessary to resort to lighter methods, such as DPL. This type of test requires equipment that is easier to transport and is suitable for areas that are difficult to access.

► **Other alternative methods:** sometimes it is necessary to resort to alternative surface sampling such as auger drilling or Shelby tubes, mainly for taking undisturbed samples from areas of peat and thixotropic soils (soils with a gel-like consistency), in order to analyse their special characteristics and geomechanical behaviour under stress.



DRAINAGE

Existing elements and watercourses are regularly measured in order to design new drainage works according to the expected flow and return period.



MULTINATIONAL TEAM

From left to right, Vidas Milisauskas (Ardanuy), Nikita Grismanovskis (Ineco), Jānis Plakanis (Rail Baltica), Edgars Oglīnš (Rail Baltica), Antanas Veselka (Ardanuy) and Israel González (Ineco). During field visits they were also advised by Rail Baltica's geotechnical engineers Christopher Davies and Pēteris Šķēls.

The ground conditions pose significant challenges for the implementation of the campaign: a natural environment that is difficult to access, with dense forests and numerous rivers and wetlands; the presence of wildlife such as bears, deer and reindeer; and the cold and wet climate, which affects machinery. In terms of soil type, there are large flooded areas and an abundance of soft and peaty soils, which need to be analysed in detail to avoid differential settlement and embankment failure in the future.

OTHER WORKS

The Ineco team is also working to locate deposits for the supply of materials. The Latvia North section will be built almost entirely on embankments with an average height of 4 to 5 metres along its 94-kilometre length. This amounts to some 8 million m³ of material. Therefore, all active quarries in a 60-kilometre radius surrounding the route, some 100 in total, are being inventoried.

In addition, nearly 1,000 affected buildings have been visited, studied and inventoried in order to design measures to minimise the acoustic impact of the future railway line, one of the fundamental aspects of the project from an environmental point of view.

Meanwhile, drainage works, viaducts, canals or unique features of the terrain are being routinely visited to take measurements and gather detailed information on the construction elements for the rest of the team.

Ineco's local team is also in charge of coordinating and obtaining construction permits, which requires coordinating all those involved: administrations, municipalities, public companies and owners.

It should also be noted that all the geotechnical investigations carried out are integrated into the project's BIM environment, using specialised software. This provides a 3D geological model, which enables the interaction of structures and construction elements with the local geology to be observed, facilitates a more detailed, accurate and efficient design, and improves the planning of works. ■



THE TERRAIN

Most of the 94 kilometres run through forests and wetlands, over soils of glacial, sub-glacial, fluvial and coastal of Quaternary origin and morphology.



TRACKS AND STATIONS

The route runs through different stations, such as Salacgriva, Adazi or Skulte, where it will coexist alongside the old conventional network station.



In addition to aircraft, various types of vehicles circulate on the aprons for towing, handling, follow-me (guidance), passenger and crew transport, maintenance, etc.

PHOTO: INECO/AEROCIVIL

Control on the ground to keep things flowing in the air

At large airports, having an Apron Management Service or AMS to guide aircraft on the ground reduces the workload of controllers and improves operational efficiency. Ineco has conducted a study to implement an AMS at Colombia's El Dorado airport

By Carlos Barbas and Javier Vázquez, aeronautical engineers, and Antonio Pernas, civil engineer

El Dorado international airport in Bogotá, Colombia, is one of the most important airports in Latin America: it is the third largest in terms of passenger volume, with more than 35 million passengers per year, the second largest in terms of operations, with 315,000 flights, and the largest in terms of the volume of air cargo transported,

with around 725,000 tonnes per year, according to 2019 data from the Civil Aeronautics Air Transport office. Expansion plans underway to meet the increase in traffic expected by 2030 include the implementation of an Apron Management Service, or AMS, to improve efficiency and reduce ground movement delays.

Ineco, together with the Colombian engineering company Integral, has carried out the technical, operational, administrative and cost studies for Aerocivil, the Colombian aeronautical authority, to develop and implement an AMS at El Dorado, the first of its kind in the country. To this end, the different possibilities for its implementation and



MONITORING FROM THE TOWER

It is proposed that the future AMS facility be physically located on the first floor of the control tower. In 2011, Ineco and the Spanish architecture firm GOP were commissioned to study, design and outfit the new tower (see IT46).

PHOTO: INECO/AEROCIVIL



Operational positions of the AMS: in the centre, the supervisor and on both sides, the operators.

the conditions for the tendering and contracting of the service by Aerocivil have been analysed.

An AMS is an airport service that is specifically dedicated to managing and securing the movement of vehicles and aircraft on aprons. The International Civil Aviation Organisation (ICAO) recommends the implementation of an AMS when warranted by traffic volume and operating conditions. In Spain, its implementation was gradually introduced, starting in 2011, in airports with an annual traffic of over 250,000 flights, such as Madrid and Barcelona. Until 2017, Ineco was in charge of the transition and provision of the service in Madrid for Aena and provided support to ENAIRE in Barcelona, where the service was handled by control staff.

At the international level, different AMS models exist in Canada, China, Japan and the United Arab Emirates. In the United States, the system is implemented at major airports such as JFK in New York, Chicago and Las Vegas; and in Europe, at Madrid-Barajas, Barcelona-El Prat, Frankfurt, Amsterdam-Schiphol, Munich and Zurich airports.

In Colombia, the Apron Management Service at all airports is carried out through coordinated management between the air traffic services (ATS), the aerodrome administration and the airlines. Specifically, in the case of El Dorado International Airport, the control tower is currently responsible for regulating movement between aprons, controlling the entry of aircraft and ensuring the rapid and safe movement of vehicles, among other activities.

Assigning these functions to an AMS unit will reduce the workload of ground controllers (GND), enabling them to better manage taxiing on the manoeuvring area. The increased specialisation of the AMS in the management of taxiing and reversing on aprons will also help to improve operational fluidity and efficiency.

The implementation of the AMS does not necessarily require major investments in new infrastructure, equipment or technology, since the same infrastructures are used as those employed by tower control. In the case of El Dorado, it is proposed to physically locate the service on the first floor of the new control tower. In 2011, Ineco and the Spanish architecture firm GOP were commissioned to study, design and outfit the new tower (see ITRANSPORTE 46).

Thus, the proposal, developed in coordination with Aerocivil's Directorate of Telecommunications and Air Navigation

Aids, will not require major adaptation works, apart from the upgrading of the electrical system and the radio transmitter centre, as well as the establishment of intermediate waiting points on the airfield to identify the traffic transfer points between the control tower and the AMS. Cameras (CCTV) will be installed at the non-visible points of the commercial aprons (T1, T2 and TC), which are the responsibility of the AMS, an area that has been divided into two sectors: north and south. The service will also be supported by an A-SMGCS (Advanced Surface Movement Guidance and Control System), which automatically alerts and resolves potential aircraft and vehicle conflicts regardless of weather conditions), which is being deployed at El Dorado.

