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WHERE DO WE STAND IN THE SPACE RACE?

The question of where the United States stands in relation to the Soviet Union in the race to achieve a useful capability for space flight is not one which can be given a simple answer, and yet finding an acceptable answer is important both to assessing our current position in the world and to decisions on what we should be doing in the immediate future.

One aspect of this question relates to the field of opinion without regard to exact physical comparisons. Both nations have had some notable successes, but any review of world press commentaries, public opinion polls, and similar assessments certainly gives the edge to the Soviet Union. Partly because the early Soviet successes were unexpected among laymen, and partly because the Soviet Union has been able to give the impression of ever heavier payloads placed in orbit at strategic moments without evident failures, that government has created a powerful image of scientific and technical leadership which in turn has enhanced its power to play rocket blackmail. The United States has gained some advantages from its open frankness including detailed discussion of technology, timetables, and operational difficulties, but the slippages and failures along the way have not inspired the same kind of awe the Soviet Union has achieved. Undoubtedly,

the larger number of launchings made here, and the publicised successes of Tiros weather pictures, Pioneer V long distance communication, Echo signal reflection, and airborne Discoverer capsule snatching are all successes which we should capitalize upon, but they should not be reason for blinding ourselves to other, more pertinent comparisons which bear upon the future progress and security of the Nation.

Perhaps there is no objective proof of which country is ahead psychologically, if interpretation remains a subjective quality. However, it seems undeniable that the Soviet Union's investment in space exploits has brought political and perhaps military rewards of tremendous value which we have not been able to neutralize through our own efforts to date.

Now to turn to more objective, quantitative comparisons between the two countries: This is fraught with perils, too, because the Soviet and American programs have followed somewhat different paths, and unlike things are not easy to compare. Considering the leadtimes involved, it is correct that if the United States program were merely a reaction to the Soviet program, matching exploit with exploit, we probably never would catch up, for the Soviet program seems to have a definite momentum, and the initiative would remain theirs. Our program should be worth pursuing for its own values quite aside from our foreign competition, and should be comprehensively planned to meet our several objectives.

But a recognition that it may not need to meet specific Soviet achievements can too easily be used as an excuse for not doing enough either to meet internal needs or the external ones of the image of success in a rivalry of great significance.

There is a too natural tendency to compare a few specific accomplishments by each of the two contending powers in the space race, and drawing conclusions which may be valid in their specifics but are not valid to an assessments of the main stream developments toward broad goals. Which is a bigger accomplishment: to take photographs of the back side of the Moon or to take thousands of weather photographs of the Earth? Both are fine achievements. The weather pictures continued for a longer period of time and were put to immediate practical uses. The pictures of the back side of the Moon represented new exploration of a very high order. Keeping in mind the warning above that the United States response should not be just to react to Soviet accomplishments, it still remains instructive to compare the accomplishments of each country and ask the question: How soon could the rival perform a similar feat? There seem today to be more American accomplishments which could be duplicated by the Soviet Union within a year or so of a decision to do this than is true in reverse. And perhaps one of the biggest factors in this is the Soviet lead in acquiring a large and reliable booster rocket. Until Saturn becomes operational in 1964, we cannot match the current Soviet capability in putting up heavy and complex payloads.

The point has been made that the two programs differ in their particulars, but that certain mainstream goals should still be identifiable which are applicable to both nations, affording a basis for long run comparison. What are these goals? The aim of space research and development is to acquire a capability to use space and to travel through space so that we can extend the frontiers of knowledge of Nature's processes, including increased control of our environment, and an understanding of matter, energy and life itself. With this knowledge and capability, we want to be able to use the space medium and the new forces and resources we discover to enhance the well-being and security of both our own people and of mankind in general. With this broad and sweeping purpose, what comparisons can we make?

The United States program includes a comprehensive study of radiation, solar and geophysical phenomena. It looks forward to a program of application in communications, weather prediction, navigation, geodetic survey and astronomical study. It includes a step by step approach to manned flight first for a few hours in orbit around the Earth, and later in larger satellite stations and to the Moon and planets. It is a program which will bring much knowledge, and if there were no outside pressures or considerations, would be harder to challenge as less than adequate. But in fact, it calls for a limited assignment of available resources of

manpower and material below our existing capabilities to progress, and seems most unlikely to close any gap in the race with the Soviet Union. This is the almost unanimous opinion of technical men at the working levels who are not restricted by the policy considerations which influence the public statements of those who control the flow of funds.

