ED9E, a new electric train for Kazakhstan Railways  p. 4
Contents

company news

cover story
ED9E electric train: The current: alternate, the benefits: direct

production
TransMashHolding and Tver Railcar Institute developed four models of baggage carriages

management
TransMashHolding development strategy: To reach everyone

innovations
TRTrans, TransMashHolding’s engineering center

traditions
VL85: a road warrior from Novocherkassk

Transmashholding

A Magazine for Transmashholding Partners

Editor-in-Chief
Konstantin Dorokhin
k.dorokhin@tmholding.ru

Editorial Office address:
26 Butyrskiy Val St., bldg. 1, Moscow, 127055
Phone: (495) 660-89-50

Published in collaboration with MediaLine Publishers
www.medialine-pressa.ru

General Manager
Larisa Rudakova

Design Artist
Ilya Malov

Editorial Director
Dmitry Dorofeyev

Copy Editor
Irina Demina

Design and Typesetting
Inna Titova, Maria Tyrygina
Alexei Sukonkin

Proofreaders
Galina Bondarenko
Larisa Nikolaeva
Alina Babich

Prepress
Andrei Klochkov
Maxim Kuperman
Anastasiya Morozova

Approved for printing on 04.07.14
Printed by Union Print
Press run: 999 copies.
Time to start!

An electric train of the future

The presentation of a prototype electric train EG2T, the latest development of the plant in collaboration with TransMashHolding, was conducted at Tver Carriage Works (TVZ). EG2T is the first representative of a new family of Russian electric trains created in Transmashholding. The train is designed using leading edge technical solutions. The exterior and interior design was done by Integral Design and Development, one of the leading companies in Europe whose designs were implemented in many European railways. Electric train EG2T meets the most stringent demands of passenger transport carriers. The concept involves the ability to create modifications for speeds up to 120 or 160 km/h, and in the future — up to 250 km/h for high-speed railways. The new rolling stock will be produced using Tver Carriage Works facilities.

“The technical, operating, and consumer characteristics of the new Russian electric train are at least at the level of models produced by foreign manufacturers,” said Andrei Solovey, TVZ CEO, introducing the innovative product. The requirements on which the design was based include, for example, soft riding achieved by using pneumatic suspension technology, as well as reduced noise and vibration. The latest principles of modular space configuration were used in the design, which provides the ability to quickly adapt the carriage space to the needs of different operators: the train can be an urban one, a long distance one, a regional one, an airport express, etc. Using the latest technologies increased the service life of the electric train to 40 years. The first two electric trains will be commissioned before the end of 2014.

Cooperation

Plus two!

TransMashHolding will build new express trains and double-decker electric trains for Central Suburban Passenger Company (TsPPK). The agreement was signed on June 17, 2014. TransMashHolding will develop two new electric trains with asynchronous traction motors for use in suburban express passenger transportation, and electric double-decker trains for interregional transportation. The agreement was signed by TsPPK CEO Michael Hromov and TMH CEO Andrey Andreev. It is expected that the supply contract for express trains will be approved by the end of 2014, and for double-decker trains, by the middle of 2015.

The new projects are a part of TMH program for creating a new family of Russian electric trains (the head project is Ivolga, an urban electric train EG2T). The train designers use the latest technical solutions that ensure reduced operating costs and maximum ride comfort for passengers.
Federal Passenger Company has approved a design project for double-decker carriages with seats that are being developed at Tver Carriage Works (TVZ, a subsidiary of TransMashholding).

The project design was developed by Giugiaro Design (Turin, Italy), a global leader in transportation vehicle design, in close cooperation with experts from TVZ.

The fabric upholstery of window seats will be orange, and of the aisle seats, gray. In the business class, the seats are placed according to 2 + 1 scheme; the seats will be upholstered in cherry-colored genuine leather. The business class seats will be swiveling so all passengers can sit facing the head of the train. Luggage racks in the business class carriages will be made of extra durable tinted glass. The ceilings will be equipped with low-power LED lights, creating a starry sky effect. The VIP section will be made especially comfortable, with a soft two-seat couch, transformable tables, and a large screen TV entertainment system.

Prototypes of carriages with the new interior will be built in October 2014, and the delivery of the entire lot of ten economy class carriages and five business class carriages is scheduled for April 2015.

On July 19, 2014, at the IX International Rail Business Forum Strategic Partnership 1520 in Sochi, an agreement for supply of locomotives was signed between TMH and Russian Railways (RZhD).

The agreement includes almost all models of serial production electric and diesel locomotives that Russian Railways use. A key feature of the contract is its duration of three years. The agreement will be in force from 2015 to 2017. During this period, 1008 locomotives of the models EP1M, 2ESSK, 3ESSK, EP2K, TEP70BS, 2TE25A, TEM18DM, 2TE116U, 3TE116U, and 2TE116UD will be built for the needs of Russian Railways.

According to current practice, the amount, timing and cost of rolling stock produced by TransMashholding for the needs of Russian Railways, are normally regulated by one-year contracts. TMH has been advocating a transition to a three-year agreement for the supply of standard products for several years now. From the point of view of the manufacturer, such contracts facilitate planning and attracting credit resources required for the development of the company’s R&D and production facilities.
The current: alternate, the benefits: direct

In March 2014, Demikhovsky Engineering Plant handed over to Kazakhstan Temir Joly (Kazakhstan Railways) the first two 8-carriage AC electric trains ED9E in accordance with the supply contract signed in the autumn of 2013. **STARTING IN APRIL, THE NEW TRAINS WILL SERVE ON ASTANA — BOROVOE AND ASTANA — KARAGANDA LINES.**
According to a Kazakh tradition, the enhanced comfort electric trains got their own names. ED9E No.0028 was named Okzhetpes in honor of a majestic cliff on the shore of Lake Auliekol. ED9E No.0029 was named Sary-Arka, which means Yellow Ridge, after an area in the central Kazakhstan.

