PRESS RELEASE

SNCF AND PARTNERS JOIN FORCES TO DEVELOP DRIVERLESS TRAINS BY 2023

PARIS, 12TH SEPTEMBER 2018

SNCF and Institut de Recherche Technologique (IRT) Railenium, Alstom, Altran, Ansaldo, Apsys, Bombardier, Bosch, Spirops and Thales announced the creation of two consortia to develop prototypes of driverless trains within the next five years.

A RAILWAY REVOLUTION

This major project is part of SNCF’s vision for the railway of the future, driven by its technology transformation. By making SNCF the first operator of a driverless train, SNCF and its partners are staking out positions as French and global leaders in the race to build the rail industry of tomorrow.

Two consortia were launched in January 2018 and are headed by SNCF and IRT Railenium for a five-year period.

One consortium - Alstom, Altran, Ansaldo and Apsys - will produce the prototype of a driverless freight train. The second, made up of Bombardier, Bosch, Spirops and Thales, will focus on a prototype driverless regional passenger train.

The total budget for this phase of the project is €57 million. 30% is financed by SNCF, 30% by the State and 40% by the partners.
OPEN INNOVATION: BRINGING EXPERTISES TOGETHER

The partnerships bring together major industrial players from the rail, the air sector, automotive, engineering and AI industries. Additional strong support comes from the French State through ANR, the French National Research Agency.

Two other public bodies - France’s National Rail Safety Authority (EPSF) and the National Cybersecurity Agency of France (ANSSI) - are contributing their expertise in railway safety and cybersecurity to each consortium.

All these expertise allow to go further in key areas of the future autonomous train: obstacle detection, reading of signaling, geolocation, environmental monitoring, train and hazard management.

“We face major human and tech challenges”, says Luc Laroche, who heads the Driverless Train project. “To meet them, we’ve pooled our collective intelligence, plus the experience, skills and expertise of partners from a range of industries. These partnerships are a world first through the ambitious goals, approach and competencies they bring together.”

BENEFITS FOR PASSENGERS AND FREIGHT

Rail automation delivers concrete benefits for both passengers and freight customers:

+ **Increased capacity**: more trains on the track mean greater capacity for carrying people and goods

+ **Smoother flows and frequency**: thanks to harmonized traffic and optimized speeds means smoother resolution of unforeseen disruptions

+ **Care for the environment**, thanks to reduced use of energy.

"The digital transformation of the network and the signaling will allow to circulate more trains and better trains. It is essential to develop the autonomous train. It will make us a champion of industrial digital", says Patrick Jeantet, President of SNCF Réseau.

"Carrying more people and more goods, with better service, more fuel efficiency and even more safety, is what makes the autonomous train possible. With the autonomous train, all the trains will circulate in a harmonized way and the railway exploitation will gain in fluidity. And more fluidity, it is a better regularity and a greater punctuality of the trains. This is a major challenge for SNCF which circulates 17,000 trains and carries 4 million passengers a day”, said Guillaume Pepy, President of SNCF. "We are fully engaged, with our partners, in building the train of the future …and the future of the train"
ABOUT SNCF GROUP

SNCF is a global leader in passenger and freight transport services, with revenue of €33.5 billion in 2017, of which one-third on international markets. With 270,000 employees in 120 countries, SNCF draws on its foundations in French rail and its extensive experience as an architect of transport services. It aims to become the benchmark for mobility and logistics solutions in France and worldwide. SNCF has six core businesses: SNCF Réseau (management and operation of the French rail network); commuter transport (mass transit in the Paris region, TER regional rail, and Keolis in France and worldwide); long-distance rail (TGV in Oui, Ouigo, Intercités, Eurostar, Thalys, Ouibus and more, and ticket sales through Oui.sncf); SNCF Gares & Connexions (station management and development), SNCF Logistics (freight transport and logistics worldwide with Geodis, Fret SNCF and Ermewa) and SNCF Immobilier (management and optimization of SNCF property and land assets).

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THE PARTNERS

ALSTOM

Jean-Baptiste Eymeoud, Senior Vice President France, Alstom
“This joint endeavour with SNCF, Railenium and other consortium members is an immense opportunity for Alstom to showcase our expertise and capacity for innovation in rail automation and driverless transport systems, and to further cement our leading position in new driverless and digital technologies.”