PROJECT DEVELOPMENT

This project was developed through the structuring and scope established in the terms of reference defined jointly with

the GPA and the Directorate of Air Navigation Services of the Colombian Civil Aeronautics.

Ineco's multidisciplinary team carried out a field visit and around fifty working groups with the different stakeholders involved throughout the three phases of the project:

Diagnosis of the current situation

The first step was to gather all available information on the airport's equipment, procedures, infrastructure, operations and human resources, as well as applicable national and international standards and recommendations. The operation of more than 4,000 flights was also sampled for the months of December 2019 to March 2020.

In addition, a benchmarking study of three international airports with an AMS –Madrid-Barajas, Amsterdam-Schiphol and Frankfurt – was carried out to assess implementation alternatives and the

AMS model best suited to the needs of El Dorado. Among other conclusions drawn from this comparative analysis were the weight of staff training –between three months and one year, depending on the airport– in service start-up times, the improvement in operational efficiency and costs, and the maintenance of safety levels, since AMS operators receive specific training and provide pilots with exactly the same information and instructions as controllers.

AMS proposal

Based on the conclusions of the diagnosis and the benchmarking study, up to six different service implementation alternatives were analysed to identify the most suitable for El Dorado. To this end, aspects such as the distribution of functions between the ATS and the AMS, the physical location of the service, the adaptation of the control and navigation systems (ATM, CNS and MET), the provision model (Aeronáutica Civil will evaluate the implementation model of the project based on the results of these studies), and the definition of the regulations: the establishment of specific conditions in the specifications or changes to the national regulations, the Colombian Aeronautical Regulations (CAR), which are considered the most appropriate.

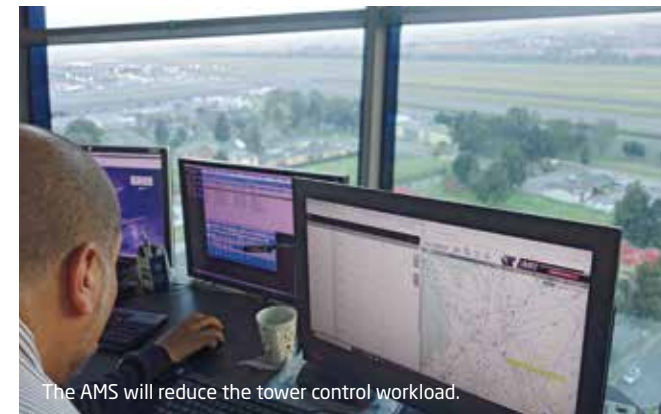
The proposed functions to be assumed by the AMS at El Dorado airport, which until now were carried out by the control tower, include:

- ▶ Providing apron instructions to aircraft and trailers, such as push-back and taxiing instructions to or from the parking stand assigned by the Operations Coordination Centre (OCC), which will communicate this to both apron management and tower control.
- ▶ Monitor compliance with TOBT (Target Off-Block Time) and TSAT (Target Start-Up Approval Time) targets. The service will be integrated into the airport's A-CDM (collaborative decision making) processes.
- ▶ Monitoring tarmac vehicle traffic to avoid aircraft hazards and reporting non-compliance.
- ▶ The implementation of the service will take place during towing to SPOTs, the painted markings on the pavement of taxiways indicating where aircraft can

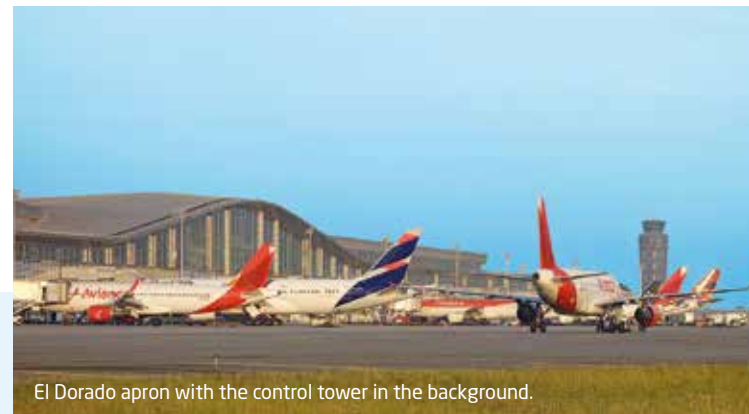


PHOTO: INECO/AEROCIVIL

A new AMS-specific CCTV system will be installed on the apron to ensure the availability of cameras in areas not directly visible from the tower.



The AMS will reduce the tower control workload.



El Dorado apron with the control tower in the background.

PHOTOS: INECO/AEROCIVIL

TRAFFIC CONTROL IN THE MOVEMENT AREA

It is not only necessary to monitor and organise air traffic movements when aircraft are in the air, but also when they are on the ground, taxiing around the airport. All aircraft movements on the ground are managed by control personnel, or by AMS personnel if on aprons, where the safe and smooth coexistence of aircraft with all vehicles and personnel moving along the apron must be ensured.

In addition to the aircraft, there are a number of vehicles that operate in the movement area following strict safety protocols and procedures: tractors, which tow the aircraft from the assigned parking positions; follow me; service and supply (handling); fuel supply; loading and unloading of luggage and freights; and mobile stairway trucks and buses for embarking and disembarking passengers and crews. In addition, where appropriate, there are emergency and security vehicles (ambulance, fire brigade, civil protection, police, etc.), customs, cleaning and maintenance vehicles, customs, cleaning and maintenance.

As a result, the movement area at busy airports, and in particular the aprons where aircraft are parked, can become congested. Ensuring that all aircraft and vehicle movements are carried out safely and smoothly is fundamental to the efficiency of airport operations, where every second counts. Hence, the International Civil Aviation Organisation (ICAO) regulations for airport design and operations provide for the possibility of traffic management on the apron to be entrusted to an apron management service (AMS) that is separate from the air traffic service (ATS), which is in charge of tower control.

The functions and responsibilities of each must be perfectly defined and both services must be coordinated with each other, for which a protocol called 'Letter of Agreement' (LoA) is established, which specifies the areas of responsibility of each service, when, how and where control is transferred from one to the other (transfer points), the procedures to be followed in the event of Low Visibility Procedures (LVP), emergencies and contingencies, etc.



A snapshot of the information-gathering field visit, which also included the analysis of more than 4,000 flights.

as tower control or the airport manager, is required.

In terms of staffing, a team of six supervisors and 18 AMS operators, who will receive specific training, is proposed. For this, the Centre for Aeronautical Studies (CEA) of Aerocivil, which has developed a specific training programme for AMS personnel, has collaborated in this project.

