

Six months ago the question was,

“Who says there’s a race for space?”

Today it’s,

What Are We Racing For?

by Eberhardt Rechtin

Our country is now engaged in an effort to go into space at a pace which was almost inconceivable only five years ago. We did not embark upon this course easily or without considerable controversy. We are not the only country so engaged. As a point of fact, it was the vigorous activity of the Soviet Union which prompted our own scale of activity and which has given the exploration of space most of the elements of a race.

Superficially, at least, you might give the present status of the race by saying that the Russians are definitely ahead in terms of the size of their payloads, and that the United States is definitely ahead in terms of the quality and quantity of information obtained from superior instrumentation. It is also fair to state that this particular race got off to a badly organized start. The two racers did not start at the same time. There is some question that the two racers are going in the same direction. The scientific merit of this whole demonstration is certainly not obvious. And we seem to have a few Generals on the race-track as well.

If, six months ago, the question was, “Who says there’s a space race?” then today the question might be, “What are we racing for?”

One of the remarkable things about human societies is that by the time a society is sufficiently well organized to plan everything ahead of time with complete knowledge of all its motivations, the society is on the way out. A dynamic society which is moving ahead generally embarks upon new ventures almost brashly, and leaves it to later historians (from Homer to Parkinson) to fill in all the reasons. If our present space race were mankind’s first, then the reasons for running it might be difficult to find at this particular time. But this is by no means the first venture of its kind — and the motives for launching it are just about

the same as they have always been.

One of the strongest motives is as a demonstration of a successful society. A successful society must have sufficient organization, purpose, skill, energy and assets even to start large projects and certainly to complete them. It is far more difficult to carry out a large and well organized program than it is to carry out a collection of smaller, independent programs. The societies which built the cities of ancient Crete, the Acropolis, the city of Rome, the magnificent churches of Europe, and the wonders of the Far East were certainly not weak and anarchistic.

If the elements of competition are also present, these projects are carried on with salesmanship and prestige in mind. We have had World’s Fairs for thousands of years. Cities of medieval Europe built towers; the number and heights of the towers were an indication of the wealth of the city. Later, these cities built magnificent cathedrals. The sales and public relations aspects of such projects were tremendously important then, and are now, in acquiring a share of the world trade market.

For example, the recent Soviet successes in space have unquestionably affected the world market in their favor. The Russians are now selling more bridges and roads and electronic equipment and automobiles and surgical supplies to the world at large than they did before Sputnik I, even though the launching of Sputnik I had no more to do with these specific world market goods than the towers of Europe had to do with local trade. To the worldwide consumers, it seems readily apparent that a society that can launch the first satellite is certainly capable of building a good bridge.

There is often a memorial or a monumental aspect to these ventures as well — the recognition of forces that are stronger than the individual, such as religion,

freedom, democracy, the church, the king, and the state. Khrushchev has been endeavoring to exploit this aspect of the situation by claiming that one of the strong underlying forces of the Russian space program is the philosophy of communism. He maintains that one of the reasons for the success of the venture is the 40 years of communist society which preceded the space program.

Channeling excess energy

One of the more surprising, but most compelling, reasons for programs from the building of the Acropolis to the space program is the need for channeling the excess energy of a society in a direction which will hold the society together rather than tear it apart. When Pericles was asked why he was proposing the construction of the temples on the Acropolis, he admitted that one of his strongest reasons was to provide an outlet for the energies of the youth of Athens as a way of minimizing juvenile delinquency! More recently, the late Louis Ridenour maintained that such seemingly wasteful projects as crash military programs and marginal space activities were a necessity in the United States because otherwise our excess productivity would immediately lead to a depression. It is for the same reason that our U.S. Department of Labor is viewing the years of 1965 to 1970 with some concern, because at that time there will be an enormous influx of raw labor caused by the post-World-War-II birthrate surge. Large projects have real value as at least a partial solution to channeling excess energy.

Although it is difficult to measure the exact value of large-scale memorial projects, there is little question of the economic and social benefits which they produce. These are above and beyond such practical benefits as aqueducts, highways, harbors, electronic components, and new military devices.

More than 100 years ago, Michael Faraday was demonstrating his electromagnetic equipment to a British government committee in the hope of obtaining government support. One member of the committee admitted he was fascinated but asked Faraday, "What practical benefits can we expect?"

"I can't answer that question," Faraday replied, "but I can tell you this: 100 years from now you will be taxing it."

These large-scale races or adventures or projects have strikingly similar characteristics, whether they occurred thousands of years B.C. or A.D. Generally speaking, these projects are undertaken in time of peace and are abandoned or interrupted by periods of war. Occasionally, a project is undertaken which is never successfully completed. The projects which fail before they start are generally lost to history. However, projects which have proceeded for quite some time before they were abandoned as unsuccessful, or were interrupted by war, or were destroyed by a suc-

ceeding society, are still known to us. The Tower of Babel and the Sacred Circle at Stonehenge, England, are examples. It would be interesting sometime to describe the collapse of the Tower of Babel project in social and union jurisdictional terms rather than in the religious terms of the Bible.