ALTRAN

William Rozé, COO Europe, Altran
“As a specialist in smart, driverless, connected mobility for automotive and aerospace, we are proud to be playing our part in transforming the rail industry in the coming years by tackling the technology challenges that will shape the future of mobility.”

ANSAŁDO STS

Gilles Pascault, Chairman, Ansaldo STS France
“Ansaldo STS has been working with SNCF on advanced signalling, command and control systems for many years, offering a fresh approach to transport solutions. The driverless train project is an opportunity for us to push the boundaries of technology even further, together with SNCF, and shape a more modern rail industry fit for the future.”

APSYS

Christian Forestier, Chairman, APSYS
“We are proud to be working alongside SNCF on this driverless train project. It provides yet another opportunity for APSYS to apply its cybersecurity expertise to a real-world prototype vehicle.”

BOMBARDIER

Laurent Boyer, President, Bombardier France and Benelux
“Bombardier Transportation’s engineers in Northern France are poised to tackle this challenge in
partnership with members of the consortium and SNCF. They will be responsible for integrating the different intelligent technologies to automate a Regio 2N trainset that, once complete, will be France’s first driverless passenger train. This is a strategically important project for Bombardier and the rail industry at large.”

BOSCH

Heiko Carrie, President, Bosch France and Benelux
“As a world-class supplier of mobility solutions, Bosch Group is delighted to be part of the consortium and proud that our technologies will play a part in this landmark project to develop the driverless train of the future.”

RAILENIUM

Yves Ramette, President, Railenium
“The driverless train project is central to our research and innovation strategy at Railenium, the Technological Research Institute for France’s rail industry. We are delighted that the biggest names in manufacturing and academia will be involved in making this collaborative venture a success, and tackling the scientific and technology challenges that will shape the future of rail.”

SPIROPS

Jérôme Hoibian, Co-founder, SpirOps
“As a pioneer in AI R&D for more than 14 years, SpirOps has developed proprietary human behaviour modelling technologies. Crowd simulation and driverless vehicles are our bread and butter. We believe that these two areas of expertise are ideally suited to rail applications, and will help address the technical challenges that come with developing a fully driverless train.”

THALES

Patrice Caine, Chairman and Chief Executive Officer, Thales
“Thales has been pioneering driverless metro systems for more than 30 years and has extensive expertise in rail signalling. We are harnessing our deep knowledge of key digital technologies—connectivity, big data, AI and cybersecurity—for the aerospace, avionics, defence and security industries to make SNCF’s driverless train a reality.”
Our expertise
Alstom has been at the forefront of rail automation for more than 30 years. It develops and markets on-board and ground-based electronic sub-systems for rolling stock and signalling applications, spanning all levels of safety. Alstom is a world leader in automatic train protection systems, with a complete range of metro, mainline and freight solutions. Several years ago it launched an internal R&D programme, Driving Automation, to introduce automation across its entire range.

Our contribution to the consortium
As the lead member of the consortium, Alstom will work with its partners to develop a driverless freight train operating up to grade of automation (GoA) 4 on track fitted with ERTMS and conventional lineside signalling systems.
Alstom brings to the table a wealth of expertise and a solid track record of delivery. Its fully driverless (GoA 4) metro systems are in use in Singapore, Lausanne and other cities around the world, and it has installed CBTC signalling systems on more than 1,500 km of track across 83 lines, over half of which more than 43 carry trains operating autonomously at various levels.
Alstom is a major name in mainline rail—especially ERTMS signalling—as the leading supplier of European Vital Computer (EVC) platforms. Semi-autonomous (GoA 2) trains fitted with its systems operate freight services in Kazakhstan, as well as intercity passenger services elsewhere. As the leader of the EU’s Shift2Rail TD2.2 working group, Alstom is developing automatic train operation (ATO) specifications and a prototype that will serve as a benchmark for a future Europe-wide mainline ATO standard.

Our ambition
Being part of the consortium will give Alstom yet another chance to make automation a key growth driver across its mobility solutions—in passenger and freight rail, and in related segments such as buses and shuttles. By harnessing the energy and ideas that are already out there, Alstom expects the venture to make a real difference in the pace and scale of innovation in driverless technologies.

