Transmashholding
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“MOSCOW” – FOR MOSCOW

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Transmashholding

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PROMISING FLAT CAR

Transmashholding conducted successful acceptance tests of the prototype models of high-speed flat cars for transportation of large-capacity containers.

The new flat car of the 13–6954 model is intended for transportation of one 40/45' container (including refrigerator containers with an autonomous diesel-generator unit). The flat car was designed with utilization of elements of the running gear and units of passenger rolling stock, including the high-speed bi-axial bogie with central swing suspension (the 18–6960 model). The operating speed of the flat car is 150 km/h. It is equipped with an electropneumatic brake system.

The operation of new flat cars will allow accelerating freight transportation and transit between China and European countries. Flat cars are expected to be used for forming high-speed container trains and will be operated in transit service between China and the EU along the Trans-Siberian main line on the following routes: Zabaikalsk — Brest (5.5 days) and Naushki — Brest (4.5 days).

The speed of the new rolling stock makes its operation suitable for the main Eurasian transport corridors, including the future ITC North — South.

A contract on delivery of the first flat cars of the 13–6954 model was signed this past September at the InnoTrans 2016 trade fair in Berlin. The project is being implemented by JSC Transmash jointly with KST, LLC and Russian Railways.

MAIN SPECIFICATIONS:

36 T —
Load carrying capacity

24 T —
Tare weight of car

15,270 MM —
Length over coupler pulling faces

OUR “MILLIONAIRES”

The 2ES5 electric locomotives traveled the first million kilometers.

The total number of kilometers traveled by five mainline 2ES5 Scythian AC freight electric locomotives manufactured by Novocherkassk Electric Locomotive Plant (NEVZ) has exceeded the symbolic milestone of 1,000,000 km.

The locomotives demonstrated excellent economy and compliance with the set reliability targets. As of 2017, the inherent availability (a key indicator of reliability of electric locomotives) stands at 0.99. The double-section 2ES5 demonstrates an ability to haul high-tonnage freight trains weighing 6.3 tons (as a rule, such rolling stock would be hauled by three-section locomotives) in operating areas with a complex grading of tracks. The utilization of the modern system of regenerative braking in these locomotives delivers enhanced energy efficiency. The locomotive’s design incorporates an array of new technical, ergonomic and environmental solutions, which results in a multi-fold reduction of the volume of maintenance, increased time between repairs, and energy savings.

NOTE

The 2ES5 is a mainline AC freight electric locomotive with asynchronous traction motors. The locomotive is designed by the TRTrans engineering center founded by Transmashholding jointly with its strategic partner, the French company Alstom.

REACHING THE SCOPE OF THE CUSTOMS UNION

Transmashholding completed certification of all its products in serial production for compliance with the technical regulations of the Customs Union.

Since 2014, when certification of compliance with the Technical Regulations of the Customs Union began, the holding’s enterprises have obtained more than 100 certificates. The last products to pass certification were the locomotives of Kolomensky Zavod (KZ) — the EP2K passenger DC electric locomotive and the TEP70BS passenger diesel locomotive.

Some of Transmashholding products were issued the Customs Union’s certificates without prior certification in accordance with the national requirements. These are the 2TE25KM and TEM19 diesel locomotives of Bryansk Engineering Plant (BMZ), and the 4ES5K mainline AC electric locomotive of Novocherkassk Electric Locomotive Plant, the EP2D and EP3D, which are DC and AC electrical trains of Demikhovsky Engineering Plant, and the locomotive-traction rail cars of Tver Carriage Works — 61–4483 (for accompanying freight and service trains), 61–4495 (for transportation of convicts), and 61–4492 (passenger bilevel cars with seats).

Currently, certification of the new diesel locomotives manufactured by Bryansk Engineering Plant — the shunting TEM28 and the mainline freight 3TE25K2M is underway. Obtainment of a certificate is a mandatory requirement to all rolling stock. It allows an unrestricted operation of machinery and locomotives in the countries of the Eurasian Economic Union — Russia, Kazakhstan, Belarus, Armenia, and Kirghizia.

IMPORT SUBSTITUTION IN ACTION

NEVZ launched production of DTK-417K traction motors for diesel locomotives.
The new products by NEVZ are called to replace the motors purchased in Ukraine. Within a short time period (from April of 2014), NEVZ carried out activities aimed at the commercial production of electric traction motors (ETM). The design documentation for the ETMs was drawn up for four models. In order to organize its own production process, the plant purchased new equipment, developed new technical processes, built 17 units of nonconventional and specialized equipment for assembling the ETMs and manufacturing blanks for their components. Almost 1,000 technical tools were designed and built. The unique feature of the DTK-417K motors lies in the utilization of the traction motor suspension on rotating bearings. The need to switch to the traction motor suspension on rotating bearings is attributed to the fact that this is one of the bottlenecks of maintenance, service life and reliability of the elements of the diesel locomotive's bogie.

In 2017, NEVZ will build more than 1,000 motors of the DTK-417K series.

PLUS 22%

According to the results of 2016, the volume of sales of Transmashholding goods and services grew by 22% reaching 120 billion rubles.
The largest growth is demonstrated by the sales of cars for electric trains — 49% (from 174 to 259 units, including 121 rail cars of the EP2D electric train in 2016). Sales of bilevel cars grew by 23% (from 70 to 86 units). Sales of unilevel sleeping cars and passenger cars grew by 317% (from 35 to 146 units). There is a 15% growth in the number of sold metro cars (from 235 to 271 units). In 2016, the main part of the contract on deliveries of diesel trains to Serbia was implemented (52 cars compared to 4 in the previous year).

There is a significant growth in the segment of mainline freight diesel locomotives standing at 48% (202 sections of the mainline 2TE25KM in 2016 against 136 in 2015). Overall, sales of mainline locomotives (diesel locomotives and electric locomotives) saw a total growth of 6% — from 267 to 283 sections.

In 2016, several models of innovative rail equipment of various types were designed and built: the new-generation "Moscow" metro train, the TEM28 mainline freight diesel locomotive, the new version of the HPM2M industrial electric locomotive, and the new battery-trolley locomotive for the metro system. Modernization of metro cars for the Budapest Metro was launched. Last year, new AC and DC electric trains EP2D and EP3D were designed and built.

POSTAL CARS

Russian Post and Transmashholding signed an agreement on cooperation on design and deliveries of postal freight rail cars.
The document was signed within the framework of the St. Petersburg International Economic Forum. It bears the signatures of Russian Post CEO Dmitry Strashnov and Transmashholding General Director Kirill Lipa. The built cars are to be used both on Russian domestic routes and in international post transit service from China to Europe across Russia. Pursuant to the agreement, Transmashholding undertakes to continue improving the design and technical characteristics of rail cars based on the experience with their operation. Russian Post plans to purchase ca. 300 new rail cars in 2017–2019 in full compliance with current legislation.

