CONSTRUCCIONES Y AUXILIAR DE FERROCARRILES S.A.

www.caf.net

Administration Offices
Padilla, 17
28006 Madrid
Spain

Registered Office
J.M. Iturrioz, 26
20200 Beasain, Gipuzkoa
Spain

SUBSIDIARIES

MADRID · PARIS · LONDON · MUNICH · WASHINGTON D.C. · NEW DELHI · MEXICO D.F. · ROME · SYDNEY
WARSAW · SAO PAULO · BUENOS AIRES · ISTANBUL · ROTTERDAM · DOHA · KUALA LUMPUR · SANTIAGO DE CHILE

PRODUCTION SITES

SPAIN · FRANCE · USA · BRAZIL · MEXICO

Project funded by the Ministry of Industry, Tourism and Trade. Competitiveness plan programme.

oaris

oaris

aris

oaris

s

CONSTRUCCIONES Y AUXILIAR DE FERROCARRILES S.A.

oaris

CUTTING-EDGE TECHNOLOGY AT 350 KM/H

High-speed networks have become key factors in many countries' competitiveness. These networks are a sustainable mobility solution in contrast with other means of transport such as cars and planes, providing the public with rapid transport at competitive prices.

CAF has extensive experience in the manufacture and maintenance of high-speed trains. In recent years, the company has supplied Spanish train operator Renfe with 250 km/h trains, Series 120 and 121, after previously contributing to the supply of the Spanish High-Speed Train (AVE) for the Madrid-Seville line. CAF also supplied 12 high-speed trains to Turkish State Railways (TCDD) in the period 2007-2010.

OARIS, 350 KM/H

The fruit of considerable R&D investment, CAF has developed the Oaris very high speed train family, capable of speeds up to 350 km/h. Created using CAF's high reliability technology, this range of distributed traction trains is a combination of cutting-edge features in terms of design, modularity, safety and passenger comfort.

Oaris has been designed for international gauge (1,435mm) and to suit different supply voltages of the infrastructure systems. The platform's modular design concept means operators can set up 4, 6 or 8-car trains for highest passenger capacity.

Oaris also incorporates the latest dynamics, aerodynamics and noise technologies, in full compliance with cross-wind and pressure wave regulations, minimising both internal and external noise. Oaris meets all current TSIs: high speed TSI, PRM TSI and Safety in Railway Tunnels TSI, among others.

CROSS-BORDER CONNECTIONS

OARIS IS A **COMPREHENSIVE, VERSATILE** SOLUTION ABLE TO **OPERATE CROSS-BORDER** SERVICES ON **ALL TYPES OF HIGH-SPEED NETWORK.**

RAILWAY INTEROPERABILITY

Railway interoperability is built in to every CAF transport solution. Series 120 and 121 of high speed trains supplied to Renfe are a clear example of this: these trains run on tracks supplied at different voltages (3,000 VDC to 25 kV AC) and with different signalling systems (from ASFA to ERTMS or LZB).

The aim of Oaris is to facilitate clients' international operations management based on maximum reliability and a cutting edge, state-of-the-art technology fleet. This train is designed to operate on any type of high-speed network, including cross-border transit.

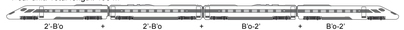
In addition, Oaris can be specified with the BRAVA universal variable gauge system enabling the train to switch to any track gauge without stopping.

BENEFITS OF DISTRIBUTED TRACTION

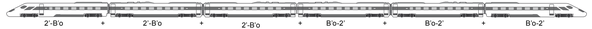
- Higher passenger capacity, since the train consist does not need a separate locomotive and every car can take passengers.
- Fewer gangway connections and longer passenger saloons.
- Improved acceleration and braking, especially on high track gradients.
- Less infrastructure investment needed due to reduced axle load.
- Capacity to power and brake a higher number of wheelsets.
- Increased safety due to reduced braking distance.

FLEXIBLE CONFIGURATION

4-car unit. Total length: 103 m



6-car unit. Total length: 152 m



8-car unit. Total length: 202 m

HIGH TRANSPORT CAPACITY

Operators need train sets designed to transport the highest possible numbers of passengers at a time. Oaris' 4, 6 and 8-car configurations mean that great seat numbers can be provided. In addition, the platform is designed so two units can be coupled together so trains with even higher passenger capacity can be operated.

Oaris does not have any shared bogies. This structure means trains can have fewer gangway connections, making for more efficient use of space and clearing the way for longer passenger saloons. All in all, it is a smart response to operators' requirement for large-capacity trains.

