Full range of freights & full range of distances - with consistently high efficiency

* High speed (up to 500 km per hour) intercity and international cargo and passenger transport systems with capacity up to 500,000 pass. per day.

* High productive transport systems (up to 250 mln. tons per year) and also rail-string pipeline systems with external drive and also tube-string pipeline systems

* City public transport systems with capacity up to 25,000 pass. per hour and also horizontal lift systems with long (up to 2 km) span distance.

* All the string transport systems are effective electricity & information cable transmitting systems based on supporting and anchor columns

* Universal (multifunctional) truss-string transport system for simultaneously carrying several above mentioned string transport systems
High speed (up to 500 km per hour) intercity-international cargo-passenger transport systems (up to 500,000 pass. per day)
City public transport systems (up to 25 000 pass. per hour) and also horizontal lift systems with long (up to 2 km) span distance.
High productive transport systems (up to 250 mln. tons per year) and also rail-string conveyer systems with external drive and also tube-string pipeline systems.
High-rise transport for the sea-shelf development tube-string pipeline transport systems electricity & information transmitting with cables carried by intermediate and anchor support columns
Distinguishing constructive features

• HIGH RATES OF TECHNICAL & ECONOMIC EFFICIENCY

at all the stages of the practical implementation of the projects (design, construction and maintenance) due to the complex of know-how in design, technological, organizational & operational aspects.

• RAIL-STRING & ABOVE THE GROUND TRACK SUPPORTING STRUCTURES

lightweight and thin, placed above the ground on columns, continuous (without temperature joints), reinforced by pre-stressed (by stretching) strings and rail-track structure.

• ANCHOR SUPPORT COLUMNS

(number of ASC – about 1%)
close the longitudinal forces in strings & track supporting structures on the Earth surface crust

• INTERMEDIATE SUPPORTING COLUMNS

(number of ISC - about 99%)
support track structure and bear mainly vertical loads and horizontal wind and other side loads

• RAIL-ROLLING STOCK

it is always steel wheels rail transport with automotive algorithms of organization of and motion control
Lightweight & thin, placed above the ground & continuous rail-string track supporting structure

• Pre-stressed by stretching continuous HARD (left) & SEMI-HARD (right) RAIL-STRING used for light and medium freight, public city and high-speed string transport systems, including the horizontal lift between high-rise building (skyscrapers) with a large (up to 2 km) in-between distance.

• Pre-stressed by stretching continuous RAIL-STRING TRUSS-TRACK STRUCTURE used for heavy freight, high-speed and intercity & international, and also for heavy multifunctional string-truss transport system
Anchor & Intermediate supporting columns

- Anchor columns (with 2-3 km span distance) are used for loopback longitudinal forces arising from the pre-stressed continuous string and rail track structures. Intermediate supporting columns (with 40-60 m span distance) are used to support pre-stressed continuous string and rail track structures bearing mainly vertical loads and also suffer some side horizontal loads.

- The optimal above the ground height for all types of supporting columns is 4-6 meters. In case of necessity at some segments the height could be 1 meter and lower or about 10-20 meters and higher.
- The supporting columns could be made of reinforced concrete (modular or monolithic), welded steel, composite or high-strength aluminum alloys materials.
- The basement of supporting columns depending on grounds load bearing capacity could be pile (knock-in, screw, etc.), or slab - monolithic or modular.
Rolling stock: UNI-buses & UNI-cars

• ROLLING STOCK is always with steel wheels for rail track with dual restraints:
  - passenger UNI-buses (city public and high speed intercity-international transport systems);
  - freight UNI-cars (for bulk, piece and special cargo).

• For the decrease of innovative risks the UNI-buses & UNI-cars elemental structure is based on using only the best of finished product samples from leaders of appropriate industries.

• The special steel wheel and steel rail profiles provide the following results:
  - minimum wheel rolling resistance;
  - reduced abrasion and noise;
  - reduced contact stresses;
  - improved durability & safety.
Rail-string transport infrastructure

- The rail-string infrastructure includes: passenger stations and terminals, loading and unloading freight terminals, service & garages parks, charge stations, turnout switches, control system, power-communication systems, etc.