The names emphasize the uniqueness of trains — the look of ED9E produced in 2014 has changed significantly through the use of modular fiberglass cab. It is the first time that the head carriages with the new, aerodynamically optimized, shape were used in a train. In addition, the enhanced ED9E compare favorably with those of the older series on a number of factors, the most important being its decreased power consumption.

**HISTORY OF DEVELOPMENT**

Prior to the creation of ED9E, Russia had no regenerative braking AC electric trains with energy-saving equipment. A pilot electric section of ED9E No.0001 (the head and electric carriages) was produced at Demikhovsky Engineering Plant (DMZ) in May 2006. It was equipped with KEO-25, a set of experimental energy-saving electrical equipment produced by Elektrosila. The new rolling stock has demonstrated high efficiency through the use of effective systems of smooth start and regenerative braking. Reduced energy consumption for traction has reduced the number of electric carriages in the train and therefore cut capital and operating expenses.

**RECOGNITION OF EFFICIENCY**

Russian Railways, the largest customer of Demikhovsky Engineering Plant, appreciated the new generation train. This is evidenced by the fact that 20 ED9E trains were used to transport participants and guests of the World University Games held in Kazan in 2013. Currently 25 ED9E trains are used by Gorkovsky Railways.

Kazakhstan Railways, a permanent user of trains manufactured by DMZ, also noticed the modified train. Kazakhstan Temir Joly has been cooperating with Demikhovsky Engineering Plant for more than ten years. So when the need arose to acquire five enhanced comfort trains, KTJ had no doubt whom to choose as a supplier of rolling stock. In October 2013 a contract was signed to supply the modernized ED9E.

**SIGNIFICANT ECONOMY**

Using energy-efficient electrical equipment can improve the traction and energy efficiency of ED9E electric trains. Power consumption is reduced by 20–30% depending on the operating conditions. Using energy-saving equipment helps to reduce rheostat losses at start by 50%, reduce current loads on traction equipment, and significantly increase reliability.

VIP1000 reversible converter and MPSU microprocessor control system installed on ED9E provide smooth contactless regulation of traction modes and regenerative braking almost until the train stops. MPSU can perform enhanced performance check on power devices and VIP1000, identify failed equipment and promptly notify the locomotive crew and depot attendants of any failures that occur. The resulting diagnostic information is stored in nonvolatile memory.

An undoubted advantage of the modernized ED9E electric trains is the ability to use standardized traction engines, increased power TED10U1 that allow the rolling stock to reach a maximum speed of 130 km/h. The engines have smaller dimensions and mass. Due to the increased power, capital expenditures and operating costs of the train service are reduced.

A512/60 batteries installed in the electric trains are highly reliable and require no electrolyte topping up. The maintenance-free batteries can reduce the negative impact on people and the environment.

**RESTYLING OUTSIDE**

When a contract to supply ED9E trains for Kazakhstan Railways was being signed, the experts from DMZ offered an original idea: to redesign the head part. Kazakhstan Temir Joly endorsed the idea.
By this time, Demikhovsky Engineering Plant had successfully used modular fiberglass cabin in the manufacture of electric train ED4M No.0500. After that, the recognizable head part became the hallmark of the 500th series ED4M and of DMZ.

Starting with No.0028, head carriages of ED9E also got stylish. Designed with aerodynamics in mind, the frontal part has lower resistance to air flow and reduces the noise level in the cab.

In addition to exterior design upgrade, proven technical solutions meeting modern requirements were used in designing the electric train. Carriage coupling device designed for zero lash rigid carriage coupling help reduce the dynamic load on the traction gear and the passengers. Sealed carriage-to-carriage passages provide low noise levels, better heat insulation of the carriage interiors, and protection from outer precipitation. Thanks to these design features, the passengers and crew can now go from carriage to carriage faster and easier.

Automatic sliding plug doors are convenient for exiting not only to high, but also to low platforms. The doors mechanism prevents catching of body parts or personal items in the doors.

Bright blue paintwork emphasizes the individuality of ED9E trains manufactured by DMZ for Kazakhstan Railways. The paint with increased durability and resistance to detergents and UV rays preserves the attractive appearance of rolling stock.

COMFORT INSIDE

The interiors of the electric train are designed in a unified style using the latest trends of industrial design. Cabin walls and side walls are made of fiberglass. Using this material more than triples the service life of the panels and provides durability of the interior finishes.

Upon customer’s request, Demikhovsky Engineering plant can develop customized interiors with any internal floor plan. It is also possible to install a bar or environmentally friendly vacuum toilets.

ED9E trains produced for Kazakhstan Temir Joly are formed using 1st, 2nd, and 3rd class carriages. In the 1st class carriages, the seats for passengers are arranged according to 2 + 2 scheme with tables between them, in the 2nd class carriages, 2 + 2 with folding tables, and the 3rd class carriages have the standard six-seater couches.

The seats are made of modern wear-resistant materials. Couches and seats for passengers have modern ergonomic design and are optimally positioned in carriages.
positioned in the car, which adds to passenger comfort.

The head and trailer carriages of the ED9E trains sent to Kazakhstan have sections for conductors. 1st and 2nd class carriages are equipped with monitors for video broadcasting. Wireless Internet access (WiFi) is provided. Four cars are equipped with washrooms.

The electric train has video surveillance inside carriages and in vestibules, as well as on the outer perimeter of head coaches. The system registers the events and saves video recordings in nonvolatile memory. The information is displayed on the operator cabin dashboard in real time.

