

# Innovation driven development

The Russian Railways Group's R&D activities and innovation driven development follow the priorities set forth in the Company's Long-Term Development Programme until 2025, as well as the Group's Research and Development Strategy until 2025 and further until 2030 (the "White Book"), in line with the country's strategic development goals and global R&D trends.



The Group's Comprehensive Innovative Development Programme (the "CIDP") lays the groundwork for implementing the Long-Term Development Programme. The programme currently in place is the CIDP until 2025<sup>1</sup>. It includes 11 groups of key projects and proposals for streamlining innovation activities and establishes partnership mechanisms underpinned by open innovation principles.

Key areas of the Group's innovation driven development:

- developing a customer-focused transportation and logistics system in a unified transportation space;
- establishing and implementing dynamic transportation management systems using artificial intelligence;
- implementing innovative systems to automate and mechanise station processes;
- setting requirements for the construction and deployment of innovative rolling stock;
- developing and implementing advanced equipment and technologies for track maintenance infrastructure, railway automation and telematics, electrification and power supply, innovative information and telecommunication technologies;
- developing the traffic safety management system and risk management methods associated with the transportation safety and reliability;
- developing and implementing equipment and technologies for promoting high-speed and ultra high-speed railway transport;
- promoting technologies for heavy-duty freight traffic management;
- improving energy efficiency of operations;
- implementing the best available technologies in environmental protection;
- promoting the quality control system.

The Group aims to lead the way in unlocking innovation across the economy by fostering collaboration with the national scientific institutions, industrial enterprises, small and medium-sized businesses, and other stakeholders that are a part of the national innovation system. To this end, it has placed significant focus on taking forward the open innovation principles.

## The Group's innovation driven activities

All business units of Russian Railways are engaged, to a various extent, in innovation. They plan and implement innovation projects aimed at boosting economic and non-economic performance, providing regular updates on the projects and their progress in the context of the CIDP mid-term plan. There is an expert task force led by Deputy CEO, Chief Engineer of Russian Railways, that is responsible for selecting innovation projects and activities and overseeing the implementation of the CIDP.

The Company's branches take part in testing innovative solutions and fostering interaction between the Group and participants of innovative ecosystems across the constituent entities of the Russian Federation, including those operating on regional innovation platforms.

<sup>1</sup> Approved by the Company's Board of Directors (Minutes No. 13 dated 26 February 2019).

In 2020, innovation projects delivered the following outcomes:

- an increase in profitability, quality of service and passenger satisfaction attributable to Lastochka electric trains, new rolling stock for freight traffic (innovative gondola cars), innovative rolling stock for passenger transport (double-decker cars) and expanded use of double-decker trains;
- improved passenger train service on the Moscow Central Circle and throughout the Moscow Central Diameters contributing to the development of the Moscow Transport Hub;
- reduced operating costs, increased traffic safety, optimised expenses achieved through the implementation of innovation projects to introduce AI-powered traffic control systems, develop an automated train traffic prediction system based on simulation modelling, create and put in place virtual coupling – a wireless inter carriage link technology, and introduce the technology of driving freight trains without assistant;
- enhanced traffic safety thanks to constant monitoring of rolling stock movement and the condition of infrastructure facilities, including by using predictive analytics;
- higher information security, new technical diagnostic tools for the infrastructure and rolling stock;
- a unified corporate hardware and software environment to enable the transition to minimum manning solutions for maintenance and commercial acceptance of rolling stock at marshalling yards, and introduction of modern automation systems for station processes;
- increased train traffic safety and transport safety, high operational readiness to carry guaranteed volumes of freight and passenger transportation;

- improved information and transport security and more effective management of resources, risks and reliability across the life cycle of railway infrastructure facilities and rolling stock;
- optimised fuel and energy consumption and efficient transportation thanks to new generation locomotives;
- reduced adverse impacts on the environment (decreased discharge of insufficiently treated waste water and greenhouse gas emissions) enabled by innovative technologies.

In 2020, Group invested a total of RUB 197.43 bn in innovation projects, including R&D. The funding planned for 2021 stands at RUB 170.03 bn.

### Key innovation driven development projects in 2020

Below are the innovation projects implemented as part of the CIDP in 2020:

- A unified processes model was designed for the Northern Latitudinal Railway.
- Technical requirements were developed for long-distance double-decker electric trains.
- As part of the project to increase the speeds at the Moscow – Nizhny Novgorod section, a new traffic management technology was introduced on 17 EP20 locomotives. Using a DMR-RUS channel to transmit critical information, it enables their operation at speeds of over 160 km/h.
- The Company put into permanent use an automated traffic management system on the Moscow Railway and an unmanned locomotive system for shunting operations on the Oktyabrskaya Railway (Luzhskaya station).

- Following the results of tests carried out at the Severnaya, Kuybyshevskaya and Sverdlovskaya Railways, Ledokol – specialised equipment for instant removal of ice from pedestrian surfaces (LLC Baraban Scientific and Technical Company) – proved its efficiency. The initial demand for the equipment across the network is estimated at 111 units.
- Tests were completed for the integrated pneumatic hydro-pulse cleaning technology used in heat engineering equipment (R-Techno LLC) to be included in the Russian Railways investment programme for 2021.
- A downhole sensor for measuring the content of petroleum products in waste water (Gazenergo projekt Institute LLC) successfully passed trials on the Moscow Railway.