- The turnout switches are combined with stations, terminals, garages and parks - built on joint with anchor support columns heavy basement. Depending on speed range the turnout switches could be “low-speed”, “speedy” and “high-speed”, and depending on traffic regime – “with break in movement” and “without break – on the run”.

- Initially compact and lightweight rolling stock with high speed & repetition rate - reduce the size (consumption of materials) and the cost of all infrastructure elements in comparison to infrastructure of the traditional railway.
String-technology KNOW-HOW is not only a string tension forces closing diagram

• materials for strings, for body and rail head, for body fillers of supporting string-rail track structure;
• methods of engineering calculations in respect to specific pre-stressed continuous structures parameters;
• engineering solutions and design for: - strings reinforcing ropes formation and the anchoring, technology of fabrication, - transportation and installation of kilometers long string-rail track and/or string-trusses into one for the entire route; - high speed, safety and comfortable rolling stock;
• unique algorithms for automated control, serving technologies, maintenance procedures etc.

• as well as dozens of other KNOW-HOW that are essential for the establishment consistently high efficiently string transport system, which is ready to meet any extreme climate or extreme terrain conditions.
Innovative string technology

• The innovative nature of string technology is largely formed by additional synergy, which is composed of "simple and clear" solutions, each of which individually is well known to any engineer educated person.

• The practical implementation of the projects based on string technology assumes using only the best of finished product samples from leaders of appropriate industries in its elemental structure.

• Also string technology initially constructed to meets all the stringent technical, environmental and other requirements of local regulations of the construction of bridges and railways, rolling stock and engineering infrastructure objects, etc.

• Due to all that features really innovative string technology virtually has no innovative component within investment risks.
Low CAPEX factors

• material consumption reduced up to 300 kg per meter of string-rail track structure due to a special pre-stressed string reinforcement closed to the ground;
• reduced the complexity and the content of the construction works:
  - exclusion of the preparation of large linear areas (less 100 m² for 1 km need);
  - foundation works content - screwing or knocking pile at every 30-50 m span distance, so the geological underlay study and project-design works are also simply and short implemented;
  - all four seasons construction works (especially for permafrost, swamp, flooded etc. terrains)
  - very high level of industrialization and productivity with labor intensity reduction and so very high quality of welding with the reducing the amount of welding seam longitude;
• independence of material consumption and labor intensity of the terrain conditions;
• scalability of the string-rail track structure and rolling stock for the definite transport task;
• high load capacity to rolling stock weight coefficient (K = gross / net);
• high cargo transmission speed and high repetition rate (no peak loads) reduces rolling stock park and dimensions of terminals, stations, depots and other infrastructure;
• full automation of freight rolling stock, which reduces:
  - rolling stock cost as to excluded cost of creating the driver's working space;
  - full automation of traffic organization (without driver's subject) simplifies the control algorithms and increases the reliability and safety of the whole system;
• use of traditional materials and standard components, assemblies, and process equipment.
Low OPEX factors

- **minimum energy consumption due to:**
  - minimum steel wheel (by steel rail) rolling resistance;
  - innovative (string-logic) aerodynamic contours, esp. for the high speed rolling stock;
  - recovery of energy between cargo & empty rout directions and down- & up- rout segments;
  - minimum or no peak operating regimes due to
  - scalability of all the transport system elements (track, rolling stock and infrastructure);
  - product pipeline traffic organization logic;

- **reducing the number of personnel and payroll savings through:**
  - automation of the rolling stock, i.e., without drivers;
  - absence of unstable track embankments (serving and maintenance works reduction):
    - clearing the rail track from snow and ice, etc.;
    - serving of with auto-routs intersections, security guard of infrastructure, etc.;
    - repairing and serving of embankments bank, retaining walls and culverts, etc.

