

# SATELLITES

*Let's face up to the obvious fact that the Russians are ahead of us. So what do we do about it?*

*by W. H. Pickering*

THE SATELLITE PROGRAM has, of course, had a tremendous amount of publicity in the last few months, and has become a significant factor in politics, not only in this country, but in international politics as well.

Let me summarize some of the facts about the IGY satellite projects. Early in 1955 the International IGY group, the CSAGI (Comité Spécial de L'Année Géophysique Internationale) committee, recommended to the various national committees that a satellite project would be of scientific value as a part of the IGY.

In the summer of 1955 the President of the United States announced that this country would accept the challenge and fly a satellite during the IGY period. A few weeks later the Russians announced that they would also establish a satellite program.

In the United States, the President announced that the program would be established with the assistance of the Department of Defense and also with the assistance of the U.S. National Committee for the IGY. The Department of Defense was given the task of providing the vehicle for the satellite, the proving ground for firing the rocket, and support for the observing stations.

The U.S. National Committee was given the responsibility of deciding on the scientific experiments to go in the satellite, and of seeing that the experiments were built

and ready to fly in the satellite. The Department of Defense, in turn, assigned the Naval Research Laboratory the overall responsibility of the so-called Vanguard project; they were to build the vehicle, accept the scientific experiments from the U.S. National Committee, and fly these experiments with the help of various other agencies in the Department of Defense.

(As far as the Russian program is concerned, I am afraid that we don't know much about how it is organized. We had some more or less casual conversation with the Russian delegates to the International Astronautical Federation in Barcelona in October, and at that time the Russians merely emphasized that their scientific program was integrated with their rocket program so as to make a sensible overall program.)

At various international meetings of the IGY groups, the U.S. and U.S.S.R. described the scientific experiments they proposed to do—and ended up with the same general classes of experiments. The U.S. provided some more information about its general program; the U.S.S.R. was rather vague about the details of its rocketry—and, in fact, of its program in general. In speaking with some Russians about this vagueness, I heard the comment that, in Russia, they don't feel you should talk about a complex experiment until you've got it under your belt. They took this stand on the details of the satellite experiment.

*"Satellites" has been adapted from a talk given by Dr. Pickering at Caltech's YMCA Forum on November 20, 1957.*

The CSAGI requested both countries to provide the expected firing dates for the satellite program, because observing stations all over the world would want to be ready for observations. But neither the U.S. nor U.S.S.R. ever provided any dates to the CSAGI.

This brings us to the fall of this year, when the Russians put up two satellites. These satellites—to reiterate what we all know—were fired on October 4 and November 2, from a point somewhere around the Caspian Sea, and in a general northeasterly direction. They established orbits about 65 degrees inclined to the equator. These orbits were of such a nature that all parts of the world lying between 65 degrees latitude north and 65 degrees latitude south at some time or other would be passed over by the orbit. Therefore, people living between these latitudes—essentially all of the civilized world—have a chance to observe or listen to the satellites at some time or other.

### A series of Sputniks

Right after the firing of the first Russian satellite, Professor A. A. Blagonravov (who was a U.S.S.R. delegate of the CSAGI Conference on Rockets and Satellites in Washington, D.C., at the time) stated that there were two satellites ready to go. The two which have been fired are presumably these two. However, the Russians expect to fire a series during the IGY period, so we can look for Sputniks from time to time during the next year. Professor Blagonravov said that they would be more or less evenly spaced during the IGY period but would contain different experiments and would be different sizes and shapes.

Of the two objects which have been fired already, the Russians stated that the first was a satellite which was separated from its final-stage rocket and which weighed about 180 pounds. The second object was apparently left attached to its final-stage rocket, and its weight was given at about 1,100 pounds. It is probable that both satellites used the same final-stage rocket: the difference between them is just the matter of separating the instrument compartment in one case and leaving it attached in the other.

The U.S. has gone through a lot of self-examination since the Russian satellites were fired. The President has stated that the U.S. would attempt to fly a small satellite in December and the Vanguard satellite in March. The Army has been asked to modify its Jupiter-C research vehicle to launch a satellite in a manner first proposed by the Army in its "Project Orbitor" design in 1955. The Army has stated that this satellite will be launched sometime after the first of the year.

Like the Vanguard project, the Army program relies on the cooperation of several agencies. The two principal agencies are the Army Ballistic Missile Agency at Huntsville, Alabama, and the Caltech Jet Propulsion Laboratory in Pasadena. The Army Ballistic Missile Agency is responsible for the construction and launching of the first, or booster, stage.