STRAIGHT TALK

Dmitry Strashnov, CEO, Russian Post:
— Rail transport is one of the most efficient modes of transportation in terms of its costs and reliability. Currently, it accounts for 50% of the total volume of transportation of mail in Russia. Russian Post owns more than 800 rail cars and plans to increase its shipments by rail both across this country and internationally. In 2018–2019, we will be launching a direct postal rail route, Beijing — Moscow — Berlin, which will require some 75 modern rail cars.

WE SET AMBITIOUS GOALS BEFORE US

Economy and finance are the primary indicators of any company's standing, including that of Transmashholding. Oleg Domsky, Deputy General Director for Economy and Finance, talks about the situation in this area.

Uniform approaches are key to efficiency

At the stage of Transmashholding's financial and economic establishment, we had to develop and implement a uniform system of financial reporting and planning, set a uniform corporate standard, and achieve its uninterrupted functioning. Historically, each enterprise has had its own path in this area, but managing them does not allow room for speaking "different languages." Today, the company pursues a uniform corporate accounting policy for bookkeeping and tax reporting; we have developed a "clockwork" planning system and budget operational management. As befits a large company, Transmashholding submits its consolidated accounting statements according to the Russian and international standards (IFRS).

We are living in a media age, with automation of all processes becoming part and parcel of our life.

GLOBAL EXPERIENCE SHOWS THAT INTRODUCTION OF AUTOMATED CONTROL SYSTEMS ALLOWS REDUCING THE VOLUME OF CURRENT ASSETS BY 20–30%.

In order to keep abreast of the times, we had to enhance our level of automation of accounting and all processes related to management. This is not an easy task. It requires persistent, systematic and continuous efforts of employees of all levels and functional areas. In the past 15 years, the company has acquired automated management systems for managing its sales, budgeting, accounting, etc. This work is still ongoing: employees of the IT departments of the holding are creating, in essence, an independent automated control system (ACS) of the company that takes into consideration the needs of its enterprises.

Thanks to the newly introduced systems, Transmashholding has become a more transparent and manageable structure, and, most importantly, it has become a united company in terms of its economy and finances.

Exciting markets

A unified, large holding has significant advantages for attracting financing. Our plants have always been able to obtain loans. The benefit of a large company is that it is more attractive to a financial investor. This is attributed to the fact that a large company has diversified sales; it does not depend on one market or client, and has a possibility for a financial maneuver — internal help from the enterprises. This allows investors to evaluate the credit risk in a more positive manner, hence, it gives them an opportunity to offer more financial resources on better terms.

However, even a large company has to earn investors' trust, which is not an easy task. It is necessary to meet a number of mandatory requirements. First, investors need to be furnished with reliable and sufficient information about its business — accounting statements that are verified by a reputable audit company (Ernst & Young has

been such auditor for Transmashholding for many years) must reveal its risks that emerge in the course of business, and disclose its shareholding structure. Second, it is necessary to obtain an opinion of reputable experts regarding the credit risk that the investors can rely on in their decision.

In 2016, for the first time in its history, Transmashholding was assigned two creditworthiness ratings: according to the national scale of the Expert RA rating agency (A++ an extremely high creditworthiness rating) and the international scale — from Fitch, one of the three globally recognized agencies (BB— outlook "stable"). The assigned ratings are quite high and allow us to attract a wide circle of investors — from pension funds and investment banks to private individuals.

Third, it is necessary to have an ongoing dialog with investment community, and share information about the performance, achievements, and emerging risks. This allows not only maintaining a strong interest in the existing debt instruments, but also creating room for future borrowings. Since Transmashholding didn't list its bonds for more than five years, our preparation efforts consisted in holding presentations for investors and organizing individual meetings where we provided answers even to the most uncomfortable and tricky questions. We are very open with investors, since honesty and good performance are a guarantee of a long-term, mutually beneficial cooperation.

In February of 2017, after a long break, Transmashholding 3-year bonds for the amount of 10 billion rubles were listed at the Moscow Exchange. We are proud of the results and strong demand (applications were submitted by more than 50 investors). Applications for our debt instruments were submitted with 9.95% interest rate per annum, which is by far better than the average rate of borrowing that the company has had in the past few years.

How does such successful placement benefit the company? It yields more affordable loans, and higher current liquidity (these are 3-year bonds, while loans mainly have a 1-year term). Additionally, the company has made it possible for itself to attract financial resources from the market that are needed for operational and investment activities. In 2017, we might list another bond issue.

OLEG DOMSKY:

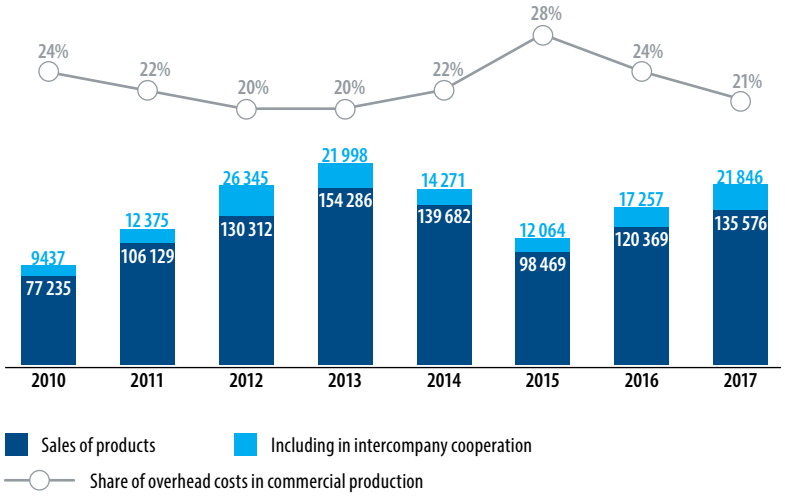
— Transmashholding is a dynamic, developing company. In the past 15 years, we have walked the path leading from separate enterprises preoccupied with survival problems to one of the largest companies in machine building, a modern holding that is attractive not only to Russian, but foreign institutional and financial investors. A strong interest in the company was once again confirmed in February of this year, when after a long break the company listed its bonds for the amount of 10 billion rubles. Our comeback to the public market of borrowings was accompanied by strong demand, which exceeded the offer by four times!

The successful activity of the company and its employees aimed at the exploration of new markets and development of new products, continuous work on cost optimization and quality assurance gives Transmashholding the opportunity to be confident in tomorrow; this confidence is transferred to our partners. In our industry with severe competition, we cannot afford slowing down; there are many goals and objectives that need to be achieved in order to become a full-fledged participant of the global market of transport engineering.

