



INTERNATIONAL

MINING

Technology

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HALL OF FAME

## Aleksandr Egorov / SURFACE MINING



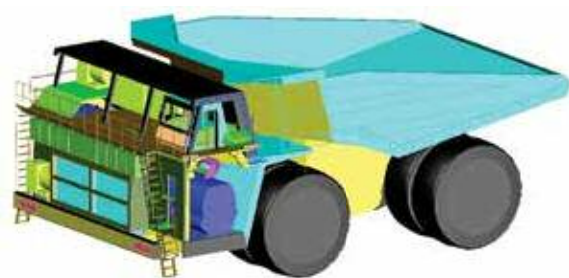
Aleksandr Egorov has devoted more than 40 years of his life to work at OJSC "BELAZ" with more than a half of this period being involved into research, development and implementation of many ambitious engineering projects, including but not limited to development of the 240-t and 360-t trucks, development of the autonomous truck, development of the first in the world 90-t truck with electric drive. All of these projects he was in charge of demanded the development of great many unique technical solutions, but none of them was probably as demanding as the project for the development of the mining dump truck BELAZ-75710 with payload capacity of 450 t.

One of many considerations behind the idea of the development of this project is connected with the consequences of the global financial crisis when the amounts of extraction of commercial minerals were decreasing together with the commodity prices. In these conditions mining companies will need new equipment with higher payload capacity, capable of moving bigger volumes of minerals in one cycle, providing lower operational cost due fuel efficiency in order to keep their operations running.



*1st assembled BELAZ-75710 truck at the factory*

It is also worth mentioning that the first attempt of creation of ultrahigh payload capacity dump truck (more than 400 t) was made by the engineering team under command of Egorov back in 97-98 of the last century. The concept was developed in response to the request made by Chilean copper mining company CODELCO. But although the concept was approved by the customer the practical realization of this project was not feasible due to unique design of many components together with various limitations of manufacturing capabilities.

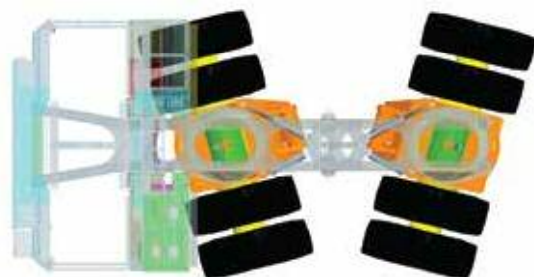


*The first ultrahigh payload capacity BELAZ concept with articulated frame*

Nowadays, having at their disposal more advanced technological levels of production capabilities and rich experience based on previously implemented projects, the engineering team under Egorov's command was able to develop this unprecedented product. Nevertheless, during the development process the engineering team had to face a wide variety of challenges and to invent unique solutions to resolve them. It would be worth to mention at least a few.

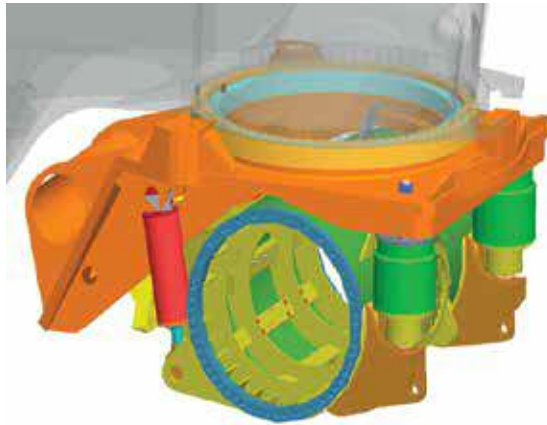
The first one is quite obvious. How can you achieve the 25% increase of payload capacity when there are no bigger tires available on the market? How you do provide the possibility of truck operation in the same conditions together with other super-size trucks without the need for the end-user to change the mine profile, road width or loading equipment? How can you provide enough power to move such a load without drastic increase in fuel consumption?

To solve these issues, it was decided to use eight tyres with the highest possible payload capacity of 105 t. But this in turn created new challenges connected with the arrangement of the wheels and steering schematic of the truck.



*Original steering kinematics design*

To address these challenges, the engineering team developed a unique suspension system that features two steerable axles on two semi-frames (see the picture on the left). This solution allowed not only to keep the rigid frame but also to remove a certain number of loads from it and achieve a turning radius of less than 20 m with all-wheel drive and four-corner electrodynamic braking on top of that with the application of two driving axles. In order to provide sufficient power, it was decided to use two engines with two electric drive systems (one per axle), which in its turn required development of the solution to match two drive systems to provide optimal control and smooth driving.



It was a hard hit-or-miss way and Egorov was entirely responsible and involved not only in developing ideas and concepts and finding a right solution from scratch for constantly arising challenges and issues. He also has done a lot to bring together and accommodate the opposed conceptions from different working groups in the engineering team and to keep the project moving in the right direction.

In 2013 the first pilot truck was manufactured in metal and even the first trials at the factory testing grounds proved the correctness of the applied technical solutions for the design of the dump truck. Field testing in the tough operational conditions in the Kuzbass region (Russia) revealed further benefits of the truck design, including 15% fuel economy due to optimal settings of the engine-alternator units (when driving without load the truck automatically switches to using only one engine) compared to 360-t BELAZ trucks working in the same mine. Dynamic unloading due to the powerful hydraulic drive allowed to compensate additional time for loading of the larger volume body. Initial concerns in regard with tyre wear due to use of four dual tyres proved to be wrong. Application of the innovative steering kinematics provided excellent maneuverability and showed a 10% decrease of tyre wear compared to the traditional 2x4 wheel arrangement of the mining trucks operated in the same conditions.



*BELAZ-75710 in operation*

Due to all of these reasons the operating company placed an order for two more BELAZ-75710 trucks prior to the end of the testing period.

Since the production of the first truck the engineering team under the command of Egorov has been awarded more than six inventors certificates for different units and systems of the dump truck. The unique suspension design was honoured by the Swedish Steel Prize (an engineering contest held by Swedish steel manufacturer SSAB). The truck achieved two entries in the Guinness World Records book.

By the end of testing period (end of July, 2017) the truck moved more than 6 Mt with total mileage of more the 70,000 km.