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Chapter 29

GEORGY NIKOLAEVICH BABAKIN'S CONTRIBUTION TO THE DEVELOPMENT OF AUTOMATIC SPACE STATIONS*

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Georgy Nikolaevich Babakin's 70th birthday anniversary was in 1984. He was the Chief Designer of the automatic space stations for exploration of the Moon, Venus, and Mars. He was a Hero of Socialist Labour, a Lenin Prize Winner, and a Corresponding Member of the Academy of Sciences of the U.S.S.R. Under his direct leadership, and with his personal participation, new types of space stations were created, which solved many very complicated tasks in the study of celestial bodies, that became ever more complicated with every step, and with every new project.

Scientific discoveries, made by the materials supplied by these stations, have not lost their significance even today. The stations themselves, with their designing and engineering solutions, are being successfully developed and, up to now, strike one's imagination with their vitality, importance, originality, and bravery of technological design; even today they help to solve new tasks of space exploration.

G. N. Babakin started his work in the space technology field in the middle of the 1960s, when, on the initiative of S. P. Korolev, efforts on a "far-out space" were passed from his designing office to the one headed by G. N. Babakin. It was not at all accidental. The authority of this designing office was determined by its great efficiency, and by the work that was done at a very high engineering and scientific level. Moreover, a number of developments, frankly speaking, were simply ahead of their time, and that fact sometimes blocked their adoption.

From March, 1965, the space phase began in the designing office, where G. N. Babakin was appointed Chief Designer; he was not a participant of the GIRD and GDL works, but he was familiar with the space subjects from individual sources. Many things in cosmonautics he, and all of his staff, had to learn for the first time. And, what was surprising and worthy of acknowledgement, was the fact that the learning period was so short, yet the practical results were so evident.

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G. N. Babakin had one trait, which not only helped him to become familiar with new themes, but it also always helped him in difficult situations. It was his mastery of relations with the accessory manufacturers—a very difficult question in any field of industrial activity. With the modern wide cooperation of works, when the head enterprise is connected with dozens, and sometimes hundreds, of subcontractor counter-representatives, these relations are often the basis of success. Here, besides documents defining these relations, it is necessary to have the tact and authority of a chief designer, unity in understanding of the final-goal, and the notion of personal responsibility. One must have the will not to take an easy step (which may be far from correct), not to shift the responsibility for failure or for unfulfillment of the assigned work to the accessory manufacturer, even though he might be at fault in that very case. It is not simple to withstand temptation to remain, in the eyes of superiors, an infallible person, one who did not fulfill the given task only because of some others' blunder and negligence. It is much more difficult to acknowledge one's own responsibility for failure. G. N. Babakin was always fully responsible for his own work. Traditions of his designing office required that not a single chief designer of an accessory manufacturer could shift his responsibilities, whereas the chief designer of the whole complex was also responsible for the accessory manufacturers' work.

Without touching on the details of the initial stage of Moon exploration by our country, we will only state that the first success along the space path of G. N. Babakin's designing office was the preparation, the launching, and the first-in-the-world soft landing on the Moon surface by *Luna 9*. On February 3, 1966, a panoramic view of the soft-landing area was transmitted from the Lunar surface. For the first time some information on the micro relief of the Lunar soil was obtained, and the myth of the multi-meter thickness of dust on the Moon surface was destroyed. In this way the "Moon pathway" began. Without mentioning all the automatic space stations created after *Luna 9* for fulfillment of the wide scientific program of Moon exploration, we shall only state that the first-in-the-world artificial lunar satellite, the first automatic lunar rockets delivering samples of lunar soil to the Earth, the first remote-controlled Lunokhods—lunar roving vehicles (i.e. scientific laboratories, which all together covered nearly 50 kilometers on the Moon surface), and numerically from the *Luna 9* up to *Luna 24*, were created at G. N. Babakin's designing office. The success of the *Luna 9* station played a great role in the maturing of Babakin as the Chief Designer. Within a few months of his work on the new subject, Babakin successfully fulfilled the tasks assigned. His proposals were concrete and convincing, and the volume of the carried-out experiments won respect. The accessory manufacturers believed him to be a technical leader able, in a short period of time, to dive into some very difficult problems and draw the right conclusions.

Here are the sheets of the 1966 lunar calendar, which was a very difficult year for the designing office confronted by new themes:

February 3: *Luna 9*, the first soft landing, and the first transmission of the lunar panoramic view;

April 3: *Luna 10*, the first artificial lunar satellite;

August 28: *Luna 11*, the second artificial lunar satellite;

October 25: *Luna 12*, the third satellite, which took and transmitted the Moon photographs from orbit;

December 24: *Luna 13*, the second soft lunar landing.

Five lunar stations in one year, and not a single one resembled the former. Each station had a different goal, newer scientific equipment and another engineering approach; each station was a step forward, and always presented something new. And it not only had something new each time, but also the priority!

A special feature of all the designs created at the G. N. Babakin designing office was the use of the rational unification principle: the creation of a basic design capable of providing the solution of many, sometimes not very similar, tasks.

In 1966, individual ideas, works, and recommendations of scientists formed the basis for the worked-out plan to be used in the exploration of the Moon and the other planets in the solar system. Besides the Moon, the plan envisaged the solution of some definite tasks in the exploration of Venus and Mars, i.e. of the planets nearest Earth. This was also the theme of G. N. Babakin's designing office.