Looking from the outside

I would like to discuss creditworthiness ratings. As I have already mentioned, this is an opinion of independent experts who evaluate the company in

PERFORMANCE INDICATORS OF SC TRANSMASHHOLDING
Sales, M rubles



Despite a significant decline in the volume of sales in 2015, the company resumed its stable growth. As of 2017, we expect to reach the volume of earnings comparable to 2014.

The performance indicators (e.g. share of overhead costs in commercial production) are better than in 2014. I believe that in 2017–2018 we have the potential to achieve the record low indicators of overhead costs demonstrated in 2012–2013 and secure them across the holding at the level below 20%.

comparison to other companies — investment objects. There is severe competition between borrowers from various countries and industries on the capital market. This is why a professional opinion from an outsider is very valuable from the standpoint of a comprehensive understanding of the business, its strong points and those areas that need improvement.

In the analytical report published by Fitch after assigning the rating it was noted that the company is an unquestionable leader on the Russian market of transport engineering, and has long-term contracts with major clients, such as Russian Railways, FPC, the Moscow Metro, and many others. The company has a conservative financial policy and a moderate level of debt burden. The holding's technological leadership in its segment was not left unnoticed either.

We have carefully analyzed the areas that we will have to work on in the nearest future. Among the areas that have potential for improvement are diversification of markets and the client base, including growth of the export share; increased share of services in earnings; growth of cash flow over the long term; development of corporate culture. All of these areas are important aspects of the company's strategic development in the nearest 5–10 years.

Savings are a must

We are setting ambitious goals for ourselves: besides maintaining the leadership position on the Russian market, we aspire to actively develop our export of products worldwide. This means that we must adapt to the demands and rules that drive the global market. From the standpoint of pricing, quality and consumer properties, deliveries of rolling stock face the most severe competition with the leaders of the industry of transport engineering, except for a few closed markets. The cornerstone issue is achievement of the prime cost of products that can help us win in this competitive struggle. The holding has always made an effort to optimize the prime cost. However, today we are transitioning to the utilization of updated approaches based on the latest innovations in the area of management of production processes. We have to start from the very beginning — the process of product design. The existing PDM systems will be unified and centralized. We will ensure their direct correlation with the systems of SD designing, and integrate uniform nomenclature directories and registers of purchased integrated parts and components. The holding's designer will be guided by the company's uniform principles of product design. This work will allow creating a product that has a set prime cost, controlling it at the stage of development and implementation, and departing from "artificial" monopolists among suppliers. Our dedicated analytical division will allow working with the prime cost in regard to its construct and purchased integrated parts at all stages of the lifecycle of a product.

Then, there is production. We realize that we can significantly enhance the accuracy of planning and the level of analytics by introducing an automated system of production planning and semi-finished product accounting. This is a milestone project for the plants, which requires much effort. After the pilot launch at DMZ and MWM in 2017, we have to

IN 2016–2017, THE VOLUME OF CONCESSIONAL FINANCING WITH GOVERNMENT SUPPORT RAISED BY TRANSMASHHOLDING WILL EXCEED 5 BILLION RUBLES

achieve automation of all largest enterprises of the holding. What would be the effect?

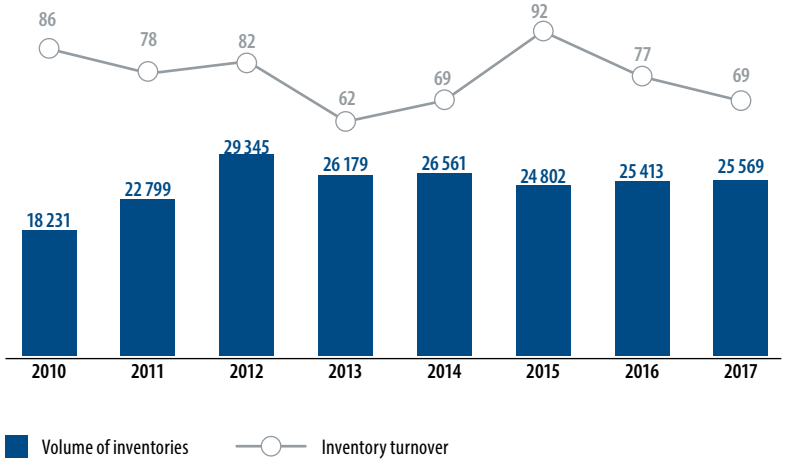
Transitioning to management with the help of the above-mentioned automated systems will allow reducing the need in current assets (due to the reduction of inventories and work in progress, minimizing small turnover and non-liquid inventory holdings), and determining inefficient areas in the ownership structure with a surgery-like precision, this way decreasing the final cost of a product, hence, making it more competitive.

Another important area is aligning the labor norms and materials consumption with today's reality. The volume of this work is difficult to overestimate. To be honest with you, many are frightened by the prospects of such strenuous work. However, without solving this problem, it is impossible to efficiently manage the costs, hence, there is no other choice. As they say, all things are difficult before they are easy!

It is always difficult to deal with expenditures; it is an unpopular and time-consuming task. There won't be a full-fledged result without participation of every employee of the company. In order to see the "cascading" of the objectives downwards and ensure continuity in their achievement, the holding is conducting a pilot launch of the system of key performance indicators (KPI) with an integrated motivating component. Appropriate incentives for people are an integral part of any large-scale work. I believe we succeeded in finding the right balance. Despite the fact that any test introduction will require adjustments and changes, the effect of adoption of incentives based on the KPI will bear fruit in the future.

PERFORMANCE INDICATORS OF SC TRANSMASHHOLDING

Volume of inventories, M rubles



In 2015, there was a temporary decrease in the efficiency of utilization of current assets (e.g. deterioration of the inventory turnover ratio) attributed to a sharp decline in earnings.

However, in 2017 we expect to achieve the inventory turnover ratio comparable to that of 2014. There is potential for improvement of this ratio. With subsequent introduction of automation systems, principles of lean production and meticulous, smooth work, I believe it is possible to improve this ratio by another 10–15% in the coming years.

I would like to emphasize that in working on expenditures there should be no room for any leniency regarding quality! We can sell to our client only high-quality products. No one wants a cheap, but malfunctioning locomotive or electric train!

The financial and economic division of the machine building holding is an auxiliary function. We do not build or manufacture rolling stock, and do not deal with procurement or marketing. On the other hand, it is apparent that we have an important role in organizing financing for smooth operation of the plants, and a leading role in business planning and prime cost management. In the past few years, it has become impossible to imagine sales of products without organizing financing for the client, and export — without obtaining export loans and guarantees. A positive opinion of investors about the holding is a guarantee of successful mobilization of capital and enhancement of the company's image in Russia and beyond.

