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THE SOVIET PEACE COMMITTEE

XX CENTURY AND PEACE

■ ВЕК XX И МИР ■ ■ LE XX^e SIECLE ET LA PAIX ■ ■ EL SIGLO XX Y LA PAZ ■

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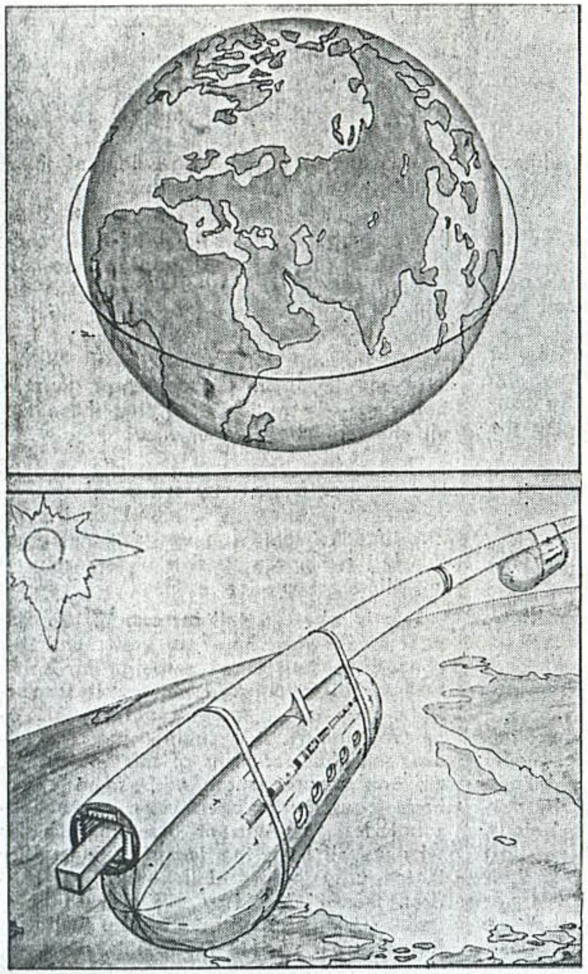
THE PLANET'S 'RING BUOY'

By Anatoly YUNITSKY



We should already have started thinking about the coming commercial utilization of near space, Anatoly Yunitsky, an engineer from Gomel, said, addressing a Soviet-American seminar. His project of a fundametally new space transport vehicle is called upon to ensure large-scale transportation of cargoes to orbits. Is this project feasible? The author says that technologically it certainly is. As to the spending, it will be comparable to that needed for the Star Wars system. It will be necessary to pool the efforts of the whole of humankind to carry out this strictly peaceful global project.

Scheme of planetary transpart means.

Drawing by Dmitry YEMANOV

Today, having more or less thoroughly developed earth, which seemed so boundless, and having taken a look at it from aside, from outer space, we have suddenly come to understand that the resources of our wonderful blue planet—whether spatial, raw materials or energy—have their limit, which our civilization is swiftly approaching. More and more people are coming to understand that in the near future humankind will find itself faced with a dilemma: either give up any further substantial progress in general, having stabilized technology in order to organize in the final analysis a more or less comfortable and stable life on the planet, or start looking for new living expanses and resources in space.

Although there may be no option because, due to the natural inertia of technological progress, we may not be able in time—before catastrophic overheating, pollution of the environment and depletion of the resources which are within man's reach—to decelerate our development. The possible minimum "braking distance" of spontaneously developing humankind in the present-day conditions of political and social discord is too long.

Such is the view of the pessimists.

Optimists, however, believe that the massive egress into space, and its development, will by no means amount to an exodus, but will be a striving for light and space, putting it in the words of the brilliant Tsiolkovsky. People will need space because of its boundless expanses, inexhaustible resources and qualitatively new conditions of habitation, as the basis for the development of production and science and the qualitative growth of human society and its social flourishing.

This is as far as the peaceful plans are concerned.

But humankind has a "malignant tumour"—the military-industrial complexes of industrialized countries—which can spit out metastases into outer space and in the final analysis bring about the destruction in a nuclear conflagration of the entire "organism" or civilization, which is inimitable and possibly the only in the expanses of the Galaxy. But if these trillions of dollars are channelled not into the implementation of the Star Wars programme, but into the peaceful development of outer space, humankind will not only not die, but will enter a qualitatively new stage of its development.

Be what it may, therefore, the colonization of outer space seems to be an inevitable stage in the development of our civilization. But will humankind be prepared to make such a step if it draws exclusively on traditional notions and views concerning the likely ways of solving the problems that arise in this case?