Comfortable climate in carriages is maintained by air conditioning systems. Forced ventilation in the vestibules quickly removes stale air.

Upon customer’s request, passenger counting system and train locating equipment may be installed.

**AIDING OPERATORS**

ED9E trains are equipped with new unified driver dashboards. They combine perfectly with the traditional electric train safety systems. The layout of the dashboard, the location of displays and controls allow the operator to drive the train alone, without an assistant, if necessary. The set of equipment in the cabin is supplemented by a passenger-driver warning and communication system and an outdoor surveillance system for embarking and disembarking.

In the production of electric trains, DMZ pays attention not only to the convenience of passenger travel, but also to comfortable working conditions for locomotive crews. For example, ED9E cab is equipped with comfortable ergonomic chairs, air conditioning system, and an improved design of the cabin door.

**CONVENIENCE FOR ALL**

Demikhovsky Engineering Plant has over seven years of practice in the creation of barrier-free environment for people with disabilities in the trains. Upon customer’s request the head carriages of modified ED9E may be equipped with folding ramps. These devices allow people on wheelchairs to get in the carriage unimpeded. Inside of the carriages, there are special places with wheelchair mounts.

Environmentally friendly washroom has special handrails and is adapted for use by people with disabilities. Increased area washrooms have been designed with wheelchair movement in mind.

---

IGOR VLADIMIROVICH ZATS, deputy head of pre-project development and testing, DMZ:

— When our plant began working on ED9E for Kazakhstan Temir Joly, we decided to bring something new into the project. Namely, the interesting, recognizable design of the head car.

The exterior of the electric train as a modern means of passenger transportation must meet international industrial aesthetics standards. Aerodynamically shaped fiberglass cabin is now a hallmark of DMZ.

Customized coloring of rolling stock is the fruit of joint efforts by KTJ designers and ours. Bright colors favorably emphasize the modernized look of ED9E.

As for the carriage interiors, we fully satisfy the needs of customers and passengers. This was facilitated by our cooperation with TsPPK which makes high enough demands for comfort in the trains. Working in such conditions is a good incentive to improve DMZ products.
THE UPGRADE WAS SUCCESSFUL
In April, a ceremony opening the first run of ED9E No.0028 and 0029 was held in the Republic of Kazakhstan. According to Kazakhstan Temir Joly PR service, the trains fully meet the international standards of suburban transportation. All design decisions are made according to customer’s wishes and reflect the latest trends in industrial aesthetics and decoration. The new trains will stand out from the ones previously operated on Astana — Borovoe and Astana — Karaganda lines. The fruitful cooperation between Demikhovsky Engineering Plant and Kazakhstan Temir Joly has started back in 2003. Over these years, DMZ has delivered 10 ED9MK, 32 ED9M, and 16 ED9E electric train carriages to KTJ. According to the existing agreement, three more 8-carriage ED9E trains will be sent to Kazakhstan by mid-2014.

The main technical specifications of an electric train with basic waggonage (2 H + 4E + 2 P)

<table>
<thead>
<tr>
<th>Current type</th>
<th>Alternate, 25 KV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic waggonage</td>
<td>8 carriages</td>
</tr>
<tr>
<td>Number of seats in a basic waggonage train</td>
<td>824</td>
</tr>
<tr>
<td>Waggonage options</td>
<td>4, 6, 9, 10 carriages</td>
</tr>
<tr>
<td>Platform type</td>
<td>High, low</td>
</tr>
<tr>
<td>Number of doops per side</td>
<td>2</td>
</tr>
<tr>
<td>Overall hour power of electric traction motors, kW</td>
<td>3520</td>
</tr>
<tr>
<td>Design speed of the electric train, km/h</td>
<td>120</td>
</tr>
<tr>
<td>Average acceleration in traction mode on a horizontal section of the path to a speed of 60 km/h, m/s²</td>
<td>0.6–0.8</td>
</tr>
<tr>
<td>Average deceleration in electrical service braking mode on a horizontal section of the track from the speed of 80 km/h, m/s²</td>
<td>0.6–0.8</td>
</tr>
<tr>
<td>Average speed on the stretch of 3.5 km with speeding-up path of not more than 1,750 m, km/h</td>
<td>70</td>
</tr>
<tr>
<td>Braking distance on a straight horizontal section of the track from the speed of 120 km/h with maximum passenger load, m, not more than:</td>
<td></td>
</tr>
<tr>
<td>— at fully electro-pneumatic braking</td>
<td>1000</td>
</tr>
<tr>
<td>— at emergency pneumatic braking</td>
<td>1080</td>
</tr>
<tr>
<td>Specific energy consumption in design mode of motion (excluding consumption for heating and own use), W·h/t·km, not more than</td>
<td>28.0</td>
</tr>
</tbody>
</table>
Design solutions used in the electric train

**ELECTRICAL EQUIPMENT:**
- Energy-saving electrical equipment kit
- Driver's unified dashboard of phase III development with an integrated system for management, diagnostics, and security
- Modern reversible converter VIP-1000
- Traction transformer ODTsE-2000/25 U1
- Maintenance free batteries A512/60
- LED technology (LED line light inside the carriage, warning LED lights on head cars, embarkation/disembarkation lights, and LED lighting in the vestibules)

**CARRIAGE BODY:**
- Upgraded frontal part of the head car
- Zero lash coupling
- Sealed carriage-to-carriage passages
- The paintwork

**PASSENGER COMPARTMENT:**
- Sliding plug exterior doors with an electrical pneumatic actuator providing access to high and low platforms
- Upgraded interior
- Video surveillance system in carriages and vestibules
- Improved design of the driver's cab door

**CLIMATIC EQUIPMENT:**
- The microclimate system inside the carriage
- Forced ventilation in the vestibules with separate switching from HVAC system

**PNEUMATIC EQUIPMENT:**
- A screw compressor unit

**ADDITIONAL FEATURES:**
- Barrier-free design for passengers with disabilities
- Environmentally friendly toilets
RUSSIAN RAILWAYS ARE REFORMING ITS BAGGAGE AND LIGHT CARGO TRANSPORTATION SYSTEM. TO MEET MODERN REQUIREMENTS IN THIS AREA, TRANSMASHHOLDING AND TVER RAILCAR INSTITUTE HAVE DEVELOPED NEW BAGGAGE CARRIAGES, FOUR MODELS AT ONCE.