As Transmashholding employees, we have a common cause. I am convinced that finance specialists and economists have had an important role from the inception of the company and will continue performing their duties with integrity!

ALEXEY VOROTILKIN: “TRANSMASHHOLDING IS AHEAD OF ITS TIME”

The asset of Transmashholding employees is their experience multiplied by new knowledge. Deputy General Director for Locomotive Building Development Alexey Vorotilkin is confident of that. During our conversation, he told us about the future of locomotives and their conquest of the global market in the future.

Advantages

▶ Alexey Valerievich, what is your view of today's level of development of locomotive building at Transmashholding?

◀ I will start by saying that Transmashholding has just celebrated its 15th anniversary. In order to create a company of such scale and, despite the economic crises, for so many years to perform an efficient work, it required an enormous potential of the engineering and design thought. At the stage of the company's establishment, its management set a primary goal for itself – to preserve the team of engineers, designers and technologists. Simply put, to preserve "the brain" of all enterprises: not to allow them to be overcome by the overall Russian trend of the 90s and leave for cooperatives, supermarkets and private security firms. We achieved the set goal with an outstanding result: we did not just preserve the team of locomotive builders, but created all necessary conditions for its development and creativity.

Today, each plant of the holding has its own R&D departments and technological centers. They follow the new trends in machine building, select the best global practices in the industry, and, if necessary, "tailor" them to our legislative, supervisory and departmental standards in order for us to produce competitive products.

The company is growing fast, and there is evidence to that. As an example, I can use one date that is significant to me: in 2013, Russian Railways purchased 862 locomotives, which was the level of 1992!

▶ What are the strengths of our locomotive builders?

◀ The locomotive builders of our holding represent a convergence of the new and traditional engineering schools. In the past few years, we have been joined by a number of young and promising specialists. Luckily, Russia has a system of educating locomotive builders, which is comprised of higher educational institutions and technical colleges affiliated with Russian Railways. This is significant, since a modern engineer does not sit at a draft board, but works with complex software. This is why it is important to have an interaction between specialists: experienced engineers share their invaluable (this is no exaggeration) experience with young engineers who, in their turn, help them master 3D. For instance, when I visited our company TRTrans for the first time, I was pleasantly surprised: the average age of employees is 30 years. Of course, these engineers need supervisors who began building locomotives with a draft board. Although this may sound like a cliché, I am convinced that the convergence of experience and youth allows our holding to look into the future with optimism.

BY 2030, WE INTEND TO UNIFY UP TO 70% OF ELEMENTS OF ALL LOCOMOTIVES THAT WE MANUFACTURE

Time of changes

▶ How do you see the main area of development of locomotive building? What is the logic behind the development of this area of the holding's activities in the years to come?

◀ The development strategy of a machine building company, especially a unique one, such as Transmashholding, depends directly on customer requirements. Their requirements get stricter each year.

Today, the world is concerned with global environmental issues, in particular, depletion of natural resources and contamination of the environment. This means that it is time for Transmashholding to reassess some of its manufacturing processes and enhance the measures aimed at the mitigation of negative environmental impact. Given the specific nature of the holding's plants, our main goal is to learn to save energy resources. Additionally, we have some experience in this regard in our work on the new electric locomotive on the basis of the 2ES5S, which can be called energy-efficient. Over the long-term, we are willing to modify all locomotives in order to adapt them to the new environmental requirements of our clients.

Over the medium term, Transmashholding plans to achieve another important goal – reduction of the cost of a locomotive. This is a request from Russian Railways, our key client. To be honest, this is a difficult task, but we have already found a solution: we will have to unify the main components of the locomotive. It is clear that an electric locomotive and a diesel locomotive are two different locomotives. However, what they do have in common (wheels, compressors, numerous control elements, etc.) will be uniform. By 2030, we intend to unify up to 70% of the elements of all locomotives that we manufacture.

▶ ***What new locomotives is the holding expected to build in the nearest future and over the medium term? What technical solutions are to be implemented?***

◀ I will answer this question with a question: do you know that many of Japan's great inventions of the

TODAY, BESIDES PRODUCTION OF LOCOMOTIVES OF THE RAIL CAR TYPE, TRANSMASHHOLDING IS WORKING IN TWO OTHER PROMISING AREAS: DEVELOPMENT OF A SINGLE-SECTION LOCOMOTIVE OF MEDIUM CAPACITY AND A MACHINE THAT CAN BE USED IN ANY PART OF ROLLING STOCK

past decades have been copied from our magazine "Young Technologist," specifically from its section "Build It Yourself"?

What I am implying is that I cannot reveal all advanced technological solutions of our company. However, I will say that we satisfy all of our clients' demands. For instance, our engineers and designers have designed the Ermak four-section locomotive. As of today, the capacity of these locomotives is impaired by only one factor – the durability of automatic coupling (it does not exceed 150 tons per second). Currently, our specialists are working on this problem. By the way, the heavy-tonnage service was launched on the rail transport of the Soviet Union. In the 80s, freight trains weighing 30 and 40 tons were tested. These trains were not only able to move, but they could "haul" freight over a few hundred kilometers. This was a real success!

Today, in addition to production of locomotives of the rail car type, Transmashholding is working in two promising areas: it is developing a single-section locomotive of medium capacity and a machine that can be used in any part of rolling stock.

OF GREATEST INTEREST TO US ARE THE MARKETS OF THE MIDDLE EAST AND NORTH AFRICA. NOT LONG AGO, WE WON A TENDER FOR MANUFACTURING A FREIGHT DIESEL LOCOMOTIVE FOR CUBA

Equal partnership

▶ ***The key operator of your locomotives is JSC RZD. What actions need to be taken by the holding in order to strengthen the relationships with its key partner?***

◀ In the 90s, the machine building industry in our country was in complete decline: rolling stock did not get upgraded; many factories suspended their operations; and some were bankrupt. The system of manufacturing of components and spare parts for locomotives was very inefficient. Naturally, machinery was worn out: it is no secret that in the early 2000s the wear and tear of the locomotive fleet of Russian Railways stood at 80% in some categories. Globally, this indicator ranged from 55% to 60%.

That was how the idea of creating Transmashholding was born. Immediately, it was

entrusted with a task of reducing the percentage of wear and tear of Russian Railways' locomotives. That goal was achieved. In the past 15 years, the company has had a difficult path of numerous technical decisions: from major modernization of locomotives of old series to creation of new-generation locomotives.

