

WHY RACE FOR SPACE?

The controversy continues over sending men to explore the Moon. President Kennedy recently proposed cooperation in a heretofore competitive arena. Here is a recent talk by an Assistant Director of JPL, viewing the race from on the track.

by Eberhardt Rechtin

This country is now seriously embarked on a race for space. It was not always so. The start was certainly disorganized. For awhile there was only one racer, the Soviet Union, putting on a demonstration of unrivaled skill. When it showed up, the second racer—the United States—started off in a completely different direction from the first racer. And now we have still more contenders, including the French, the British, and possibly the Egyptians.

Surprisingly, for a while we did not even know why we were racing — we only knew that we were. Or maybe it was not so surprising after all: A truly dynamic society is usually brash and proceeds in directions which it feels intuitively are correct without working the reasons out ahead of time. Indeed, a society which plans every move in elaborate detail is usually on the road to extinction. But, once committed to the race, it is vital to study the field, to plan the pace, based on the rewards and the competition, and to understand how to take advantage of breaks or to recoup losses.

The present space race has many similarities with earlier international races. Parallels can be found throughout all recorded history. Using history as a guide, it is not difficult to work out general motivations for such races and even to learn a few lessons of success or failure from them.

Let us define a race as a fairly-well-coordinated

effort of a society, using at least one percent of its gross productivity per year and aimed at providing prestige, influencing world politics and trade, providing work and wealth through productivity of the racing country, and unifying the country by providing one element of national purpose.

One kind of a race is war. Compared to other kinds of races, war is certainly more expensive and destructive. Particularly in modern wars, it is not clear that anyone wins. On the other hand, the motivations for war, the improvement or defense of one's position in the world relative to others by brutal means, are simple, primitive, and relatively easy to understand. Survival is so easily understood that even cold wars can call forth the willing expenditure of resources at a far higher level than is characteristic of other kinds of races. For example, our defense budget is ten times our civilian space budget, perhaps because the motivations are better understood and the potential consequences greater.

Peaceful races have much more complex motivations, are less easily understood, and are more subject to criticism by other competitors for the same resources. This is by no means bad. The peaceful races provide discussions of national purpose in areas which will make our country great, discussions which never even arise if our only national purpose is survival. In other words, we

might very well view our defense budget as aimed at preventing war so that our country can debate and work toward peaceful goals. In our free and defended society, we can now debate the space race in terms of national purpose. The debate is healthy and necessary both for the space race and for all of our national purposes.

There have been many previous peaceful races. Free enterprise itself is based on the competition of racers. The world has been largely explored by different countries racing over the horizon into the unknown. Cathedrals, palaces, Parthenons, pyramids, roads, canals, seaways, and airways have been built as the result of races. Many of the motivations for these races are also characteristic of the space race. We are demonstrating that we are a highly successful society with sufficient skill, purpose, energy, stamina, organization, and national purpose to do a very large project.

It is considerably more difficult to do one large project than many small projects. We have now recognized that public relations, marketing, and sales are major ingredients in the space program. The space program certainly affects the world market. A quick calculation some years back showed that the Soviet Union probably acquired some five billion dollars worth of the world market just by the launching of Sputnik I. Traders on the world market were much impressed with Sputnik I and it seemed evident to these prospective customers that a society which could launch the first earth satellite could probably build reasonable dams and bridges and supply goods and services of high quality.

Whether this is actually true or not is immaterial. The customer thought it was. Khrushchev also maintained that the communist form of government, having been operative in the Soviet Union for more than 40 years, was a major factor in raising the country from a fairly backward nation to one which could be first in space.

A new contender in the race, the United Kingdom, is seriously considering launching and operating its own communications satellite system, not only for the commercial benefit of the United Kingdom but also to demonstrate that the sun has not yet set on the British Empire. The British are very concerned that participation in the space race has been equated in the world with advanced industrial technology, and that if the United Kingdom does not participate it will continue to see its scientists and technologists (and the industries which they create) leaving the British Empire.