We tend to associate the words "space" and "development of outer space" with the words "rocket" and "missile-space technology". Over less than 30 years practical cosmonautics, which started its countdown on October 4, 1957 with the launching of the first man-made satellite of the earth, have registered immense successes which have surprised and amazed the whole world on more than one occasion.

But let us take a look at missile-space technology under a different angle, namely, solely as a means of transport. As of today about 10,000 tons of payload have been injected into space by the efforts of the whole of humankind. Is this much or little? Today working space begins at an altitude of 200-300 km from the surface of the planet, where most orbital stations and satellites fly. And if we draw an analogy with land transport, we shall see that during the same time one steady cart and a pair of good horses can carry the same amount of cargoes over the same distance of 200-300 km on earth.

So it appears that on one side of the scales we have the transport equivalent to only one cart and on the other—hundreds of billions of roubles and the titanic work of hundreds of thousands of workers, engineers and scientists. Work which is beyond the power of the economies of many states.

It has already been estimated that 85 frequent launchings of the American Space Shuttle alone will bring about a catastrophic and irreversible destruction of the planet's ozone layer with the products formed by the combustion of rocket fuel. If this happens, it will cause the death of everything over an area of millions of square kilometres under the action of the powerful ultraviolet radiation of the Sun freely penetrating through to the surface of the planet. Therefore the ecological transport limit of rocket technology of the Space Shuttle type is in the order of 10,000 tons of cargo a year. This transport work, which is the maximum on the "planet-orbit" route, can be done on the surface of the earth by one truck of average carrying capacity.

Let us stage a mental experiment—remove all transport from the planet, that is, all cars and trucks, buses, trolleybuses, street cars, trains, airplanes, helicopters, river- and sea-going ships, motorcycles. and bicycles and horse-drawn transport as well. Let us leave only one truck on earth. Will it meet the transport needs of our civilization, the industrial and power engineering needs of the whole planet? A second question is also logical: will rocket transport equivalent to one motor vehicle (and this is its limit!) ensure the industrialization of outer space where, with time, and this will happen sooner or later, there will be established an industry commensurable with the present-day land-based industry and even surpassing it in scale?

On the other hand, a third question legitimately arises: maybe we don't need space at all, the more so that it is so difficult and fabulously costly for us to make our way into outer space?

Life on earth originated some four billion years ago. A long time. Therefore, evolution during these billions of years has created such forms of life for which terrestrial conditions are ideal. We are the children of the planet earth. Nowhere else in the vast expanses of the Universe can there be better conditions for us earthmen than on our small and so fragile blue globe. Therefore, in orbit the seeds planted in soil do not wish to sprout, whereas a cosmonaut, whose health can be envied by any one of us non-cosmonauts is not much different from a gravely sick person for days on end, sometimes even weeks, on his return from orbit. This is natural and explicable.

But who will venture to assert that, to smelt steel, for example, there is a need only for a force of gravity equivalent to 9.81 m/sec²? (It is this force of gravity that has been given us on the planet and we are not in a position to change it.) And who said that for the same smelting of steel there is an ideal gaseous medium consisting of 78 per cent of nitrogen and 21 per cent of oxygen? (It is this composition of the atmosphere that our planet has, and we are not in a position, nor do we have any need, to change it.) The same can be said about any other technological process. Ideal for most processes are zero parameters of the environment—the absence of the force of gravity, that is, weightlessness, and the absence of the gaseous medium, that is, vacuum.

On earth it is more costly to obtain one cubic metre of high and utrahigh vacuum than to smelt a cubic metre of steel or extract a ton of oil. On the other hand, above our heads, at a distance of only 300 km and higher, it is free. And weightlessness cannot in general be obtained on the planet, not considering several short moments of free fall.

What will be given for the same smelting of steel by the above-mentioned space technological parameters: weightlessness and vacuum? An increase in its operational characteristics by one order. In this case there will be a need to smelt not half a billion tons of steel a year in the world, as is done today, but about 50 million tons, whereas the USSR alone now has to smelt 160 million tons of steel every year, and still it is in short supply.Then it will be possible to close down nine ont of every ten iron ore pits, just as it will be possible to close down nine out of every ten iron ore pits, just as it will be possible to close down coal mines and steel mills. And if space raw materials were put to use, then not a single new pit would disfigure the face of our planet and not a single factory chimney would eject smoke which is so alien to the blue sky of our planet and to the sensitive lungs of our children.