How can we make any judgments about the Soviet program? It is a common statement by our top officials that we can not make comparisons because we do not know what the Soviet program is. Of course we do not have an exact blueprint, and yet for those who will look, there is no great mystery about the Soviet plans. Every experiment they have accomplished to date has been first predicted and discussed in their published records prior to the experiments. They have outlined comprehensive plans for the future quite as all inclusive as any we have programmed. One definite comparison which can be made is to note experiments and sizes of vehicles already accomplished, and then to note the estimated time by which our own orderly plan which is not just a reaction to theirs will include the same capability. In general, this shows a three to five-year lag in most respects. This is a gap which will not be closed without a major and conscious effort over a period of years.

What accounts for Soviet successes; are they genuine?

There is no magic way, no secret fuel which accounts for the Soviet record. Almost certainly they have had many failures, and we can regret that if we have knowledge of the details of these failures that these cannot be published without revealing our sources of information, in the interest of a balanced perspective and a keener insight into how the Soviet technicians have overcome their problems. As to the question of whether Soviet successes have been genuine, one of the most disheartening aspects has been the capacity of some American officials to maintain their own illusions and comfortable explanations as they have retreated from one position to another.

The Soviet achievement of the atomic bomb in 1949 came years sooner than most of our "experts" thought likely. The air transportable thermonuclear weapon apparently was tested sooner in the Soviet Union than in the United States. The Soviet announcement of a plan for an IGY scientific satellite caused no particular concern. When Sputnik I went into orbit, at first some commentators were convinced that the release was in error because it said 184 pounds of payload instead of 18.4 (the approximate weight of our still developing Vanguard). Then prominent men referred to it as a "hunk of cast iron", a "silly bauble", and were not disturbed "one iota". We were told that a bomb could not fall from orbit, and that even to hit the Moon was a simpler problem than to send an ICBM from one continent to another. One widely publicised

estimate of the thrust required to mount the first sputniks was conveniently less than that of our own ICBM thrust. This was theoretically possible, but ignored the reasons why the Soviet Union chose early to develop a large amount of thrust for their ICBM in days when warheads were not so small. Further, as sputnik accomplishments grew, modest first stages would have implied high performance upper stages which also are not yet ready in this country. When it was conceded later that Soviet thrust was greater than our own, then it was explained that we were ahead in guidance, miniaturization, and power supply. Since then the Soviet Union has demonstrated its guidance capabilities, at least according to its own claims, and with some checkable evidence as well, by its near pass at the Moon, its lunar impact, it backside photos, its Pacific rocket tests, and the recovery of the dogs from orbit. Sputnik III demonstrated the reliability of its power supply and electronics by broadcasting for the almost two years of its life in orbit. Perhaps many of its instruments were not miniaturized, although the Soviet scientists said it contained thousands of transistors. The assessment must lie in the view that with plenty of carrying capacity, emphasis was put upon reliability rather than miniaturization per se, and the significance of this for the future is that manned space flight cannot include miniaturization of man himself. Consequently, in the main stream of long run development, large weight lifting capability is absolutely essential both to

carrying men and to advanced automatic stations which must make many measurements at great distances.

Can we take at face value Soviet claims about their space accomplishments? Of course they will mislead us whenever it suits their purposes if they think they can get away with it. This has certainly been their code in other areas of international relations. We know they hide their failures. At the same time, so far it has suited their purposes to keep their claims with regard to space consistent with such independent data as we can assemble from a variety of sources, including a pattern and pace of development consistent with what we are sure we could do if we had started as soon and had worked with the same singleness of purpose.

Let us now look at some specific Soviet space accomplishments as a clue to possible span of lead over the United States, even though such comparisons are open to some challenge. Sputnik I in October, 1957 carried a payload we did not equal until about Discoverer II in April, 1959. At least according to Dr. Sedov, it carried a weight into orbit not yet matched by any United States launching, except approximately by Project Score in December, 1958.

Sputnik II carried a payload into orbit in November, 1957 which the United States did not match or exceed until Midas II

in May, 1960. Its transporting of a living warm-blooded vertebrate has yet to be matched in this country.