Another important area: at one of the meetings of the R&D board, the head of Russian Railways announced new objectives of the enhanced efficiency of high-tonnage service – operation on multiple and distribution traction. This has to do with a locomotive of a certain capacity which can be placed in several sections at the center of rolling stock, at the head end or trail end of a train.

One crew will control the electric locomotive. If our key customer needs such locomotives, we must learn to manufacture them. Transmashholding has already performed some groundwork in this area and produced prototypes. Currently, we are considering a successful global practice for adoption, which consists in selling a locomotive with subsequent support and maintenance throughout its lifecycle. We have all necessary resources and competencies in order to implement the idea of manufacturing locomotives and offering maintenance services. This is exactly how the EP20 electric locomotives are serviced today. We have reached a conclusion that such practice will be beneficial for all participants of the chain Transmashholding – Russian Railways – Maintenance.

I will add that Transmashholding is adjusting to new realities: a customer is not satisfied with having a new, reliable and technically functioning locomotive. The locomotive must have an economic effect for both the manufacturer and servicing company.

To conquer the world

▶ ***What is the strategy of the locomotive builders for expanding to external markets? What markets are most promising?***

◀ Today, we are already working with foreign customers. Our clients are railway companies from Kazakhstan, Uzbekistan, and Belarus. Ukraine and even China used to buy our locomotives. By the way, recently our colleagues have taken a business trip to Belarus in order to exchange experience with our Belarusian partners. They were able to see for themselves the successful operation of our TEP70BS locomotive in that country.

Of greatest interest to us are the markets of the Middle East and North Africa. Not long ago, we won a tender for manufacturing a freight diesel locomotive for Cuba. In this tender we left behind the world's leading manufacturers, including General Electric.

THROUGHOUT THE YEARS OF IT OPERATIONS, TRANSMASHHOLDING SUCCEEDED IN PRESERVING AND MULTIPLYING ITS STAFF OF NOT ONLY ENGINEERS AND DESIGNERS, BUT ALSO REPRESENTATIVES OF GENERAL TRADES

Does your work with foreign markets require modification of the existing locomotives? If so, how extensive is it going to be?

This is one of the key issues that we need to resolve in the nearest future. However, we see clearly that in order to operate successfully on the global market, we will have to adapt to its conditions. To make myself clear: there are more than 10 types of track gauges in the world. However, the most common are 1435 mm and 1520 mm, which we have already worked with. This means, we have excellent opportunities.

The freight diesel locomotive that Cuba needs has never been manufactured by our plants. However, we are not going to start from scratch, since engineers and designers designed a similar model in the past.

The freight diesel locomotive to be designed for Cuba will be a platform for manufacturing similar products for other countries across the globe that we plan to cooperate with. We are dealing with a uniform design and uniform technical "fittings" of locomotives. All other equipment (collecting , conditioning, cleaning systems, etc) will depend on customer needs and their location. For instance, a locomotive manufactured for a locality with dry climate and strong winds will be equipped with additional systems of air intake and purification.

The freight diesel locomotive for Cuba will be assembled at the plant in Kolomna. Moreover, this plant can become an experimental site for manufacturing locomotives for foreign markets.

Throughout the years of its operations, Transmashholding succeeded in preserving and multiplying its staff of not only engineers and designers, but also representatives of general trades. We are developing and introducing innovative solutions into our production. Upon the whole, this allows us to look into the future with confidence. I am convinced that all plans the company has will be realized successfully.

“MOSCOW” — FOR

MOSCOW

Transmashholding is not waiting for tomorrow to implement its bold plans: between 2017-2020, the company will deliver to the Moscow Metro 912 rail cars that incorporate proven technologies and innovations. It is only symbolic that the new-generation cars are named after Moscow. The first "Moscow" trains are already operated on the Tagansko-Krasnopresnenskaya metro line.

Comfortable ride

A ride in new-generation metro cars can be compared to a comfortable mini trip. One can enjoy the comfort of ergonomic seats (that can be folded, if necessary) and read a book, for instance. Even standing on the Moscow train has become more comfortable: first, they have a specially designed layout of railings, with their total number increased by 30%.

Changes have affected the design of the railings as well: there is a special "warm" coating on the segment that comes into contact with passengers' hands. Transmashholding has taken into consideration people with disabilities as well; the head end cars are equipped with special seats. It will be convenient for passengers with baby strollers or bikes.

Breathing on the Moscow train has literally become more pleasant: the system of air diffusion was completely redesigned. Now, treated air is supplied to each car through special air ducts and gets evenly distributed around the train, eliminating so-called dead climatic zones. Even lighting in the new cars has become more pleasant: "smart" LED lights adjust the temperature of lighting to the physiological needs of a human body. The equipment is fully safe for passengers, since diffusers of the light fixtures are made from noncombustible materials. Even in case of an emergency, passengers are well protected, since the light fixtures have an anti-vandal film that will prevent broken fragments of the diffuser from falling to the floor. The door bucks on the trains look different now, which means they perform a new function: their bevel side directs the flow of passengers rushing to step out on the platform.

There are no obstacles, since the railings that used to be located near the doors are now

installed near the seats. In order to make room near the doorways, Transmashholding specialists had to reinforce the structure of the car body.

"Moscow" could not have the status of the new-generation rail car without modern interactive technologies. Transmashholding designers were aware of that and equipped each train with sensory information screens. Do you need to find a station? To map out your route from A to B? Calculate the time of travel? Information screens can aid with all of this. By the way, they are designed as 19'' anti-vandal screens.

Focus on safety

Safety became the underlying concept in designing the new trains. Each compartment on the "Moscow" train is equipped with a complex video surveillance system: four cameras on the ceiling and one at each emergency communication unit. The driver's cab is no exception: there are four cameras that allow monitoring the condition of the route. Footage from the cameras, if necessary, can be transferred to the metro situation center via the wireless communication channel.

The new cars are very comfortable for passengers, including those with disabilities.

A RIDE IN THE NEW-GENERATION CARS CAN BE COMPARED TO A COMFORTABLE MINI-TRIP

Fire safety measures have been enhanced as well: the system of fire detecting and extinguishing has a larger number of control areas. Special attention is paid to monitoring the areas with high-voltage equipment.

Transmashholding has made an effort to prevent passengers from being accidentally trapped by the doors. For this purpose, the doorway was enlarged by 12% (which is 1,400 mm against 1,250 mm). Safe boarding and deboarding of passengers are also ensured by LED elements that are mounted on the door frames and doors. The logic of this mechanism is very simple and similar to the traffic lights: a green light turns on — please start moving. When white light is on — continue deboarding

BLITZ INTERVIEW

NIKOLAI POLUKHOV, Chief Designer of the project INTELPRO TMH, LLC

COMPLETE MODERNIZATION

— What are the key differences with the Oka?

