

SOVIET PEACE FOUNDATION
"STAR WORLD" CENTER

"ECOTERRA" PROGRAM AS A POSSIBLE SCENARIO
OF CIVILIZATION PROGRESS BASED ON SPACE
INDUSTRIALIZATION WITH THE HELP OF
U P T V

Theme Leader
GOLUBE V.A.

Gomel
1988

E C O T E R R A
= P R O G R A M

SPACE WORLD CENTER

The Joint Program is sponsored by the Soviet Peace Foundation (Resolution of the Soviet Peace Foundation Executive Bureau dated May 25, 1988, No. 34-88B)

ECOTERRA PROGRAM

ABSTRACT

Elaborated by the Star World Center(Gomel) to draw international participation

The present-day state of our civilization progress is characterized by the emergence of global problems requiring joint efforts of the humanity to be solved.

The most acute problem is environmental pollution. The industries created by the humanity exhaust substances into the environment affecting the biosphere balance which has established during millions of years and which is a prerequisite for man's existence. As a result we are witnessing a dramatic increase in cancer, allergic, pulmonary and cardiovascular diseases, genetic and hereditary disorders. The landscape keeps changing irreparably the soil gets eroded, forests disappear, seas and oceans get contaminated, the planet's ozone layer is being intensively destroyed.

If the existing tendencies of industrial development persist they will cause catastrophic consequences.

The ECOTERRA program helps solve the global problems of the humanity by transferring industries into the space.

The important problem to realize this task is to develop a transport means capable to deliver various loads into the space in necessary quantities. Such geospace transport means should be able to support the establishment of space industries comparable with the terrestrial industries.

The space rocket engineering is incapable in principle to ensure the establishment of space industries in the near future before an ecological crisis has hit the earth. For example, during 30 years of space flights the entire world has been able to deliver into the space just 10 thousand tons of payload. A single truck is enough on the earth to transport this amount of load, yet the industries are serviced by millions of trucks, therefore a similar scope of cargo traffic should be established for the space industries.

To solve this problem it is projected to create a universal planetary transport vehicle(UPTV) within the framework of the ECOTERRA program.

Let us recall briefly the essence of the project. Imagine a framed trestle running, for instance, along the parallel 55 degrees northern latitude (the latitude of Moscow, central part of the UK and southern part of Canada) as a ring embracing the planet in the plane parallel to the equatorial plane (the trestle may be erected at a different latitude). In this case it will be 23 thousand kilometers long. On the mainland it is supported on ordinary legs, in the ocean it is floated on pontoons fixed below the water surface. The guideway structure is erected at a height 10-30 meters. It includes a linear electric motor running inside an evacuable tubular channel carried on the trestle. Inside this tube a rotor encircles the planet and it is the payload to be injected into the airless space. It may contain raw materials, components, semifinished products, parts, tools and so on necessary for erection in the space.

In what way does the UPTV function? Preassembled parts of the rotor are linked together and one by one are inserted into the tubular channel through special windows. Then the air is pumped off and this giant ring is ready for ascent.

The system of electromagnets is energized and the rotor gets suspended and stabilized in the center of the tube. Then the rotor is started by the linear motors and runs along the channel and respectively round the earth. The mass of the rotor is considerable (each run meter has the cross section about 10 centimeters in diameter and weighs 10-50 kilograms), therefore it takes days or even weeks until it develops the escape velocity, at this moment the terrestrial gravitational forces are counterbalanced by centrifugal forces and the rotor becomes weightless. Once the speed reaches 10 kilometers per second the linear motor is deactivated together with magnetic suspension; nothing arrests the evacuable shell on the trestle together with the streamlined circular rotor inside (a special magnetic suspension system continues to align it strictly along the center of the tube). The rotor as big as the planet in size develops the centrifugal forces overcoming the terrestrial gravitational forces and breaks away from the surface stretching similarly to a byke rubber tube (initially due to the elasticity of structural materials, then due to special telescoping links providing for double extension), it takes several dozens of minutes for it to get through the planet's gas shell and fully ascend to a circular orbit.

From the point of view of economics, technology and science this project is realizable approximately by the year of 2005.

It is only at the first glance that the project may seem phantastic, yet a number of experts confirm that from the point of view of science, technology, economics as well as socially and politically the UPTV project may be realized within the same term as the SDI project being developed in the USA.

The UPTV project is the backbone of the ECOTERRA program realization.

TASK OF THE PROGRAM: within the foreseeable future (25...40 years) to combine the efforts of the entire mankind to remove industries and power facilities from the terrestrial biosphere and transfer them into the space taking into account that such removal of ecologically dangerous portion of the technosphere will allow to establish conditions for a better decent and harmonious life and development of each personality, nation, people and the entire civilization.

For a wide-scale industrial development in the space the ECOTERRA program envisages the intensification of environment protection by all the available industrial and economic means.

CONDITIONS REQUIRED TO DEVELOP AND REALIZE THE PROGRAM: financial support of initial research and development projects, intensive promotion of ecologically clean world concepts to shape favourable international social and political thinking.

The basic aspects of the program being developed by the Star World Center are sponsored by the Soviet Peace Foundation.

Trends of international cooperation during the initial stages of the program:

1. Joint development and creation of power means to improve the efficiency and reliability of national and international power supply systems. Such means placed underground as circular UPTV physical models several kilometers in diameter represent energy kinetic hyperaccumulators.

2. Development and creation of linear motors and magnetic suspension to accelerate the UPTV in evacuable tunnels up to 10 km per sec. These systems may be utilized as superhigh-speed terrestrial transport means.

3. Development of systems to control the entire geospace transport system and the planet's space-based industrial belt.

Taking into account the large scope of research, engineering and development of new materials for the UPTV these activities may be put forward as a basis for conversion of military industrial complexes and military political alliances.

Since the existing and projected scientific space research is based on the rocket concept of space development, so far the space projects have cost over 500 billion dollars, therefore it can hardly be expected that the ECOTERRA program will win an effective aid from any state within the nearest future. The UPTV project as the backbone of the program is evaluated at 500 billion dollars including 100 billion dollars for research and development. The ECOTERRA program covers practically all the spheres of knowledge including social, political and philosophical aspects as well as specific technical subjects and problems of weather and climate control on the planet, the ozone layer condition, problems of efficient agricultural management and so on, therefore it will lead to such a breakthrough in the progress of our civilization which is never feasible with the limited task programs such as the SDIE, a piloted flight to Mars and others. Hence, joint efforts of all the countries in the world are needed.

Mankind is in danger!

They are only joint international efforts that can save our planet for the posterity.

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Earth is the cradle of the humanity, yet
it cannot stay in its cradle forever.

K.E.Tsiolkovsky

Forceful ways of solving international conflicts as well as technological activities of any country which are ecologically ineffective, polluting the environment and causing, in the long run, irreversible changes of the habitat should be banned...since all this can destroy the ecological balance of the human society and put the very existence of the civilisation under threat.
(Ecological Imperative - Ecoforum for Peace., Sofia:Press, 1986, Aug.)

The present ECOTERRA Program has been elaborated following the Appeal of M.S.Gorbachev, the General Secretary of the CPSU, to all the progressive mankind (Declaration of January the 15th, 1986) to undertake practical development of large-scale projects of peaceful space development jointly by the entire humanity as one of the most important ways of ensuring progress on the whole planet and of shaping a reliable security system for all.

The ECOTERRA Program is also a reply to the Declaration and Appeal of the International Organization ECOFORUM FOR PEACE (Varna, 1986) to all the peoples and governments to save humanity and life on the planet. The basis of the Program is a principally new solution of rocketless cargo injections into the neighbouring space currently under development in the USSR.

The ECOTERRA Program has been sponsored by the Soviet Peace Foundation and is intended to draw active participation of the present day generation to the benefit of our posterity.

1. GLOBAL PROBLEMS OF MODERN CIVILISATION

The progress of today's civilisation is characterized by the appearance of global problems which require joint efforts of the entire humanity for their solution. These problems are ecology, raw materials, energy, race of armaments, social inequality of countries and regions, agricultural produce deficit, rapid growth of population on limited territories put to use, etc.

