PHOTOGRAPH THIS SHEET

ADA084507

DTIC ACCESSION NUMBER

LEVEL

INVENTORY

FTD-ID(RS)T-1495-79

DOCUMENT IDENTIFICATION

DISTRIBUTION STATEMENT A
Approved for public release;
Distribution Unlimited

DISTRIBUTION STATEMENT

ACCESSION FOR	
NTIS GRA&I	☑
DTIC TAB	☐
UNANNOUNCED	☐
JUSTIFICATION	
BY	
DISTRIBUTION /	
AVAILABILITY CODES	
DIST	AVAIL AND/OR SPECIAL
A	

DISTRIBUTION STAMP

DTIC
ELECTE
S MAY 22 1980 D
D

DATE ACCESSIONED

DATE RECEIVED IN DTIC

PHOTOGRAPH THIS SHEET AND RETURN TO DTIC-DDA-2

DTIC FORM 70A OCT 79

DOCUMENT PROCESSING SHEET

FTD-ID(RS)T-1495-79

FOREIGN TECHNOLOGY DIVISION

INTO SPACE WITHOUT ROCKETS: A NEW IDEA FOR SPACE LAUNCH

By

Yu. Artsutanov

EDITED TRANSLATION

FTD-ID(RS)T-1495-79 26 October 1979

MICROFICHE NR: FTD-79-C-001416

INTO SPACE WITHOUT ROCKETS: A NEW IDEA FOR SPACE LAUNCH

By: Yu. Artsutanov

English pages: 6

Source: Znaniye-Sila, Nr. 7, 1969, p.25.

Country of Origin: USSR
Translated by: Bernard L. Tauber
Requester: AFFDL/FBG

U. S. BOARD ON GEOGRAPHIC NAMES TRANSLITERATION SYSTEM

Block	Italic	Transliteration	Block	Italic	Transliteration
А а	*А а*	A, a	Р р	*Р р*	R, r
Б б	*Б б*	B, b	С с	*С с*	S, s
В в	*В в*	V, v	Т т	*Т т*	T, t
Г г	*Г г*	G, g	У у	*У у*	U, u
Д д	*Д д*	D, d	Ф ф	*Ф ф*	F, f
Е е	*Е е*	Ye, ye; E, e*	Х х	*Х х*	Kh, kh
Ж ж	*Ж ж*	Zh, zh	Ц ц	*Ц ц*	Ts, ts
З з	*З з*	Z, z	Ч ч	*Ч ч*	Ch, ch
И и	*И и*	I, i	Ш ш	*Ш ш*	Sh, sh
Й й	*Й й*	Y, y	Щ щ	*Щ щ*	Shch, shch
К к	*К к*	K, k	Ъ ъ	*Ъ ъ*	"
Л л	*Л л*	L, l	Ы ы	*Ы ы*	Y, y
М м	*М м*	M, m	Ь ь	*Ь ь*	'
Н н	*Н н*	N, n	Э э	*Э э*	E, e
О о	*О о*	O, o	Ю ю	*Ю ю*	Yu, yu
П п	*П п*	P, p	Я я	*Я я*	Ya, ya

*ye initially, after vowels, and after ъ, ь; e elsewhere.
When written as ё in Russian, transliterate as yё or ё.

RUSSIAN AND ENGLISH TRIGONOMETRIC FUNCTIONS

Russian	English	Russian	English	Russian	English
sin	sin	sh	sinh	arc sh	$\sinh^{-1}$
cos	cos	ch	cosh	arc ch	$\cosh^{-1}$
tg	tan	th	tanh	arc th	$\tanh^{-1}$
ctg	cot	cth	coth	arc cth	$\coth^{-1}$
sec	sec	sch	sech	arc sch	sech^{-1}
cosec	csc	csch	csch	arc csch	csch^{-1}

Russian	English
rot	curl
lg	log

INTO SPACE WITHOUT ROCKETS: A NEW IDEA FOR SPACE LAUNCH

Yu. Artsutanov

"An elevator into space" - this idea was put forth in 1960 by the author of the article which you are now reading. We recall that this was fantastic but based on a firm theoretical foundation of a plan for constructing a tower about 35,000 kilometers high - a tower whose upper end would be equivalent to a satellite rotating in a so-called stationary orbit. In this orbit, the satellite would "hang motionlessly" above a selected point on the Earth's surface. Thus, it would be possible to go into space by rising to the top of the tower in a regular elevator rather than using rockets. And there - simply pushing off energetically, one could find himself in outer space. Now, engineer Yuriy Artsutanov tells about a new project which is just as fantastic and just as theoretically realistic.