Or take the same power engineering for the development of which industrialized countries spend up to 40 per cent of their budgets. Millions of people are now engaged in drilling multikilometre-long wells in Siberia, Alaska and far in the ocean, and digging vast pits in practically all corners of the earth's dry land to obtain oil and coal. Other millions of people carry the fuel obtained with such difficulty across thousands of kilometres for still other millions to burn it in furnaces and engines. The fourth category, now running to hundreds of millions, inhale the "banknotes" (D. I. Mendeleyev's definition) received from burning smoke and soot and think more and more often that soon a gas mask will become just as indispensable in the house as an umbrella.

In space there is no need for either the first, the second or the third millions of people. After all, up there it is possible to obtain up to a million kW of power from one square kilometre of illuminated surface. An open-work carcass in the shape of a paraboloid with a thin light-reflecting film drawn on it with a diameter of several kilometres, in the focus of which there is the usual steam generator of the closed cycle with a cryogenic heat-transfer agent, will replace several such powerful electric power stations as the Chernobyl atomic plant. And there will be no smoke, soot or radioactive waste, dumping which now on earth, we lay the control over their preservation on the twentieth and thirtieth of our generations. There will be no accidents either because the natural thermonuclear reactor—the Sun—has been programmed for faultless operation during many billions of years.

Thus, it is in our days that a sharp need has arisen to look for ways for large-scale development of outer space. In this case the following conditions must be observed.

First, the cost of geospace transportations must be lowered approximately a thousand times in comparison with what it is today, that is, to a level close to the cost of land transportations. Otherwise, the industrialization of outer space will be beyond what humankind can afford. For instance, if only a million tons of cargo is delivered to space a year at the prices of today (cf.: the volume of present-day cargo transportations on the USSR territory alone amounts to several billion tons annually), this will cost several trillion dollars a year.

Second, transport must not have ecological limitations on the growing volume of cargo transportation from earth to space, up to a billion tons of cargoes a year, which will ensure development for centuries ahead, development without fear of doing harm to the planet's biosphere.

Third, geospace transport must be based on modern instead of future achievements of science and technology so that it could be realized within the same time limits as those envisaged by the US administration for the SDI programme. Otherwise space will be more quickly developed by military-industrial complexes and humankind will simply have no more strength, funds or time left for peaceful efforts on the same scale.

Fourth, the project must preclude the possibility of its being realized by one country. Then it will serve as the basis for uniting all countries with one common and noble goal and render pressure and dictation by the superpowers impossible. Global problems must be tackled by the entire world community instead of being dictated by the interests of one country.

Fifth, the realization of the project must be beneficial for all countries, the entire world community, including the military-industrial complexes. The latter's possibility to influence the destinies of the world must not be ignored. They can be joined at the earliest stages with a higher rate of profit than in the event of realizing military programmes. This would make it possible with time to place military-industrial complexes on a peaceful footing and write off military conflicts on our long-suffering planet at last into the archives.

This "ring buoy" of the planet could be based on a space transport system or a universal transport vehicle (PTV) capable of delivering hundreds of millions of tons of cargo and hundreds of millions of passengers to orbit during one flight. It is consistent with all the aforesaid demands. The construction of such a PTV, with a mass of hundreds of millions of tons and a rated input of hundreds of millions of kW, is something to be effected in the distant future, the mid-21st century, not earlier. However, the construction of a PTV will be a multistage process, on the initial stage of which (in time — the beginning of the next century) I would like to dwell in greater detail.

Imagine an open-work bridge of the railway pedestrian crossing type going beyond the horizon in both directions. It girdles the planet along the equator or passes along a plane running parallel to it. The bridge copies the bold relief of the terrain and evens out the microrelief of the earth's surface. Above water expanses, which are longer than dry land, this construction will rest on anchored floating platforms. Energy-generating and administrative buildings, plants and space shops and houses and stations for forming space cargo flow will also serve as the pylons of the bridge.

Above the bridge there will be a track running along it, linear motor and a magnetic suspension system. A vacuum-filled pipe casing with a rotor inside it is placed along the motor and magnetic suspension with the possibility of further elevation. The light thin-walled casing and the rotor inside it, having 30 and 10 cm respectively in diameter, thus embrace the planet and have a length of 40,000 km. The rotor is intended to be put in orbit and is therefore made out of the payload to be delivered to orbit: raw materials and supplies to be processed in space into articles and constructions, and also out of constructional elements and their prefabricated parts which are necessary for building different installations.