The countries of Europe have established the

European Space Research Organization and the European Launching Development Organization not really to explore space but to produce technological benefits for the community of European nations.

The Egyptians maintain that they will launch earth satellites and, although this might seem strange to us, the Egyptians have not unreasonable motivations. The world that the Egyptians are interested in consists primarily of the Near East and that nearly-self-contained world has not yet launched its first satellite.

The history of the United States participation in the space race is well known. Our participation in space, except for the dreams and hopes of a limited number of us, began with the Eisenhower decision to support an earth satellite project as part of the International Geophysical Year. Participation was to be scientific and as non-competitive as most purely scientific endeavors can be expected to be. In other words, although one scientific group or another might discover some new and important scientific fact, the discovery was more nearly a credit to the individual than to nationalistic competition. In other words, it was decided that there was not going to be a race. The Russians obviously decided differently at that time.

The next major decision was that the space effort was going to be fairly significant in size, but that all of the effort should not be carried out in the Department of Defense. Furthermore, as much of our space exploration as possible was supposed to be civilian, unclassified, and open for the world to see.

The National Aeronautics and Space Administration was established under bipartisan sponsorship with the Space Act of 1958, one of the most forward-looking and statesmanlike accomplishments of the time. However, although the Act recognized that competition might be present, its stated purpose was to make the United States *a* leader in space, not *the* leader.

Dr. Keith Glennan, an eminent scientist and president of the Case Institute of Technology, was appointed as NASA's chief under the continuing policy that the United States was not in a race for space. The Russians again decided differently. Our space program continued to expand up to about one billion dollars per year, a level which in retrospect was non-controversial. But then, at this critical juncture, we had an election based to a remarkable degree on discussions of national purpose.

The position of *both* candidates, with respect to

space exploration, was that there was a race whether we wanted it or not, and that we had better recognize it and do something about it. Senator Kennedy was emphatic about moving ahead with vigor. It is less well recognized that Vice President Nixon also supported the idea of a race, but was hampered by the need to defend the then-existing policy.

After the election, President Kennedy made the standard announcement that the previous policies on the space race would be retained for the time being, but there was clearly a major change in policy in the wind. Dr. Keith Glennan, an ideal administrator for the program of scientific exploration, was allowed to resign shortly after the election and was replaced with one of Washington's best politicians, "Jim" Webb, a man known for successes in Budget Bureau and Congressional circles.

Although it hadn't been announced yet, it was clear within NASA that a decision had been made that we were in a space race and that this race clearly had major impact on the international scene. Within both the NASA and the Department of Defense, debates which had been going on since about 1959 were accelerated, concerning the goal of the race, the permissible annual cost of the race, and so on. There were proponents of earth satellite stations, lunar landings, and planetary landings.

Most of us felt that the elections and Congressional opinions clearly indicated a mandate to engage in the space race, to *do* something, although the technical goal itself was not specified. Two months after Gagarin's flight and its world reaction, three weeks after Shepard's flight, six-and-a-half months after the election, and three-and-a-half years after Sputnik I, the decision was formally made that we were in a space race.

Contrary to some recent articles in the public press, I disagree that public policy in the space race was abruptly changed because of the Cuban Bay of Pigs. It certainly never occurred to any of us at the time that a change had not been in the wind for quite some time and none of us connected the two situations except in a very general way. As I remember it, we felt that the only reason the decision was not made sooner was that it was necessary to consider more urgent things first, and most of us were glad that the Cuban situation didn't delay the decision any more than it did. The decision had several parts:

1. The first good chance to beat the Russians

was for a manned lunar landing.

2. Expenditure rates would have to be increased by about a factor of five over the then-president budgets to accomplish this.
3. To obtain required long-term funding, long-term support of Congress was essential and an increasing level of debate should be anticipated.
4. NASA would have to become a political as well as a technical agency if it was to compete for resources at the required scale.