"There is no motion, said the bearded wise man..." In these lines, Pushkin recalled the old argument between Zeno of Elea, son of Teleutagoras, and Diogenes of Sinope. The famous Zeno paradox ("If an arrow flies, it is at some point in space at each instant and if it is at this point in space at each instant it is stationary in it; but a body cannot move and be stationary simultaneously, consequently there is no motion") and its solutions were written about many times already and really, this is not what

we are discussing. But I recalled the Zeno paradox for this reason.

However rapidly a wheel may roll along a road, at any instant some point of the rim touches the ground. In other words, it is stationary and its speed relative to the ground equals zero. On the other hand, the speed of the translational (not rotational) motion of the opposite point of the rim is twice as great as the speed of the axis. So that here we no longer have a paradox but customary reality.

It is clear that the greater the diameter, the greater the time that the points of the rim are close to the ground. In other words, they move with speeds which differ very slightly from zero. Let us say that if we take a wheel with a diameter of 4 kilometers and start it along a road at a speed of 36 kilometers per hour, then any quick ant who happens to be nearby is able to scramble onto it: a calculation shows that the point of contact will cover a distance of 2 millimeters during the time of about 0.1 seconds. And if the ant, I repeat, is sufficiently prompt he uses this circumstance, jumps on this unique streetcar under way and rolls along at a speed which is unheard of from the ant's point of view of him: up to 72 km per hour! The trip will take little more than a minute and then the point where the ant sits will again come in contact with the road and our traveller, coping in jest with a distance of three quarters of a kilometer, happily slides onto the ground.

And now about the satellite.

Imagine that a wheel with a diameter of 2000 kilometers is rolling along the Earth's equator. Why namely 2000 kilometers? This will be discussed somewhat later.

Thus, a wheel with a diameter of 2000 kilometers is rushing along the equator over a specially laid road with a speed of (for the nave) 7 kilometers per second. Each point on the giant rim is in contact with the Earth for an insignificant instant. But if it is no longer an ant which is somewhere on the road, and a man makes an alighting platform, then the contact point will travel a little more than a distance of only 2.5 meters past the platform in one second. That is, it will move with the speed of a fast-walking man. Please be seated! Or, if it is convenient, attach a comfortable car with travellers to the rim!

Immediately after this, the car rushes into space together with the rim. The overload reaches 5 g's. It is not particularly pleasant - but for an ordinary person such an overload is not fearsome. At an altitude of 1 kilometer velocity reaches 280 m per second and at an altitude of 10 kilometers - 900 meters per second. However great this speed is, it is much less than cosmic speed and air resistance will not play a substantial role. Even at an altitude of 100 kilometers, that is, where the atmospheric resistance is infinitesimally small, flight will proceed with a velocity of only 3 kilometers per second.

At the very top of the wheel the car with the travellers is now flying at a speed of 14 kilometers per second - almost at solar escape velocity! - and, separating, exactly at midnight (local satellite time) when its speed is added with the Earth's speed of flight around the sun, it sets off on a trip beyond the limits of the solar system. But separating at any other point - on flight which does not emerge beyond the limits of the solar system. So, on the strength of this the diameter of the wheel is selected namely as 2000 kilometers: we simply have no need for velocity of more than 14 km/s.

The return to Earth occurs in the reverse order: the car is attached to the wheel at a point where the velocity of the rim is equal to the velocity of the car. The rim with the attached "ant," reducing speed smoothly, takes off for the Earth and there at a docking platform the car is separated at a speed close to zero. A soft landing has been accomplished.

I already hear the objection: "Wheel! Really, can one create such a wheel? And the road along the equator with a length of 40,000 kilometers, across the sea and ocean!... No, the project in the best case is a game of the mind and no more..."

Actually, the objections are serious. But you see, no one requires that the wheel be made with a continuous rim. For we are not assuming the construction of an infinite number of alighting and docking platforms! Then, we can break the rim or, more correctly, restrict it so that only one spoke and a massive nave which will fly along the orbit of an Earth satellite remain. The spokes will roll along the surface of the Earth like a giant star fish. At the points where the "star" touches the Earth we have the alighting-docking platforms. As a result, we do not even need a road with a length of 40,000 kilometers. Furthermore, we can even be limited to two spokes with such a rotating diameter! As you see, here it is already much more realistic than seems at first glance.