Regardless of the project, there seems to be a running fire of criticism throughout the project and often long after its completion. The criticism generally proposes smaller projects of limited participation and of more immediate need. The criticism by certain groups in Athens over Pericles' construction of the Acropolis sounds surprisingly like the criticism of elements in the United States over the NASA annual budget.

There have always been hundreds of people to maintain that, by spending only one percent of the budget of the large program on their own particular program, the relative benefits would presumably be greater. Curiously enough, there are seldom critics who would propose alternate programs of the same scale as the large program, with the single exception of advocates of national defense whose proposals almost invariably are an order of magnitude greater.

Adding uniqueness to practicality

Although these demonstrations of a successful society are strongly concentrated in the areas of engineering and technology, to be really successful they seem to need certain elements which are certainly beyond those needed for strictly functional or utilitarian purposes. We find palaces with magnificent landscaping. We find churches whose domes are far higher than are needed for air conditioning. Supporting columns are sculptured, ceilings are elaborately decorated, floors are inlaid. And yet, these often expensive departures from the ordinary are the things that are remembered by future generations and are the real distinguishing marks of a large-scale success.

These are the elements that are destroyed first by any radically different society which tries to replace the original society. These are also the elements that are continuously modified and improved by a continuation of the original society. It is this extraordinary element which is necessary to add uniqueness or identity to the program which excites the admiration and respect of the audience. A good modern example is that part of the generally practical space program which tries to place a man on the moon (and return him to the earth) — an effort whose immediate utilitarian value is certainly controversial at best.

In other words, we might answer the question of "What are we racing for?" by stating that we are racing for the same things which dynamic and successful societies have raced for from the beginning of history.

In the light of historical precedents, it is illuminating to attempt to answer some of the modern questions which have been asked about the space program. For example, we might question the size of the NASA

budget, or the position of science in the space exploration program, or the value of the Mercury Program, or the presence of Generals on the racetrack.

The NASA budget, or even the total space program budget, including all military applications, is actually relatively small compared to similar projects in the past. The total space program budget is somewhat less than two billion dollars per year — which amounts to less than 0.4 of 1 percent of the energy and productivity of our country as described by our gross national product.

As another comparison, the present NASA budget of one billion dollars per year is less than 2½ percent of our annual defense budget. In comparison, societies in the past have customarily carried out large projects of far greater relative scope than this. Indeed, the space program, instead of being criticized, might well be commended for generating so much interest, enthusiasm, and prestige per dollar spent, in comparison with earlier projects.

Again on a comparative basis, we might predict that the space program can grow considerably if it can attract the same relative support that built the Palace of Knossos, the city of Rome, the cathedrals, and other monuments in the past.

The importance of science

So much for the size of the budget. Now let's consider the importance of science.

Despite the great interest of scientists in the space program, science is not, and cannot be, the driving force for space exploration. The reasons for this are quite fundamental. Advanced science is so abstract, and so little understood even to the scientist himself, that it makes very poor public relations and propaganda to people at large. Therefore, it is not reasonable to expect a ground swell of support for scientific projects just because they are scientific. Scientific exploration, by its very nature, is seldom successful more than 50 percent of the time and is often successful less than 10 to 15 percent of the time. Consequently, any scientific proposal is immediately subjected to alternate scientific proposals whose presumed success ratio might be higher. For this reason, scientific studies in space are often roundly criticized by scientists working in other fields, who maintain that, by spending even a small fraction of the money spent in the space program, they could obtain far greater results.

This criticism, as we have seen, is classical. The more general criticism, however — which might be paraphrased by the question, "Was it worth 150 million dollars to find out that the earth was not quite round?" or, "Was it worth 20 million dollars to discover the Van Allen belt?" — can certainly not be so easily dismissed. The answer to such questions is most simply given by declaring that the purpose of such programs is *not* scientific but rather political,

economic, social, and psychological.

If we *must* assign costs, we should therefore start by assigning costs to these requirements of the program first. In so doing we find that the net cost of performing a scientific experiment is actually quite small. It is no more correct to bill the scientific experimenters in the space program for space technology than it is to bill the oceanographer for the cost of advancing ocean technology by finding the best hydrodynamic shape for a submarine. Indeed, the use of scientific merit as a major criterion in evaluating space programs yields such patently peculiar answers that the criterion itself *must* be incorrect.

Quite obviously, there must be less expensive ways of discovering the Van Allen belt and discovering that the earth is pear-shaped than the way which was actually used. Since these experiments were done by satellites, and since there is every prospect that further experiments will be carried out, the answer must lie in the fact that there are considerably more returns to the space program than just the scientific results.