In 2020, as part of the project to introduce automatic movement control on electric trains, acceptance tests were completed for the automatic control system on Lastochka ES2G-113, an electric train equipped with a machine vision system that runs on the Moscow Central Circle. On top of that, an ES2G-136 electric train powered by machine vision was purchased for subsequent tests with ES2G-113. This step is expected to facilitate a transition to fully automatic operation. It is implemented in sync with the development of design documents for a prototype of Lastochka electric train that will operate in a fully automatic mode, which will continue into 2021.

## Projects implemented as part of the Russian Railways' Digital Transformation Strategy

The Company's Digital Transformation Strategy until 2025 (the "Strategy") is aligned with the Long-Term Development Programme in terms of timing, financial metrics, activities and targets. The financial metrics of the Strategy are in turn aligned with the Company's three-year investment programme. Apart from the integration of digital technology, the digital transformation projects are geared towards improving business processes, updating regulations and creating a digital culture within the Company.

The digital transformation in Russian Railways will be focused on the following 8 digital platforms:

- multimodal passenger transportation;
- multimodal freight transportation;
- transportation and logistics hubs;
- local infrastructure operator;
- logistics operator in e-commerce;
- transportation management;
- business support processes;
- traction stock.

These platforms will be leveraged to develop digital services and improve the effective use of the existing digital assets such as data from information systems to reduce the operating costs or generate additional income. Such services will be geared towards both internal users (end

customers, Company's employees) and external customers (mainly passengers and freight forwarders). The Strategy provides for implementation of 55 projects based on the use of high-potential end-to-end technologies, including the Internet of Things, "big data", distributed ledgers (blockchain), artificial intelligence, virtual and augmented reality, advanced data transmission solutions (such as quantum communications).

In 2020, the Company implemented the following major digital transformation projects:

1. International intermodal container service as part of the INTERTRAN project using paperless technology on the Ningbo port (China) – Vladivostok



port (Russia) – Kolyadichi station (Belarus) route.

2. Russian Railways launched a new website with all passenger information available on the home page – tickets, bonus programme, promos, contact details. The Company’s mobile services have been growing, with 14.7 m long-distance tickets and 2 m suburban tickets issued via the Russian Railways Passengers mobile app.
3. The Company launched document exchange through the interdepartmental electronic document management system (MEDO) and established interaction with the Federal Tax Service switching to the tax monitoring regime. 126 business units of the Company



4. The Company completed the development of internal digital tools, such as the Employee Service Portal with 10 new services becoming available. At the present moment, employees of Russian Railways have access to more than 40 digital services, and the number of users exceeded 600 thousand.
5. A career portal of Russian Railways was launched. It is visited by more than 100 thousand people monthly, including both the Company’s employees and external users interested in vacancies with the Company.
6. As part of the improvement of the Foreign Projects automated system, the Company introduced services offering additional features with regard to foreign projects of Russian Railways.
7. The Company completed testing of its long-distance travel documents issuance service for passengers with disabilities that uses information from the Federal Register of Disabled Persons.
8. As part of the Digital Railway Station project, execution control and planning modules were put into commercial operation at the Kinel station of the Kuybyshevskaya Railway and the Chelyabinsk-Main Station of the South Urals Railway.
9. The Company designed a new interface for the Personal Account of the Russian Railways freight transportation.
10. An automated service builder was launched to meet the needs of freight transportation customers.
11. The Company deployed new software modules for the Intelligent Railway Transport Management System (the “IRTMS”) and developed the core functionality for the IRTMS project in the Eastern Operating Domain.
12. A blockchain-powered service for managing rail track life cycle was introduced.
13. The Company completed the first stage of works pertaining to the development of the life cycle management system for infrastructure facilities of Russian Railways based on Building Information Modelling (BIM) technology.

**Quantum communications**

As defined by the Russian Government in the Digital Economy of the Russian Federation national programme, Russian Railways acts as the company responsible for the development of the quantum communications sector. Russian Railways together with the leading research centres and the expert community prepared a roadmap that was approved by the Praesidium of the Government Commission on Digital Development, Use of Information Technologies to Improve the Quality of Life and the Conditions for Doing Business in August 2020.

The development of quantum communications in Russia will contribute to creating an integrated secure infrastructure for the digital economy and the public administration system, which is particularly important in the face of modern information security threats. The main users will include Russian Railways, as an operator of essential transport infrastructure, telecom operators, government bodies, financial institutions, healthcare organisations, operators of critical infrastructure, and organisations operating intellectual property.

Russian Railways established a Steering Committee for the Implementation of the Quantum Communications Roadmap to serve as a coordinating body. It also created the Quantum Communications Section as part of the Russian Railways Scientific and Technical Council that will act as an expert council bringing together major science and industry leaders.