Presently the most acute problem is the problem of environment pollution. The industrial potential created by the humanity constantly exhausts into the biosphere the substances affecting the biocene balance established during millions of years, while it is a prerequisite of the man's existence. Nowadays one living species disappears every day. There has been a dramatic rise in cancer, allergic reactions, pulmonary and cardio-vascular disorders as well as genetic and hereditary diseases. The landscape is changing irreparably, soils are getting eroded, forests are vanishing, seas and oceans are getting polluted, the ozone layer protecting all the living against the hard ultraviolet radiation is being destroyed.

If the existing tendencies connected with the terrestrial industries persist the above problems will bring about catastrophic sequences.

The supplies of raw materials and energy sufficient to maintain the consumption level reached by the humanity is as important. Experts believe that within 50 to 100 years to come the resources of oil, gas, copper ore and other minerals will be exhausted. Depletion of natural resources will cause utilization of raw materials with a poor content of the required components and their reprocessing will, in its turn, aggravate the ecological situation. Alongside with the traditional resources the lack of non-traditional resources such as potable water, pure air, soil fertility is getting more and more acute every year. Already now there is little space to erect works, factories, power plants. With a seemingly wealthy contemporary society the problem of producing means for all the earth's inhabitants to live a dignified life has not been solved. Too much poverty and famine. Demographic problems keep accumulating from year to year.

The military-industrial complex has attained terrifying proportions. A huge portion of the planet's active population invests its potential in the industries intended for destruction.

2. WAYS OF SOLVING GLOBAL PROBLEMS

Three ways of solving global problems have been evolved so far:

- preservation of the attained development rates of modern production by gearing it to closed cycles;
- reduction and termination of consumer production ("back to nature");
- maintenance of the existing industrial development rates and elimination of negative effects by transferring industries into space.

The first way of solving the global problems is not feasible because of the following reasons:

- the elementary components of the final industrial products differ from the raw components, hence multiple waste is unavoidable and it is also different from the initial raw materials thus introducing disbalance into the environment;
- evolution of the biosphere has lasted billions of years unaffected by any production processes, therefore any introduction of non-biological processes inevitably violates the established harmonic balance.

Termination of mass production to solve the problems will catastrophically reduce the man's living standards, emphasize the demographic problems, famine and social injustice.

The present Program serves to substantiate the transfer of industries into space to solve the global problems of humanity.

3. GEOSPACE TRANSPORT ALTERNATIVES

The most acute problem of the industrial potential transfer into space is the availability of transport means enabling to inject material resources in required quantities from the earth into the space. The quantity of material resources to be injected should satisfy the production scope comparable with the existing one.

At present to supply the industrial production 100 billion tons of raw materials are transported annually. To maintain a

corresponding production level in the space it is necessary to deliver hundreds of millions of tons per year and do it in an ecologically harmless way. The cost of deliveries should be comparable with the present day level for the ground transport.

In a more remote future it is envisaged to supply cosmic production with raw materials from the space (the asteroid belt, resources of planets and their satellites).

At present the following geospace delivery means are known:

- carrier-rocket;
- electromagnetic accelerator;
- space lift;
- universal planetary transport vehicle.

During 30 years of actual space flights about 10 thousand tons of various loads have been injected into lower circular orbits with the help of carrier-rockets. At the same time it has been assessed that 85 repeated launchings of carrier-rockets of the space shuttle type will cause irreversible changes in the planet's ozone layer and ionosphere. Hence, such means is no good in principle to deliver the required millions of tons of loads into space. Here also, according to what a number of experts forecast, even in remote future the rocket vehicles will never bring the cost of transportation to the level 100 dollars per kilogram.

Magnetic accelerators are characterized by great payload acceleration during the speed-up and passage through the atmosphere, supergreat capacities of acceleration system (centamillion kilowatts together with negative (thermal, acoustic and chemical) effects upon the atmosphere. The delivery cost of one kilogram of load by such accelerators will also be about 100 dollars.

As regards the space lift the following may be remarked. Its mass is rated a billion tons to be injected by carrier-rockets or magnetic accelerators into the orbit to have it assembled there. The strength of materials to construct the lift should exceed the strength of steel approximately thousandfold.

Therefore, the technical means to deliver loads in required quantities and satisfy the ecological requirements is the universal planetary transport vehicle (UPTV).

4. UNIVERSAL PLANETARY TRANSPORT VEHICLE

The UPTV is a stretched-line structure embracing the earth, for example, at the equator plane (or runs parallel to it at a distance up to several thousand kilometers), it has a trestle about 10 meters high supporting a way track (see Fig.1). In water the trestle legs are supported by pontoons floating below the ocean level and they are anchored to the bottom(Fig.2).

The waytrack comprises a linear motor extending through an evacuable shell(Fig.3). A rotor extends inside the shell and it embraces the planet. The rotor is intended to be injected into the space, therefore its body and core are made from payload to be delivered (raw materials, semifinished structures and articles that have a rod-like configuration).

The portions of the rotor core and body are prepared beforehand and are connected together as by welding and introduced into the shell in series to make up the rotor. The shell with the rotor inside is put into the starting position (between the windings of the linear motor), air is evacuated from the shell to set up pressure in it several thousand times below the atmospheric.

To speed up the rotor the linear motor stator winding is energized with alternating current, as a result a running field appears in the gap between the left-hand and right-hand stator windings which is induced by multiphase currents in the stator windings. Transverse electric currents are induced in the outer conductive layer (coating) of the rotor which is made, for example, from copper, aluminium or superconductor. The induced currents interact with cross currents, thus a mechanical force is developed along the longitudinal axis of the rotor throughout its length. Simultaneously the rotor gets magnetically suspended along the center of the shell and it is stabilized in this position. To reduce energy losses high-temperature superconductors may be used in the UPTV electric systems and they will enable to bring its efficiency up to 100 per cent. The rotor starts moving practically without resistance along the shell, thus, while revolving around the earth, will gradually (for example, during several days) gain high speed. Once the orbital velocity is attained the rotor gets weightless and with further acceleration it will strain to lift (to proceed into a higher circular orbit), yet the magnetic suspension will hold it back.