Sputnik III of May, 1958 also carried a payload not exceeded by a narrow margin until Midas II, two years later. Sputnik II also carried within it all the experiments we had planned for the entire IGY period plus all the principal experiments planned for the next year or two thereafter.

All three of the Cosmic Rockets, or Luniks as we call them, launched between January, 1959 and October, 1959 carried payloads to the vicinity of the Moon which we will not duplicate completely in weight until Saturn becomes available around 1964.

The two Cosmic Ship launchings of 1960 (sometimes called Sputnik IV and V) with over 10,000 pounds of payload each, and perhaps as much as 25,000 pounds of total weight in orbit seem to represent the Soviet equivalent of our 1964 Saturn launch vehicle capability together with a potential manned space ship equivalent to our Project Apollo which is still four or five years away from realization. All suggested characteristics of the Soviet space ships used in 1960 are far more ambitious than our planned Mercury capsules which have not yet been put into orbit even with animals. The Soviet return of dogs from orbit included instrumentation, telemetry techniques, and other evidences of bioastronautical experience our own specialists do not expect

to be able to match in entirety for another five years.

Although there is yet no proof of how soon it will come about, Khrushchev in his artful way casually mentioned in his recent visit to Finland that "soon" the Soviet Union would launch satellites weighing 60 tons. The prediction was obscure, but represents not an impossible goal, for it is of the same order of magnitude which this country hopes to achieve in about eight years with a concept we have labeled Nova.

These comparisons are over simplified and open to some rebuttal, but at least have more validity than any simple count on the number of launchings each country has made to date. They certainly show no apparent trend toward closing the gap. And certainly the Soviet achievements are consistent with the mainstream objectives of a real capability to travel through and use space. So are most of our experiments, but on a later time scale by perhaps three to five or more years.

Some consolation can be taken from the fact that with our limited weight lifting capacity we have tried to extract a maximum of new information about space. This is true, and we have been able to announce first such discoveries as the Van Allen radiation belts and the pear shaped character of the Earth. A word of caution is required at the same time, however. As the front runner, the Soviet Union has capitalized upon announcing

its successes and discoveries which would have maximum political and military effects in the world struggle, but they have held to a minimum disclosing information about space and rocketry techniques which would help us to catch up. One could argue with equal validity that some of their delayed releases of space science findings represent (a) copying of our analytical results after we did the pioneering interpretation, or (b) disclosure of what had already been noted only after it was apparent that this knowledge was available to us anyway.

Consistent with the Soviet penchant for secrecy, we have never been allowed near their launchings by invitation, and we do not really know whether the full list of experiments in their satellites has been disclosed - in fact the weights announced suggest that some additional tests have been carried without announcement. This raises questions not only about scientific progress, but also about the military uses of space. The Soviet program has more than justified itself in cold war terms alone, but it almost certainly relates to weapons systems as well.

The Soviet Union has made much of the claim that its space research is related exclusively to scientific advancement. But this must be assessed in terms of their unwillingness to allow anyone to approach their launching facilities or to see even photographs of their complete rocket assemblies. And the claim to

peaceful development is also lessened with their frequent references to the long range, great destructive power, accuracy and large numbers of ICBMs whose technology and development are so completely interwoven with space development.

The United States also champions the use of space for peaceful purposes. However, being an open society, we have also suffered a propaganda barrage because our military services are known to be working in space technology, even though the same is undoubtedly true in the Soviet Union. We feel that military use of space technology can support peace on several counts. The same technology useful to communications, navigation and weather reporting can be used interchangeably by military and civilian activities. Midas and Samos detection satellites even if used exclusively by military agencies can support peace by lessening the chance of surprise attack against the free world. Manned space vehicles, whether developed by military or civilian agencies, are equally useful to the peaceful exploration of space just as military as well as civilian activity have opened Antarctica and long range air flight to peaceful purposes.

The role of potential attack weapons in space has been very obscure. No one any longer doubts that ballistic weapons to fly from point to point on the Earth represent a revolutionary force on strategy. In some quarters there seems the same

unwillingness to recognize that future weapons systems based in space may produce new revolutions leapfrogging the ICBMs which now occupy our attention. This is not surprising, for some very able and sound thinkers earlier felt the same way about the ICBM before they learned the hard way that they were wrong.