About Alstom
As a promoter of sustainable mobility, Alstom develops and markets systems, equipment and services for the transport sector. Alstom offers a complete range of solutions (from high-speed trains to metros, tramways and e-buses), passenger solutions, customized services (maintenance, modernisation), infrastructure, signalling and digital mobility solutions. Alstom is a world leader in integrated transport systems. The company recorded sales of €8.0 billion and booked €7.2 billion of orders in the 2017/18 fiscal year. Headquartered in France, Alstom is present in over 60 countries and employs 34,500 people. www.alstom.com
Our expertise
Altran is a global leader in innovative engineering for complex value-added systems, delivering technology and industrial solutions to customers in the aerospace, automotive, energy and other sectors. It has a strategic interest in the rail industry, where it intends to forge lasting partnerships with customers such as SNCF and Alstom—as it does elsewhere—to help them transform their businesses. Altran brings to the consortium its capabilities in processes, tools and technologies, drawing on a large body of research, industrial applications and centres of expertise in automotive and other industries, and in fields such as automation, AI, deep learning, IoT and data fusion.

Our contribution to the consortium
Altran is using model-based systems engineering methodology to help SNCF manage complex systems projects. Within the consortium, Altran leads on the overall integration and validation strategy for the driverless freight train system, drawing on its track record in autonomous system design and testing, most notably in automotive applications. It will use modelling methods, tools and processes, as well as massive computational simulation, to run a battery of combinatorial tests on the system. It is also tasked with developing image, audio, vibration and other sensors, as well as AI, deep learning and data fusion algorithms, for environment perception.

Our ambition
Altran is proud to play its part in the far-reaching transformation of the rail industry, working alongside key industry partners to develop new technologies that will deliver safer, smoother travel in the coming decades. Altran will be at the forefront of designing, developing, testing and operating the driverless rail systems of tomorrow.

About Altran
Altran ranks as the undisputed global leader in Engineering and R&D services (ER&D), following its acquisition of Aricent. The company offers clients an unmatched value proposition to address their transformation and innovation needs. Altran works alongside its clients, from initial concept through industrialization, to invent the products and services of tomorrow. For over 30 years, the company has provided expertise in aerospace, automotive, defense, energy, finance, life sciences, railway and telecommunications. The Aricent acquisition extends this leadership to semiconductors, digital experience and design innovation. Combined, Altran and Aricent generated revenues of €2.9 billion in 2017, with some 45,000 employees in more than 30 countries. www.altran.com
Our expertise
Copenhagen’s driverless metro system is perhaps the best-known example of Ansaldo STS’s automated transport expertise. When the metro opened in 2002, the technology behind the system was at the leading edge of innovation. And that is where the company has remained ever since, continually fine-tuning its solutions to cater to customer demand. It broke new ground in the rail industry when it unveiled the world’s first driverless freight train, operating on a 280 km line. The success of its passenger and freight rail technology is due in no small part to its policy of partnership. Ansaldo STS works hand in hand with its customers, pushing the boundaries of technology and inventing new ways to boost rail and urban transport network capacity and keep people and goods safer.

Our contribution to the consortium
Ansaldo STS’s role is to show that the consortium’s objective—developing a driverless freight train - is feasible. To do that, it will harness its capacity for innovation and present solutions and technologies to overcome the challenges of rail automation, including changes along the way.

Ansaldo STS is involved in specifying and designing the general system architecture, developing the ATO system core, and bringing to the table its expertise in geolocation of trains.

Our ambition
Ansaldo STS has always sought to push the boundaries of technology. Operating in Europe and Asia, it was behind the earliest Paris metro lines and France’s first high-speed track. And more recently, it pioneered some of the first autonomous transport systems and made an important contribution to ERTMS, CBTC and other advanced technologies that have since become industry standards.

SNCF’s driverless train project is an opportunity for the company to push these boundaries even further and, together with its partners, shape a more modern rail industry fit for the future.