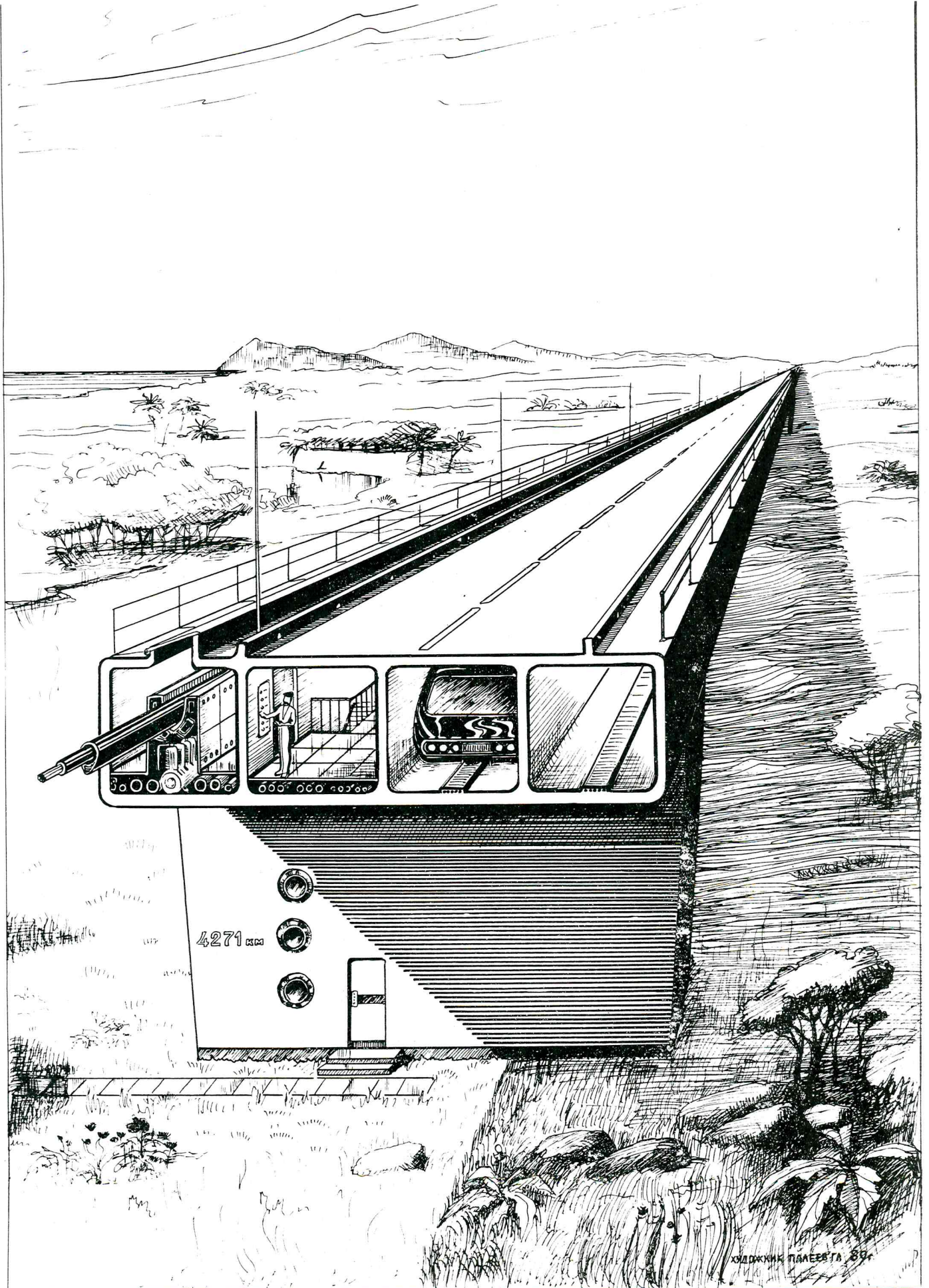


Fig.1. The dry land portion of the UPTV cargo version (shown at the moment the rotor lifts into space)

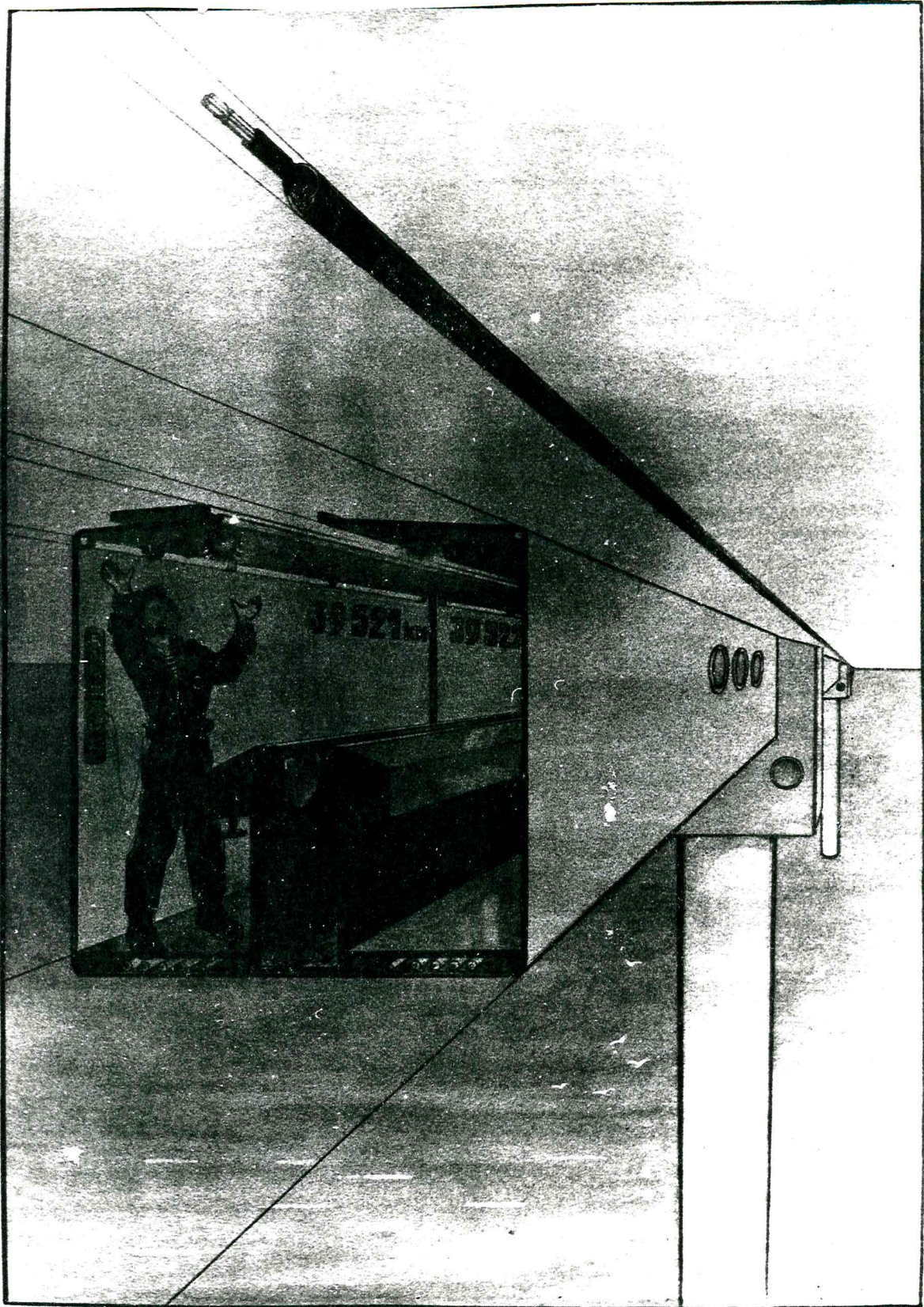


Fig.3. The way track structure of the UPTV (shown at the moment the rotor lifts into space).

Once the rated speed, e.g., 12 m/sec, is gained the vacuum valve is shut off (making the shell air-tight), the linear motor is switched off together with the magnetic suspension along the way track and the retainers holding the shell on the trestle are released. At the same time a self-sustained magnetic suspension is switched on to suspend the vacuum shell in respect to the rotor. Since the rotor has developed the speed sufficient to take it off to a higher circular orbit and it is itself a ring embracing the planet so this ring will retain its inertia of rotation and will increase in diameter until it is fully above the atmosphere in the near space. On the way up the rotor will carry along the stationary protective shell and, therefore, will pass through the atmosphere in vacuum. After dense layers of the atmosphere have been passed explosive charges are actuated and the shell gets split longitudinally into two parts which parachute back to the earth for reuse.

While the ring ascends the rotor stretches 0.157 per cent per 10 kilometers of height (e.g., all sorts of steel withstand 15...40 per cent stretch as a fracture limit). Then, for example, at a height 100 kilometers tensile stresses in the rotor body become critical and it snaps into sections A-A (Fig.4) where its sidewall has a calibrated thinner neck (fillet). The body fragments thus formed are stretched longitudinally, therefore they start to contract in length to the value of elastic deformation. At this moment the potential energy of elastic tensioning is absorbed by frictional shoes contacting the exterior surface of the rotor core. Oppositely, when a fragment is too long (100 kilometers and more) during contraction its ends may develop a too high speed and cause impact destruction of the rotor. At the same time or slightly later the core is similarly split in sections B-B located between the sections A-A to make up fragments and these fragments will also contract.

After that the rotor acquires a configuration of consecutive telescopic connections capable of double expansion. Due to this it may be injected into any circular orbit up to 6 400 kilometers high without any correcting jet engines since their function is fulfilled by friction clutches in telescopic connections (they ensure smooth braking of the rotor ring during its extension and, correspondingly, of the radial component of its motion).