Remember also that the world situation at the time was that the cold war would probably go on until it resulted in nuclear war, unless the Russian people revolted against their communist leaders. The probability of revolt was very dim and was growing dimmer as the Russians became increasingly proud of their technological achievements. If there was any tie between the Cuban situation and the space race, it was that in both cases the United States was tired of being pushed around. Indeed, President Kennedy said as much when he gave the reasons for the lunar expedition.

Consequences of the decision to race

The decision to race has had some remarkable consequences, not all of which were foreseen by any means. Most of the consequences have been on the positive and useful side, which is as good a criterion as any for judging the wisdom of a decision. One of the best consequences was that discussions of national purpose have continued unabated and much of the previous lethargy of the American people to this discussion has dissipated. The space budget annually brings up discussions of alternate projects, the purpose of the race, and the relationship of the race to almost every other national problem.

I can illustrate this in a personal way. The first time I ever gave a talk on "Why Race for Space" happened to be one week before the election of President Kennedy. Almost every year since, I have been requested, and found it worthwhile, to give a talk under much the same title. Mr. Webb, the Administrator of the NASA, would probably tell you that he has been giving a talk on the same subject continuously, ever since his appointment. Now, while there might be some consternation in the Space Agency over all the work that it takes to engage in a debate, no one questions the essential need for the debate as a way of determining the pace of the space race that is desired by the

American public and its representatives in Congress. And, as an American citizen, I have welcomed the interest of large audiences to discussions of national purpose.

A consequence of the need for general support on a large scale was the corollary decision that more parts of the country would have to participate in the space business than before. This did *not* mean that effort was to be taken from other parts of the country such as California, but rather that if the existing efforts were to expand, there must also be expansion elsewhere. Putting it in more blunt political terms, California has benefited handsomely from the decision that the Manned Spacecraft Center should be located in Houston, Texas.

Another consequence of the decision to race was a remarkable revamping of American industry. A recent poll by the Harvard Business School of businessmen across the country found them strongly in support of the space race because it was resulting in revamping old companies and starting new companies based on more advanced technologies, in a way which could only be compared with the American refurbishing of German and Japanese industry after the war. In other words, the space race had resulted in the rejuvenation of major parts of American industry which would put them in a much more competitive position with the rapidly rising German and Japanese industries.

Another rather curious consequence had to do with civil rights. Although it is doubtful that the decision was consciously made with this end in view, the decision to put a great deal of space industry into the South resulted in an influx of engineers and scientists and their social standards into the Deep South. Wherever these people went, they took with them a long background of civil equality and a reasonably objective view of life. This was best illustrated in the integration of the Alabama universities. In Huntsville, Alabama, the home of the Marshall Space Flight Center and its associated industry, the local majority was willing to do battle with the governor of the state to ensure that integration *would* occur and that the community would not be labeled as part of Deep South Alabama. The same reaction could be expected near Cape Canaveral; Michoud, Louisiana; the Mississippi Test Center; Houston, Texas; and so forth.

A consequence of the decision that the space race would be a matter of public debate was also the corollary that public support should determine

the *kind* as well as the pace of the space program. For example, there are two self-consistent approaches toward exploring the Moon. The first approach is to use unmanned spacecraft and to take somewhat more time. This approach produces considerably less drama for the audience, less understanding and personal identification and satisfaction by the audience, and, consequently, less financial support. The reduced level of financial support is consistent with an unmanned, slower exploration of the Moon.

The second consistent approach is to use manned flight with a moderate degree of urgency. There is considerably more drama for the audience; there is more understanding, personal identification, and satisfaction by the audience; and, consequently, more financial support. The higher degree of financial support is consistent with a manned program of moderate urgency.

As far as the engineers and scientists are concerned, either approach is technically practical and, although the results will be different, there is no conclusive technical argument that one approach is better or worse than the other for exploring the Moon. As far as the engineers are concerned, the difference between the two approaches is not unlike the difference between building ferries or building bridges across the Golden Gate in San Francisco. It depends upon what the customer wants and is willing to pay for.