A security analysis of the procedures and the implementation of the AMS has been carried out, as well as an implementation and operational cost study.

start taxiing, after taxiing back from the parking position, and the setting of the radio frequencies established for the respective operational coordination.

▶ Implementing the Low Visibility Procedure (LVP, an action protocol that is activated in the event that visibility is reduced below certain values due to weather conditions).

To this end, local coordination procedures (letters of agreement) have been developed, in coordination with Aerocivil air traffic control staff, covering those functions where responsibility is divided or coordination of the AMS with the responsible party for the function, such

Implementation plan

Lastly, the technical specifications and specifications for a public tender for a turnkey project contract were drawn up, in the event that the Civil Aeronautics Authority should decide to have a third party provide the service: preliminary studies, market analysis, minute of the contract, technical specifications, formats, etc.

The proposed contract duration is six years (12 months of implementation and five years of service provision), which has been deemed the most appropriate period to balance the interests of Civil Aviation and at the same time make the tender attractive to a sufficient number of candidates. ■



PHOTO: JUAN JOSÉ CALABUIG (INECO)

Transport for NSW and Sydney Trains have embarked on an ambitious program to modernise the heavy rail network. In the photo, Cronulla station, a coastal city 20 kilometres south of Sydney's city centre.

Ineco renews its Australia contract through to 2024

The company has expanded the services it currently provides for Network Rail Consulting in Australia as a systems integrator. This is a critical role for Sydney's commuter network to significantly increase its capacity and absorb future demand.

By **Rebeca Fernández**, telecommunications engineer and **Beatriz Sierra**, industrial engineer

Ineco will continue to offer its experience in railway signalling by working as a systems integrator for the British company, Network Rail Consulting (NRC) until mid-2024. The purpose of the contract is to support Transport for NSW, in the definition, integration and implementation of the network's new rail systems, as a sub-contracted consultant to NRC together with the companies Acmena and Go-Ahead Group.

The contract is part of the Digital Systems Program, which aims to upgrade signalling to European Train Control Systems (ETCS) Level 2 which is part of the European ERTMS system for the rail operator and manager, Sydney Trains. This is a critical factor in enabling the network to signifi-

cantly increase its capacity and absorb future demand. The installation of a rail traffic management system will also improve efficiency in incident response.

In December 2018, the NSW government announced an investment of more than \$800 million in technology improvements in order to modernise parts of the Sydney Trains network, including the development of digital systems, to be brought into service gradually. The contract extension allows this work to be continued over the next few years.

THE PURPOSE OF THE CONTRACT IS TO SUPPORT TRANSPORT FOR NSW IN THE DEFINITION, IMPLEMENTATION AND INTEGRATION OF DIGITAL SYSTEMS INTO THE RAIL NETWORK

The purpose of the contract is to support Transport for NSW in the definition, implementation and integration of Digital Systems into the rail network. Digital Systems is part of TfNSW's 'More Trains, More Services' program.

RAILWAY SIGNALLING SPECIALISTS
The main activities to be carried out by Ineco, once the requirements and system definition documents have been completed, are the supervision of the design of the systems developed by the different technology suppliers (trackside and on-board ETCS, traffic management system and fixed and mobile communications); the definition and development of operational standards; the definition and management of system integration tests; support in the entry into service; and

WHAT WILL DIGITAL SYSTEMS ACHIEVE?

With the safety improvements of automatic train protection technology, this program will replace existing signalling and train control with modern, internationally-proven smart systems.



The replacement of traditional signalling equipment with the latest 'in cab' train control technology (European Train Control System ETCS Level 2).



Automatic train operation, which supports train drivers -who are in control- to control speeds and provide shorter and more efficient travel times.



The introduction of the Traffic Management System (TMS) to help the network recover from disruptions, obtain backups and operate as quickly as possible.



The modernisation of the network will improve its capacity and efficiency, as well as the comfort of the users. In the image, a view of Sydney Harbor from one of the trains.

PHOTO: JUAN JOSÉ CALABUIG (INECO)

technical advice. Once the first contracts (track and TMS) were awarded, the Digital Systems Program moved on to the Integrated Preliminary Design Phase (IPDP). Ineco experts in Sydney and Madrid are working with professionals and companies in different countries (Australia, Japan, Germany, Spain, UK, Switzerland, Belgium) under special circumstances, since personal meetings and travel have been restricted due to the COVID-19 pandemic.

Ineco is providing its experience in the definition of systems, monitoring,

design and testing of the European rail traffic management system (ERTMS), on which it has been collaborating for many years at the highest level, both for its implementation in the Spanish high-speed network (AVE) and in the main corridors of the European continent.

The extension of the first contract in Australia consolidates Ineco's position as a leading engineering company present in the five continents and demonstrates not only the client's trust but also the excellent work carried out by our team. ■

Spanish engineering talent

The excellence of Spanish engineering relies on the quality of its professionals' talent. Attracting and developing this talent is a priority in people management strategies. Yet attracting and engaging the right people requires a holistic approach that not only brings in specialised talent but also provides career opportunities for teams throughout their career with the company.

By **Mónica Lauda**, graduate in Psychology and Master's in HR Management

THOUGHT AND STRUCTURE

Practical training is essential to develop talent and face the new challenges of the engineering sector. In the image, the sculpture *Wonderland* by Jaume Plensa (2012), a 12-metre-high stainless steel head installed in Calgary, Canada, which visitors can enter and, from inside, see the city's skyline.

For HR professionals, the challenge is enormous: it is not only a matter of recruiting the best candidates for specialised jobs, but it is increasingly necessary to have personalised career plans that contribute to the motivation, loyalty and well-being of all those who work in the company. The talent management paradigm has changed, but what are the new challenges and how can we respond to them?

Ineco developed its roadmap some time ago. The objective is to promote skills development, technical and management training, lifelong learning, languages, innovation and creativity among its professionals while ensuring effective internal knowledge management that is in line with our corporate values of experience, trust and rigour. This is all done with innovation and technology in mind.

MORE THAN 150,000 HOURS OF TRAINING IN 2020

After more than 50 years of history developing highly complex technical projects with the most cutting-edge and avant-garde technologies, the incorporation of new talent into the company and the development of attractive career plans must include a comprehensive training and lo-

yalty programme, as well as appropriate internal knowledge management, as a key strategic aspect.

In 2020 alone, more than 150,000 hours of training were delivered at Ineco to more than 22,000 participants, with a satisfaction level of 8 out of 10, demonstrating the training quality of both the teachers and the teaching content. The professional training plans created at Ineco's Internal Training School stand out in this respect. This is an investment that the company is committed to as an essential driver for developing the best talent, which is capable of tackling the challenges of the engineering sector.