Even as we seek genuine accommodations to restrict the use of outer space to peaceful purposes, we should not let our development work on the mastery of space be held back by Soviet propaganda when nothing would suit their purposes better than to delay us while they accomplish some decisive breakthrough in space weapons. If we do choose to pursue such development, this no more makes us warmongerers than any other measures we take in the interest of deterrence and defense of the free world.

Some of the revolutionary weapons developments related to space can already be foreseen, but necessary security forecloses a public discussion of these techniques. What they do mean is that whether space research is pursued primarily by a civilian agency or by military agencies or by both, space research at an accelerated pace is important in at least three different ways. One, it is worth pursuing with real vigor even if there were no foreign rival because of the benefits it will bring both to science and to our economic well-being. Two, it is worth a major effort because of its role in the cold war as a symbol of our scientific

and technical capabilities and leadership. Three, it must be pursued in the interest of direct military survival at a time when new revolutionary weapons concepts are being born.

The greatest disservice to the Nation is performed by those who preach complacency with regard to the level of our accomplishments in space and the pace at which we are moving forward. Of course we have every reason to be proud, and the results are magnificent. But they are not enough, and not enough means there are substantial requirements for fresh attention to setting our space goals, organizing our space effort, and providing greater funds to pursue the work.

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SCORECARD OF UNITED STATES AND SOVIET LAUNCHINGS

(This is unofficial because the Soviet Union has not disclosed gross weights in orbit, but those for the first three Sputniks have been claimed by Sedov all to have exceed Project Score, and that for Sputnik II was estimated by the Rand Corp. in Space Handbook. Weights as given for the Cosmic Rockets (Luniks) are the Soviet announcements. Weights for the Cosmic Ships (last two) are estimated as consistent with earlier practice and the probable use of a million and a half pounds of thrust for launching.)

Date	Name	Gross	Payload	Cumulative Gross	Cumulative Payload
10/4/57	Sputnik I	8,800	184	8,800	184
11/3/57	Sputnik II	11,000	1,120	19,800	1,304
1/31/58	Explorer I	31	18	31	18
3/17/58	Vanguard I	53	3	84	21
3/26/58	Explorer III	31	19	115	40
5/15/58	Sputnik III	13,200	2,925	33,000	4,229
7/26/58	Explorer IV	38	26	153	66
12/18/58	Score	8,750	150	8,903	216
1/2/59	Cosmic Rocket I	3,245	796	36,245	5,025
2/17/59	Vanguard II	71	21	8,974	237
2/28/59	Discoverer I	1,300	40	10,274	277
3/3/59	Pioneer IV	13	8	10,287	285
4/13/59	Discoverer II	1,610	440	11,897	725
8/7/59	Explorer VI	192	142	12,089	867
8/13/59	Discoverer V	1,700	300	13,789	1,167
8/19/59	Discoverer VI	1,700	300	15,489	1,467
9/12/59	Cosmic Rocket II	3,331	860	39,576	5,885
9/18/59	Vanguard III	100	50	15,589	1,517
10/4/59	Cosmic Rocket III	3,424	959	43,000	6,844
10/13/59	Explorer VII	92	70	15,681	1,587
11/7/59	Discoverer VII	1,700	300	17,381	1,887
11/20/59	Discoverer VIII	1,700	300	19,081	2,187
3/11/60	Pioneer V	145	95	19,226	2,282
4/1/60	Tiros I	320	270	19,546	2,552
4/13/60	Transit IB	315	265	19,861	2,817
4/15/60	Discoverer XI	1,700	300	21,561	3,117
5/15/60	Cosmic Ship I	25,000	10,009	68,000	16,859
5/24/60	Midas II	5,000	3,000	26,561	6,117
6/22/60	Transit IIA	315	223	26,876	6,340
6/22/60	Greb	-	42	26,876	6,382
8/10/60	Discoverer XIII	1,700	300	28,576	6,682
8/12/60	Echo I	241	163	28,817	6,845
8/18/60	Discoverer XIV	1,700	300	30,517	7,145
8/19/60	Cosmic Ship II	25,000	10,143	93,000	27,002
9/13/60	Discoverer XV	1,700	300	32,217	7,445
10/4/60	Courier IB	550	500	32,767	7,945

UNITED STATES: 27 separate launchings; 32,767 lbs. gross and 7,945 pounds payload.

SOVIET UNION: 8 separate launchings; 93,000 lbs. gross and 27,002 pounds payload. The payload of either of the last two shots exceeded the total payload of all 27 United States shots.