Four road war

From the late 1980s and up until recently, transportation of baggage and light cargo received insufficient attention. However, when Federal Passenger Company was established in the course of the restructuring of Russian Railways, opportunities analysis showed that with the competent customer relations management there may be a demand for such services. To operate this type of transportation, a subsidiary, FPK Logistics, was created, which currently carries out baggage and light cargo transportation using baggage cars that are part of passenger and postal-and-baggage trains.

The entire fleet of Russian Railways carriages was transferred into the books of FPK Logistics. But as in recent decades there were practically no purchases of new cars, most of these cars are at least 30 years old. Working in a market highly competitive with other modes of transport, especially automotive vehicles, FPK Logistics experts decided that successful operation requires not just purchasing new carriages, but purchasing ones with fundamentally new characteristics.

A NEW DIRECTION

Russia’s leading manufacturer of locomotive traction passenger cars, Tver Carriage Works (TVZ), has in recent years launched many new models of passenger cars. In 2008 it started production of a new line of passenger cars, including compartment cars, second-class cars, headquarter cars with radio equipment and equipment for passengers with disabilities, cars with seats, dining cars, etc. In 2013, TVZ started production of double-decker line of cars. Given the plant’s advanced expertise in design and production of new passenger car models, the Federal Passenger Company sent a proposal to TVZ to undertake the development of a new generation of cars.

However, for the next two years the design bureau was fully booked. The main challenge that the TVZ engineers faced was the extension of the double-decker cars family. Two models with seats are currently in development, and a new staff car with a bar is in the plans, as well as an upgrade of double-decker sleeping cars. But to lose a potential order of FPK Logistics meant losing a promising and growing market. And then TransMashHolding management and Tver Carriage Works made an unusual decision, to outsource part of the baggage car design work to Tver Railcar Institute (TIV) located next to the plant.

There was one more reason to involve the experts from TIV. The fact is that the requirements for baggage cars are very contradictory. A baggage car must carry a load and provide the volume of the cargo space which are pretty big for a passenger type car, and at the same time it must allow the maximum speed of 160 km/h. In addition, to provide reasonable lifecycle cost, the new baggage car should be relatively inexpensive and easy to maintain and repair. To resolve all those problems at once is impossible without some research, so the decision to bring in TIV...
FOUR MODELS

On March 21, 2014, Russian Railways Vice-President Mikhail Akulov approved the design specifications for the baggage cars. At this point, the main technical solutions to be used in the design of cars have already been developed, justified, and approved by the customer. To fully meet the customer needs, it was planned to develop and produce four versions of a car.

The first modification is the basic one. The cargo space takes up the entire volume of the car. Compared with the previous generation of cars, the volume has increased significantly and is now equal to 205 cubic meters. The car floor is designed to allow using a forklift.

The second model is a carriage with the ability to transport motorcars. In addition to carriage of type 1, this carriage will be equipped with end doors so the cars can drive inside. The cars will be transported in two tiers, with the floor of the second tier being transformable, either lifting or folding. The carriage will hold eight business sedans such as Toyota Camry. With single-tier loading, the carriage will hold four SUVs or three minivans.

I would like to elaborate on the reasons for creating this type of carriage. Currently there is a significant flow of light cargo from the Central Russia to the Far East. However, there is almost no demand for cargo transportation in the opposite direction. At the same time, motorcars produced at the South Korea

THE TERM “POSTAL AND BAGGAGE CAR” IS AN ERRONEOUS ONE. THERE IS A POSTAL AND BAGGAGE TRAIN. POSTAL CARS AND BAGGAGE CARS ARE TWO DIFFERENT CLASSES OF PASSENGER-TYPE CARRIAGES. IT IS A BAGGAGE CAR THAT THIS ARTICLE PAYS MOST ATTENTION TO. AS TO THE DEVELOPMENT OF NEW GENERATION POSTAL CARRIAGES, IT IS A QUESTION OF THE MARKET NEEDS OF TOMORROW
staff accompanying the baggage cars: a service department, a sleeping section with two beds, and a bathroom unit with toilet and shower. The car will have “residential” heating provided by a standard electric car combination boiler. Upon request, an optional air conditioning system may be installed.

In addition to the accommodation of the accompanying personnel, this car must perform another important function. Signals from various systems of type 1 and type 2 cars: greaseboxes heating control, fire alarm and fire extinguishing systems, alarm systems that ensure the safety of goods, etc. will be transmitted to the dashboard of this carriage. Thus, in addition to the basic functions, transportation of cargo and baggage, the carriage will serve as a sort of bee queen, with the working bees being cars of type 1 and type 2. A system for monitoring, diagnosis and management (SKDU) of this car can simultaneously monitor up to four connected cars of type 1 and type 2. Such functional structure of baggage trains will minimize operator costs and ensure full road safety and security of cargo.