Ineco, aware of its role as the driving force behind the prestige of Spanish engineering, is also committed to collaborative training and knowledge management environments such as the Communities of Practice, the Ineco Forums and the Specialisation Programme in Railway Operational Safety, which was recently set up in conjunction with the University Carlos III. This course is aimed at professionals in the railway sector and aims to provide a comprehensive insight into the field of safety from key players in the Spanish railway system and its operational safety, who have assisted in the design of the programme (Adif, AESF, Ineco and Renfe).

SCHOLARSHIPS FOR THE DEVELOPMENT OF YOUNG TALENT

Ineco has several programmes focused on discovering talent in universities, providing students with a career plan for joining the company.

Thus, the AYRFE and AYREA programmes are aimed at final-year students in the disciplines of industrial engineering, telecommunications, aeronautics and aerospace. Since their introduction in 2019, a total of 95 students have joined the programmes, 57 of whom have joined Ineco's workforce and received funding support for the master's programme.

Aimed at final year undergraduate and master's degree students in Industrial Engineering and Telecommunications, the 2021 AYRFE programme offers 36 scholarships in the fields of signalling, energy, rolling stock, safety and telecommunications. As a result of the meetings and presentations held at the public partner universities –the Polytechnic University of Madrid,

University Carlos III and Rey Juan Carlos University– all the scholarships offered in the first quarter of the year have been filled.

The AYREA programme, aimed at final-year aeronautics, aerospace and telecommunications students, has 28 active scholarships in 2021 in all areas of air navigation: ATM, CNS, GNSS, and U-Space-drones. In addition to the agreements in force with the Polytechnic University of Madrid and the Centre for Advanced Aviation Studies of the US Corporation MITRE, the biennial agreement with the Reference Centre for Research, Development and Innovation in ATM (CRIDA) has been renewed in 2021, which has enabled access to two projects of the so-called 'SESAR Exploratory Research': ISOBAR, which addresses the use of Big Data and probability predictions of meteorological phenomena, and NOSTROMO, which develops performance measurement models of the Air Navigation System on a European scale, using artificial intelligence.

On the other hand, Ineco, together with the Spanish Institute of Engineering and the Network of University-Business Foundations (REDFUE), also organises the annual Distinction for Excellence in Internships Competition for engineering students, which awards prizes to three internships undertaken in Spanish companies. This recognition is supported by a series of theory and practice-based courses that help train future engineers and enable them to contribute to strengthening the prestige of Spanish engineering. Following the success of the first edition, the three institutions launched the second call for applications in 2021, which focuses on the search for excellence in business internships. The winning internships will be rewarded with a first prize of 4,000 euros and two runners-up prizes of 1,000 euros for second and third place. ■

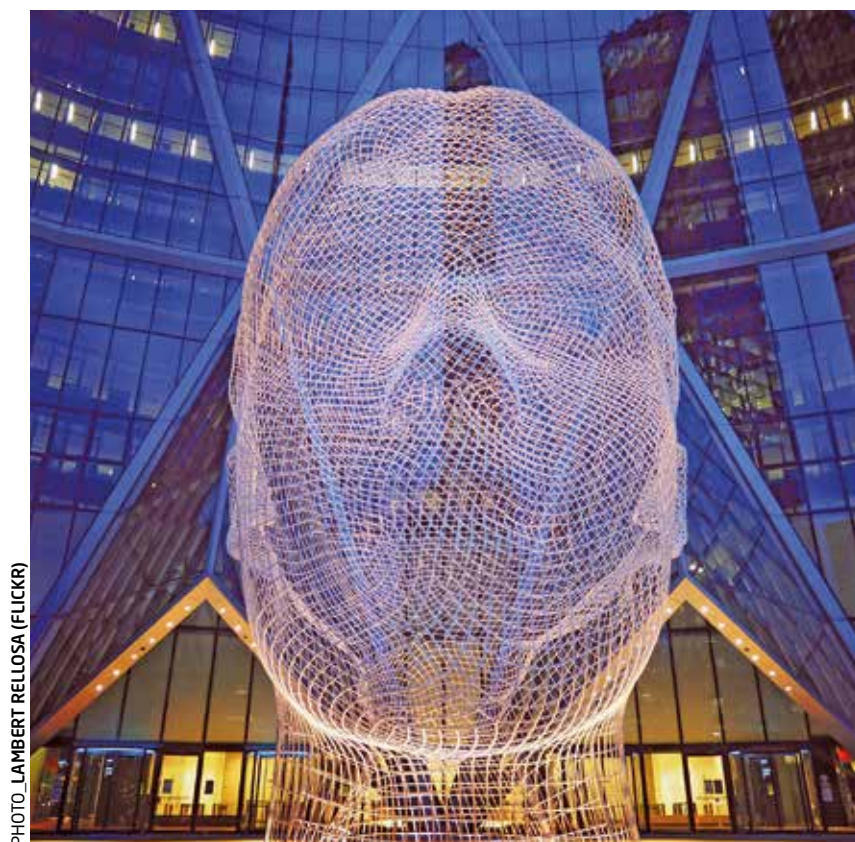


PHOTO: LAMBERT RELLOSA (FLICKR)

In recent decades, challenges such as the health crisis, climate change and technological disruption have led society in general and companies in particular to incorporate new values and redefine the essential skills of their employees. Younger generations expect companies to engage them as participants and protagonists in their own professional development, while at the same time wanting their work to have a positive impact on society. In turn, older professionals make a decisive contribution by securing and preserving business know-how and knowledge in organisations.



PHOTOS: INECO

WELCOME DAYS AND SCHOLARSHIPS

Pictures of some of the most recent welcome days and a presentation of the AYRFE scholarships (bottom right photo).

Strong measures to get off the ground

INVESTING AGAINST THE CRISIS
ENAIRE's Operational Plan, approved in February 2021, foresees an investment of 127.1 million euros this year for technological and airspace transformation.

PHOTO_ENAIRE

ENAIRE is responding to the slowdown in world air traffic caused by the deepest crisis in the history of aviation, with a set of measures and investments that put the main focus on social, environmental, technological and safety issues.

By **Francisco Olmedo**, aeronautical engineer

In November 2020, EUROCONTROL published three scenarios for air transport recovery, all of which are linked to the evolution of the pandemic and the progress of vaccination efforts. In the most optimistic scenario, it predicted that traffic would return to 2019 levels by 2024.

The Spanish national air navigation manager and Aena's main shareholder has faced the challenge of the decline in air traffic caused by the COVID-19 pandemic with the implementation of several lines of action: ENAIRE's new business strategy, Flight Plan 2025 takes up the baton from Flight Plan 2020 (see ITRANSPORTE 60) and focuses on the recovery of the aeronautical sector and communication and cooperation between the company and its employees.