- **multiple safety factor, durability and units**
  - increased repair and service periods;
  - reduction of accidents and the low insurance costs;

- **all weather and season operation.**
Active and passive safety

• «The second (above ground) level" means: - not collision with rolling stock of any other transport systems, agricultural and other machinery, pedestrians, domestic and wild animals; - resistance to floods, earthquakes, tornadoes, landslides and other natural hazards; - perfect visibility of the track structure and rolling stock.
• Dual restraint flanges or rollers, each wheel independent suspension and high aerodynamic performance body provides high resistance to lateral wind hurricane, heavy rain, snow, hail, icing, fog, sand and dust storms.
• High evenness way, no joints in the rails, and the rough makes the high speed motion smoothly and safely. Undermining several supporting intermediate columns will only increase the distance of the continuous spans and the track will keep its performance (but at lower speeds). Undermining the anchor supporting column requires hundreds of kilograms of explosives.
• The evacuation of passengers on the ground provided by means of like aircraft and climbing rescue equipment - hoses, ladders, tow trucks. Also the emergency transportation to the nearest station is available.
• Active safety is provided by: duplication and even triplication critical units, regular testing of the track structure and rolling stock park; fires detection and automatic firefighting systems, life support in emergency situations systems, collecting and display of all of the information to a central control center.
• String transport has the highest in building construction and in transport minimum 10-fold safety margin on the carrying capacity and durability.
Social-economic effect

• effective instrument of resolution of social and economic problems - development and settlement of remote and resource-rich areas, the development of above-street urban transport and expanding the boundaries of the cities with better living comfort, the convergence of trade (especially food) markets, good transport access of remote regions;
• revival of the economy through the balanced development of all the regions in of the real sector of the economy, education and science, the formation of new centers of social and economic growth, the increase in the gross national product, national income and the tax base of federal, regional and local budgets, the creation of a large number of employers;
• strengthening geopolitical influence in the world by offering effective transport linking technology between Europe, Asia and the East, the expansion of the resource and innovative potential of companies, whole countries and world economy;
• reduction of energy consumption (coal, oil, gas, hydro, nuclear etc.), non-metallic materials, ferrous and nonferrous metals, decreasing of environmental pollution and from conservation of millions of hectares of natural landscapes and fertile land under newly build routs, decrease the harmful impact to humans, animals and plants, and other ecosystems, lower emissions, noise, electromagnetic fields and other factors of negative anthropogenic impact of the transport sector on the environment and humans.
String transport promotion strategy

• The mere economic efficiency, even uniquely high, not enough for any innovative transport technology to be effectively competitive with traditional technologies. The advantages of traditional transport technologies - the dozens of years of successful operation, the practical visibility of million kilometers of existing routes in the world, as well as well-functioning - scientific and educational, engineering and design, manufacturing and operation - infrastructure, and of course, the consumer market standard transport services.

• Therefore, the string transport technology start-up market field lies in the transport supporting of either remote and resource-reach areas with the extreme climate and topographic conditions, or over crowded with on-ground traffic megalopolis - where the traditional transport systems (auto, rail-way, etc.) either not effective or simply have not technical solution, and the string transport stays the only possible solution with the highest standards of efficiency and safety.
DEVELOPMENT OF ANY MINERAL FIELD NECESSARILY INVOLVES THE SOLUTION OF A COMPLEX TRANSPORTATION AND LOGISTICS PROBLEMS

(on the stage of mineral field development – delivery of)
- CONSTRUCTION MACHINERY AND WORKERS
- BUILDING MATERIALS AND CONSTRUCTION MODULARS,
- MINING AND PROCESS EQUIPMENT

(on the stage of the field exploitation – delivery of)
- PERSONNEL ON FIELD AND BACK
- RESOURCES FOR THE PRODUCTION NEEDS
- MINED MINERALS TO THE CONCENTRATOR PLANT
- CONCENTRATE TO ITS CONSUMERS AND FOR EXPORT

UNITSKY STRING TRANSPORT
NOT DEVELOPING OF MOST ALREADY EXPLORED AND UNIQUE MINERAL FIELDS IS EXPLAINED BY THEIR INACCESSIBILITY