From my own point of view as one of several hundred million customers, I am glad that we are going to explore the Moon with men, even though my own business in the past has been that of unmanned exploration of space. I like the manned exploration because it is more dramatic and does result in much more challenging national discussions than simply a technological extension of the sounding rocket program. The only real technical mistake would be to attempt to do the manned exploration of the Moon at the funding level appropriate for the unmanned. The consequences to the Golden Gate Bridge of trying to build it with funds set aside for ferry operation would have been much the same.

The manned exploration obviously has a more profound influence on the country. Eric Sevareid expressed the thought particularly well way back on May 26th of this year: "After the first men walk upon the Moon, old Earth will never be the same and the change will be in the two societies, Russia and America, now competing for the catalytic honor of commencing the alteration." To paraphrase him slightly, Sevareid noted that the

search transfigures the searcher and may well be more important than the marvels discovered.

The offer of cooperation in space research

President Kennedy, before the United Nations, recently made the offer that "surely we should explore whether the scientists and astronauts of our two countries — indeed, of all the world — cannot work together on the conquest of space, sending some day in this decade to the Moon, not the representatives of a single nation, but the representatives of all humanity." As with everything in the space business, this offer generated considerable discussion. I propose to continue the discussion here.

First of all, let us consider the *offer* and then discuss practical cooperation after that. The background of the offer has been well reported in the press. It was pretty obvious that the President did not discuss the offer ahead of time with NASA. We further know that the reaction of the White House press secretary to the implication that the offer meant a change in policy and an attempt to get out of the commitment of a race to the Moon was a rather angry retort that this was not the case. We have the President's letter to Representative Albert Thomas stating that, indeed, the offer did *not* represent a change in policy; on the other hand, the President has not yet revealed his reasons behind making the particular offer at the particular time. We also know that the Russians were caught flatfooted by the boldness and sincerity of the offer and have yet to make a well-thought-out reply. This, then, is the (incomplete) set of facts.

The critics of the space race have had a field day with this situation, calling the space race everything from a Moon-doggle to a forty-billion-dollar political shell game. They may be right. It would be presumptuous of me to claim that I have an inside track to the President's mind. But I would like to offer an alternate explanation which fits the same facts and which, if the explanation turns out to be true, permits a set of predictions as to what ought to happen next.

I will start out the alternate explanation with a set of assumptions. I will assume that the President knew what he was doing and had thought out the possible moves of both sides at least two steps in the future, much as in the Cuban missile-withdrawal situation. I will further assume that the President does not want out of the space race and regards the country as very much committed

to winning it in front of an international audience. And finally I will assume that the reasons for the offer were for the benefit of the Department of State and the intelligence community and that it was believed that these benefits could be accrued without a damaging effect on the NASA.

If these assumptions are true, the first question to ask is what benefits might accrue to the Department of State and the intelligence community. If we assume that the Russians are out to bury us and are very much in the space race (as maintained by their cosmonauts but not by their academicians), then they are preparing secretly and it becomes important to try to find out their intentions. *The intelligence effort necessary to find out the Russians' intentions is considerably simplified* if we can get the Russians to make a public announcement on the world stage. If the Russians do intend to compete, they must be marshalling the technology to do so and must be developing large boost rockets to be able to undertake the job. (In the United States, we are developing the Saturn C-V class of vehicle for this purpose and have so announced.) Russian development of still larger boost rockets has obvious implications to national defense and their long-term intentions in the cold war. If the offer of a cooperative effort can smoke out the Russians on these points in this situation, this country will have gained a great deal.

On the other hand, let us again suppose that the Russians intend to bury us but have decided that the lunar expedition is too expensive, and the amount of information which they have on the dangers of space is too scant, for them to make the effort. If this is the case, then an offer of cooperation from a position of strength may force the competition to concede, and this country would have won the Moon race politically.

