Academician Mishin Criticizes Past Space Policies

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[Interview with Academician V. Mishin by A. Tarasov: "Missions In Dream and In Reality"; date and place not given; first paragraph is PRAVDA introduction]

[Text] Chief designer Korolev-general designer Glushko.... This is the succession usually accepted in the leadership of the space rocket firm now known as the Energiya Scientific-Production Association. But there is one other name that was for many years hidden in the shadows: S.P. Korolev's first deputy and, after his death, leader of the design bureau from 1966 to 1974.... Now, for example, a certain photograph has come to light of the now dead Academician Kurchatov. Next to him we see Academician Korolev, and now the scene expands a little: Kurchatov, Korolev, Keldysh. But in fact there are five people in the photograph: Kurchatov, Korolev, Keldysh, Mishin, and corresponding member of the USSR Academy of Sciences V.M. Iyevlev. I saw that photograph for the first time in the home of Vasiliy Pavlovich Mishin, academician, Hero of Socialist Labor, Lenin Prize laureate, State Prize laureate, deputy and successor to Korolev in the post of leader of the firm, now a professor at the Moscow Aviation Institute. Vasiliy Pavlovich gave me permission to ask questions, and I ventured to do so....

[Tarasov] It probably does not surprise you that at the ordinary everyday level the following divergent idea enjoys currency: When Korolev died so suddenly that was when we started to fall behind in space research. There were tragedies: The deaths of Komarov, Dobrovolskiy, Volkov, Patsayev.... We lost the moon to the Americans.... And the new chief designer, who had surrendered up "space", was removed for this, after which the successes again started to come....

[Mishin] Nothing surprises me after the fact that up until today my name has not been mentioned in the history of space exploration.... The names of many fine designers still working today were also not mentioned. Sergey Pavlovich Korolev himself became known only after his death, but it is not up to us to judge the correctness or incorrectness of personal assessments. Korolev's obituary, subsequently signed by the leadership, was written by me and sent to Brezhnev at his request. I saw that even then not everyone was willing to have his name made known as the major organizer of our space rocket technology.

So let us leave the purely personal feelings about appointments and dismissals. We are not here indulging in idle talk. If we talk about the main subject, then I would like to share some serious thoughts. First, if Korolev had lived longer we would undoubtedly have gone into space incomparably further. It was not just a question of his energy, persistence, and authority. First and foremost, under him we went our own way and sought out and found our own solutions. Then we started to look at the Americans, were depressed by their example, and started to attempt some immediate successes and were distracted by propaganda advantages.

Second, accidents also happened when Korolev was there. It is most unfortunate that the degree of risk in this field is in general great. It happens that accidents are also associated with professional inaccuracies or carelessness; for example, the explosion in the silo of an oxygen rocket that incinerated six people. The reason? A soldier was unscrewing a light bulb, and there was a short circuit and an explosion. This was a year after Marshal Nedelin and several dozen people had been burned.

If we talk about the two accidents involving the Soyuz vehicle that shook us all, then we would bring up the two systems that flew successfully in Korolev's time. He had a rule: Do not change something that has already flown. If you are doing something new look both ways, seek out different versions, make improvements. The parachute

system for Komarov's vehicle was tested repeatedly, but during the mission the braking parachute failed to operate.

[Tarasov] They used to say that his launch was brought forward artificially for the sake of a holiday....

[Mishin] No, that is not true. It was purely the equipment here. Those kinds of trends did creep into the top leadership—for example, D.F. Ustinov—but there was no direct pressure. Indeed, the equipment would not allow it. I remember only once when near the 23d Party Congress a lunar satellite was launched and played the national anthem. We merely put the idea to the chief designer in the design bureau, G.N. Babakin, but they forced him to do it. And well, there was a second satellite—the one launched on the 40th anniversary of the Great October Socialist Revolution in 1957....