Among the first emergency measures, ENAIRE took the decision to drastically reduce its air traffic control charges at the end of 2020. The Spanish mainland en-route charge was reduced from 51.08 euros in 2020 to 45.44 euros in 2021, a decrease of 11%. Likewise, the en-route charge in the Canary Islands, which had already been lowered previously and is already lower than on the mainland, has also been reduced from 43.73 euros to 40 euros, a drop of 8.5%. According to the company's data, Spain dropped its mainland en-route charges by 26% and those of the Canary Islands by 20% in 2020 and 2021, providing important support to the aviation sector during these years of crisis. Through these measures, ENAIRE aims to contribute to the recovery of air traffic in the face of its worst crisis in history due to the effects of COVID-19, to reduce costs for airlines and to help reduce ticket prices for end-users of flights.

ENAIRE's Operational Plan, approved in February 2021, foresees an investment of 127.1 million euros this year for technological and airspace transformation. Among the main priorities are safety,

Digital Sky, environmental sustainability, development of new strategic services, innovation and transformation 5.0. With the implementation of these initiatives, ENAIRE seeks to make counter-cyclical and transformative investments that will enable it to emerge stronger from times of crisis.

One of the main pillars of ENAIRE's roadmap for the coming years is digital transformation, a field for which the Council of Ministers authorised, in April 2021, the tendering of contracts for investments in business management application development projects for an amount of more than 28 million euros to be spread over two years. With this investment, ENAIRE aims to increase the productivity and efficiency of processes, improve the satisfaction of internal and external users through the use of technological tools, and facilitate and speed up administrative procedures through the digitalisation of processes.

OPPORTUNITY FOR TRANSFORMATION

ENAIRE's roadmap prioritises safety, the Digital Sky, environmental sustainability, the development of new strategic services, innovation and the 5.0 transformation. With the implementation of these initiatives, ENAIRE seeks to make counter-cyclical and transformative investments that will enable it to emerge stronger from times of crisis.



PHOTO_ENAIRE

ENAIRE also has a budget of two million euros for the development of its U-Space platform in Spain. This development will enable them to provide services for the automated management of drone operations beyond line-of-sight range, in specific reserved spaces called 'U-space' and, most importantly, in a centralised manner via CIS (Common Information Services). These services are essential to safely support drone operations when the new European U-Space regulation comes into force in January 2023. The company also participates in various European programmes such as the AMU-LED project conducted with drones, within the framework of SESAR, or the DACUS project, in which European companies and institutions participate. Ineco is also involved in these projects.

Reducing the environmental impact of each flight is a priority issue for the EU, which is counting on SESAR's high-tech initiatives to modernise the sector and achieve a better flight planning leading to reduced emissions and noise pollution, and optimised energy efficiency. ENAIRE has been collaborating with the European SESAR project since it began in 2008. Since then, the company has participated in around a hundred projects (the programme consists of more than 300), assuming a leading role in 16 of them.

Furthermore, as a collaborating company with the United Nations Global Compact, ENAIRE has joined REDI, the Business Network for LGBTI Diversity and Inclusion in 2021 within the framework of the Protocol signed on 29 June by the Ministry of Transport, Mobility and Urban Agenda (MITMA) with the aforementioned association. This initiative is part of the commitment to the implementation of equality and human rights as defined in the Sustainable Development Goals (SDGs) of the 2030 Agenda, to which the company is firmly committed. ■

ÁNGEL LUIS ARIAS

“737 million euros will be invested to modernise Spanish air navigation and become a global operator”



PHOTO: ENAIRE

If EUROCONTROL's most optimistic forecasts hold true, air traffic will not recover to 2019 levels until 2024. Now that the workload has decreased, are they taking advantage of this situation to implement new technologies?

ENAIRE's Strategic Plan 2021-2025, the so-called Flight Plan 2025, has been developed taking into account the impact of the COVID-19 pandemic, as well as the transformation taking place in the air navigation sector. The ultimate goal is to emerge stronger from this terrible crisis that has hit the airline industry so hard.

Flight Plan 2025 has a strong international focus and aims to promote the modernisation of ENAIRE through technological and digital transformation and cultural and organisational change, with the intensive participation and involvement of our professionals and stakeholders. This plan proposes air mobility in its threefold dimension as a human right, an element of social cohesion and a lever for economic growth.

Thus, apart from strengthening safety as a main strategic priority, it states that the scalability and resilience of services must ensure economic sustainability, improving the efficien-

A LENGTHY CAREER IN CIVIL AND MILITARY AVIATION

Ángel Luis Arias Serrano holds a degree in aeronautical engineering from the UPM and a Master's degree in General Business Management. He belongs to the Military Corps of the Air Force and the Civil Aeronautical Engineers Corps. He has worked in the Air Force since 1984, followed by a number of aeronautical organisations and companies. At Aena, he has held the positions of Director of Strategic Planning, Deputy Director to the Presidency and Director of Strategy, Innovation and Sustainability. He held the position of General Director of Civil Aviation from January 2012 until his appointment as General Director of ENAIRE in 2015. During this period he also chaired the Governing Board of the Aviation Safety Agency (AESAs), and was a member of the Boards of Directors of Aena and SENASA, as well as Vice-Chairman of EUROCONTROL.

cy, productivity and flexibility of the organisation and the quality of services, optimising the use of resources and taking advantage of all the available technological improvements that we are already developing and implementing.

What investments will ENAIRE make in the 2021-2025 period?

We have planned, and are already implementing, a major investment plan to digitalise and comprehensively modernise Spanish air navigation technology in line with the requirements of the Single European Sky (SESAR programme) and to embark upon development and internationalisation efforts in order to become a global services operator.

Between 2021 and 2025, ENAIRE will invest more than 100 million euros per year, with the most significant investment of 172.4 million euros in 2022. The total investment amount for the period is 737 million euros.

They have further reduced charges, their main source of income. What are your turnover forecasts for 2021?

En-route charges have actually been lowered again in 2021,

to 11% on the mainland and 8.5% in the Canary Islands, which were already among the lowest, again as a measure to support airlines in this second year of the pandemic.

In terms of our revenue, we believe that the 2021 charge reductions may be offset by the increase in traffic in 2021 over 2020, but we do not expect our 2021 revenue to exceed 50% that of 2019.

In truth, our forecasts are that ENAIRE will not recover its 2019 turnover before 2024, although this will be heavily influenced by the evolution of the health and economic crisis and its consequent impact on air traffic.

What is the 'Green Sky' project and what new measures to reduce carbon emissions would you highlight?