Technological development comes first

Also, it is true of science that no great discoveries are made until the technology is ready for them. The underlying principles of physics have presumably always been the same, and yet the discovery of the motions of the solar system had to await the development of the telescope, and the formulation of the laws of electromagnetism had to await the development of simple electrical components. At the present time, the amount of science which can be accomplished in space must await the launching of larger and larger payloads, better and better communications, guidance, control, and so forth. By any comparison which we would wish to make, the expense of developing technology far outshadows the cost of the novel scientific experiment.

One further feature of science precludes its being used as the driving force for the space program. The value of scientific results is very seldom known at the time of discovery and, unfortunately, there is no theorem which states that all scientific discoveries will be valuable. It is difficult to gain immediate support when the value of scientific results is determined ten to a hundred years later.

It is characteristic of efforts such as the space program that they represent technological achievements of considerable magnitude. Virtually by definition, therefore, the efforts and cost are largely devoted to technological advancement.

To the technologist there will always be high value in reaching the moon or the planets or the stars, even if there were too little weight allowance to permit any scientific measurements to be made the first time.

Using science as a criterion is an excellent way of producing a wrong answer to the question of the value of the Mercury Program. It is evident to most

people, including most of the people in the Mercury Program, that the purely scientific value of that program is zero.

As a matter of fact, one quick way of distinguishing between a space scientist and a space technologist is to ask the individual in question what he thinks of the Mercury Program. The scientist will invariably say that it is a terrible program. The technologist will almost always state that this program is advancing technology as rapidly as it possibly can and that, as such, it is a valuable and worthwhile program.

Generals on the racetrack

We now come to the question of Generals on the racetrack. Again, on a comparative basis, we can see that in the past there have been programs with Generals present and those with Generals absent. The presence or absence of the Generals per se seems to be less correlated with success or failure than with the prevailing conditions at the time. If the nation is strongly concerned with national defense and security, it will have mobilized a fair amount of its national effort along those lines for some time. The military arts, including military science and engineering, will be strongly developed and will attract some of the finest brains in the country. Under these circumstances, we find that the military technologist is not only present, he is extremely valuable.

From past history, the Generals on the racetrack are dangerous only when they attempt to convert a peaceful activity into an instrument of war and are foolish only when they try to justify advancing technology solely on the basis of military requirements.

As you may have gathered, I believe that the space program is inherently a good idea and that, after the difficult start, both the civilian and the military programs are proceeding in a generally worthwhile direction. Whether we are proceeding at a great enough pace is another question altogether. The answer to this question lies in a comparison with the Soviet Union. In this kind of a race, it does not pay to be a poor second — and never has paid. It is not always necessary to be markedly out in front, but it helps.

It would be foolish of us to maintain that the Soviet Union is not presently the pace setter. We would seriously underestimate the Soviet Union if we were to assume that the United States could put a man in space first, for example. We are probably three to five years behind the Russians in those aspects of space technology which depend upon large chemical propulsion units. These aspects, unfortunately, control the size of the launching booster.

On the other hand, the prediction of the future may be surprisingly bright for the United States. The United States has often been compared unfavorably to other countries in terms of our generation of science; but it has never been unfavorably compared with any other nation in its astonishing ability in

technology. Inasmuch as the space race is a demonstration of technology, the United States has available to it basic assets which no other country, including the Soviet Union, can claim.

Whether or not these assets will be applied efficiently to the space program is again a separate question. One measure of the assets which are applied to the space program is the size of the budget. If the United States were to apply the same relative effort in the space program that the Soviets apply in theirs, the United States would unquestionably surpass the Soviet Union in less than ten years, even giving the Russians a lead-time of five years. We are not, at the present, putting forth this effort, although we are putting forth enough effort that the gap will close slowly.

One encouraging aspect of most races is that the initial pace setter does not necessarily win the race. Instead, the successful winner is often the racer who has mastered the art of being second when it is not so important, and then being first at the final payoff. This is a *real* art. It involves crowding the pace setter in such a way that the pace setter will begin to make mistakes and will begin to feel the pressure.

Crowding the pace setter

For example, the recent U.S. technological successes in the space race seem to be crowding the Russians in a way which hurts. There is slowly mounting evidence that the Russian space shots are now no longer invariably successful. There certainly have been missed opportunities, long periods without successful launchings, and occasionally evidences of incomplete engineering. The Russian pictures of the back side of the moon were surprisingly poor considering the payload weight available. The engineering deficiency seems to have been in the communication link, an area in which the U.S. has done particularly well. Recently their propagandists had to virtually republish an older achievement of sending animals up to 120 miles.

Needless to say, the advantages of being second are only temporary.

Six months ago there was some question as to whether or not we were in a space race. We now know that we *are* in a space race and that it is likely to be a fairly long one. We are not racing purely for science. We are racing to demonstrate that we are a successful and dynamic society. We are racing for the prestige necessary in a purely economic world market situation. We are racing as one method of channeling our excess energy and productivity, and for such side benefits as may result. We are racing to demonstrate that democracy is every bit as good as, if not far superior to, communism; and at times we are racing out of the sheer joy and exuberance that has long been characteristic of a proud and capable people engaged in a pursuit of happiness.