The fourth model is the baggage car with conductors’ section, in which the cargo compartment is equipped with climate control heating and ventilation systems. These cars are used for transportation of goods that cannot be stored and transported in unheated spaces or spaces with high humidity. The traffic flows for such delicate items are small, but the demand for such cars exists.

GREAT POTENTIAL
Thus, Tver railcar builders intend to offer a whole new line of railway carriages. Despite the fact that the new generation of cars was created under the requirements of FIC Logistics, which is a priority customer, there is confidence that such cars will be in demand by other providers of expedited freight transportation. The created cars have significant potential for development: for example, postal carriages and other modifications can be created by adopting the base model to the specific needs of specific customers.

One of the main priorities of Transmashholding group of companies is customer focus. The newly developed line of carriages which will go into production at TVZ in 2015 is a valid proof of that. The scope of production will be determined by the market demands. However there is no doubt that the new cars have great market prospects.
To reach everyone

All major international companies face the same problem: how to explain a strategy developed at the highest level and reflecting the global vector of business development to rank-and-file employees so each of them becomes involved in the change process. After all, it is the staff commitment that makes or breaks in the company’s success.
To ensure efficient implementation of the holding development strategy, the production system group conducted two-day workshops in February — April 2014 in all the holding’s plants giving the plant management hands-on training on X-matrices methodology. To date, top management of seven enterprises has undergone training: BMZ, NEVZ, TVZ, KZ, TsSM, DMZ, and MBM.

The answer to this question was found by Toyota, a world leader not only in the automotive industry, but also in the creation of efficient business systems, back in 1950–1960s, and the answer was a tool called Hoshin Kanri. This phrase can be translated from Japanese as ‘a compass’, and in a broader sense, as ‘policy management’. Practically all the world’s major companies have long since adopted this tool and now use it successfully, including Alstom. For example, Russian Railways uses the Hoshin Kanri technique on October Railway.

Hoshin Kanri is a structured, regular iterative process that results in a document called an X-matrix which outlines the general direction of the company development. The strategy is then deployed through plans of action embedded into each other (PDCA).

Hoshin Kanri process applied for an individual TMH plant is represented schematically in Fig.1. 1.

X-matrix of each level consists of four main blocks: the global goals, strategy, tactics, and quantitative objectives. At the same time, strategies and global goals at lower levels are inextricably linked with the tactics and quantitative objectives of the higher levels. Therefore, a change made on one level propagates rapidly and causes changes in all the others.

The principle of filling an X-matrix is schematically shown in Fig.3.

INTRODUCTION OF X-MATRICES IN THE TRANSMASHOLDING PLANTS
Currently the work on the enterprise development technical strategy is underway in the holding. Representatives of senior management from Alstom Transport are also involved. The following strategies are relevant for all plants: achieving a breakthrough in product quality, staff development, implementation of project management paradigm, cost management, and completion of the restructuring of enterprises. To ensure efficient implementation of the holding development strategy, the production system group conducted two-day workshops in February — April 2014 in all the holding’s plants giving the plant management hands-on training on X-matrices methodology. To date, top management of seven enterprises has undergone training: BMZ, NEVZ, TVZ, KZ, TsSM, DMZ, and MBM.
In preparation for the workshop, a plant level (L1 level) X-matrix was worked through with every CEO, this X-matrix being based in turn on the incoming data from the holding level matrix. The above strategies were supplemented by tactical initiatives of each plant. For example, for BMZ, 19 plant level tactics have been identified, including installation of two model line for main products, creating a new platform (TEM23), improvement of production planning, and revision of personnel motivation system. The actual project of the plant transformation, which had been started earlier, received a catchy slogan, “BMZ is the first in any train!”

During the workshop X-matrices for the main departments of the company were built: production departments, technical departments, and logistics and support departments (L2 level). Then the top managers presented their development strategies to heads of offices, who in turn created L3 level X-matrices containing tactical objectives of offices. Further, the heads of offices and production facilities ‘cascaded’ the tasks to heads of operating teams who made very specific action plans to achieve the overall manage-

---

**DMITRY DYAKOV,** Deputy Head of production, BMZ:

— We can assume that a few centuries ago Suvorov already tried to implement the alignment of production system... in the army. After all, he is quoted as saying, Every soldier must understand his maneuver. This is precisely the principle of cascading. When the commander sets goals, every soldier must not only know but understand his maneuver. Applied to our production, it means the following: a worker does not just come into the workshop and manufacture a part, but he must also know why exactly this many parts were ordered today, why it is necessary to optimize production space, how to improve production methods, how to implement 5S in the workplace, etc. This is one of the methods of production system, which helps to create a team capable of catching and seeing the situation changes, analyzing them, and producing and implementing a set of actions as a response to these changes.
Hoshin Kanri, the main tool for the implementation of the global strategy in the company

Currently, the plants adjust their X-matrices, striving for full interconnectivity between matrices of different levels. Particular attention is paid to working with process indicators, most of which can be found in the future unified dashboard of a plant.

RELATIONSHIP BETWEEN X-MATRICES AND DASHBOARDS
To make informed decisions, managers at various levels need to rely on accurate and timely business information. Dashboards store data about the

Hoshin Kanri, the main tool for the implementation of the global strategy in the company

CURRENTLY, THE PLANTS ADJUST THEIR X-MATRICES, STRIVING FOR FULL INTERCONNECTIVITY BETWEEN MATRICES OF DIFFERENT LEVELS. PARTICULAR ATTENTION IS PAID TO WORKING WITH PROCESS INDICATORS, MOST OF WHICH CAN BE FOUND IN THE FUTURE UNIFIED DASHBOARD OF A PLANT.

