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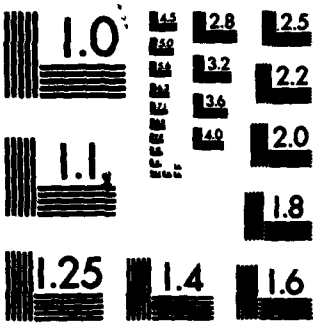

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FOREIGN TECHNOLOGY DIVISION

AREAS OF THE RATIONAL USE OF DIFFERENT SPACECRAFT POWER SYSTEMS

by

A. A. Kuladin, S. V. Timashev and V. P. Ivanov

Approved for public release;
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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.

§17.4 AREAS OF THE RATIONAL USE OF DIFFERENT SPACECRAFT POWER SYSTEMS

A.A. Kuladin, S.V. Timashev and V.P. Ivanov

By areas of the rational use of different energy systems, which differ from each other by the type of the source and converter of the primary energy, the type of onboard reaction engines and so on, we usually understand as conditions in which the use of their individual classes is most expedient. The number of such conditions includes the following: the necessary average values of electrical power; programs of the change in the required power during a definite period of time (during one revolution of the spacecraft, during one day, and so on); duration of active functioning of the spacecraft and the effect of the surrounding medium (resistance of the atmosphere, radiation belt and so on); the total required power of the characteristic speed, and so on.

The expediency of the use of a certain kind of onboard power system, depending on the enumerated conditions, will be determined by the totality of the separate criteria and indices of comparative efficiency of their main elements: power and propulsion plants, devices for the removal of heat released in the operation of the different onboard users, and so on. As was mentioned, at present there does not exist any generalized criteria according to the optimum of which it would be possible to select for any space objects the most rational types of power and propulsion plants. For each type of problems solvable by the spacecraft of a definite specific purpose, there exist their own optimal classes of power systems with the

appropriate complex of parameters of the operating process and remaining data of their individual elements. However, for the general concepts of the areas of use of main elements of the onboard power system - power and propulsion plants - it is possible to distinguish a number of the main indices or conditions of rather their possible than their rational use. The number of these indices includes the following: the average required power, duration of their provision, the required total value of the characteristic speed, and the time of its reaching.

Then, keeping in mind the basic properties and data of the power and propulsion plants examined in this book, the indicated areas can be judged from the following two tables.

Table 17.3

1) Продолжительность функционирования	2) Среднепотребляемая мощность				
	3) Десятки Вт	4) Сотни Вт	5) Единицы кВт	6) Десятки кВт	7) Сотни кВт и более
8) Единицы сут.	1	4 / 2 3	4 / 3		
9) До 30—40 сут.	4 6 / 1 2	4 5 6 / 2 3	4 5 / 3		
10) До 2—3 мес.	4 6 / 2	4 5 6 / 2 3 6	5 8 9 / 8 9	8 9 10	
11) До 1 года	4 7 / 7	4 5 7 / 7	5 8 9 / 8 9	8 9 10	9 10 11
12) Свыше 1 года	4 7 / 7	4 5 7 / 7	5 8 9 / 8 9	8 9 10	9 10 11

Key: 1) Duration of functioning; 2) Average required power; 3) Tens of W; 4) Hundreds of W; 5) Units of kW; 6) Tens of kW; 7) Hundreds of kW and more; 8) Units of days; 9) To 30-40 days; 10) To 2-3 months; 11) To one year; 12) More than one year.

Table 17.4

$\Delta V/\delta t$ м/с² / m/s^2	ΔV, м/с / m/s						
	50	200	500	1000	2000	3000	5000
10^{-2}	12	12	12+13	12+14	12+14	12+15	12+15
10^{-3}	12 13	12 / 12+13	13	13+14	14	14 15	14 15 16
10^{-4}	13	13	13+14	14	14 15	15 16	16
10^{-5}	13	14	14 15	15 16	16	16	16

Designations (to the tables):

1 - chemical batteries;
2 - chemical powerplants on the basis of fuel elements;
3 - chemical powerplants on the basis of machine converters;
4 - solar batteries;
5 - solar thermal powerplants;
6 - radioisotopic generators on the basis of briefly living isotopes;
7 - radioisotopic generators on the basis of long-living isotopes;
8 - YaEU [Nuclear Powerplant] based on TELP [?-Thermionic Converter];
9 - YaEU based on TEMP [?-Thermoelectromagnetic Converter];
10 - YaEU based on turbogenerator converters;
11 - YaEU based on MGDP [?-Magnetohydrodynamic Converter];
12 - engines on compressed air and micro-ZhRD [micro-Liquid Propellant Rocket Engines];
13 - electrothermal engines;
14 - electromagnetic engines of continuous operation;
15 - pulsed electromagnetic engines;
16 - electrostatic engines.

The numerator characterizes the possible types of powerplants when conditions of the surrounding medium have an effect on the operation, and the denominator characterizes the types of powerplants the operation of which does not depend on conditions of the surrounding medium.

Recommendations resulting from the given tables are, to a considerable degree, conditional, since they do not consider such important factors as features of the operation, cost, the possibility of creation at definite periods, and so on.

Thus the data of the tables should be considered only as preliminary concepts concerning areas of the possible use of different classes of the power and propulsion plants.

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