

Development of Siberian Transportation

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Abstract—The article proposes the transport system in which the vehicle "Monolet" is capable to provide high weight return on size of commercial loading, at the expense of power supply from the sources which are put out of the vehicle.

Keywords—new transport system, single-rail railway, modes of transport, aerodynamic elevating force, monolet

I. INTRODUCTION

The projects of high-speed highways, implemented by JSC "Russian Railways" and those which are still in the stage of coordination, are focused only on the carrying out of passenger transportation, and also cover mostly Central part of Russia, while the transport system of the Eastern Trans-Urals of the country has not been developed significantly for more than a quarter of the century. At the same time, the material resources of the people's well-being, concentrated on the surface of our planet and in its depths, on the territory from the Urals to the Pacific ocean, almost not covered by the population and means of control and protection, are still considered to be the richest in the world, and are constantly in the focus of greedy views from all borders. Their effective development and protection depend primarily on the reliability of transport links. The entire Eastern Trans-Urals region of the country has, in fact, one efficient, strategically important highway for road, rail and air transport, which are located along the southern border and connect the same major industrial centers. These thin links no longer meet the modern requirements of operation; they malfunction more and more often, threatening economic and man-made disasters to huge regions.

There are practically no reliable transport links, except for air and water routes and roads of local importance, in the meridional direction. Local roads are not able to grow into highways if they do not connect major junctions. Today we can not seriously talk about the creation of such things taking into account the situation with the country's economy.

In our opinion, the disadvantages of the transport system of the Eastern Trans-Ural region, which serve as a deterrent to its intensive development, are primarily due to the untenable for this region concept of the development and the control of its living space, based on the idea of creating stationary land transport links, the main basis of which is a solid roadbed. Geotectonics of the region, climatic conditions and the length of these relations require enormous costs for the country to create and maintain them. The necessity to include tunnels in the transport network, dictated by the conditions of the terrain, increases the vulnerability of the track and the danger of the transport process (a vivid example of the construction of the Severo-Mujski tunnel).

Unfortunately, today the situation with the country's economy is determined, to a large extent, by the ability of the authorities to dispose properly the raw materials and fuel resources granted to us by nature. Along with the need to

increase readiness to respond to serious challenges relating to the country's defense, this task puts forward increasing demands for the development and modernization of transport links.

Thus, the purpose of strengthening the defense capability, along with improving the efficient development of natural resources of Siberia, the Far East and the North of the country, makes it necessary to search for opportunities to rationalize Russian transport links in non-traditional areas, both for our own needs and for the needs of the world community.

II. ANALYSIS OF PROSPECTS OF APPLICATION OF KNOWN TRANSPORT SYSTEMS FOR THE EASTERN TRANS-URALS ZONE

A. The use of the territory of Russia for the rationalization of world transport links can reduce dramatically the mileage of goods and passengers between the points of Europe and Asia. Despite the fact that the range of sea crossings between them is 30-35 thousand km, a relatively cheap and highly reliable railway from the Western to the Eastern border of Russia is particularly attractive.

The lack of technical equipment of the country's railways, including the Trans-Siberian railway, which was built in the XIX century [1], is a significant obstacle here. At the same time, the mileage of goods by rail between Moscow and Vladivostok exceeds this distance in the shortest direction by almost 2 thousand km, which can be implemented in modern conditions.

The solution to the problem can be the construction of a new high-speed double-track with a gauge, adopted in most countries of the world, and using the latest technical solutions for the creation of high-speed rail transport. Carrying out the main task of ensuring international transit of passengers and goods, such a "superhighway" could serve as a basic support for the development of local transport links in the meridional direction, including non-traditional ways of technical implementation for Russia.

However, the concept of the development and the control of the living space, which is based on the idea of creating a stationary land transport links, the main basis of which is a solid roadbed, look untenable for the Eastern Urals of the country.

This applies equally (adjusted for the specific load per unit of vehicle) to the strategically important highway parallel to the main course of the railway.

B. Water and air routes are represented in the zone of the Eastern Trans-Urals by a limited number of transport links that meet the characteristics of highways: water, mainly in the meridional direction, air – in the latitudinal direction. This restriction is dictated by the small number of large industrial centers in the Asian part of the country – mounting groups for highways, which, in turn, is due to the weak motivation of population density growth.