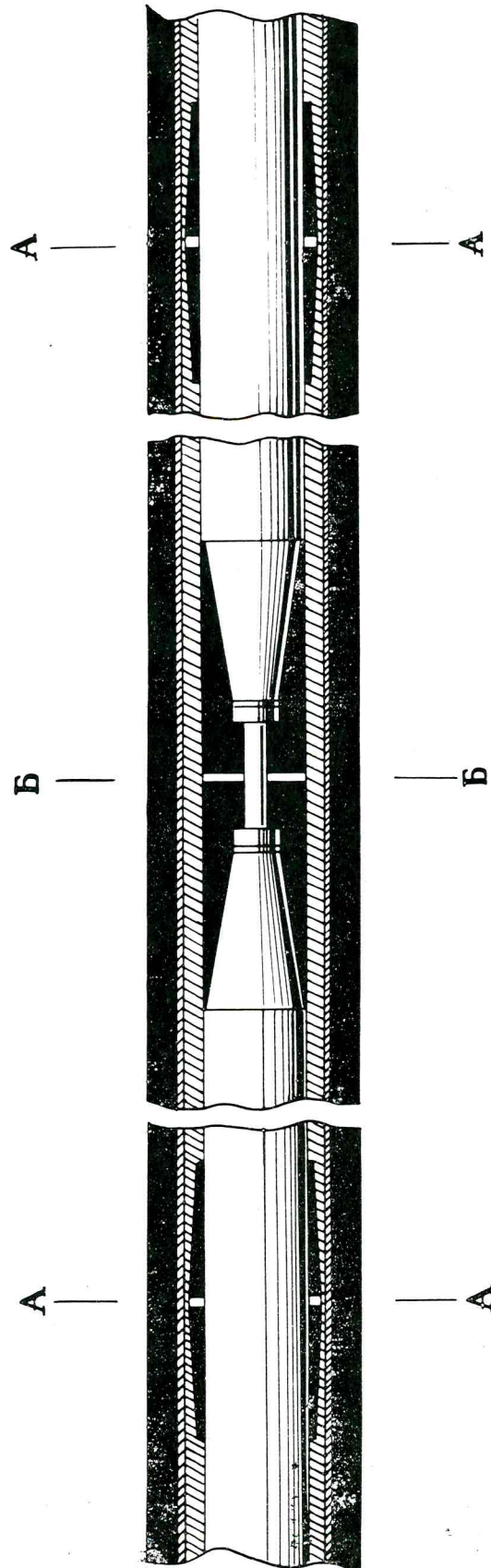


Fig.4. Design of the rotor(longitudinal section)

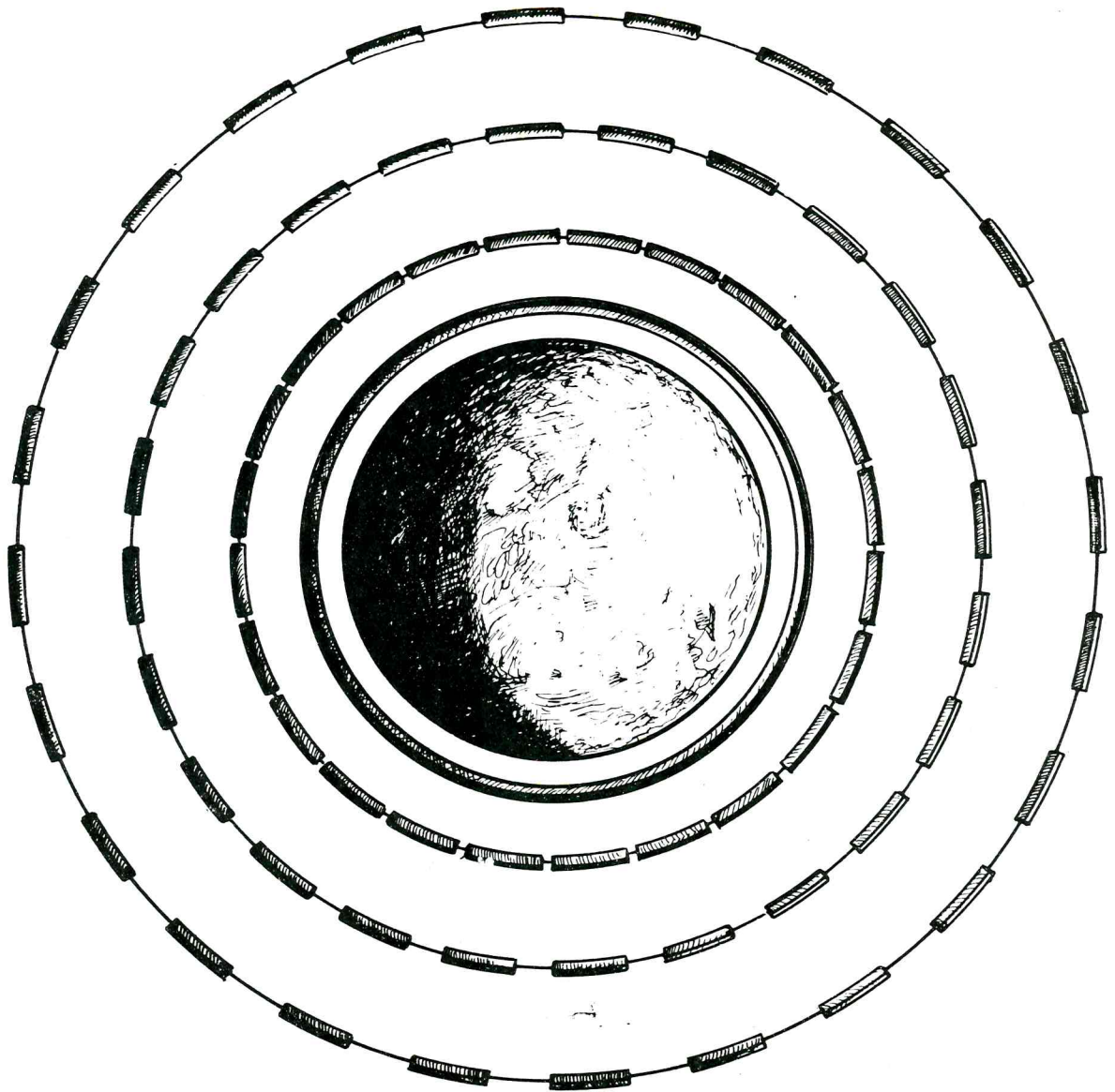


Fig.5. Stages of the rotor penetration into space.

To reduce the height of the trestle in most complicated stretches of the UPTV, say, when passing across the Andes in South America its longitudinal profile may be smoothly inscribed into the broken site relief with the radii of curvature 100 kilometers and more. Such sites with the total stretch of several per cent of the equator length will require a more powerful field suspension along the track (dozens of times more powerful than for flat stretches). When the rotor lifts in the Andes it will retain for some time its curvilinear configuration (similarly to the motion of ballistic antennas), anyway this will not affect its exit into the space since in the process of ascent the rotor will gradually acquire an ideal ring shape which corresponds to the minimum of energy in the system. In the same way, in order to reduce the scope of construction work the trestle may smoothly bend (in the plan) around separate peaks or mountains.

The basic technical and economic parameters of the UPTV are listed in the Table. Only the following initial parameters are given: the starting speed of the rotor is 12 km/sec, the cost of power is 1 cent /kWh; the capital outlay is 200 billion dollars (5 million dollars per kilometer); the UPTV service life is 50 years; the cost of operation is 100 thous. dollars annually per kilometer of the UPTV length; the mass of the protective evacuable shell is 100 per cent in respect to the mass of the rotor and its service life is 50 ascents above the atmosphere, the cost of the shell is 10 dollars per kilogram.

From the Table it follows that, for example, in order to create the cargo traffic 10 million tons annually at 50% efficiency of the UPTV 45 million kW will be required to energize its system, so the cost of load injection into the orbit will be equal to 1.4 dollar per kilogram (for comparison, the cost of load injection with the help of a shuttle vehicle is 15,000 dollar per kilogram. To establish such cargo traffic it is sufficient to launch the rotor 10 times a year, i.e. approximately once a month, its mass being 1 million tons (25 kg/m). If the average density of load packing is 5 g/cu.cm, the cross section of the rotor will be 50 cm² and its diameter approximately 80 millimeters.