THE MAIN INACCESSIBILITY FACTOR IS LONG DISTANCE WITH EXTREME CLIMATE AND TOPOGRAPHIC CONDITIONS:

• EXTREMELY HIGH OR LOW TEMPERATURES, AS WELL AS ANNUAL CHANGES IN TEMPERATURE IN THE RANGE OF 100°C;
• AREAS OF PERMAFROST, SNOW AND ICE, SWAMP AND FLOODED SITES, FORESTRY OR SENSITIVE TUNDRA, OFFSHORE, MOUNTAINOUS TERRAIN, SANDY DESERTS, RUGGED TERRAIN AND THE LIKE;
• MANY OTHER CLIMATIC AND TOPOGRAPHIC FACTORS INCREASING CAPEX AND OPEX.
THE DEVELOPMENT OF REMOTE AND RESOURCE-REACH AREAS WITH EXTREME CLIMATE AND TOPOGRAPHIC CONDITIONS BY MEANS OF TRADITIONAL TRANSPORT SYSTEMS COULD BE EITHER NOT EFFECTIVE OR SIMPLY HAVE NOT TECHNICAL SOLUTION.

RAIL-STRING TRANSPORT TECHNOLOGY IS SEVERAL TIMES MORE EFFECTIVE AND COULD BE REALIZED WITH ANY EXTREME CLIMATE AND TOPOGRAPHIC CONDITIONS.
TUBE-STRING PIPELINE SYSTEMS
as a part of multifunctional
above-ground transport system
Tube-string pipeline system – MIN CAPEX

• Several times low (then underground pipeline) materials consumption, design & construction works complexity and terms - all this is due to the fact that a string-tube pipeline is:
  - unloaded from bending and any other external loads during all project stages - transportation, construction and operation;
  - pre-stretched in the longitudinal direction, which means no temperature compressive and flexural stresses, and pre-compressed in the radial direction, which means less resulted working pressure of the tube walls;

• No contact with the ground and the perfect straightness of string-tube pipeline means:
  - completely elimination or reduction of the following works (and costs) – preparation of linear areas (drainage, logging, alignment, etc.), building of construction and infrastructure support transport system for pre-delivery of machinery, materials and workers, building of pipeline electro-chemical protection and hydro- and thermal insulation, selection of transported gas;
  - other content, reduced volume and terms of pre-project, design and construction works, as well as excavation and foundation work, limited by screwing (or knocking) piles with minimum negative impact on the environment;
  - the highest level of construction works industrialization while reducing machinery size and park, providing initially perfect transport accessibility and electricity power supply.
Tube-string pipeline system – MIN OPEX

• Much more low inner pipeline walls liquid (gas) friction energy losses due to the perfect linearity and better internal surface wall mirror;

• No hydro (gas) shocks due to eliminated temperature compensation «П» pockets;

• Much more low repair and maintenance work complexity (and costs) due to:
  - much more long treatment segments (temperature compensation «П» pockets);
  - reduction of rainfall (less resistance to fluid and/or gas flow);
  - reduced costs of preventing accidents measures;
  - reduced time and cost of possible accidents consequences eliminating;

• Much more low environmental damage to string-tube pipeline rout territories:
  - non-infringement of hydrology of ground, surface water and flood waters;
  - the absence of obstacles to the free movement of animals, people, machinery etc.;
  - effective prevention and rapid elimination of the consequences of possible accidents;

• Several times higher durability of all and any string-tube pipeline elements.
Despite the high degree of innovation and a lot of engineering, construction and technological know-how

**STRING TRANSPORT SYSTEM**
**IS DESIGNED AND CONSTRUCTED STRICTLY IN ACCORDANCE WITH THE TECHNICAL, ENVIRONMENTAL AND OTHER REQUIREMENTS OF RUSSIA, UN, EU AND US STANDARDS**

for the purpose of design and construction of bridges, overpasses, pre-stressed structures, railways, auto-roads, business and industrial buildings, transport infrastructure, automation and control systems, power supply and communications, passenger and cargo rolling stock construction, as well as its components, assemblies and systems.
String technology – HISTORY & STAGES

1977 – 1994
- 1-st apply for invention by Anatoly Yunitskiy
- 1-st publication in scientific journals of the USSR.
- Recognition of the string technologies by Cosmonautics Federation of the USSR and 1st grant.
- 1-st International Scientific-Practical Conference on String Space Technology;
- Popular science film about string technologies and its author Yunitskiy;
- Soviet Peace Fund Grant to build Design Office in Gomel.