Flight Plan 2025 considers environmental sustainability as a fundamental issue that must be tackled in conjunction with the recovery of the air transport sector. 'Green Sky' is the name of ENAIRE's sustainability strategy for the 2021-2025 period.

'Green Sky' is based on three basic lines of action, two of which are specifically aimed at climate action, and a third one aimed at reducing other impacts on the environment. ENAIRE contributes to the fight against climate change, firstly, by reducing atmospheric emissions associated with air transport through the actions contained in the 'Fly Clean' programme, which aims to optimise our air route network and reduce the distances flown and aircraft fuel consumed.

A second programme, called 'Eco-ENAIRE', contributes to the reduction of ENAIRE's own emissions through an ambitious plan for energy efficiency and self-consumption of renewable energies. Similarly, our sustainability strategy includes a specific programme, called 'Fly Quiet', with the aim of reducing the acoustic impact on the airport's surrounding populations and protected natural areas.

The widespread use of virtual networks has increased cyber-attacks, have you been affected, and what protective measures are being taken in the aviation sector?

Remote working has received a strong backing that has brought it to the forefront of the social and labour market. The communication and remote access infrastructure, which was already in place and fully functional, as well as different collaborative tools, have seen their use increase exponentially, strengthening in terms of capacity and infrastructure. All of this, of course, while applying rigorous security measures to guarantee the integrity and confidentiality of information, as well as the availability of the as-

sociated services, in full compliance with the Certification of Conformity with the National Security Scheme, for which we have been awarded the highest category.

Thanks to all of this, despite having observed an increase in cyber-attacks during the pandemic, ENAIRE has continued to provide its services in accordance with its commitments to security, quality and efficiency, without suffering any incident with a negative impact on its operations.

In January 2023, the new European 'U-Space' regulation on drones will enter into force. What advantages will ENAIRE's 'U-Space' platform offer?

The 'U-Space' platform will improve the safety and efficiency of operations by providing enhanced situational awareness (i.e. operators/pilots will be able to be aware, in real

time, of drones flying in the vicinity, with the ability to see them on their screens at all times). This is very important as even in Visual Line of Sight (VLOS) flights there are situations where it is difficult to tell whether our drone is sufficiently far away from another drone in the vicinity. All of this is a simple but fundamental example of how to increase the safety.

All of the automation and digitalisation involved in the platform will also be very useful. This will make flight planning much more streamlined, efficient and safe, while greatly reducing the number of operational coordinations that our professionals have to perform.

It will also provide other benefits such as ensuring people's privacy. We will be able to know for sure that the drones flying around us are legal drones, operated by professionals. This is also something that our platform will provide through the Network e-Identification service. This will enable law enforcement agencies to monitor the drones they are flying at all times.

In their recovery plan, they have emphasised communication and cooperation between the company and its professionals. What are these measures?

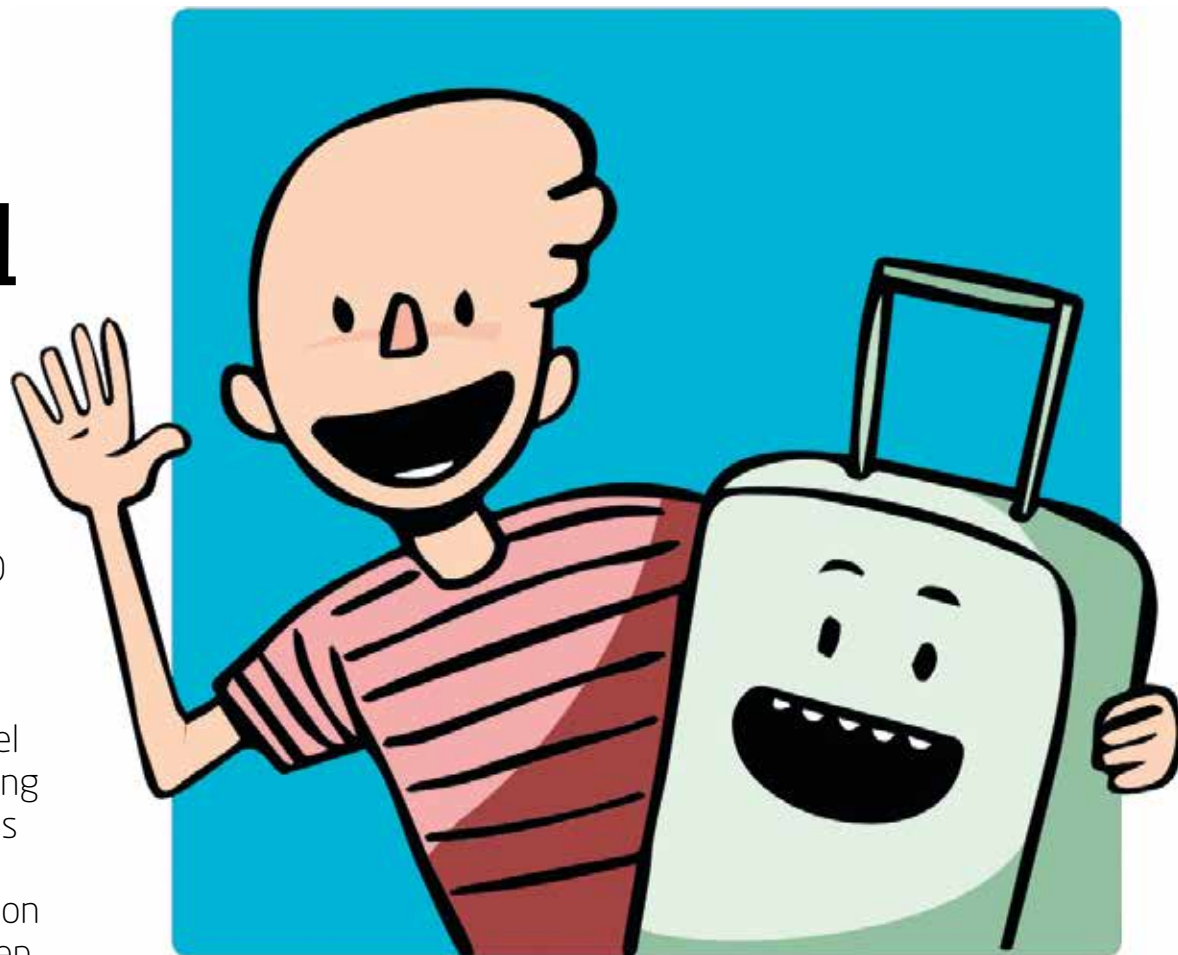
ENAIRE is an organisation that has long been committed to ensuring the well-being of the people that make up its workforce. Accordingly, since 2020 ENAIRE has sought to reinforce this approach to support its leaders and teams. A very important part of the Flight 2025 Plan focuses on promoting cultural transformation, diversity management, talent, conciliation, project orientation, team promotion etc. In short, on achieving a working relationship committed both to sustainability and growth and to the personal and professional progress of all its employees. ■

FLIGHT PLAN
2025 CONSIDERS
ENVIRONMENTAL
SUSTAINABILITY AS A
FUNDAMENTAL ISSUE
THAT MUST BE TACKLED
IN CONJUNCTION WITH
THE RECOVERY OF
THE AIR TRANSPORT
SECTOR. 'GREEN SKY' IS
THE NAME OF ENAIRE'S
SUSTAINABILITY
STRATEGY FOR THE
2021-2025 PERIOD

A friend to fly with

For a child with ASD (Autism Spectrum Disorder) or SLI (Specific Language Impairment), air travel can be an overwhelming experience. Ineco has developed a highly visual mobile application that explains each step of the journey to make it more understandable and enjoyable.