Table

TECHNICAL AND ECONOMIC PARAMETERS

Parameter	Parameter versus the UPTV efficiency					
	The UPTV with ablative protection			The UPTV with protective shell		
	e f f i c i e n c y			e f f i c i e n c y		
	10%	50%	90%	10%	50%	90%
1	2	3	4	5	6	7
Power consumption during acceleration in respect to the cargo traffic:						
numerator - total, million kW	2.7	0.55	0.30	1.6	0.32	0.18
denominator - per km of length - 100 thous.t/year	68	14	7.6	40	8	4.5
- 1 million t/year	27	5.5	3	16	3.2	1.8
	680	140	76	400	80	45
- 10 million t/year	270	55	30	160	32	18
	6800	1400	760	4000	800	450
-100 Million t/year	2700	550	300	1600	320	180
	68000	14000	7600	40000	8000	4500

Continuation of the Table

1	2	3	4	5	6	7
Energy consumption for injection of one kilogram of load						
- kWh	240	48	27	140	28	16
- kgs of conventional fuel	30	6	3.3	17	3.5	2
Cost in dollars of one kg load delivery to the orbit versus the cargo traffic:						
- 100 thous.t/year	84	82	82	82	80	80
- 1 mln. t/year	12	10	10	9.6	8.5	8.4
- 10 mln t/year	5.2	3.3	3.1	2.4	1.3	1.2
- 100 mln. t/year	4.5	2.6	2.4	1.7	0.56	0.44

The very first injection of the rotor will establish around the planet a ring structure at a height 500...5000 kilometers or higher and this ring will serve as a base for creation of a cosmic necklace around the earth and for establishment of a single transport and communication system between the works, factories, power plants and living modules to be set up in the space. Consecutive rotor exits into the space will serve to deliver the components of solar power plants in the form of wound rolls with film reflectors inside and bars to construct the frameworks of the power plants each of them with a square surface of dozens of square kilometers. However, a single injection of the rotor is not sufficient for erection of solar power plants with a total capacity above 100 million kilowatts. The energy they generate will then be used to expand industrial production in the orbit and partially will be transmitted to the earth for the consumption by the UPTV.

After the cargo UPTV has been put to use and space industrialization started the demand for geospace cargo traffic will start growing dramatically. Initially this demand will be met by increasing the cross section of the rotor and its mass and by more frequent injections into the space. Then the UPTV will undergo its first reconstruction: the power of the linear motors will be increased, the track cross dimensions will be expanded. At that time the rotor will not be made up of payload to be injected but it will become stationary with a mass about 10 million tons (250 kg/m). The vacuum shell will be provided with self-sustained linear motors and a more powerful field suspension (Fig.6). Then the shell will be able to exit into the space together with the rotor and its external suspension will have special dependent modules to deliver millions of tons of loads and millions of passengers. Expending 100...1000 billion dollars annually for the UPTV reconstruction (these sums may be deducted from the expenses for arms) by the year 2050 the humanity may have completed the near space industrialization where most of the industries and power sources of the planet will have been placed.

Apart from the equatorial version most preferable on the grounds of celestial mechanics the UPTV supporting structure may embrace the planet in a different plane parallel to the equator up to the North (or South) polar circle. The latitude versions of the UPTV may be preferable to the equatorial one because of geographic, economic, political or some other advantages.

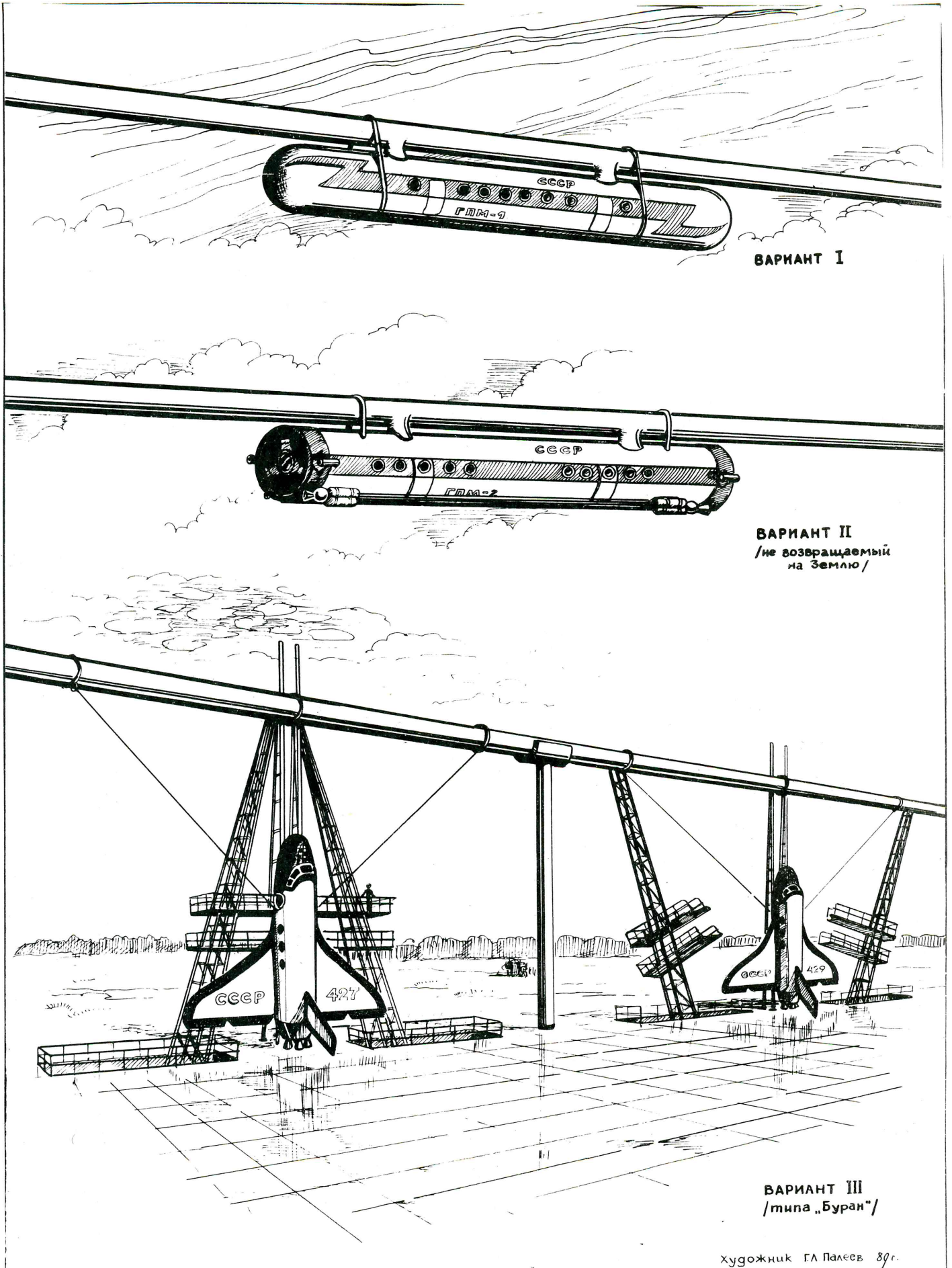


Fig.6. The UPTV cargo-passenger version.

To control the ascent into the space, especially during its passage through the atmosphere the UPTV shell should be ballasted, for this purpose water or oxygen, liquid or gaseous, may be used. The peculiarity of the UPTV latitude version is that the rotor when stretching in diameter during its ascent at the same time will be shifting towards the equator plane. Also the speed of the ascent and the rate of stretching may be controlled so that the UPTV will be shifting towards the equator above the stratosphere parallel to the earth's surface (the latitude will increase towards the equator until it becomes equal to the equator or 40 thousand kilometers long). Noiselessly moving above the ozone layer the UPTV will yield oxygen or water vapours as a thin layer above the territories of the USSR, USA, Japan, European and other industrial countries which cause destruction of the ozone layer by their economic activities.

With the geospace traffic 10 to 100 million tons annually 1 to 20 million tons of the above ballast may be injected into the stratosphere which will be enough to stabilize the ozone layer and control the state of the ozone sphere of the entire planet. Some portion of the water vapours which remains undecomposed into hydrogen and oxygen (water decomposition process is continuous in the upper atmosphere layers due to the ultraviolet radiation of the sun, yet it is insufficiently intensive because of the lack of water vapours in the stratosphere) will serve as a specific filter binding and returning to the earth's surface the contaminants which deplete the ozone layer, yet it will proceed in such quantities as to be harmless for the atmosphere near the planet's surface whence, in fact, most of the contaminants ascend.

By monitoring the total ozone content as well as its concentration in specific areas it is possible to control weather and climate of the entire planet and locally by suppressing the incidence of destructive storms, typhoons, cyclones. It will not be difficult to realize. Though ozone accounts for only one decamillionth portion of the total mass of the atmosphere it absorbs about four per cent of the solar energy incident upon the earth. The remaining atmosphere, i.e. water vapours, dust, clouds, absorbs only three times more of solar energy. Therefore, by altering the condition of the ozone layer an effective quick-response control of the atmospheric conditions may be created for the entire planet: direction of winds, accumulation of clouds, air temperature. It is

significant that such interference with the weather "kitchen" is ecologically clean since the ozone will not be a foreign matter for the ozone layer itself.