About Ansaldo STS
Ansaldo STS is an international technology company specializing in the design, construction and management of transport and signaling systems for railways and subways. The company acts as a supplier and systems integrator for turnkey projects around the world. Ansaldo STS, a Hitachi group company since 2015, is headquartered in Genoa (Italy) and employs 4,228 people in 30 countries. In 2017, it achieved a turnover of 1,361.0 million euros with an operating profit (EBIT) of 100.8 million euros and a consolidated net profit of 64.9 million euros. www.ansaldo-sts.com
Our expertise

APSYS, a subsidiary of Airbus, provides scientifically and technologically advanced consulting and software solutions to help its customers manage technical, human and operational risks. Its 450-strong team of experts tackles the challenges posed by major technology projects—designing more reliable aircraft, improving driverless vehicle safety, managing nuclear facility obsolescence, and protecting industrial assets against cyberattacks.

Through its services, APSYS helps future-proof business models for its customers in the aerospace, defence, transport, manufacturing and energy industries. In 2017, revenue in the mid-sized firm’s Industrial Cyber Security (IoT) business grew a remarkable 50% year on year, from €5 million to €7.7 million, and it has been responsible for protecting Airbus aircraft against cyberattacks for the past five years.

APSYS serves more than 70 customers worldwide. It has subsidiaries in Germany and the UK, as well as a presence in China, Japan, South America and Eastern Europe.

APSYS is well-placed to identify key vulnerabilities in the rail industry, drawing on a thorough understanding of the sector’s products and challenges gained through two decades of delivering safety analysis, performance assessment and integrated logistics support services to rail customers. For the past year and more, APSYS has been providing cybersecurity risk management services to Alstom, risk-assessing its products, production processes and tools, and working with its people to develop a cybersecurity governance framework.

As cyberattackers have turned their attentions to planes, trains and other forms of mass transit, so APSYS has harnessed its aerospace expertise to develop a potent cyber-risk assessment methodology to counter this emerging threat.

APSYS is involved in the Institute for Technological Research’s (IRT) Simulation of Autonomous Vehicle Safety (SVA) project, working alongside Renault and PSA on driverless vehicle system reliability and safety.

Our contribution to the consortium

APSYS is tasked with designing cybersecurity solutions for the consortium’s prototype driverless freight train—which, if it is to be manufactured at scale, will need to be technically robust enough to withstand cyberattacks. It also leads on cybersecurity matters throughout the project more generally. APSYS is responsible for defining security needs, drafting technical and security specifications, drawing up the risk assessment protocol, and risk-assessing the product throughout its life cycle.
BOMBARDIER

Our expertise
Renowned as France’s first industrial rail site, about 2,000 people work on Bombardier’s facility in Crespin (Nord), including 500 engineers and managers. The company designs, builds and commissions different types of equipment. The company is specialized in double deck platforms. Three emblematic projects are now in production: OMNEO (in the Premium and Regio 2N regional versions); the Francilien, an ultra-modern commuter train for Greater Paris; and the RER NG, as part of a consortium, for the E and D lines of the RER.

Our contribution to the consortium
Bombardier Transportation’s role is to retrofit a conventional Region 2N trainset with driverless systems and to handle the interface between the train and the railway infrastructure, drawing on the people, equipment and technologies at its Crespin rail vehicles production site.

Its first task will be to determine how upgrading to driverless impacts the architecture of a standard passenger train, using its findings to design a concept operating at grades of automation (GoA) 2 to 4. It will also use its Virtual Bird simulator to model how a future driverless passenger train might function in real-world conditions.

This ground-breaking project will involve changes to the way some of the train’s key functions work, and could well set new standards in the industry.

Bombardier will draw on its international expertise to develop a special on-board diagnostics system for the driverless train—a system capable of troubleshooting problems, making decisions and taking remedial action to get the train back on track without human intervention. Bombardier will also be heavily involved in conducting the safety tests that the driverless train will need to pass before it can operate on rail networks in France and elsewhere in Europe.

Bombardier will retrofit the technologies developed under the project to a Regio 2N trainset designed and manufactured at its site in Crespin. The resulting driverless demonstrator will be capable of operating without human intervention on track fitted with ERTMS and conventional lineside signalling systems.

Our ambition
Ever-growing demand for mobility is pushing existing rail infrastructure to its limits. Bombardier’s R&D work focuses on inventing sophisticated, powerful, cost-effective solutions to help operators address this challenge.

Bombardier Transportation, as a specialist rail integrator, is proud to be part of a consortium that will develop France’s first driverless passenger train. This forward-thinking project will serve passengers, operators and the entire rail industry.