Oaris' modular construction means that each car can have 1 or 2 doors per side, for faster passenger boarding and disembarkation.

HIGH RELIABILITY FOR EFFICIENT OPERATION

Oaris' high performance guarantees high safety and reliability levels throughout its life cycle. High availability is essential to offer clients a safe fleet for continuous, uninterrupted revenue service.

Moreover, its design and highly standardised component specification simplify long-term maintenance. And the train structure means lower axle loads, and consequently, reduced track wear. All these factors combine to reduce the clients' operating and maintenance costs.

OPTIMISED LIFE CYCLE COSTS

Oaris meets the need for minimal costs over service life. This results in 2 main benefits:

- Reduced energy consumption through optimised aerodynamic design, high performance traction equipment, reduced weight, efficient driving strategy definition and regenerative braking.

- Saving on maintenance costs, thanks to a design and a maintenance strategy strongly focused on vehicle reliability and maintainability.

CUSTOM INTERIORS FOR ENHANCED COMFORT...

Oaris is synonymous with comfort. Every part of its design is undertaken with the goal of offering passengers in both, business and standard class, the best possible on-board experience.

Seats, which can be reclining and swivel, are available in a range of upholstery finishes, such as flat weave, moquette and leather. Business class seats can be converted into aircraft-class beds, for even greater passenger comfort. Other details include automatically adjustable LED lighting, tables, on-demand entertainment screens, Ethernet and Wi-Fi for internet services, power outlets, USB charging points, public address systems, etc.

Oaris' modularity and flexibility means highly flexible configurations are possible to suit each client or operator's specific needs. Oaris is designed from the ground up for a broad range of modules, such as cafés, restaurant cars, meeting areas, vending machines and luggage storage for even greater passenger comfort.

Other variables, such as the seat pitch or the number of toilets per car are also customisable to suit the type of service the train will be used for.

... NOT ONLY FOR PASSENGERS

The cab too has been designed with comfort in mind - maximum driver comfort. It meets all international interoperability standards and UIC 651 and 612.

Every aspect of the cab and its shapes (control panel, appropriate finishes, windscreens and side windows) has been designed to minimise injury in the event of accident. Just as much care has gone into its anti-glare cab lighting.

The cab is equipped with individually controlled air conditioning. And it can be fitted out for 2-person operation.

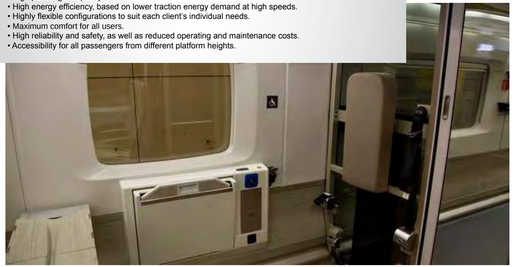
A TRAIN FOR ALL

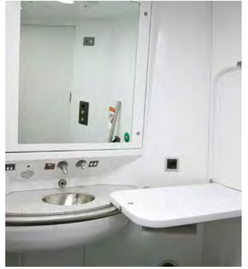
Oaris fully complies with the PRM TSI. It has areas to meet the needs of travellers with reduced mobility, including accessible toilets. In addition, lifts to facilitate boarding and disembarkation can be fitted if the platform infrastructure requires such devices.

Moreover, the interior is carefully designed to ensure PRM passengers can easily move about the train: its wide gangways provide more room for ease of movement and there are no steps or other obstacles from one end of the train to the other.

ADVANTAGES OF OARIS

- Technology specifically designed for full interoperability.
- High passenger capacity.
- High energy efficiency, based on lower traction energy demand at high speeds.
- Highly flexible configurations to suit each client's individual needs.
- Maximum comfort for all users.
- High reliability and safety, as well as reduced operating and maintenance costs.
- Accessibility for all passengers from different platform heights.





TECHNICAL DATA

DIMENSIONS

• Total train length (4, 6 and 8-car consists)	103 m / 152 m / 202 m
• Length of cab car	26.7 m
• Length of intermediate car	24.7 m
• Maximum exterior width	2,954 mm
• Maximum height above top of rail	3,890 mm
• Gauge	UIC 505-1
• Track gauge	1,435 mm *
• Carbody wheelbase	16.9 m
• Bogie wheelbase	
Fixed gauge bogie	2.5 m
Variable gauge bogie	2.8 m

PERFORMANCE

• Maximum Speed	350 km/h
• Rated maximum power (8 cars)	8,800 kW

PASSENGER CAPACITY

• Seated places	4 cars (up to 240 seats + 2 PRM) 6 cars (up to 400 seats + 2 PRM) 8 cars (up to 560 seats + 2 PRM)

