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FOREIGN TECHNOLOGY DIVISION

SHOT TO THE MOON FROM A CANNON

by

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EDITED TRANSLATION

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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

GRAPHICS DISCLAIMER

All figures, graphics, tables, equations, etc. merged into this translation were extracted from the best quality copy available.

Shot to the Moon from a Cannon ("From the Earth to the Moon"); Revisited

V. Mikhalev, engineer

When the mastery of space assumes industrial scale, the question concerning the methods of delivering basic artificial Earth satellites, structural materials for scientific and industrial structures, space bases, and then entire interplanetary cities inevititably arises. Millions of tons of diverse freight will have to be "hurled" into space, by overcoming the Earth's gravity or, on the other hand, it will have to be lifted from the Moon, Mars, Venus and directed to the cradle of mankind - the Earth.

For large-scale operation a rocket is a too expensive type of transportation. The transportation, for example, of diamonds, if they are even directly on the lunar surface, will be unacceptable due to the the incredible expense.

As is evident, the industrial mastery of space with the employment of rocket transport is unprofitable. This means, it is necessary to seek out other methods of delivering people and freight into space. And, in order to facilitate this search, it is necessary to clearly understand what the main deficiencies of rocket transport are.

In the first place, it consists in the fact, that a rocket carries onboard a very tremendous fuel supply.

"Excuse me!", says the reader. "Is it really possible to separate the fuel from the transport means?"

"And why not!" "You know a projectile, coming out of the barrel of a gun, is also a means of transport. It carries within itself a canister or, for example, an explosive charge."

"This is just a return to the old, disgraced idea of Jules Verne, contained in "Shot to the Moon from a Cannon" ("From the Earth to the Moon"), - others are again being noted with mistrust."

"And why, in fact, is this idea of a genial visionary poor? Is it possible, that it simply needs updating? Let's try to examine it in this respect."

The main deficiency of a cannon as a means of transport boosting is the too great acceleration after it is fired. The second is the impossibility of attaining escape velocity due to the limited rate of the expansion of gases. And there are other deficiencies, but not of a fundamental nature.

And if not a powder, but an electrical cannon is taken - a tremendous solenoid, let us say, 500 km long. Within the solenoid tube there is a vacuum. Magnetic cushions on the internal surface prevent the friction of the capsule vehicle against the walls of the tube. Locking chambers ensure the hermetic sealing during the loading of the capsules into the device. The exit end of the tube, aimed into space, is separated from the atmosphere by an automatic breechblock and a film diaphragm, which is pierced during the launch of the capsule. The breechblock operates automatically behind it, and to pump out the air after the restoration of the film curtain only a small section about one kilometer long will be required.

After having been launched the capsule will pierce the thickness of the atmosphere. In order that not too much energy is expended on

this, the shape of the capsule should be very elongated - in the form of a very large needle.

It is necessary to equip the nose section of the needle with special thickening made from heat-resistant material. During the 5-6 seconds, that it takes to "broach" the atmosphere the velocity losses of the capsule will be very insignificant.

The acceleration of the capsule within the solenoid is ensured by the automatic switching of the windings, positioned along the tube. During an acceleration of 8g for boosting the capsule to a velocity of 8 km/s a time of about $\approx$100 s is required, with a power of about 320 kW per 1 kg of weight of the capsule

$$\left(N=\frac{mv^2}{2t}; M=\frac{P}{q}\right).$$

Consequently, with a capsule weight of 1000 tons a pulsed power of 320 million kW is required, which exceeds by more than 2 times the power of all the electrical generating plants in the Soviet Union. But if the electrical cannon fires a thousand-ton capsule only 20 times per day (twenty-four hour period), then the average power is reduced by almost 45 times, constituting a total of about 7 million kW. This is completely commensurate with the power of a large modern hydroelectric power generating plant. Electrical energy accumulators - powerful capacitors or storage batteries - ensure the obtaining of the necessary power pulse.

In this case the productivity of the installation will be as high as twenty thousand tons per day (twenty-four hour period). Such a cannon will lift into space in one shot a much greater load, than all the rockets, launched during the 10 years of the space age.

Certainly, the realization of such a project is fraught with a great number of difficulties. For example, for supplying such colossal power to the windings of the gigantic solenoid of the capsule space accelerator, apparently, it will be necessary to employ the supercon-

ductivity properties of certain materials at low temperatures. Great difficulties will arise during the very precise assembly of the tube and the magnetic cushion, and in the solving of the problems of the hermetic sealing of the locks, the automatic breechblocks and other components of the project.

But one thing is clear - the installation with a power of several million kilowatts will be able to hurl 20 thousand tons of freight into space during the course of one twenty-four hour period (a day). Probably, the game is worth the candle!