The work on the creation of automatic interplanetary stations began at the S. P. Korolev designing bureau: *Venera 1* was created in 1961, *Venera 3* in 1965, and *Mars 1* in 1962. The operation of these stations supplied much interesting data about space on the way to planets, but unfortunately it gave no information about the planets themselves. The plan still remained a plan only. Then came 1967 and the *Venera 4* flight.

Strenuous work and many meditations preceded that event. It was necessary to solve numerous, most complicated problems. What was the main difficultly in designing Venus stations? The answer is that these stations and their descent vehicles had to be designed for the pressures and temperatures of the Venus atmosphere, which the stations themselves had to determine.

At the beginning of the 1960s, there was considerable divergence in scientists opinions concerning the nature of the Venus atmosphere and the planet itself. It suffices to mention that the values of the expected atmospheric pressure differed among scientists by one hundred percent. But it was not one and the same thing to design, work out, and build a structure intended for one or for a hundred atmospheres of external pressure, or to withstand temperatures of 10°C or of 400°C.

Venera 4 safely reached the planet's surroundings, entered the atmosphere, and began its parachute-descent to the surface. The descent vehicle withstood the pressure of 17 atmospheres, although it was designed for only 10 atmospheres. However, it failed to descend fully to the Venus surface and to continue its transmission to Earth. The data obtained demonstrated vividly that the near-surface pressures were much greater than those previously introduced into Venera design.

Within the Venus field, space engineering designers had to learn the science and technology of high pressures, unusual g-loads, and temperatures, as well as to invent newer test methods, newer materials, and newer structures. They had to get acquainted (not theoretically but practically) with the influence of g-loads in the planet's atmosphere never imagined, even in science-fiction literature. These g-loads were from 400 to 450 units at a time, when designers were familiar with 10 or 20 units only! What did it mean? It meant that any device, bolt, or bracket became 400 or 450 times heavier than its normal Earth weight! And it had to remain intact, without losing its efficiency.

It is clear that in creating a vehicle, especially a new one, a designer studies the latest achievements, generalizes the methods of forerunners, and peruses lists of inventions and patents. And what were designers of vehicles for the Venus surface landing to do? Whose experience could they borrow? Whose achievements could they utilize? And not only the pressures and g-loads were extremely high, but the temperatures were plus 400-500°C. And all these "delights" act not separately, but together, during descent into the atmosphere of that marvelous "morning star."

Calculations showed that the descent vehicle could, in principle, begin to swing upon entering the atmosphere, and it was absolutely necessary to secure a stable position. This was also not an easy problem, but one which G. N. Babakin had to solve. There was always something to think over, something to discuss with one's colleagues. And it would be wonderful – a normal creative process – had it not been for the astronomic deadline, (i.e., the best time for space station launching to Venus).

Not going into the details of this difficult problem, including other accompanying problems, we shall only state that the main task of reaching the Venus surface by a space station in operating condition was solved. The station *Venera 7*, upon reaching the planet's surface in 1970, transmitted to the Earth the following: 90 atmospheres pressure, a temperature of 480°C, a composition of mainly carbon dioxide, and a number of other scientific data.

The Mars stations were being designed with launchings planned for 1971. It was the last project in G. N. Babakin's life. *Mars 2* and *Mars 3* reached that planet four months after his sudden death, beginning their path of nearly 500 million kilometers while he was still alive.

Thereafter, *Mars 4*, *5*, *6*, *7*, and *Venera 8*, *9*, *10*, *11*, *12*, *13*, *14*, *15*, *16* were launched into flight. These transmitted unique television panoramic views of Venus' surface, and radio maps of its preplar regions.

The fact that every station launched after Babakin's death became a new milestone in space exploration, showed the great services of scientists who successfully continued the cause to which Babakin was devoted. But these stations also served as new evidence of his talent in science and engineering, his designer's talent. The vehicles, created under his guidance, possessed possibilities for further development, and thus determined, for a long time, the ways and means for space exploration with the aid of automatic stations.

In 1968, on M. V. Keldysh's personal initiative, a degree of Doctor of Technical Sciences was conferred on G. N. Babakin for his great personal contribution to the creation of the Venera spacecraft, and at the end of November of 1979 he was elected a Corresponding Member of the Academy of Sciences of the U.S.S.R., Division of Mechanics and Control Processes.

Fifteen stations started towards the Moon, Venus, and Mars when Georgy Nikolaevich was alive, and many more went into space after his death. In March, 1965, G. N. Babakin became the Chief Designer. He died in August 1971. Certainly, G. N. Babakin was not an ordinary person. And the matter is not that there are not many chief designers, the people who concentrate in their hands great manpower and material resources with only the goal to solve definite, extremely important, tasks, sometimes ones of State significance. Every chief designer is an original; every one has his own personality.

Were there a task set to analyze creative development of each chief designer, and on this basis to make generalizations and point out whether there exists something general, inherent only among chief designers, then there is no doubt that that "general-something" would be a combination of characteristics, such as indomitable imagination and the ability to think in categories of reality, such as fundamental nature, profoundness of knowledge, and a wide range of interests, such as firmness when coming to the conclusions, and flexibility when searching for ways of their realization. And naturally the all-embracing devotion to "the cause one serves."

Georgy Nikolaevich Babakin was such a person, and so he still remains, and will remain, in the memory of those who shared with him the happiness of success, and the anxiety and bitterness of failures, The Chief Designer.