1995 – 2000
- Scientific school foundation and the 1-st scientific monograph on string technology by Anatoly Yunitskiy;
- 1-st prototype models and there test in a wind tunnel;
- 1-st UN grant;
- 1-st generation of string technology.

2001 – 2009
- 1-st full size string rout in Moscow region;
- 2-nd UN grant;
- Receiving 36 patents;
- Design company “Unitsky String Transport Ltd” foundation in Moscow and design office in Minsk;
- State contracts with the administrations of:
  - Krasnoyarsk Territory;
  - The city of Khabarovsk;
  - The city of Stavropol;
  - Khanty-Mansiysk;
- The President of the Russia support at a meeting of the State Council dedicated to innovation in the transport sector;
- 2-nd generation of string technology.

2010 – 2013
- Design school in Minsk foundation;
- 3-d generation of string technology which meets the standards of RF, UN, EU & US to enter the global transport market;
- Design and engineering companies in Australia and the UK foundation for the certification of technology and access to the international market with 4-th generation string technology.

UNITSKY STRING TRANSPORT
The World 1-st full size rail-string rout in Moscow region

- longitude — 150 m
- supporting column height — up to 15 m
- span distance — up to 48 m
- maximum rout slope — 10%
- material consumption — 120 kg/m
- string (stretch) tension — 450 ton
- rolling stock weight — up to 15 ton

Within 2001 - 2009 years it was implemented more than 100 tests and experiments with the string construction for different loading and weather conditions. It was selected special materials and optimal design solutions. It was examined validated calculation methods. It was received more than 15 expert opinions. As a result, next 4-th generation of string-technology developed and prepared for certification and practical application.
String transport — RECOGNIZED TECHNOLOGY

1977 - string technology development start.
1994 – 1-st apply for invention on string technology.
More 5 billion rubles (at present time) and also more 1000 person-year engineering labor spent on Scientific-Research, prototyping and testing, patent protection and promotion.

More 30 diplomas and awards

More 15 expert opinion on String technology, incl.: - Transport Problems Institute (Russian Academy Science); - Siberian Division of Russian Academy of Transport; - State Construction Ministry of Russia; - Ministry of Economy and Transport of Russia; - Russian Engineering Academy; - Saint-Petersburg State Rail-Way University; - United Nations, etc.

More 40 patients for inventions
GENERAL CONSTRUCTOR of rail-string technology platform

• He is the author of over 10 scientific books, over 200 scientific papers, over 150 inventions, about 50 of them tackling string technology, and 29 of them tackling construction, machinery, electronic and chemical industry technologies practically used in Russia, Belarus, Ukraine, and other CIS countries.

• engineer on rail-way - 1973;
• engineer-technology and scientific-research specialist on patents and inventions - 1985;
• engineer on high-rise buildings - 2006

• Doctor of Philosophy on Transport - 2002
• Academician of RAES - 1999
• numerous other degrees and awards for the development of the transport sector.

Dr. Anatoly Yunitskiy
(author & general constructor of rail-string transport)
DEAR SIRS,

String-rail transport technology platform is a unique instrument for the increase of the efficiency of the projects with the significant share of transport component either in case of extreme climate and topographic conditions or in case of lack space in overcrowded with traffic megalopolises.

Specialists of “Unitsky String Transport Ltd” are ready to offer the most efficient transport solutions that would fundamentally improve the technical performance and the economic efficiency of your investments in the projects aimed to develop remote and rich with mineral resources areas and also to improve the transport availability and life comfort over the world.

BEST REGARDS,
ANATOLY YUNITSKIY