Dependence on seasonal operating conditions reduces dramatically the decisive advantage of the water transport: the possibility of using high-capacity vehicles (as a result, for example, the constant problem of the Northern delivery).

Serving air routes, aeronautical and aviation vehicles do not require a solid roadbed as a route (the route is determined by the unsupported displacement in space, and, therefore, can have any shape in the plan).

However, a significant counterweight to the main advantage of these types of transport, which have high flexibility with a wide range of speed movement, is that they are restricted by energy use to enable autonomous flight.

C. Cable cars are used for short-and medium-distance transport. They are particularly effective in mountainous and rough terrain, where a number of indicators are superior to all other vehicles. The main advantages of cable cars are:

- low dependence on the terrain; large permissible slopes of the track (up to 500⁰) and spans between the supports (over 500 m) allow you to lay the track at the shortest distance and cross natural and artificial obstacles without building expensive artificial constructions;

- flexibility of the road route in plan, due to the possibility of using curves of small radii (up to 5 m) and large angles of rotation (up to 180⁰);

- low dependence on atmospheric conditions, providing the possibility of uninterrupted operation in conditions of snow drifts, ice, etc.;

- the possibility of full automation of loading, transportation and unloading of goods;

- the ability to provide passengers with high aesthetic satisfaction, unattainable in the use of any other modes of transport, by laying the route to the most picturesque places.

The idea of creation and development of cable cars in cities and surrounding nature protection zones provides the achievement of the goals:

- solving the problem of passenger transportation in cities without significant reconstruction and increase in the capacity of the existing road network;

- realization of the potential of natural resources while maintaining them, through the development of international tourism industry at a high scientific, technical and cultural levels;

- providing the mining industry with a reliable, high-performance, cheap vehicle.

Thus, the economic benefit is provided by the growth of technical and cultural equipment of a city, a kray, an oblast', and a region [2], if the method of getting income meets the high environmentally-friendly requirements.

However, providing high competitiveness in local transportation [3], the relatively low load capacity of cable cars makes it impossible to use them for the main transportation of goods for such categories as raw materials and fuel resources.

D. Single-rail railways belong to the section of special elevated overpassing roads, used mainly for transportation of passengers, occasionally, for transportation of goods (mostly within the territory of an enterprise, as short-distance/intra-plant transport). The main advantages of these roads are:

- the possibility of implementing high rates of construction using industrial methods and modern installation technology, as the bulk of construction work is represented by fitter's work and as a huge amount of excavation is excluded, which are typical for modes of transport, requiring a solid roadbed. At the same time, the practical work of the existing transport is not violated. The cost of construction of a single-rail railway in the cities is less than the cost structures of a subway by 2-8 times, a modern motorway by 1.2-3.0 times and elevated railway by 2-6 times. The experience of existing single-rail railways shows that the average level of operating costs for them is 15-30% lower than that of the tram;

- single-rail railways have a high capacity, approaching the capacity of a subway, while the average operating speed at the known single-rail railways, operating within the city limits, is 1.5-2 times higher than the average speed of a subway;

- a high degree of reliability of single-rail railway is associated with independence from other types of transport and the ability to automate the process of movement at the modern technical level. A striking example is the trouble-free operation of the Wuppertal single-rail railway, operating since 1901;

- independence of operational characteristics from climatic and urban conditions and significantly lower dependence of the form of the track in terms of the complexity of the terrain, compared with the types of transport, requiring a solid roadbed.

However, the possibility of using single-rail transport for cargo transportation is limited by the carrying capacity of the track, which reduces its advantages over railway transport.

A common advantage of technical solutions [4-8], in addition to those specified in the general characteristics of cable and single-rail railways, is their ability to produce minimal pressure on the track when moving in its guides.

However, the carrying capacity of the transport systems included in the review, as well as in general elevated traffic connections, is limited. The biggest disadvantage of the modes of transport that do not require a solid roadbed, is that they are uneconomical for transportation of goods of such categories as raw materials and fuel resources.