RELATIONSHIP BETWEEN X-MATRICES AND DASHBOARDS
To make informed decisions, managers at various levels need to rely on accurate and timely business information. Dashboards store data about the
efficiency and effectiveness of business processes taking place in the enterprise. These data are used for monitoring, analysis, and management.

In 2013, key performance indicators were adopted at NEVZ (Novocherkassk Electric Locomotive Plant), and the shop floor where EP20 Olympus trains were assembled was chosen as a pilot facility.

The experience was successful, and the plant management gained a cross-KPI system that enables quick and efficient data analysis.

Since the beginning of 2014, the holding is actively working on building a standard plant dashboard which would include all the most important enterprise KPI and be updated monthly. It is planned to operating teamially include to the 2015 business plan efficiency indicators for plants in addition to the performance indicators.

The most important KPIs that will be included in the panel are the following: the efficiency of the direct workers, the ratio of indirect vs direct employees turnover of raw materials, work in process turnover, and worked hours per year per 1 m² of production facility area.

In 2014, work on the construction of X-matrices was carried out under the supervision of production system group, and in the next year, this should become a routine task, a part of annual planning of an enterprise.

THE NEXT STEPS FOR THE STRATEGY DEPLOYMENT AT THE PLANTS

Most Russian companies, and TransMashHolding plants are no exception, have a very complex hierarchical structure with many levels. This means that
ALEXANDER ALBERTOVICH VASILENKO, General Director, BMZ:

To achieve these objectives, the company management has identified tactical problems to be solved in 2014. Next, business lines directors developed matrices for each service based on the plant development strategy matrix, and so on, down to the office level. This enabled us to bring the global goals and tactical objectives of TMH defined by the management to rank-and-file workers. That way, all employees become aware of their personal roles and their contribution to the strategic development of the company. At present, the task of the plant managers at all levels is to analyze the progress in achieving the tactical objectives and implementing action plans monthly to enable prompt response to possible deviations. This approach allowed us to systematize the activities of the various divisions within the objectives of the plant and to identify the target state of the processes.

problems cascading is a long process in which it is important to ensure full transparency and openness of the company development directions. Therefore, informing all employees about the upcoming changes is a key step in the strategy deployment. Awareness, understanding, and engagement: this is the chain of action for the staff of each enterprise. The important role here is played by corporate newspapers that must regularly broadcast key management decisions, publish information about the progress of work on the X-matrices, and talk about changes taking place in the enterprises.

A successful implementation of the strategy requires full support on all levels, so the plants are now working hard to find a catchy name and slogan for the project. The plant workers must not only learn about the company’s plans, but also understand their own role in this process — through the plant newspaper, at the meetings, and, most importantly, from their direct supervisors.

Vasily Volegov, Head of Prospective Development and General Support, BMZ, analyzes the X-matrix together with Andrei Kostin, Head of Direction, TMH Production System
Russian Railways are constantly being upgraded and therefore are in need of rolling stock that conforms to the best international standards. This presents manufacturers with a nontrivial problem, the need to organize the work so that innovations and advanced technical solutions are generated almost continuously. Today, complying with this condition is a key factor that ensures preservation and expansion of market share.

IN THE RECENT YEARS TRANSMASHHOLDING FOCUSED ON RESTRUCTURING OF ITS RESEARCH AND DESIGN UNITS TO BRING THEM IN ACCORDANCE WITH MODERN REQUIREMENTS. ONE OF THE LARGEST PROJECT WAS THE CREATION OF THE TRTRANS ENGINEERING CENTER WHICH WAS A COLLABORATIVE EFFORT OF THE HOLDING AND ITS STRATEGIC PARTNER, FRENCH MACHINERY MANUFACTURING CONCERN ALSTOM.

RTrans specializes in the design and development of modern rolling stock for railways. The two partners (TransMashHolding and Alstom) own it in equal shares. The engineering center is a legal entity registered in Russia, and it owns the results of the joint development. Thus, it is a full-fledged Russian research center.

In the city of Novocherkassk, where the largest enterprise locomotive-
experience sharing

building plant owned by TransMashHolding is located, there is a branch of TRTrans that focuses on development of leading-edge electric locomotives.

Currently it has 11 business units, including the departments of quality management, mechanical integration, electrical systems, validation and testing, control systems, and others.

The branch is equipped with modern computers and graphic stations, as well as with advanced software such as CATIA, ENOVIA, ANSYS, HYPERMESH, Control Built, Test Stand, and other products used by leading developers and manufacturers of railway equipment.

To ensure effective collaboration, TRTrans has adopted a project method of work organization. The process of design uses 3D models development and computer modeling of the locomotive dynamics. Calculations of electrical, thermal, and electromagnetic processes are performed using the most advanced technologies in the world; finite elements method is used for calculating the strength of the locomotive structural elements. A particular attention is paid to electromagnetic compatibility.

BASED ON INTERNATIONAL EXPERIENCE

Achieving a qualitatively new level of development involves teaching modern methods of design and detailed study of the achievements of the world’s largest manufacturers in this field. The company managed to focus this experience in Novocherkassk by involving technical experts from Alstom. Foreign experts are working together with their Russian colleagues. Consultations of foreign partners helped to bring engineering and design work to an appropriate level of quality, reduce production costs and the costs for each project, including the disposal of obsolete locomotives. The long-term experience of All-Union Electric Locomotive Research and Development Institute, for many years the largest developer of electric locomotives whose staff created almost all Soviet locomotives, is also utilized. Some All-Union Electric Locomotive Research and Development Institute employees moved to the TRTrans team. Today it has 184 people in total.