It will be possible to rule weather in the southern hemisphere since, during the completing stage of the UPTV ascent into the space, it will oscillate in respect to the equator plane. Gradually the UPTV will afford for the creation of space industries structurally resembling the rings of Saturn. Even gaps between the rings similar to Gassini's rings for Saturn should exist so that the UPTV in its ascent due to oscillations in respect to the equator plane may reach sufficiently high orbit without catching other industrial rings.

The advantages of not only averting the tendency of photosynthesis decline by vegetation on our planet as a result of the ozone layer destruction, let alone the economic effects of weather and climate control because of the terrestrial industries and energy facilities transfer into the space, will bring multifold returns on the expenditures for the UPTV cargo version realization (about 500 billion dollars). For example, with the existing tendencies of ozone deficit in the stratosphere it may be expected that in the decades to come the annual increment of the biomass on the planet will get reduced by at least 10 per cent. So the production of dry organic mass on the planet will go down 20 billion tons annually. If this deficit of the organic mass to be rated as fuel at a price 50 dollars a ton, taking into account that a portion of it will belong to a considerably more pricy agricultural produce, the damage incurred by the planet's biosphere will amount to trillions of dollars a year. And how to rate the deficit of 10 billion tons of oxygen produced by green plants? For example, to produce this amount of oxygen by decomposing water in order to compensate its depletion in the atmosphere cost will also tend to run up to trillions of dollars a year, not less. Yet, we intend to live more than one year, therefore for us to exist fairly well in future we will have to expend colossal funds for decades. And how to rate moneywise the damage due to the ozone layer depletion entailing progressive impairment of the people's health, growth of cancer, skin afflictions, nefarious effects upon the immune system and the DNA?

Moreover pipes may be used to support longitudinal elements of the UPTV trestle and inside them a super-high-speed transport means may run to connect together the USSR, the countries of

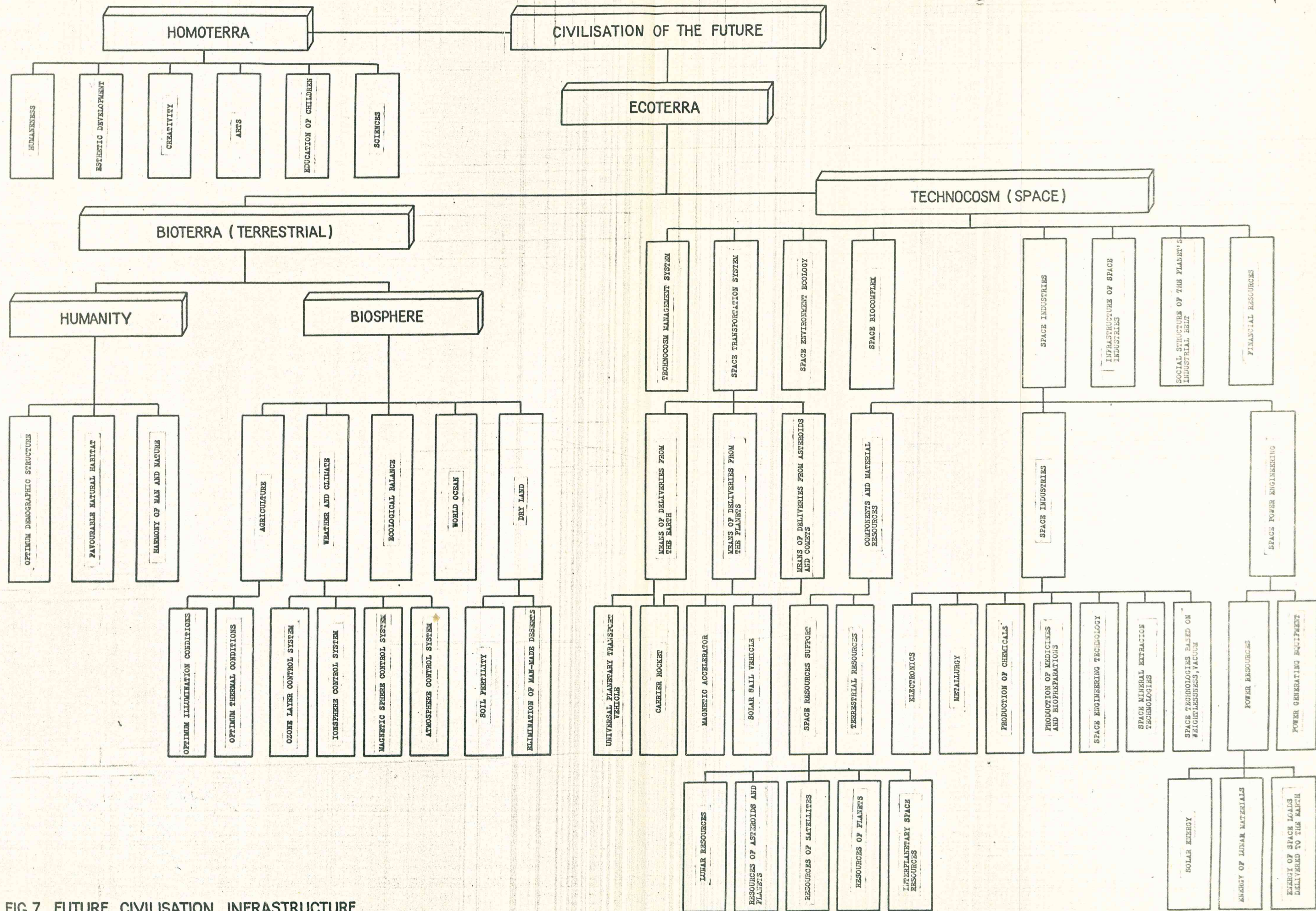


FIG.7. FUTURE CIVILISATION INFRASTRUCTURE

Europe and North America, so a round-the-world trip will take several hours . The UPTV rotor may also function as an energy hyperaccumulator to save energy of power plants operating on the night side of the earth and supply it during the peak hours on the day side. The power thus supplied may amount to dozens of millions of kilowatts.

To illustrate the feasibility of the UPTV project (from the scientific, technological and economic point of view) in the foreseeable future the following may be noted. The concrete used for the body of the dam of the Sayan-Shushenskoje hydraulic power plant (about 10 million cubic meters) alone is enough to erect all the UPTV trestle legs. If we use cars currently available on the planet, about 500 million, as bricks to erect walls along the equator it will be 50 meters tall. The SDI projects envisage the development of a magnetic gun utilizing the same principles of acceleration as the UPTV, yet the projectile will have the velocity of the order of 100 kilometers per second. As a matter of fact, the power of such a gun will amount to many thousands on kilowatts per meter of length, while for the UPTV this power is about a kilowatt (comparable with the specific power of a washing machine, while the power of a press iron is considerably greater). Thus, from the scientific, technological and economic points of view the project is realizable within the same term as the star wars.

5. SHAPING THE ASPECTS OF FUTURE CIVILISATION

The fundamental feasibility of creating a transport system capable of injecting into the space the required amounts of resources and materials enables us to approach the visualization of novel principles of shaping the future civilisation based on the creation of space industries.

The general structure of the future civilisation utilizing the space resources may be schematically presented in the following form (Fig.7).

The material basis to solve the actual social problems of the earth civilisation should be the ECOCOSM to be created by the mankind, The ECOCOSM is an entity of space production (TECHNOCOSM) and optimum ecological conditions for the development of the biosphere and life on the earth (BIOTERRA).

The HOMOTERRA is a social system, a combination of conditions ensuring the realization of social justice, equitable international human society set-up, harmonic development of faculties, the right of each individual for a decent human life and happiness.

The TECHNOCOSM is a basis for provision of man's civilisation with material resources representing a package of the following components:

- transport system for deliveries of resources;
- space industries;
- TECHNOCOSM management system;
- cosmic biocomplex;
- TECHNOCOSM social subsystem;
- space medium ecological subsystem;
- TECHNOCOSM financial subsystem.