About Bombardier Transportation
Bombardier Transportation is a global leader in rail technology and offers the broadest portfolio in the industry. It covers the full spectrum of rail solutions, ranging from trains to sub-systems and
signalling. The company also provides complete transport systems, e-mobility technology and maintenance services. As an innovation driver, Bombardier Transportation continuously breaks new ground in sustainable mobility. It provides integrated solutions that create substantial benefits for operators, passengers and the environment. Headquartered in Berlin, Germany, Bombardier Transportation employs around 39,850 people and its products and services operate in over 60 countries.
Our expertise
Bosch is a leader in driver assistance and driverless technologies for the automotive sector. Its broad expertise spans all facets of transport and mobility—from trucks, vans, motorcycles and mopeds, to trains, aircraft and ships. The company has a long history of developing solutions for the rail industry, where it has earned a reputation as a world-class supplier. Bosch has a proven track record in taking automotive technologies and successfully applying them to other segments. Trams in several major European cities use its ground-breaking forward collision warning system, which features driver assistance technologies originally designed for automotive applications that have been repurposed for rail industry customers.

Our contribution to the consortium
As one of the world’s leading suppliers of driverless vehicle hardware and software solutions, Bosch will make a valuable contribution to the driverless train consortium. It brings to the table two sophisticated environment perception systems that, once fitted, will equip the train with early detection and response capabilities. The obstacle detection system detects obstacles on the tracks, while the signal recognition system detects all “Stop”, “Clear” and “Train passing” signals. Both systems use proven, proprietary sensors, cameras and radars, and are specially designed for rail applications. These technologies, combined with input from Bosch’s consortium partners, will allow the train to “see” ahead and operate fully autonomously without human intervention.

Our ambition
For Bosch, having the chance to work on driverless train systems alongside like-minded consortium partners is an immense opportunity to showcase what it does best, deepen its expertise in repurposing automotive technologies for rail, and further develop its driverless train solutions to exacting rail industry standards.

About Bosch
The Bosch Group is a leading global supplier of technology and services. It employs roughly 402,000 associates worldwide (as of December 31, 2017). The company generated sales of 78.1 billion euros in 2017. Its operations are divided into four business sectors: Mobility Solutions, Industrial Technology, Consumer Goods, and Energy and Building Technology. As a leading IoT company, Bosch offers innovative solutions for smart homes, smart cities, connected mobility, and connected manufacturing. It uses its expertise in sensor technology, software, and services, as well as its own IoT cloud, to offer its customers connected, cross-domain solutions from a single source. The Bosch Group’s strategic objective is to deliver innovations for a connected life. Bosch improves quality of life worldwide with products and services that are innovative and spark enthusiasm. In short, Bosch creates technology that is “Invented for life.” The Bosch Group comprises Robert Bosch GmbH and its roughly 440 subsidiary and regional companies in 60 countries. Including sales and service partners, Bosch’s global manufacturing, engineering, and sales network covers nearly every country in the world. The basis for the company’s future growth is its innovative strength. At 125 locations across the globe, Bosch employs some 64,500 associates in research and development.
The company was set up in Stuttgart in 1886 by Robert Bosch (1861-1942) as “Workshop for Precision Mechanics and Electrical Engineering.” The special ownership structure of Robert Bosch GmbH guarantees the entrepreneurial freedom of the Bosch Group, making it possible for the company to plan over the long term and to undertake significant upfront investments in the safeguarding of its future. Ninety-two percent of the share capital of Robert Bosch GmbH is held by Robert Bosch Stiftung GmbH, a charitable foundation. The majority of voting rights are held by Robert Bosch Industrietreuhand KG, an industrial trust. The entrepreneurial ownership functions are carried out by the trust. The remaining shares are held by the Bosch family and by Robert Bosch GmbH.

Our expertise
Railenium is the Technological Research Institute for rail. It coordinates leading-edge research that tackles the big issues facing the industry, working with government, manufacturers and academia.

Railenium manages three research and innovation programmes spanning rail infrastructure and rolling stock. Its Driverless Train programme aims to significantly raise the bar for train performance and service standards by developing ground-breaking systems and technologies to support the driverless train component of SNCF’s Tech4Rail programme and, in doing so, lay the groundwork for the future of rail in France and around the world.