By **Pilar Morón**, project manager



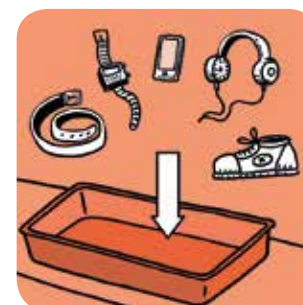
While it can be said that in recent years much progress has been made in transport accessibility measures for people with special physical needs (reduced mobility or sensory disabilities), the same cannot be said for those with cognitive disabilities. These include disorders such as ASD (Autism Spectrum Disorder) or SLI (Specific Language Impairment).

The Autism Spain Confederation, which comprises more than 140 associations, defines ASD as 'a disorder of neurobiological origin that affects the configuration of the nervous system and brain functioning, leading to difficulties in two main areas: communication and social interaction, and flexibility of thought and behaviour'. This 'invisible disability' makes it difficult for sufferers to 'adapt to change or to unforeseen situations', and can cause 'discomfort, distress or anxiety'. Autism spectrum disorders limit interaction skills, the self-regulation of emotions, verbal and non-verbal communication, and cause hypersensitivity to visual or sound stimuli.

Air travel touches on all these aspects: it involves interrupting daily routines and is a process with many steps, taking place in environments different from the usual ones –the airport, the plane– and generating a large amount of sensory stimuli and a volume of information that can be difficult to process. In addition to this, there are waiting times for check-in, boarding, etc. Therefore, flying can be a very demanding ordeal for a traveller



TEACOMPañO APP
Ineco completed an innovation project in 2019 to develop the TEAcompañó mobile application, with the collaboration of the Alanda association and Aena.



with ASD, particularly for children as well as for those accompanying them. In response to this need, Ineco completed an innovation project in 2019 to develop the TEAcompañó mobile application, with the collaboration of the Alanda association and Aena. The project is aligned with UN SDG Targets 9.1 (innovation) and 10.2 (reduced inequalities).

This is a very simple and user-friendly technological solution based on three strategies: first, to prepare the user, through games and visual resources, for what the travel experience will be like, from the moment they pack their suitcase at home until they arrive at their destination; second, to facilitate communication by prioritising images, which people with ASD/SLI generally understand better than oral or written messages; and third, to adapt the environment: to limit both inactive waiting times and information and warnings that are not relevant at each stage of the journey.

The app displays the different stages of the journey in a simple and structured way to make them understandable for children with ASD. This enhances the travel experience for them and their companions, helping them to anticipate and remember the main milestones and stages of the journey. The aim is also to make this group of people and their specific needs more visible. Other users, such as people with hearing impairment, reading and writing difficulties, tourists or migrants in general, can benefit from the application. ■

THIS IS TEACOMPañO

The application has a simple design and offers two sets of features: one for children with autism or language impairment, and one for families.

FOR CHILDREN:

Marieta, an animated suitcase, acts as a guide during the journey. Each stage of the journey is assigned a different colour and the messages are simple, brief and relevant, ensuring coherence between the written and spoken information and the animations.

The features include:

- **Games:** matchmaking, picture sorting and puzzles.
- **Pictograms:** these are sequences of three simple images to explain each stage of flight. Waiting periods have also been included, since these are particularly important for the target users of the application.
- **Images:** pre-loaded –such as 360° views showing real situations inside an airport– or images loaded by an adult.
- **Social stories:** audiovisual narratives explaining each stage of the journey, including interactive cartoons.
- **Globe:** allows the flight to be displayed on a map, according to the data previously entered by the adult.
- **Warnings:** stories with images, text and audio about possible unforeseen situations.
- **Journey:** this is a game similar to snakes and ladders that includes all the stages of the journey, which are completed in order to win a final prize.

FOR FAMILIES:

The app aims to provide families with useful information to help alleviate the stress of unforeseen events. Families can add pictures or specific information that is visible from the child's viewing area. They also have **My trip**, which includes the tasks to do and the list of items to pack; and **Journey**, which shows the stages of the trip along with shortcuts to all the features (pictograms, social stories, warnings, games and images). The application is designed to provide –with the necessary collaboration of the airport operator– real time updates on flight information, gate changes, delays, etc. There are additional possibilities, such as collecting information on the preferences and needs of this group of people to improve the service.





The most used platforms by companies to develop their products are computers (75% PC and 45% Mac), mobile devices (67% Android and 54% iOS) and in third place, consoles (38% PS4, 37% Nintendo Switch and 26% Xbox).
Source: DEV

A growing area of activity is that of serious games, which are being developed by around a quarter of Spanish companies in the sector. These are not intended for entertainment, but rather are designed for educational or training purposes.

TEMTEM

From The Flea to the 'Spanish Pokémon'

In 1983, a highly successful video game called **Bugaboo**, also known in its various versions as **The Flea**, known as **La Pulga** in Spain, was published in the UK and later in the USA. It soon reached number one in the specialised games press. Created by two programmers from Extremadura, it is currently considered the first major milestone in the development of entertainment software in Spain, which is now one of the top 10 biggest players in the sector in the world and the fifth largest in Europe in terms of turnover.

La Pulga, which today gives its name to the Spanish national industry awards, was followed during the 1980s and early 1990s by other well-received productions such as **Sir Fred**, **Livingstone Supongo** (both in 1986), **La Abadía del Crimen**

Spain is among the world's top ten players in the video game market, especially when it comes to indie productions. The sector, which is still very young, is growing at a double-digit annual rate.

By ITRANSPORTE

(1987, inspired by the film *The Name of the Rose*), **Commandos**, **PC Fútbol** and many more. All of them gave rise to what is known today as the 'golden age' of Spanish gaming, which ended in the early 1990s with the arrival of 16-bit technology.