The results of the analysis made it possible to formulate the purpose of the study: to create a transport system for Siberia, the Far East and the North of the country, independent of climatic conditions and the shape of the terrain of the operation zone that meets the requirements of high weight return on commercial load, at high speed and range.

III. ARGUMENTS FOR THE POSSIBILITY AND FEASIBILITY OF USING "MONOLET" FOR THE NEEDS OF SIBERIA, THE FAR EAST AND THE NORTH OF THE COUNTRY

The railway vehicle "Monolet" is protected by the patent for the invention of the Russian Federation № 214891 [9]. "Monolet" is a vehicle which body is provided with a structural

element made with the possibility of creating the aerodynamic lift during its movement, and mechanical means of connection with a fixed trackway, characterized by the fact that it is made with the possibility of using a conductive track on the high-speed railway sections as a carried, suspended to the vehicle element of the transport system, made as a cable-current conductor.

The very setting of the problem of creating such a mode of transport involves the development of new directions for scientific and technical support of its solution [10-11]. Here are the most obvious ones:

- while maintaining the categoricity of the railway, the new vehicle should have the qualities inherent in the aircraft;

- the power equipment, making a vehicle move, becomes combined, as in this case, there is an advantage of electric traction in combination with a jet thrust or power of the propeller, the horizontal thrust for high-speed traffic along the route, can be promoted by creating a vertical thrust, to reduce the pressure on the track;

- the structure of the construction of the route in comparison with the known transport routes with a solid roadbed changes radically, because the new mode of transport requires acceleration sections with a strong load-bearing rail and small spans between supports (near stations) and marching sections with a light rail and increased spans, which realize fully the ability of the vehicle to use aerostatic and aerodynamic forces, as well as vertical thrust of engines to reduce the pressure on the track (on long hauls), up to ensure the ability of the vehicle to carry the route on itself.

The task of creating such a vehicle has sufficient experience in solving the problems of creating and developing transport equipment by industry:

- engineering development on the creation of bodies of elevated and underground vehicles meeting the requirements of aerodynamics, is similar to the development of aircrafts;

- since along the entire route, the single-rail carrier can be (be equipped with) a current conductor, then the launch of aircraft engines attached to the vehicle and the adjustment of their work during the entire process of movement, as well as duplication in order to increase the total power of the power equipment, can be carried out with the help of electric traction motors at constant and alternating current, in the use of which sufficient experience has been gained [12];

- the experience gained during the creation of short take-off and landing aircraft using power equipments with a change in the position of the thrust vector, from vertical during take-off to horizontal in a cruise flight, can be successfully used to reduce the pressure on the track in all sections of the route;

- the route is a combination of the accelerating section, - an analogue of the airfield, - meeting the requirements for the railway track by its beneficial characteristics, [13] and the midcourse section, - an analogue of the railway track side, - to which strength requirements are reduced significantly by the use of the vehicle properties inherent in air transport; the task of creating a rail, on which a vehicle moves, can be transformed into the problem of creating a vehicle carrying a line conductor

defining the trajectory of the route that relieves designers from having to increase the rigidity of the carrying single-rail with the increase of the loading capacity of usual modes of transport which use it;

With full confidence it is possible to approve technical possibility, and creation of the offered mode of transport considering an urgent need of the country for the development of new transport links, and economic reasonability [14].

Unique in its vast territory, Russia needs this type of transport for a quick access to its natural resources, including the development of transport links in the meridional direction.

IV. PROSPECTS OF REALIZATION OF THE IDEA OF "MONOLET"

The XX century can be called the century of aviation. Indeed, the most daring technical ideas and the most advanced technologies of the century have been applied in this industry. It was aviation that became the bridge for a step into interplanetary space. However, with all the great successes of the technological progress accompanying the development of the industry, the modern aircraft was not found worthy of comparison in the biosystem of the Earth, created by the most consistent and the most rational designer – Nature.

The combination in one vehicle of the two functions of reference and reference-free motions raises doubts about the correctness of the choice of the way from the very beginning. If we consider that, excluding cases of deliberate targeted destruction of an aircraft in the air, almost 100% of flight accidents, including the most severe accidents, happen on the take-off and landing mode, then this doubt becomes more than justified.