SUPPLY VOLTAGE

• Monovoltage	25 kV
• Bi-voltage	25/3 kV // 25/1.5 kV
• Tri-voltage	25/15/3 kV // 25/15/1.5 kV // 25/3/1.5 kV

OTHER EQUIPMENT

• Air conditioning	• Signalling system: ERTMS, LZB, ASFA Digital etc.
• Passenger information system	• Watt-hour meter
• Entertainment system	• Multi-configurable area: café, vending machines, cycle module, etc.
• CCTV	
• Fire detection system	
• Control and monitoring system	

COMPLIANCE WITH THE MAIN TSIs

• High speed	• Traffic Operation and Management:
• PRM	• Rail Energy
• Safety in Railway Tunnels	• Rail Infrastructure
• Control Command and Signalling	• Maintenance

SAFETY FIRST WITH ERTMS 2!

Oaris incorporates ERTMS 1 and 2 signalling technology, guaranteeing European railway interoperability. To achieve this, it uses the ETCS (European Train Control System) onboard application via the AURIGA platform developed by CAF Signalling used in Level 1 and Level 2 infrastructure and onboard equipment.

The use of ERTMS in Oaris means that our clients can have fleets capable of operating on cross-border lines with no interruptions of any kind and the highest possible safety standards.

** 1,520 mm gauge available for Russian variant*

OARIS, KEY TO A SUSTAINABLE FUTURE

The transport sector faces the challenge of providing solutions that are not only environmentally-friendly but also meet the growing global demand for modern, comfortable transport networks. High speed trains have become one of the most important alternatives in this context, up against other means of transport such as cars and planes.

Oaris is the fruit of advances made to the optimisation of aerodynamic design and the reduction of noise and vibrations, which all go to improvements in energy efficiency and maximum user comfort. Its design goal was to strike a balance between passenger comfort and maximum passenger numbers, with consequent energy-savings thanks to the creation of spacious user areas and optimal seat numbers per unit.

Low energy consumption
The high efficiency of the traction units and the low weight of the train are key elements in Oaris' low energy consumption. That is not all: Oaris' carefully designed aerodynamics reduce its air resistance and, thus, its energy requirements.

And its regenerative braking makes a further contribution to optimising operation and achieving high efficiency. Oaris is specifically designed for regenerative braking to take priority over rheostatic and friction systems. In this way, the energy recovered in the braking process is recycled to the catenary and can either be used by another train or returned to the electricity grid.

Other implementations, such as real-time driver assistance (Driver Advisory System) and intelligently controlled auxiliary equipment when the train is stopped (Intelligent Stabling) also reduce consumption.

Reduced noise emissions
Oaris was designed using the most effective methods, such as prior calculation and trial, use of sound insulating and absorbing materials, aerodynamic shapes, and research into wheel-rail interface and interaction, to minimise wheel and wind noise.

Lightweight, recyclable materials
Oaris was designed with as much thought for the recyclability of the materials used in its manufacture as for the strength and light weight that helps reduce traction energy requirements. More so, components made from more than one material are designed so that they can be broken down into their original constituents when the train's long service life is over, thus facilitating recycling.

INTEGRATED TRANSPORT SYSTEM IMPLEMENTATION

CAF builds its Oaris platform into the integrated solutions offered to the Company's clients. These integrated projects may also include, in addition to supply of rolling stock, such other packages as civil engineering, signalling, electrification, and operation and maintenance of the system as a whole.

CAF provides integral management and engineering in every phase of the project:

System design and engineering
Once the project's feasibility studies have been completed, CAF designs the optimal railway solution to meet the needs of each railway authority or infrastructure.

System construction
The range of CAF products and services includes construction of the various elements of railway infrastructure: signalling systems, electrification of lines, other electro-mechanical systems such as ticketing and CCTV - not forgetting the supply of very high speed rolling stock.

Installation and commissioning
On-time delivery of systems ready for immediate commissioning, to the client's quality standards.

System Operation
CAF has the capacity to operate a railway system with ultimate responsibility for the system's general administration. This includes the management of all revenues and resources necessary for ensuring maximum profitability.

Maintenance and other rail services
CAF's Rail Services department implements the latest and most innovative maintenance and optimisation technologies to maximise trains' quality of service parameters and reduce life cycle costs. These services include preventive and corrective maintenance, comprehensive overhauls, modifications and improvements, management of materials and supplies, trackside assistance and staff training, to name but a few.

CAF services also include infrastructure maintenance and workshop fitting out.