This does not mean that we can stop our efforts of a lunar expedition, because that would imply that we had insufficient stamina and national purpose to accomplish our self-set goal before our international audience, but it would say that we could proceed with a program designed for less risk and cost.

Therefore, if Russian long-term intentions still remain the conquest of the world, and whether or not they are in the race, an offer of cooperation at this particular time is to our advantage.

Suppose, on the other hand, that the Russian long-term policies are aimed at joining the West rather than conquering it. It really isn't necessary, you know, that the only resolution of international competition must be a full-scale war. I recognize

that, although we have fought the Germans, Japanese, Chinese, British, Spanish, French (when we were a British colony), and a few others, it is not absolutely essential that we add the Russians to the list.

There is some indication that the Russians have decided that it might not be worthwhile to take on the United States after all and that a much more important problem is China. If this is the case, our efforts should be to try to change the cold war and to give the Russians every conceivable opportunity to move closer to the West. But obviously the Russians cannot move in this direction if we remain stubborn, aloof, or insulting. We must give the Russians reasons, sometimes face-saving reasons, for every step of the way until neither side continues to call the other side "the enemy."

One major step would be the opening up to world view of the Russian space-vehicle and tracking program. This Russian program has been completely closed to outside view until very recently. Suppose, then, that we assume for this part of the argument that the Russians are interested in moving westward. If they are, and if they have decided to engage in a competitive space race with us, just as the British, French, and Egyptians have, then this provides them a reason for being considerably more open in expressing their intentions.

On the other hand, again assuming that the Russians are interested in moving westward, but that they have found that the Moon expedition is too costly in available resources, then the offer of cooperation will permit them to join the West gracefully. They are not now in such a patently inferior position that by joining they have to acknowledge losing the race. Indeed, it is easier for them if they happen to be just slightly ahead at the moment. Therefore, an offer by us for cooperation is in our interest in this set of situations as well.

Now, in all of these cases it is important that the offer be made at a time when we can deal from a position of strength (or at the very least from a position of near-equality). Until 1960, the estimates of our lag in the space race typically varied from three to five years. The consensus these days would be from zero to two years. If this rate continues, we should be several years ahead by 1970. This year is therefore the first year when an offer of cooperation could be made from a position of reasonable strength. If we made the offer still later, at a time when we were clearly ahead, then we might be in the position of winning

the race but losing the Russians.

Therefore, from both the intelligence community and Department of State points of view, the offer of cooperation was an excellent move. From the Russian point of view, the offer calls for a statement of national purpose from them—something which clearly presents them with problems as portentous as those they faced in having to answer the Cuban missile-withdrawal demand.

But what about from the point of view of NASA? Some of the first reactions were that cooperation was technically impossible and that the offer was impractical. With all due respect to those who voiced these views, I think that the questions were asked *too soon for a thoughtful answer*. The natural defensive reaction toward preserving the space program when the questioner implies that cooperation will sharply reduce one's own program, is allayed considerably by the fact that the offer can only be made from a position of strength and that this position of strength must be maintained throughout all of the negotiations. Indeed, the best thing at the moment for the United States, awaiting the concrete expression of intentions from the Russians, is to sprint and not stop to look around. *After all, the consensus is that the Russians are slightly ahead of us at the moment.*

If, on the other hand, true and detailed cooperation does come about, the relaxation in cold war tensions resulting from much increased openness between the U.S. and the U.S.S.R. will have solved so many more important problems that the purely technical ones of matching spacecraft and vehicles can certainly not loom very large in contrast. Indeed, I would welcome the chance to help solve the purely engineering problems of matching pieces of hardware in a spirit of friendly cooperation in contrast to wondering how to solve the political science problems of a cold war. As any engineer can tell you, technical compatibility is made either very easy or very difficult by the attitudes of the participants and has little to do with the hardware itself. If everyone wants to cooperate, the hardware will fit all right. If no one wishes to cooperate, pieces of hardware from the same company won't even fit each other.