An aircraft must fly!

A surface vehicle must move on the ground!

A monolet is quite capable of becoming an intermedium in this chain.

The task of creating a "mobile airfield", a carrier aircraft which is capable to carry aircrafts on its surface and serve as a take-off site for them, providing their movement with a high starting speed when launching an aircraft or the possibility of stopping their independent flight (landing) while maintaining a high speed of movement relative to the ground, becomes feasible.

At the same time, the "Monolet", as an overland mode, which is practically not shot down aircraft carrier, or which as a high-load and high-speed vehicle can transfer troops and military equipment, meets fully the concept of the defensive strategy in the formation of the Armed forces of the country, providing the opportunity to manage a small, highly professional army.

While moving over the plains of the land, in the tundra, over the water surface, the "Monolet" is able to use the screen effect productively to create additional aerodynamic lift, so that the prospect of using it in Equatorial waters as a launch site for launching spacecrafts does not look fantastic. In this case, it is only necessary to learn how to lay the route in the sea space

using, for example, the available experience of creating fixed floating facilities such as offshore oil rigs.

Finally, it is possible to bring back to life the fleet of domestic aircraft (TU-134, TU-154, etc.), sent to the parking place because of the loss of interest to them from air carriers' side; to give a new impulse to the development of technical ideas of talented aircraft manufacturers in Russia; in fact, to implement the integration of transport systems of the country.

Russia, having the largest territory, has areas with the relative lowest population density, which means, in fact, undeveloped areas. The development of the suggested transport system will allow access to these areas without the establishment of expensive fixed base points. This is especially important for the development and operation of the polar regions of the Earth, the potential of which is now investigated a little more than at the beginning of the polar expeditions. Finally, the simple need to maintain the life of the Northern cities of the country is a sufficient argument for the creation of the offered system.

The solution problem of the creating reliable transport links in the zone of Siberia, the Far East and the North of the country in non-traditional for Russia directions, including the transport system "Monolet", should be started, taking the basic railway transport system as the most effective for the implementation of long-distance transportation, improving dramatically the quality of scientific and technical support. At the same time, it is advisable to create a single integrated experimental base for solving research problems, taking into account the close integration of transport modes in the transport system of the country [15].

A wide range of issues (technical, organizational, scientific and economic) remained outside the field of the view of the developers. However, there is full confidence in the necessity to try to implement it. This confidence is based on the quite predictable quantity of benefits in many areas of scientific and economic activities of the zones of Siberia, the Far East and the North, for example:

- in the creation of sustainable transport links in the meridional direction, including the solution of the "Northern delivery» problem [16];

- in the development of the polar regions (taking into account the predictable upcoming struggle for the possession of the expanses of the Arctic, and then probably Antarctica);

- in creation of fixed elevated intercontinental "transport bridges»;

- it will give a new impulse to the improvement of domestic aircraft, as well as will provide an opportunity to revive the mobile strategic defense at a qualitatively new level, responding to the defense concept of the Russian Armed forces formation;

- it will allow us to come close to the solution of the problem of launching spacecrafts from the Equatorial regions of the world ocean.

V. CONCLUSION

These arguments make it possible to move to the stage of a real design of the suggested transport system with the formulation of reachable and feasible:

(A) project goals and objectives:

- to strengthen the country's defense capability;
- to set up a new field of activity for the emergence of high domestic technologies;
- to balance economic potential and living standards in the regions [17];
- to ensure a decent occupation for the younger and future generations of Russians throughout the country;
- to rationalize the use of Russian transport space for its own needs and the needs of the international community.

B) actions to achieve the set goals:

- to develop methods and devices to perform a full range of research works for the railway transport system in static conditions;
- to conduct project research in the development of non-traditional for Russia transport systems and adapt the resulting research complex to the problems of the design and experimental development of these systems.

It is obvious that the solution problem of creating reliable transport links in the zone of Siberia, the Far East and the North of the country should be started by taking the basic railway transport system as the most effective for the implementation of long-distance transportation, improving dramatically the quality of scientific and technical support.

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