QUALITY IS A FOUNDATION FOR SUCCESS

Ensuring the highest product quality has the highest priority in TRTrans. With respect to the development, production, and maintenance of software and hardware for locomotives equipment control and diagnostics has its own certified quality management system.

It is expected that in December 2014 the business management system will receive certification for compliance with the International Railway Industry Standard IRIS. This system will become an efficient working tool that will help TRTrans to streamline manufacturing business processes and strengthen the company’s position in the market.

According to TRTrans CEO Oliver Giacomoni, despite the fact that the company was founded relatively recently, it has set really ambitious goals:

— High quality in all areas (from appliances to delivery time and cost) should be the main driving force behind the company. This is dictated by the fact that competition in the Russian market of railway transport grows stronger all the time. The best way to win this competition is to provide high quality design!

To solve this problem, TRTrans now creates a new organizational structure, an important part of which will be an engineering center located in Moscow.
COMPETITIVE CHALLENGES REQUIRE A SYSTEMATIC RESPONSE
The main purpose of TRTrans reorganization is to become competitive and provide customers with offers addressing their requirements. Today, the client expects to receive the product (be it a locomotive, a subway train, or any other type of rolling stock), which from the very first day of commercial operation will ensure a proper level of reliability and readiness.

Although the creation of new locomotives largely involves the use of standard (albeit high-tech) solutions, there is still enormous potential of R&D planning improvement and monitoring the implementation of the best technological solutions.

These are the tasks that the engineering center is intended to solve. Its objectives include strengthening of technical competence in all areas of rolling stock, as well as running tenders and pre-project works (this was one of the purposes for which the mixed team of experts that includes Alstom employees was created).

In addition, special attention in the work of the center will be paid to areas such as quality and validation. To ensure success in this direction, both Russian and foreign experience will be actively used.

In particular, according to Jean-Christophe Loiseau, one of the founders of TRTrans Novocherkassk who is now a top bogie expert in the Moscow office, his team will develop technical feasibility studies for the entire product line of bogies to participate in tenders, including plans for their validation.

PROJECTS
There are two projects in TRTrans portfolio — a two-system passenger locomotive EP20 and freight electric locomotive 2ES5 working on alternate current, with both built on the same underlying platform.

Many features of these locomotives have been implemented for the first time in the world. Asynchronous traction drives are used for the first time in Russian electric locomotive building. For the first time a high speed two-system locomotive was created (EP20 can move trains at speeds up to 200 km/h). The design incorporated a substantial increase of time between overhauls compared to the previous generation of locomotives. This allows a significant reduction of locomotive’s maintenance costs and greatly improves the efficiency of fleet management. These and other technical solutions led, in particular, to more than 20 times’ reduction of labor costs for maintenance, increase TBO, and provide energy savings.

It is expected that new locomotives will be created based on this platform that best meet the technical requirements of customers. Due to the high level of...
unification (exceeding 70% in EP20 and 2ES5), the railroads get an additional opportunity to reduce the cost of training for engine drivers and mechanics, and reduce downtime due to the use of identical spare parts.

The implementation of such complex projects was made possible thanks to the coordinated work demonstrated by the Russian and foreign employees of the engineering center.

INTERNATIONAL RECOGNITION

In March, the Ambassador of the French Republic in Russia M. Jean Maurice Ripert visited the Novocherkassk branch of TRTrans. Sharing his positive experiences, he said that he was happy to see such a successful example of mutually beneficial cooperation between Russia and France. The Ambassador stressed that mutual trust is the most important thing in a partnership.

The collaboration between TransMashHolding and Alstom is based on high trust on both sides. And this is a solid foundation for a long and reliable relationship, said Monsieur Ripert.

The team members of TRTrans emphasize that the company plans to conquer not only the Russian market, but international markets as well. The embodiment of these plans in life is already very close.

Plains for the future

TransMashHolding reporter met the Director General of TRTrans LLC OLIVER GIACOMONI AND ASKED HIM ABOUT THE PROSPECTS OF HIS COMPANY.

— How does TRTrans feel in the Russian market?
— Competition in the Russian market is growing rapidly, and the company needs to offer the right product with the correct value. This forces us to develop new approaches to optimize costs. To this end, we develop a new affordable platform for freight locomotive that combines the best of 2ES5 locomotives and mass production TransMashHolding locomotives at a competitive price. Currently we are busy with opening a design center in Moscow, whose primary role will be to provide technical expertise for all TransMashHolding divisions, including the branch in Novocherkassk and new subdivision in Mytishchi near Moscow on the grounds owned by Metrovagonmash. There we, in partnership with Metrovagonmash, will develop the new platform for locomotive control monitoring and diagnostics system that will be used in the subway trains.

— What export opportunities do you see in the new locomotives produced by your company?
— We are currently preparing a proposal for locomotives for freight and passenger transport in Azerbaijan. We are also looking for development opportunities outside of Russia and CIS countries, mainly referring to niche markets of locomotives. We do not exclude any possibilities and we currently conduct negotiations in Africa, Pakistan, and Australia.

— What other companies, in addition to Alstom, are you working with?
— First of all I must say that the combination of different types of expertise provides a good mutual reinforcement and undeniable advantages for both our in-house experts and for Alstom representatives, which in turn gives us a competitive edge. Due to competent design, we can combine products of TransMashHolding and Alstom, take the best from both companies and fully meet all expectations of the Russian market.

We also cooperate with other joint ventures, such as RailComp and TramRus, helping them with complicated works or localization of components. In addition, we consider creation of a traction systems design center which would allow TRTrans to develop its own traction system for the Russian market.
The need to create such an electric locomotive with the power of 10,000 kW was due to the intensive construction of BAM and the ever-increasing railway cargo traffic. All of that dictated specific performance requirements for the new locomotives, the assemblies and details of which were to ensure stable operation in harsh environments of BAM and Central Asia at temperature drops from +40 to -60°C, with the towing weight of 288 tonnes and the design speed of 110 kilometers per hour.