But how will this rotor, enclosed in an air-tight casing, girdling the planet, emerge in outer space? The linear motor and magnetic suspension are switched on. The rotor hanging in the centre of the casing comes into motion along it and, accordingly, into rotation around the planet. The rotor moves faster and faster and as soon as it reaches satellite velocity (depending on the power input it will attain this velocity several hours or days after the motor has been switched on) it becomes weightless. But the velocity continues to grow until it reaches 10,000 mps. Then the linear motor and the magnetic suspension, which kept the rotor from premature lift-off, are switched off. Since the rotor has a speed sufficient for going over to a higher circular orbit and amounts to a ring girdling the planet, this ring will continue to rotate by inertia and at the same time smoothly increase in its diameter, until it completely egresses into adjacent space, having spent several dozen minutes on this route. Although the rotor will have the velocity of a meteor, it will not burn down in the atmosphere because, while ascending, it will carry with it the vacuum-filled casing in which it was enclosed all the time prior to that. For this the casing has an autonomous magnetic suspension system relative to the rotor.

As the diameter of the ring formed by the vacuum-filled casing with the rotor inside increases in the process of orbital insertion, they lengthen by 1.57 per cent per each 100 km of ascent above the earth. It is easy to achieve this lengthening without disrupting the compactness of the material of the casing and the rotor. After injection from the dense layers of the atmosphere the casing is dropped to the ground for a repeat use, and the rotor is divided along its length into separate fragments either linked to one another in the shape of telescopic combinations or moving along independent orbits. The mass of the rotor being 25 kg per meter of length, exactly one million tons of cargo will be delivered to space during one flight.

The very first launching of the rotor forms around the earth, at an altitude of 500-1,000 km or higher, a circular structure which will subsequently serve as the basis for creating a space necklace of the planet and connect the plants, factories, power installations and dwelling complexes, built in space, with transport and energy communications to form a single system. Subsequent launchings of the rotor will be used to deliver to space elements of solar power stations, for instance, rolled film reflectors positioned inside the rotor, as well as rods for building the carcass of power stations, each with an area of dozens of square kilometres. One launching of the rotor will be enough to deliver materials for building solar power stations with an aggregate capacity of upwards of 100 million kW. The electric power they generate will then be used to meet the needs of production being unfolded in orbit, and part of it will also be transmitted back to earth for the needs of the PTV.

The volume of geospace transportations and, accordingly, the rate of industrializing outer space will be determined solely by the electric power consumed by the PTV. For instance, if the USA gives for the needs of the PTV the surplus, now unused, capacities of its electric power stations, and this is 20 million kW, upwards of 50 million tons of cargo will annually be brought to space. For the sake of comparison it can be said that if Americans wanted to send this amount of freight to space by 2100 with the help of Space Shuttle they should have started to implement their programme (with the maximum planned number of launchings being 60 a year) in roughly those years when the first homo sapiens appeared on our planet (this occurred about 40,000 years ago). The PTV, however, will send the same or even a greater amount of freight to space every year.

The total cost of this PTV can be estimated at 500 billion dollars and the mass of its metalwork at 200 million tons. Therefore the construction of a PTV is within the power of even one country, to say nothing of the world community.

The cost of electric power being lower than one cent per kWh, the cost of putting cargoes in orbit with the help of a PTV will be within the limits of one dollar per kg, which is thousands of times cheaper in comparison with rocket transport.

After the freight-carrying PTV becomes operable and the industrialization of outer space begins, the need for geospace transportations will increase. On par with this there will be a rise in the need for passenger transportations, which rocket-space transport will no longer be able to meet. It is then that the first reconstruction of the PTV will be effected. The rotor will be made not out of the payload delivered to space, but as a stationary construction with a mass in the order of 10 million tons (250 kg per long metre). The linear motor and the main magnetic suspension system will be positioned not on the bridge but in the walls of the vacuum-filled casing. This will enable the casing together with the rotor to reach out to the calculated circular orbit and to deliver on the external store—special freight and passenger containers—millions of passengers and millions of tons of cargo during one flight. Spending 100-200 billion dollars a year for the reconstruction of the PTV and the industrialization of space (these sums will be deducted from the spending on the arms race), humankind would be able by the middle of the next century to complete the industrialization of adjacent space, where the bulk of the planet's industry and power engineering will be transferred by that time.

What will remain for the planet will be clean air, unpolluted river water and seas, calm, undisturbed by shots and explosions, and a prospect of unlimited and harmonious development for the human race. After all, the development of the stellar ocean by man will be just as important a stage in the development of life on our planet as fish going ashore in prehistoric times.