The transport system evolution implies the development of the means for deliveries of loads from the earth, from the moon, from asteroids and comets, from the planets of the Solar system. The UPTV is projected to be the main means for deliveries of loads from the earth. Alongside with it carrier rockets should be extensively used for local transportation of people and loads. Raw materials from the moon, planets, asteroids and comets may be delivered by carrier rockets, magnetic accelerators, solar sail vehicles, etc.

The establishment of space industries implies the creation of production in the space, its provision with energy and material resources. Specific properties of the space (vacuum, weightlessness, superlow and superhigh temperatures, radiation, absence of life, etc.) enable to produce materials, products with unique qualities which will provide a basis for solving the global problems of the humanity within the framework of the BIOTERRA subprogram. Electronics, metallurgy, chemical production, power generation, production of medicines and biopreparations will be developed in the space. New trends in the technology of extraction, civil engineering and other space production processes will gain further progress.

The basis of the space industry expansion is the accessibility of a fundamentally new energy source. Development of a corresponding power generating equipment and processes will enable to utilize limitless energy resources of the sun, lunar materials and other celestial bodies.

The space solar power engineering may be based on the contemporary traditional power generation techniques with the use of closed-cycle steam generators and solar energy concentrators. Taking into account the cryogenic temperatures of the cosmic space the efficiency of such power generators may attain 80 per cent. Practically unlimited energy resources of the sun make the space energy prospects boundless.

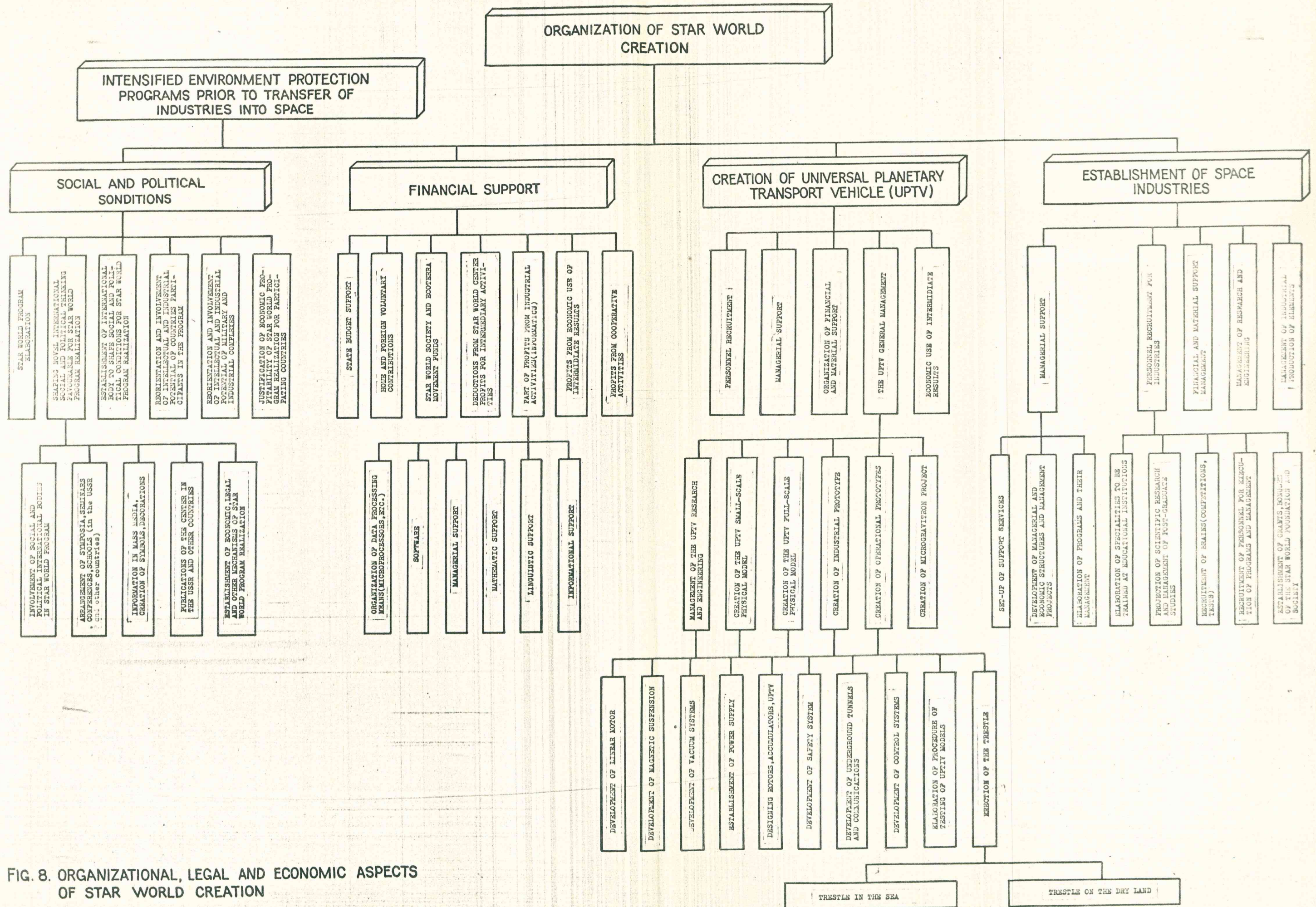


FIG. 8. ORGANIZATIONAL, LEGAL AND ECONOMIC ASPECTS OF STAR WORLD CREATION

Due to the properties of lunar soils induced by long-time influence of the solar wind it may serve as an effective energy source in nuclear power plants. Moreover each ton of the lunar soil in respect to the earth possesses such kinetic and potential energy which is equivalent to the thermal conductivity of a ton of oil. This energy of the loads delivered from the moon and other celestial bodies to the earth by the UPTV may be converted into electric energy which, if the scope of geospace transportation affords, will cover the energy demands of the BIOTERRA and TECHNOCOSM.

The possibilities to use the resources of celestial bodies (Moon, asteroids, planets and their satellites) as well as the resources of the interplanetary cosmic space will become boundless.

Creation of the TECHNOCOSM in the space affords for the material grounds to solve the actual problems of the BIOTERRA. It will become possible to establish an optimum balance between the mankind as a biological object and the biosphere. The humanity as a biological species will be capable to establish and maintain an optimum demographic structure, to create a favourable natural habitat for man, to attain the harmony of man with nature. It will proceed through the control of the following components of the biosphere:

- atmosphere(velocity and direction of winds, precipitation, humidity, temperature);
- terrestrial lands(reafforestation, elimination of soil erosion and of man-made deserts, restoration of soil fertility, etc.);
- world ocean(marine culture, restoration of ecological balance, control of sea and ocean currents, etc.);
- weather and climate(on the entire planet and in separate regions);
- ozone layer, ionsphere, geomagnetic field, etc.

All these factors together will yield an ecological balance in the biosphere. Control of illumination, thermal and other agronomic parameters will enable to radically increase the efficiency of agricultural production on the planet.

6. ORGANIZATIONAL ASPECTS OF TECHNOCOSM ESTABLISHMENT

The realization of the TECHNOCOSM subprogram implies the elaboration and introduction of the environment protection program prior to the industry transfer into the space (Fig.8). These programs may be based on target-oriented complex programs being developed in this country, on the Green Peace Program and other political and social programs abroad.

The realization of the TECHNOCOSM program presupposes a solution of organization problems in the following sequence:

- establishment of social and political conditions;
- organization of financial support;
- development of the universal planetary transport vehicle;
- creation of space industries.

Establishment of the social and economic conditions anticipating the realization of the formulated tasks implies the generation of a novel international political thinking favourable for implementation of the ECOCOSM program as a possible scenario of human civilisation progress. For these purposes it is necessary and expedient to implement actions on attracting political and social bodies to the propagation and realization of the ECOTERRA program, arrangement of symposia, conferences (the First All-Union Conference on realization of these ideas was held in Gomel in 1988, the first conference with international participation is projected to be held in Gomel in 1990), seminars. Extensive involvement of mass media, distribution of printed material, publication of special magazines, etc., are also essential.

The process of development of novel social and political conditions favourable for the ECOTERRA program realization should find its reflection in the establishment of international bodies to foster such conditions. To this end it is necessary to elaborate effective economic, legal and other mechanisms of the program realization and arrange support for their functioning.