— The rail car of type 81–760/76 is totally different from the metro car of type 81–765/766/767. Practically all systems underwent modernization. The key differences are new bodies with enlarged doorways; there is a new generation of more powerful and light-weight traction motors; the passive restraint system was upgraded; the doors acquired an electric actuator and the latest anti-nipping system. The interior of the car was fully upgraded the information system became more accurate in its calculations; now, the screens are located within passengers' visual field.

— What technical solutions do you consider to be the best?

—It is difficult to single out one particular solution. From the standpoint of metro car development, I consider the following solutions to be the most advanced: utilization of electric actuators in the doors, a crash system in hitch mechanisms, use of wide intercar walkways that create a gangway through the car, and a new-generation system of detection and extinguishing of fire that has an enormous development potential.

— What has enhanced the design reliability?

—The design reliability was made possible due to modern elements, new technical solutions based on advanced technology. This applies to most elements of rolling stock. Before the commissioning of trains, the design reliability was proven by the tests performed in late March of 2017.

The front mask of a car of 81–765/766/767 series

NUMBERS

UTILIZATION OF THE NEW, MODERN ASYNCHRONOUS TRACTION DRIVE REDUCES OPERATING COSTS BY 40%

DOORWAYS ARE WIDENED BY 12% (1,400 mm instead of 1,250 mm)

NUMBER OF RAILINGS IS INCREASED BY 30%

New technical solutions allow energy savings of up to 35%

New-generation drives (KATP-3) became by 20% more powerful and 15% lighter than before

EACH CAR HAS 8 CAMERAS

There are two sensory information screens in each car

Total number of cars in a train is 8 (with a possibility to add 2 more cars)

the train; a red light is on — stop! These signals are given to the passengers who are on the train.

Only two colors, red and green, are used for outdoor notification. The coating of intercar walkways is LED covered, although it has a different function: this will help passengers move along the train in emergency situations, e.g. in case of evacuation.

Transmashholding incorporated another innovation in the new cars: for the first time in the Russian metro history the company equipped rail cars with a crash system. This is a combination of energy-absorbing elements that are integrated into the hitch mechanisms of rolling stock. The crash system diffuses a significant amount of energy in the event of a head-on collision of a car with an obstacle, which happens due to its own deformation, hence "the volume" of energy left for body deformation is reduced significantly.

Working in tandem

The most important person on the train is the driver. This is why Transmashholding engaged a group of the Moscow Metro drivers in the process of designing the new cab. Their joint efforts resulted in the arrangement of control systems and elements on the control panel in such a manner as to make the driver's work more convenient. A new-type monitor and illumination fixtures of the control panel were installed. In order for the driver to feel at home in the cab, Transmashholding furnished it with comfortable ergonomic chairs and climate control system.

The new-generation cab was transformed not only inwardly, but outwardly as well. The main new feature is the removal of all protruding elements from its right side. Now, the functions of headlights and running lights are performed by combined LED lights mounted on the side surfaces of the head end of the cab. The doors of the cab on the "Moscow" train are equipped with automatic block system which gets activated automatically at a speed exceeding 15 kmh. Now, the doors have a window with a sliding glass panel.

A pleasure to the eye

The new metro cars are a result of enormous efforts not only on the part of engineers, but designers as well. This is why the "Moscow" train boasts stylish exterior. In this case, one can paraphrase the words of a Russian writer, since everything is beautiful about the new cars: not only their "face" and "clothes," but their "soul." In our case, it is the "technical features." The walls and roof of the cab are made from noncorrosive steel, the frame — from low-alloyed steel.

Utilization of new structural solutions reduced the weight on the new cars by 6%, which decreases power consumption and the load on the tracks. The "Moscow" trains also feature a 40% reduction of the weight of the car's floor, which was achieved with the help of the material — compressed cork covered with panels based on the high pressure laminate.

Everything is new in the "Moscow" train, even its wheels, which have a low-pressure design allowing significant noise reduction. Transmashholding specialists took even a step further: they designed new-generation drives (KATP-3) that are 15% lighter and 20% more powerful than their predecessors. Due to this innovation, the rolling stock consisting of eight cars can have six drives. The result is impressive: reduction of the train's weight allows 40% savings in operational costs! Most importantly, all these technical solutions that were incorporated in the new-generation cars allow energy savings of up to 35%.

Interior of the new metro car

Moscow Mayor Sergey Sobyanin, Deputy Mayor for Transport Maksim Liksutov and Transmashholding CEO Kirill Lipa were among the first passengers of the „Moscow" metro train

Throughout the years of its existence, Transmashholding has been committed to maintaining the high quality of its products. This is not surprising, since no respectable consumer will cooperate with a partner notorious for the poor quality of their products. Today, this area is supervised by Evgeny Belinsky, who holds the position of the head of the Transmashholding department of quality and operational reliability analysis. We asked him to share with us his views of the policy regarding quality.

QUALITY ASSURANCE POLICY: BREAKING NEW GROUND

Production of quality products is one of the key issues for any manufacturer, since business reputation is the most important factor of competitiveness. For Transmashholding, the leader on the Russian market of transport engineering, its quality assurance policy has become more important than ever.

In the year of its 15th anniversary, the holding plans on new achievements, including expansion to foreign markets. The success of new initiatives depends on the quality of products that the holding's enterprises will be able to offer to its partners. The key program that determines the prospects of operations for the holding is "Strategy 2020." One of the main areas is creation of competitive innovative products, including those that are intended for foreign markets. New technologies and solutions entail new risks, hence, stricter requirements to the quality and reliability of manufactured products. This applies not only to those units of the plants that are directly responsible for quality and its assurance but to very employee of the holding.

Reputation with a history

When the holding was established 15 years ago, each plant had its own standards of quality, which differed significantly from plant to plant. It became necessary to unify them to ensure smooth operations of different units within a single manufacturing "organism."

The history of the system that is implemented at the holding's enterprises dates back to 2009. Its basis is the system of Transmashholding's technological partner and shareholder Alstom Transport. It was adapted to the Russian conditions and until this day gets updated depending on the holding's needs.

Over the years, enormous efforts have been put into development of uniform approaches and their adoption at the plants; a quality management system was created and certified. Naturally, one cannot forget about adoption of "lean production" and "lean management" — two cornerstones of the production system of each of the holding's plants.

Today, ISO standards are fundamental standards for all; each plant has IRIS certificates according to the international railway quality standards. The quality system as a whole with its basic approaches and standards is described in the Roadmap of the Production System of CJSC Transmashholding. These standards explain how an enterprise must work in order to produce quality products.