True, this plan also has its weak point: the construction of the spoke. A calculation provides discomforting figures: the strength of materials which are to be used for construction should exceed 1000 kg/mm^2 - several times higher than the strength of existing materials. But, on the other hand, it is not proposed to build the "wheel" today.

Well, and how effective is the "productivity of the labor" of the wheel-satellite? I conducted an approximate calculation: for the weight of each spoke of about 100 tons we can in principle land on

the Earth and dispatch into space a ton of cargo every 8 minutes (with 2 "spokes").

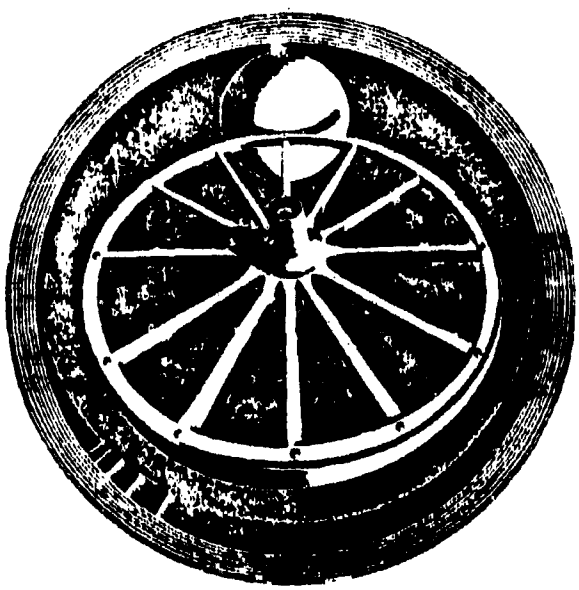
Actually, the cargo turnover will be a little less since the position of the "wheel" will not be favorable for launching the car in the required direction with each revolution of the "wheel." Considering losses to friction against the air, it is necessary to balance the amount of cargo being sent and received. For the ship being dispatched takes away part of the satellite's energy while one which is landing gives it up. This will also have to be considered, that is, discharge somewhat more cargo or turn on jet engines periodically or more massive cargoes along the diameter. By the way, these are only details now.

In order to make the movement of the "spokes" more stable, it is desirable to make the "spoke" as massive as possible. It is best of all to create a heavy satellite observatory or something of this type in this place. Moreover, communication with it will be very simple and convenient. We use the same effect of rotation of the satellite-sheel. Simply speaking, we will lower to Earth a loop of strong rope which is put on the rotating nave. A unique elevator is obtained with the aid of which it is possible to lift cargo and people into the observatory.

Interestingly, the required strength of the materials for the satellite-wheels is not connected with the gravity on the surface of the planet: for the satellite-wheel is in a state of weightlessness. Therefore, the landing of a research station, let us say, on Jupiter and its takeoff from it appears to be completely realistic. And this is without expenditures of fuel, which is especially important for a planet where gravity exceeds the Earth's gravity by more than 300 times.

In short, wheel-like or, if suitable, pseudo-wheel-like satellites can open an extremely unexpected horizon before cosmonautics.

Well, and will they be created - the future will answer this. Flights on rockets were also fantasies at one time.



DISTRIBUTION LIST

DISTRIBUTION DIRECT TO RECIPIENT

ORGANIZATION		MICROFICHE
A205	DMATC	1
A210	DMAAC	2
B344	DIA/RDS-3C	9
C043	USAMIIA	1
C509	BALLISTIC RES LABS	1
C510	AIR MOBILITY R&D LAB/FIO	1
C513	PICATINNY ARSENAL	1
C535	AVIATION SYS COMD	1
C591	FSTC	5
C619	MIA REDSTONE	1
D008	NISC	1
H300	USAICE (USAREUR)	1
P005	DOE	1
P050	CIA/CRB/ADD/SD	2
NAVORDSTA (50L)		1
NASA/NST-44		1
AFIT/LD		1
LLL/Code L-389		1
NSA/1213/TDL		2

ORGANIZATION		MICROFICHE
E053	AF/INAKA	1
E017	AF/RDXTR-W	1
E403	AFSC/INA	1
E404	AEDC	1
E408	AFWL	1
E410	ADTC	1
	FTD	
	CCN	1
	ASD/FTD/NIIS	3
	NIA/PHS	1
	NIIS	2