An important factor for creation of political conditions to realize the program is the involvement of intellectual and industrial potential of the countries participants in the STAR WORLD program as well as reorientation and exploitation of the military-industrial complexes.

The problem of effective economic support for the ECOTERRA program by the countries participants has specific importance. The program is supposed to be financed stage by stage.

Intermediate results of the ECOTERRA program will have their individual economic effect through their application. One of the first results will be the creation of an energy hyperaccumulator which represents a big-scale UPTV model and its role in the country's power supply system will be accumulation of energy generated in the nighttime to be consumed during the peak demand in the daytime. Within the next 10-20 years an energy accumulator may be elaborated with a capacity about a billion kilowatt-

hours(its cost is approximately 5 billion Rbls)which is equavalent to construction of power plants with a total capacity 100 million kW thus saving 100 billion Rbls.

The first stage is planned to be sponsored by social and political bodies (the Peace Foundation Presidium has allotted 150 thous. Rbls in 1988 for these purposes) and contributions from customer industries will support research, experimentation and designing as well as construction of industrial prototypes during the intermediate ECOTERRA program stages(energy accumulator,universal planetary transport vehicle). This support may come from the Ministry of Power Engineering of the USSR , from transport ministries,etc.

The ECOTERRA program in general is supposed to be financed by countries participants on the profit accounting principle.

A fundamental component of the program is the realization of the universal planetary transport vehicle.For this the following stages are projected:

- implementation of relevant research,experimentation and engineering;
- creation of a small-scale physical model of the UPTV(the ring diameter - 1 km, the projected term - 1995, the tentative cost - 50 million Rbls);
- creation of an industrial prototype(the UPTV cargo version, the projected term - 2015,the tentative cost - 500 billion Rbls);
- creation of operational vehicles(the UPTV cargo-passenger version with a scope of geospace traffic 1 billion tons annually).

To realize the above models and real-size units it is necessary to develop:

- a linear electric motor;
- a magnetic suspension;
- a vacuum system;
- a power supply system;
- a control system;
- a structure of rotors for energy accumulators and UPTVs;
- mathematic models simulating the functioning of technological systems of various complexity;
- a safety system;
- a system of underground tunnels(for energy accumulators) and communications;
- a carrying structure(in the sea and on the dry land).

Implementation of the UPTV industrial prototypes with preliminary research , experimentation and engineering will commence the establishment of space industries.

The components of the TECHNOCOSM are projected to be developed simultaneously within the framework of the ECOTERRA program. Tentative terms and costs of the ECOTERRA program realization are given on Fig.9 stage by stage.

CONCLUSION

The present program is a first stage of the ECOTERRA program package. Further development of this package implies more extensive research, engineering and financial support with consecutive implementation of the program proper through realization of its separate stage and involvement of sponsoring bodies.

The main objective of the preparatory stage for elaboration of guiding program documents is to bring the program to the knowledge of the leading bodies of international organizations and state governments and to prepare for an ECOTERRA International Conference.

A major role during the preparatory stage is assigned to the USSR Federation of Cosmonautics, the Soviet Peace Foundation, the Space World Foundation. The Space World Center is projected to undertake coordination and execution during elaboration of program documents.

ANNUAL CONTRIBUTIONS INTO
THE ECOTERRA PROGRAM(Rbls)

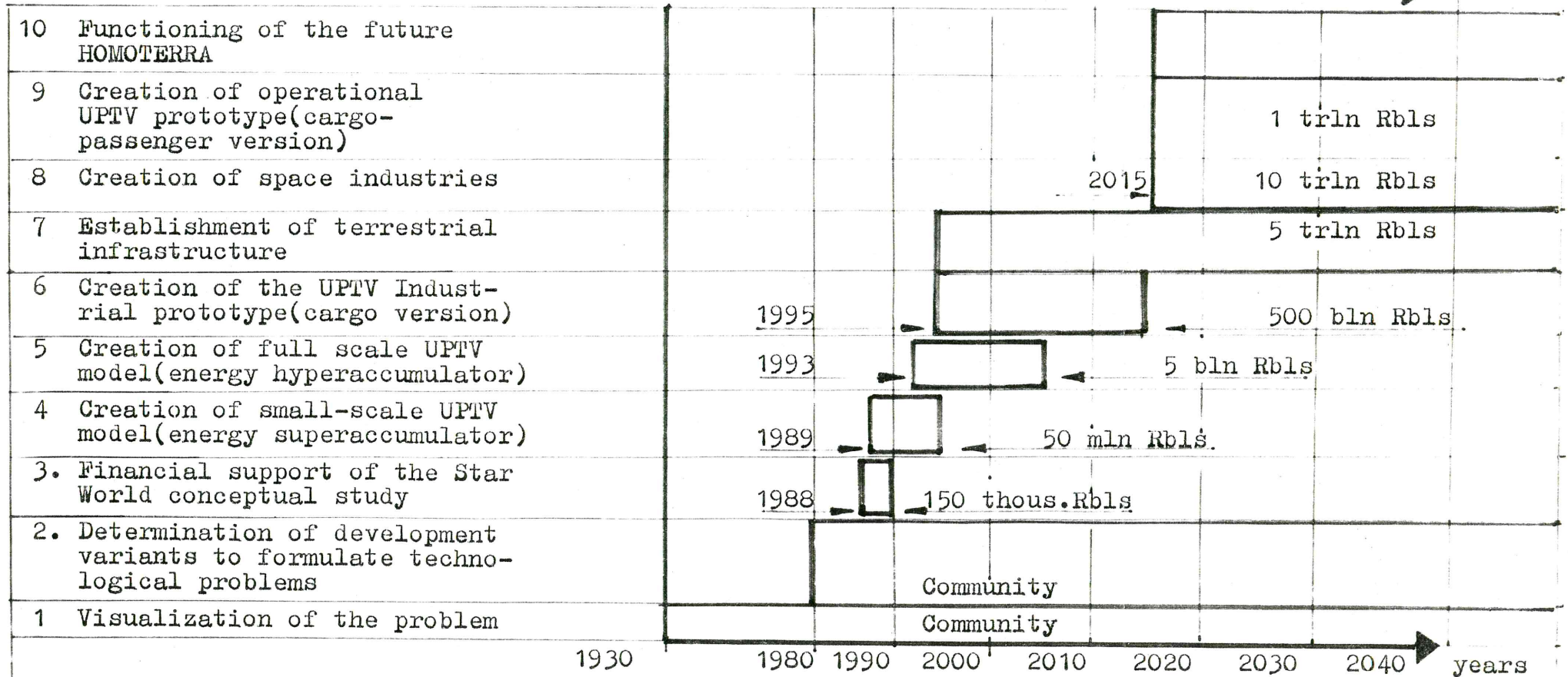
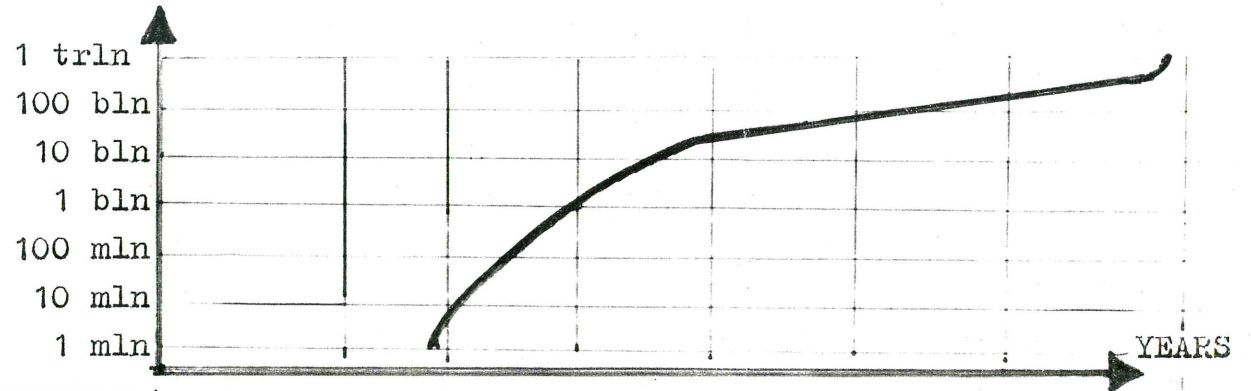


Fig.9 STAGES OF ECOTERRA PROGRAM REALIZATION