Control of installation of units in the cab of the 3ES5K electric locomotive

Acceptance control of purchased products

Everyone contributes to quality: from custodian to general director

The main principle of the quality assurance policy is an individual responsibility of each unit of production. Everyone at a plant contributes to quality — from custodian to general director.

Production of quality products is comprised of main areas: design, procurement, manufacturing, and operation. Creation of quality products starts with a "design idea" — design and development. Technical innovations and solutions incorporated into products at their development directly affect both their production and lifecycle. There are no insignificant factors; everything needs to be taken into account: labor conditions, ergonomics of work space, utilized gear and equipment, conditions of utilization of products, and features of their maintenance. The quality of manufactured products is affected by procurement. Development of a network of suppliers is one of priority tasks for the plants. The production stage is a key phase where a product is transformed from paper into metal. The results of work are a finished product. Each employee participates in its creation and affects it with their actions. Utilization or operation of a product is the result of joint efforts of all workers and specialists of CJSC Transmashholding.

In essence, the ISO standards were born as a result of the concept of Total Quality Management. The reliability of products directly depends on the business processes that are in place at every enterprise.

These are not just control measures; they represent an algorithm of the quality management of manufactured products, with responsibility taken by each employee who influences the final result.

Do not cause defects, do not accept them or pass them on

Three components of the principle of inbuilt quality are as follows: do not cause defects, do not accept defects, and do not pass them on. In order for defects not to be accepted or transferred, each of Transmashholding's plants has a technical control department. More often than not, many operations are left to self-checking. As for the quality assurance policy pursued by global industry leaders, they do not have quality control departments or supervisors; quality control is the responsibility of a production worker. Introduction of such system at our plants and assignment of production to self-checking is a future goal for Transmashholding.

In order not to make defective goods, first and foremost, one shouldn't deviate from the accepted technology. The objective of the quality assurance policy is to transition from restraining measures, which help eliminate defective goods, to preventive measures, that is to eliminate all preconditions leading to defects. This requires corrective actions, which will help change the existing conditions. This is done by special subdivisions of the holding that are responsible for the quality of products.

There are many tools related both to the ongoing control of compliance with the technology and quality requirements and the measures aimed at detection and correction of current activity and prevention of incompliant products. All stages are monitored. While products are being designed, quality standards are taken into consideration; all types and consequences of potential failures of the design are analyzed. Additionally, there are many intermediate control points of evaluation of how a designed product will function.

At the stage of procurement, of great importance are accreditation and evaluation of suppliers, their monitoring, and acceptance control — a system of additional verification and reports on incompliance of suppliers, if such cases are discovered.

Later, when products are manufactured, accepted by a customer and used, there is continuous monitoring. In the event of some inconsistencies in their quality and reliability, appropriate information is sent to designers and processed by them from the standpoint of changes and upgrades to the products. This applies not only to the fleet that is already operated. All detected inconsistencies are eliminated; this information is incorporated into the technical specifications of new products.

NEVZ quality stamp

Roadmap

Transmashholding has developed and approved a uniform Roadmap for Production System Development for all plants. There is a special section dedicated to quality where objectives to be achieved in practice are laid out.

There are annual audits of implementation of the requirements of the Roadmap. Specialists from the holding's enterprises are engaged in the audit committee. During audits, principles of and approaches to the achievement of the objectives of the Roadmap are assessed; there is also an exchange of experience between specialists of the enterprises.

Each plant is assessed based on the results of the audit, and all enterprises are assigned a rating.

Quality assessment indicators

Today, the main indicators used for the purpose of quality assessment are a share of expenditures on defects in production, share of expenditures on warranty maintenance, and delivery of products from the first, second, third pass yield. The main goal is for all products to be delivered after the first pass yield. Defective goods should not reach a customer!

Today, machine building plants implement procedures for determining nonconformance. This will allow:

• developing a uniform approach to the evaluation and recording of established nonconformance at the enterprises of CJSC Transmashholding;

• determine and exert targeted influence on established nonconformance;

• build a rating of the quality assurance divisions of the plants.

Additionally, in the course of one year, these procedures are going to be tested at the following locomotive building plants: NEVZ, Bryansk Engineering Plant, Kolomensky Zavod, and Penzadieselmash. Upon completion of the test application of the procedures for evaluation of nonconformance, they will be utilized across all enterprises of Transmashholding.

Reliability of products

The locomotive building industry has clear-cut indicators of reliability, infallibility and readiness that are set forth, among other documents, in delivery contracts with key customers. These are failure flows 1, 2 and 3, that is the number of failures per 1 million km of a locomotive's travel. There is an indicator of readiness — the inherent availability ratio. To put it in simple terms, it is the time when a locomotive is not idle due to unplanned repairs through the manufacturer's fault.

In the event of absence of specific requirements to the reliability in regulatory documents on products, during evaluation of their reliability it is possible to use such criteria as the number of damage statements per single product, total kilometers, idle time, hours of operation, etc. As of today, reliability targets for manufactured products have been approved for 2017 for each plant.

Operators evaluate the quality of performed works in regard to their conformity to drafts.

Line for assembling, testing and equipping mainline diesel locomotives.

New milestones and motion vector

The company is planning on further development of its quality systems at the plants. Speaking of the indicators achieved in 2016 during the audits under the Roadmap, it can be noted that the leading plant has a score of 3.5 out of possible 5 under the Quality section. This means there is room for improvement! Given the dynamics observed today, the strategy of development of the quality assurance policy for the nearest five years is complete.

At this stage, there is a focus on integration of manufacturing and operational phases. An enormous work is being carried out jointly with the service company Locomotive Technologies. The work involves failures in operation. Information exchange on an ongoing basis allows obtaining feedback for the manufacturer. This helps improve the overall work quality and build new machinery taking into account the experience with the existing products in operation.

New instruments that are developed by quality assurance specialists will be introduced to the Roadmap after their tests, which is a mandatory requirement for all plants.

Finally, we would like to thank the employees of all enterprises of the holding for their active participation in the implementation of the quality assurance policy and their genuine interest in the life of the enterprises. It is important to understand that personal professionalism of each and everyone directly affects the manufacturer's reputation. This is a mutually beneficial process for the employee and employer.

HEDGEHOG IN THE TUNNEL*

The "E" metro cars are of special importance to Muscovites and residents of other cities of Russia that have a subway system. These cars have been the backbone of subway systems for 50 years!

Isaak / Shutterstock.com

Lighter, faster, and more frequently

The E cars, or "Hedgehogs," as they were later called by the Russian public (due to resemblance of the series name "Ezh" to Russian word Ezh standing for Hedgehog), were born in the late 1950s. They were designed by the design subdivision for car construction of Mytischi Machine Building Plant. These cars replaced the D cars.