The offer of cooperation should therefore not result in a slackening of NASA's efforts and, if actual cooperation is negotiated, the NASA would be serving our country by solving technical compatibility questions in preference to our State and Defense Departments solving more difficult cold war problems.

Following this line of reasoning, I then conclude that the offer was a brilliant one but that the President must wait for an expression of Russian intentions before officially announcing the particular set of reasons which led him to the offer. For example, it would be a very poor idea to announce before the Russian response that the purpose of the offer was "to smoke out the enemy," because it might well turn out that the Russians were trying hard not to be the enemy and we had simply pushed them back again.

It would be equally foolish to say that our offer was based on the assumption that the Russians wished to come westward because, whether true or not, only the Russians can legitimately state their own intentions on the world stage. The President is therefore not able to state at this time the detailed reasons for the offer or for its timing. In the present blast of press criticism, this must take remarkable patience. Furthermore, consultation with NASA is not a prerequisite to the offer, providing the President can satisfactorily explain to Congress enough of the situation so that the NASA budget is not slashed (or at least is not slashed for the wrong reason!).

In any case, the offer has clarified some questions of why we race for space. First, there is such a thing as a space race. Second, some of the main reasons for the race are international in character. Third, our government has officially recognized not only that the space race affects the cold war but that the status of the cold war should affect the space race.

Some predictions

It is always risky to make predictions, but without predictions it is difficult to make decisions or to consider the desirability of the predicted course. Needless to say, my personal predictions are not necessarily those of the management. I will start with the easy ones and will first assume that detailed U.S.-Russian cooperation is limited to data exchange between racers.

I believe, then, that the U.S. will be on Mars before anyone else and probably before 1980. I believe that the U.S. and the U.S.S.R. will both be on the Moon within a year of each other, that doing so before 1970 is still a good bet, and that it is also a good bet that the U.S. will be first. In this respect, the choice of a lunar orbit rendezvous technique was significant and helpful. This decision gives us the best chance of accomplishing the mission with the minimum vehicle and yet a vehi-

cle that neither racer presently has. In other words, in the race to the Moon, the U.S. and the U.S.S.R. are starting out much closer to even than in the case of the first satellite.

It is quite possible, however, that the U.S.S.R. might send a man around the Moon first. We might just as well be prepared for that one. We should also expect the U.S.S.R. to demonstrate earth orbit rendezvous first. In other words, it is a foolish man who counts out the Russians at this stage of the game.

If the lunar expedition turns out to be a cooperative one between the U.S. and the U.S.S.R., we might expect significant cooperation in exchange of data within a year, opening up of the resources and facilities of both sides to world view within two years, and joint use of facilities in four years. The launch vehicles, the launching points, the tracking facilities, and the recovery systems might very well be mixed, depending upon demonstrations of engineering superiority in each of the areas. The arrival at the Moon, however, would probably be delayed a year or two and might cost a bit more, but I haven't heard of anyone yet who would mind paying for the overall result.

I also believe that the military will have a role in space, but I do not think that it will be via the so-called "useful manned weapon" route. Physics, logistics, and vulnerability of the man are all arguments against this route. Success will come, I think, via the more classical approach used by the Navy to explore Antarctica and the Army to explore the Far West. In other words, the exploration of space by the military is necessary to understand the new environment in *military* terms, possibly to discover it a poor arena of conflict, possibly even to deny it as an arena. No civilian has ever been able to do this task well.

The military, of course, already has an extensive reconnaissance and defense penetration space program, as demonstrated by the fact that there were more secret satellites put into orbit last year than all of the non-military satellites combined. The military program *should* continue even if the cold war cools off still more. The reconnaissance satellites are still the auditors or referees insuring that the new game is being played properly, and no one has yet declared that the *Chinese* are interested in moving West!

And, as a final prediction: A major war would unquestionably end the space race to the tragedy of mankind. We could all have a fantastic adventure if we can keep the peace. Fortunately, I believe that the space race may well help.