The final stage is a single solid-propellant rocket approximately six inches in diameter and four feet long. To the front end of this rocket is attached the payload which has the shape of a cylinder with a conical nose. The final satellite object will consist of the empty rocket, weighing about 10 pounds, attached to the payload which weighs about 20 pounds.

The scientific package consists of the cosmic ray experiment package developed by the State University of Iowa for the earth satellite program. Adaptation of this design to fit the Army launching vehicle is being carried out at the Jet Propulsion Laboratory.

There has been a great deal of speculation of one sort or another as to what all of this satellite activity means. I think the first thing that we have to agree on is the significance of the Russian success in getting these two objects up. First of all, it probably implies that they were able to do this with two shots out of two. Of course, we don't know this for sure, but they stated ahead of time that there were two objects ready, and there are two up there. We can therefore conclude that the Russians are well advanced in the technology of large rockets.

Furthermore, I would conclude that the Russians are well advanced in the guidance of large rockets, because if you are going to put up an object into an orbit, you don't just go up there and throw it; you have to throw it in the right direction. And throwing in the right direction requires a very precise guidance system.

So, the Russians have obviously solved the problem of firing large rockets and of guiding large rockets. As far as their weapon technology is concerned, they are well ahead of us, because we have not demonstrated any comparable competence in this country.

I will also make the point that this accomplishment should dispel any remaining doubts in the minds of people in this country that the Russians are a bunch of peasants. The Russians have advanced technological and scientific personnel to draw upon for this kind of program, and there is no doubt whatever about it.

### Could we have done any better?

Of course, we ask ourselves: Could we have done any better in this country? Could we have had a satellite up there? One hears all sorts of speculations, but some things stand out—for example, that the U.S. satellite program was proceeding at a rate that might not have been as rapid as one would have liked, but nevertheless was (and is) capable of meeting its objective: to get up at least one satellite in the IGY period which extends through 1958.

One can question the wisdom of just letting the program amble along at this rate, and of course one can ask: Was it really ambling along—or was it doing the best it could? We know that the Vanguard program has cost increasing amounts of money as time went on, so the total funds now authorized for the program are something over \$100,000,000. With this finding, it is not fair to say that the program is ambling along; if it hasn't

*W. H. Pickering, director of Caltech's Jet Propulsion Laboratory, holding a prototype of the cosmic ray instrumentation package to be flown in the Army satellite which is being built jointly by the Jet Propulsion Laboratory and the Army Ballistic Missile Agency.*



succeeded in getting satellites up yet, it would appear to mean that the wrong decision was made when the program was started.

This program was started with the decision to build a special Vanguard rocket. The technology of large rockets is a complicated thing, but, of course, the Naval Research Laboratory has had a lot of experience; it has built the Viking, which is a successful research rocket. Nevertheless, I think one must ask: Was it right to start two years ago to build what was essentially a new rocket? Or should one have gone to some of the military programs and said: Is there, anywhere in the military program, a rocket or potential rocket which could be used in this situation?

I think one can also comment that it is pretty obvious that very few people in this country had any appreciation of the political significance of the Russian satellite. I am sure that there were people who wanted the U.S. to have a satellite up there first. On the face of it, however, it does not appear that the people who are in a position to make decisions had a real appreciation of the significance of this accomplishment.

I think we have to remember that the proposed U.S. satellite program was never as ambitious as the Russian one. We are talking about a satellite that weighs 20

pounds, while the Russians had an instrument compartment of more than 150 pounds. So, this means that the Russian rocket which was used for launching their satellite must obviously be considerably larger than the rockets being proposed for the Vanguard, or, for that matter, for the Army satellite program which will likewise launch a 20-pound satellite.

It seems to me that what we have seen in recent weeks in this country is rather a sorry spectacle. There has been a lot of criticism of the missile programs, of the inter-service rivalry, of the various political factors which have affected technical decisions. But, are we getting out of the mess, or are we getting into it even worse?

There seems to be an unwillingness to face up to the obvious fact that the Russians are ahead of us. Let's admit this. They *are* ahead of us, so what do we do about it? What we need is strong leadership, good engineering, good management. We are not asking for a lot of scientific break-throughs. We are asking for good management and good engineering on programs which already exist and are slowly coming to fruition. We must demand an end of the petty inter-service squabbling which seems to be still going on, and an end to the petty politics which, even now, still seems to be plaguing the entire missile program.