Our contribution to the consortium
In late 2016, Railenium and SNCF’s driverless train team joined forces under an ambitious programme to develop semi-autonomous—and, ultimately, driverless—trains capable of operating on conventional track***EN SITE NON-DEDIE”, OK?**§ë&yuthyjuuil, as part of efforts to boost network capacity, improve reliability, and cut investment, operation and maintenance costs.
Railenium is also working on driverless train operation systems more broadly, developing and installing new command, control and signalling technologies, as well as solutions that will optimise rail transport operations.
The programme is expected to produce freight and TER regional train demonstrators by 2023.

Our ambition
Railenium is delighted to be a driving force for progress in France’s rail industry, working closely with manufacturers and academia to spur R&D, foster open, collaborative innovation, and shape the future of rail transport.

About Railenium
Railenium, the Technological Research Institute for rail, harnesses the power of collaborative innovation to help businesses become more competitive, drive growth and create jobs.
Railenium is based in northern France (Hauts-de-France region) and operates a network of centres of excellence and research laboratories where manufacturers and academics innovate together to tackle the big issues facing the sector. It is supported by the French State and the rail industry.
SpirOps: the art of capturing the finer points of human reasoning
SpirOps’ approach is to capitalize on the human experience and - for that purpose - to have developed technologies that extract human reasoning by ‘transferring’ it to a machine. This approach is particularly effective in predicting and simulating human behaviors (such as users on platforms or in trains), or in substituting for a complex task usually assigned to individuals (such as driving a vehicle). SpirOps is today a privileged partner of several car manufacturers in the development of autonomous vehicles as well as a research partner of the SNCF in the simulation of user behaviors.

Our contribution to the consortium
In this project SpirOps will have the triple objective of recommending to the driving module actions related to the hazards during the trip and thus to be able to react appropriately to all forms of unforeseen, to ‘understand’ the behavior on the platforms to authorize closures safe doors during a train departure, and finally to rethink the traveler information completely revisiting the man-machine dialogue. Here we will communicate directly with the artificial intelligence of the train to have information and individualized services.

Our ambition
This project is for SpirOps a unique opportunity to advance its research, to strengthen the industrialization of its solutions, but especially to put forward a soft approach to artificial intelligence, reassuring and explainable to all.
Our expertise
Thales has more than 30 years’ experience in rail signalling and driverless metro systems, building on technologies and expertise from its other business lines. The driverless train’s positioning system will draw on Thales’s Flight Avionics global navigation satellite system (GNSS) solutions—certified to stringent aerospace industry safety standards—and its track record in hybrid sensors. Meanwhile, it will exploit its Critical Information Systems and Cybersecurity expertise to protect the train from cyberattacks and develop the positioning system’s mapping module. Thales will devote a sizeable portion of its R&D budget, which amounts to around 20% of group revenue, and its R&D centres in four countries to this ambitious project.

As the driverless passenger train consortium’s specialist system architect and integrator, Thales is responsible for delivering the automatic train operation (ATO) and positioning module. Driverless trains operating on open-air track require additional modules and functionalities that are not necessary in confined spaces such as metro systems.

Our contribution to the consortium
Thales will repurpose its existing metro module using sub-systems developed by other consortium members, and will supply a brand-new, high-integrity train positioning system that meets the requisite reliability standards, eliminates the need for trackside positioning technologies, and allows the driverless train to travel on any type of track. The new positioning system will employ Thales’ Flight Avionics GNSS technology, as well as a battery of sensors including lidar, radar, cameras and an inertial measurement unit.

Our ambition
This high-profile project aligns with Thales’s strategy of harnessing key digital technologies - connectivity, big data, AI and cybersecurity- to develop autonomous systems for the aerospace, avionics, maritime and land transport industries.

About Thales
The people we all rely on to make the world go round – they rely on Thales. Our customers come to us with big ambitions: to make life better, to keep us safer. Combining a unique diversity of expertise, talents and cultures, our architects design and deliver extraordinary high technology solutions. Solutions that make tomorrow possible, today. From the bottom of the oceans to the depth of space and cyberspace, we help our customers think smarter and act faster - mastering ever greater complexity and every decisive moment along the way. With 65,000 employees in 56 countries, Thales reported sales of €15.8 billion in 2017.