The new cars became lighter (the weight of the bogie as compared to the D car was reduced to 2 tons) and faster (the train speed increased to 90 km/h against 75). This shortened the interval between trains to 1.3–1.5 min. It was estimated that the improved technological features of the car would allow increasing the annual output to 130 units at the same manufacturing sites.

In December of 1959, two test models of the E car were built. A year later, the Moscow Metro acquired a test train consisting of five cars. According to the information obtained from the metro, drafts were changed, and some elements of the car were enhanced.

Not only for the USSR

Manufacturing of the E type metro cars began in 1962, when out of 120 cars delivered to the Moscow Metro 70 were new E type cars. In 1964, the plan for metro car production stipulated a significant increase — up to 145 units. This was attributed to the completion of construction of the metro systems in Baku and Tbilisi. The D type cars were tested on the underground tracks of the Kiev metro. In late 1964, 12 cars of the E type were delivered to Kiev. During the operation of the E type cars, the drivers discovered structural flaws, which resulted in their suspension for the purpose of further improvement.

In 1966, new versions of cars with letter codes Em and Ema were to be designed specifically for the Leningrad Metro. In 1966, cars for Hungary began to be designed. Their structure had to incorporate the specific requirements of the Budapest Metro, in particular the changed gauge of tracks. The first four test cars of the Ev type were delivered to Budapest in 1967.

In 1969, the department of the chief designer of the car production headed by A.G. Akimov began designing the new E type metro car. According to the preliminary design, the weight-carrying capacity of the car was increased from 18 to 21 tons due to the reinforced suspension system. In 1970, there were plans to transition to the production of the new Zh type, but an intermediate model was built instead — the Ezh.

Applying the successful design solutions found for the design of Hungarian cars, in 1970 the plant started manufacturing the Ezh type cars and began their deliveries to the city's metro.

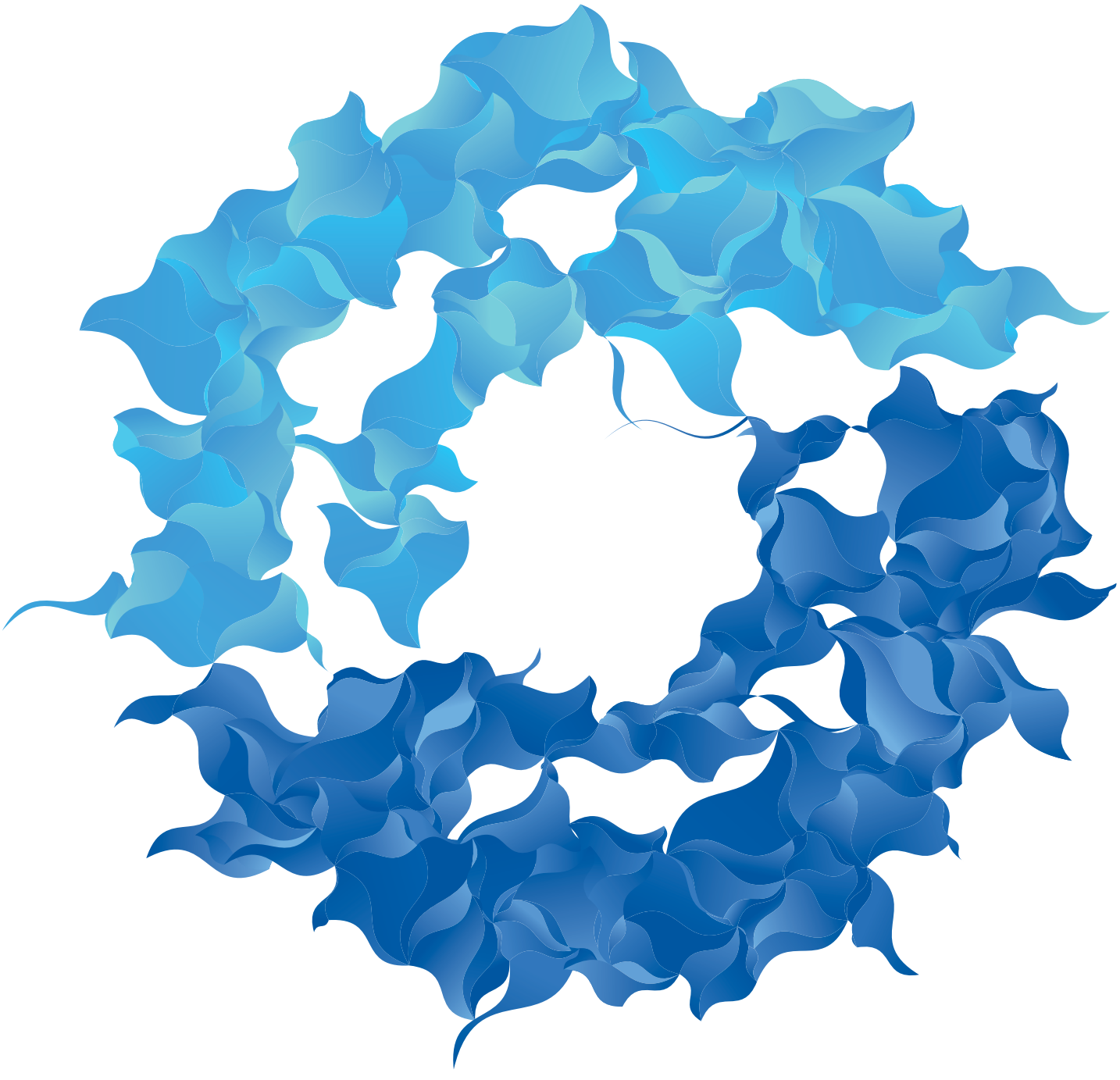
In 1973–1977, metro designers of the enterprise designed a new version of metro cars — the Ezh3. It had almost the same features as the Ezh car. The electrical schematic of cars was altered: automatic speed control, which is a traffic safety system, was adopted; cars were equipped with radio dispatcher communications, and a new control panel was installed. Based on the Ezh3 car, an export version, the Echs type car, was designed, which was intended for the Paris Metro.

Production of the Ezh3 and E type cars was terminated a long time ago. Today, cars with a totally new design get to replace them. For instance, in 2017, the Tagansko-Krasnopresnenskaya line of the Moscow Metro acquired the latest "Moscow" 81–765/766/767 metro cars. Gradually, they will replace all Ezh cars (or Hedgehogs) in the capital.

** This name of the car resembles the russian word Yozh, or Ezh — similar to the car's name, which stands for "the Hedgehog". There is a short animated movie, very popular in Russia, called «Ezhik (ezh) v tumane» (Hedgehog in the fog).*


АРС
07

TRANSMASHHOLDING



We are 15!