After a hiatus of a few years, with the turn of the century and the digital revolution, a resurgence began within the sector. In 2010, **Castlevania: Lords of Shadow**, developed by the Madrid-based studio MercurySteam, was released. The Japanese firm Konami selected them from a number of other American and Japanese proposals to redesign and revamp their product. The result was a mega-production with a budget of 20 million euros, which led to two sequels and became a worldwide critical and commercial success, marking a milestone for the sector in Spain. This is a sector that has experienced sustained growth over the last ten years, both in terms of turnover and business networks, although there is still a great deal of room for further expansion.



LEAGUE OF LEGENDS SEMIFINAL, VISTALEGRE 2019

PHOTO: RIOT GAMES

ESPORTS: BEYOND SCREENS

The video game sector's growth is not only limited to software development, but also encompasses other activities with a high economic impact, such as esports: these are official and professional competitions for various battle and strategy video games, such as **League of Legends (LoL)**, **DOTA 2** (short for Defence of the Ancients 2), **Fortnite**, or **Cs:Go** (Counter-Strike: Global Offensive). All of them draw audiences numbering in the millions, not only online via streaming (live) on platforms such as Amazon-owned Twitch, but also, until the pandemic hit, face-to-face. That is to say, with audiences flocking to large venues to watch their favourite teams and players perform live. Spain has hosted some of these competitions, such as the 2018 final and the quarter and semi-finals of the League of Legends World Championship, held in November 2019 at the Palacio de Vistalegre in Madrid, which was attended by 8,000 live spectators, and another 1.7 million online during the two weeks of matches.

Esports in Spain generated 35 million euros in 2019, 22.5 million in advertising, which together with sponsorships are the main sources of revenue, according to the Spanish Video Game Association (AEVI). The sector employs 600 people, of which 250 are professional players, and Spain represents approximately 4% of the world's esports economy, has 2.9 million fans -of which 55% are over 25 years old- and ranks 12th in the world in terms of esports audience share, which is mostly online, as well as having the highest percentage of female fans in Europe at 36%.

According to data from the Spanish video game development association DEV, in 2019, entertainment software production companies -some 400 in total, most of them small and concentrated mainly in Catalonia and Madrid, and to a lesser extent in Valencia and Andalusia- had a turnover of 920 million euros, 13% more than the previous year, 66% of which came from foreign sales. The fact that the main distribution channel is via global platforms on the Internet, mainly Steam, where 83% of Spanish studios make their sales, facilitates the process. According to DEV, physical sales account for only 4% of the total. North America (28%) and Europe (23%) are the main buyers of Spanish video games.

DEV forecasts annual turnover growth of 17% to EUR 1.7 billion by 2023. In terms of employment, the current workforce of just over 7,100 will rise to 8,500 direct jobs.

INDIE GAMES

In contrast to global and large-scale video games, the Spanish industry is characterised by the quality of its inde-

pendent productions, which enjoy great international acclaim due to the originality of their game dynamics and aesthetics. Among the most recent, some of the most successful are **Temtem** known as the Spanish Pokémon, by Madrid-based studio Crema Games, which sold half a million units on Steam in its first month; or **Blasphemous** (2019), by The Game Kitchen from Seville, which mixes the folklore of southern Spain with action adventures and combat to the rhythm of guitar and saeta (a popular song typical of Easter), which has already reached one million players on Steam.

Among the best-selling, most-played and award-winning games of the last few years are **They are billions**, set in a zombie apocalypse designed by Madrid studio Numantian Games, which reached 15th place worldwide in January 2018 on Twitch; **Gris**, by Barcelona-based Nomada Studios, an intimate story with watercolour aesthetics, which received numerous awards and achieved an average rating of outstanding on the Steam platform; and **The red strings club** (2018), cyberpunk adventure game by Valencian studio Deconstructeam. ■



THE FLEA



THE RED STRINGS CLUB



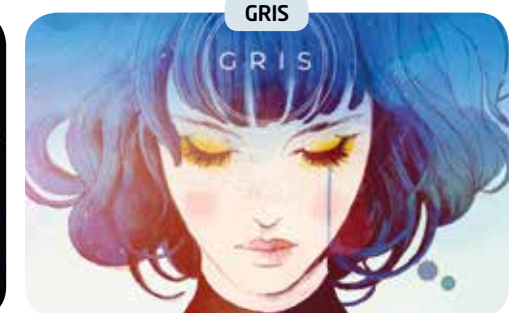
BLASPHEMOUS



COMMANDOS 2



SIR FRED



GRIS

Allies against noise

Noise produced by transport infrastructure is an environmental problem that greatly affects the nearby population. To minimise its effects, Ineco has highly qualified technicians and specialists in the evaluation and management of environmental noise.



The noise pollution team is made up of experts from various disciplines. In the picture, Ana Gendive, Ruth Ballesteros, Andrés Navarro, Celia Marivela, Concepción Garcés, Nagore Lasa, Verónica Iglesias, Mirela Vladovic and Sergio Martín.

PHOTO_ELVIRA VILA

“Our ultimate goal is to make transport infrastructure compatible with human activity”

CONCEPCIÓN GARCÉS, industrial engineer and RUTH BALLESTEROS, graduate in Biology

Their mission is to predict and assess the effects of noise emissions generated by transport infrastructures on the human population or the natural environment, and to propose measures to minimise its influence. Ineco's multidisciplinary team is made up of engineers (industrial, telecommunications, materials), graduates (environmental sciences, geography, biology) and specialists in geographic information systems and BIM. This unit of experts has more than 15 years of international

experience carrying out studies related to noise: strategic noise maps, action plans, the development of acoustic easements, acoustic analysis in environmental projects and procedures, noise reduction projects, as well as advising public administrations.

Ineco is currently committed to consolidating its leadership in this area through internal programmes that serve to reinforce its position and image as a leader in the field of environmental acoustics.

KEY POINTS

- 1 10 ENGINEERS AND SPECIALISTS IN NOISE POLLUTION ANALYSIS.
- 2 MORE THAN 15 YEARS OF EXPERIENCE IN THE INDUSTRY.
- 3 OWN METHODOLOGIES.
- 4 HANDLING OF SOFTWARE FOR GROUND INFRASTRUCTURES (CADNA, NOISEMAP, INM, AEDT).
- 5 SPECIALISTS IN ANALYSIS USING GIS TOOLS (ARCGIS, QGIS).
- 6 EXPERIENCE IN ALL MODES OF TRANSPORT: ROAD, RAILWAY AND AERONAUTICAL.

WE ARE TALENT

Great infrastructure is the product of the vision and effort of exceptional people.



A talent that enables us to improve the mobility and the quality of life of millions of people, every day.

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Committed to the aviation industry recovery

Reduction of route charge by 11%



Sustainability and Efficiency



Safety



Technology, Digitalization and Human team