AHEAD OF THE ENTIRE PLANET
Talking about the VL85 locomotive, one cannot help the endless repetition of «the first...». It is all true. This was the first 12-axle locomotive consisting of two 6-axle sections, with the body of each section resting on three 2-axle bogies. The traction and braking forces were transmitted to the body using slanted rods (instead of the conventionally used pins). For the first time in the world compressed suspension link supports were used for body mass transfer to the middle bogie, which allowed it to move freely in the transverse direction when passing curved sections of the tracks.

The locomotive engines were special too: NB-514 (the weight of copper used on each engine was reduced by almost 100 kg). Combined ventilation system was used, which allowed to cut the cost of electricity used for electrical equipment ventilation by almost 50%. For the first time in the domestic electric locomotive building practice, VL85 was equipped with automatic motion control which provided acceleration in traction mode using a preset current to a preset velocity and then maintained it, and a preliminary slowdown in the regenerative braking mode, maintaining a preset braking force in stopping braking mode and a preset speed when driving on slopes.

The efficiency factor of the locomotive reached 86%, which was the highest in the world for freight electric locomotives. A special attention was paid to improving traction properties of the new locomotive and its energy efficiency. Using regenerative braking enabled the designers team...
to save a significant portion of electrical energy due to its partial return to the contact network. The scientists of All-Union Electric Locomotive Research and Development Institute and the experts from Novocherkassk Electric Locomotive Plant achieved a 18–19 tons reduction of ferrous metals used in each locomotive, 10–12% decrease of assembly effort, and 15% reduction of nonferrous metals (wires and buses used for wiring).

A RAILWAY GIANT

Viktor Sverdlov, the former deputy director of All-Union Electric Locomotive Research and Development Institute who led the development of the electric locomotive, recalls: «This unique project was embodied in metal in the shortest possible time. All the assembly works for two pilot units were performed under supervision of the designers.»

«It’s hard, but fun!», said the workers involved in the assembly of the giant locomotive. After all, the locomotive was 12 meters longer than the standard one. This greatly complicated the wiring of the traction engines, and in addition to that there were six engines in each section instead of four.

Both electric locomotives passed their trial runs in the Novocherkassk Electric Locomotive Plant facilities. VL85–001 passed its dynamic testing and tracks impact tests in the North Caucasus Railways (Belorechensky testing grounds), and VL85–002 passed the tests of traction and power specifications in the All-Union Railway Transportation Research and Development Institute (Schcherbinka station). Then the locomotives were transferred to the Mariinsk — Krasnoyarsk — Taishet — Lena lines for experimental run. A government commission awarded the new electric locomotives the highest quality category and recommended them for mass production.

Machinists who have tested the new locomotive were delighted: «A 25% increase in the operator cabin volume, a significantly expanded view, an increased heating capacity, and the air conditioning added. The design of the cabin significantly changed, with separate consoles for the driver and his assistant replaced by a single dashboard occupying the entire front of the cab. The most modern means of multilateral radio communications were installed to facilitate our work. The soft seat dampens vibration. There is also the enhanced sound and heat insulation!»

In 1983, the main committee of the USSR Exhibition of National Economy Achievements gave the Novocherkassk Electric Locomotive Plant team a first degree award. A large group of Novocherkassk Electric Locomotive Plant and All-Union Electric Locomotive Research and Development Institute employees were awarded ENEA medals.

In 1984, Vikhorevka locomotive depot in BAM started receiving the new VL85 electric locomotives (with smoothly variable voltage of the traction motors) to replace the outdated VL60R. In total, 270 VL85 electric locomotives were manufactured to work in Krasnoyarsk, East Siberian, and Baikal-Amur mainlines. Today VL85 electric locomotive are operated in Nizhneudinsk depot (East Siberian Railway) from Mariinsk to the Borzya station.

Until now, VL85 electric locomotive remains the most powerful in the world, confirming the high quality of locomotives produced at Novocherkassk Electric Locomotive Plant that proudly bears the name of the Russian locomotive manufacturing leader! 😊
PRODUCTS AND SERVICES OF THE HOLDING:

- mainline and electric industrial locomotives;
- mainline and shunting locomotives;
- freight and passenger cars;
- electric train and subway cars;
- car casting;
- diesel locomotive engines and marine diesels;
- diesel generators and turbochargers;
- transport components;
- spare parts;
- repair and service maintenance.

OVER THE PAST FIVE YEARS, THE COMPANY HAS PRODUCED:

- over 3000 locomotives
- over 4000 passenger cars
- over 3000 electric train cars
- over 230 rail bus cars
- over 1500 subway cars
- over 2700 diesels

POSTAL ADDRESS:
Russia, 127055, Moscow, Butyrsky Val Str., 26, bld. 1

TELEPHONE: +7 (495) 744-70-93;
FAX: +7 (495) 744-70-94; E-MAIL: info@tmholding.ru
www.tmholding.ru

Transmashholding is NO. 1 IN CIS COUNTRIES in terms of the volume of rolling stock production and sales

Transmashholding is among WORLD’S TOP TEN LEADING MANUFACTURERS of railway equipment

Transmashholding is THE ONLY RUSSIAN COMPANY to have experience in creation and manufacture of the machinery for the arctic service

Transmashholding machinery is operated IN ALL CLIMATIC REGIONS OF THE EARTH

InnoTrans
International Trade Fair for Transport Technology
Hall 3.2 Stand 320