But how were things in general? We did not expect such a worldwide response to the first satellite. The idea, incidentally, was Sergey Pavlovich's personally. If it was possible to launch a "chunk of iron" on such a rocket then why not the world's first sputnik? He proposed that it be done on the fifth launch of the "number seven" rocket—immediately after the fourth, successful launch. It is common knowledge that the first three were failures. By early October 1957 we had made the sphere in a month, and it flew. After that we disbanded for a break. Korolev, Voskresenskiy, and I with our two deputies, and a group of the main workers from the special design bureau obtained travel authorization. We stayed at Bulganin's big dacha in Sochi.

We rested for exactly 5 days. I was suffering from tonsilitis because of the change in climate, and then we got a telephone call on the VCh [high frequency short wave]. "Fly back urgently. We have been tasked to make a new satellite." So we did. It turned out that Khrushchev had been pleased with the political effect of the first sputnik and he ordered another on a priority basis, and we made it on a priority basis and launched it. Only after that did we go off for a real rest. That was the way in which ideas were sometimes born, and from them it was necessary to embark on the strategy of the exploration of deep space.

[Tarasov] So that means politics did start to dictate its conditions and limitations on the space program, does it not?

[Mishin] Here, let me return to the third thought that we started with Korolev. This could also have been taken up earlier. Because, as in everything else, in astronautics things started to stagnate and the most superficial and contradictory decisions were dictated. With his decisiveness, independence, and far-sightedness, Korolev tried to oppose them. For this he came into personal conflict with the top leaders. In the final days his hands were shaking....

[Tarasov] Vasiliy Pavlovich, we have barely touched on the question. So at that time you were first deputy to Sergey Pavlovich. This was no happenstance. Please tell us about your work with Korolev.

[Mishin] It should not be thought that just because I was Korolev's first deputy, this meant that I was both a very close friend and counselor. With us, everything was with Korolev; we would not speak for weeks because of some technical disagreement. Particularly with his character. But in the main thing, in the desire to create a well-considered strategy for space exploration, we were, I hope, fellow thinkers. No, I probably did not possess the kind of will and sharp tongue that distinguished Korolev. I am prepared to admit that. But in our space situation, the replacement of one character for another and the replacement of leading personalities did not play any decisive role.

What can I say about myself? Up to 1935 I studied in the factory training school at the Central Institute of Aerohydrodynamics and mastered the specialty of fine mechanics fitter. I worked there in the shop on special tasks. Then came paid courses to prepare for the institute and authorization from the Baumanskiy Komsomol rayon committee to enroll in the Moscow Aviation Institute. The authorization required two sponsors with at least 5 years party seniority. It was competitive: five for one place. I graduated as an engineer-mechanic for aircraft munitions. I did my pre-diploma practical work in the special design bureau of the chief aircraft designer, the great designer and innovator and great scientist and teacher Viktor Fedorovich Bolkhovitinov. I was invited to work there. This special design bureau was known for its really pioneering developments—the world's first fighter powered by a "BI-1" liquid rocket engine, which flew for the first time on 15 May 1942 with pilot G. Bakhchivandzhi at the controls. This was the birth of the new rocket era in aviation. At that time we were working under conditions of evacuation not far from Sverdlovsk at a small half-ruined tube-casting plant that was totally unsuitable for aviation production.... I was also a witness to Grigoriy Bakhchivandzhi's seventh and fatal flight in the "BI-1" on 27 March 1943 when he attained a maximum speed of 970 kilometers per hour (80 percent of the speed of sound) and when the aircraft quite unexpectedly went into a dive and crashed into the ground at the edge of the airfield....

But let us return to rockets. At the end of the war, as is known, when we had already returned to Moscow, the army of General Kurochkin captured a testing ground in Debica near Warsaw with launch facilities for the V-2. The Germans had cleaned up their traces, but in places where they had fallen, bits of the rockets nevertheless remained, some parts of the structures destroyed in the dense layers of the atmosphere. They were delivered to our NII-1. A group was organized that included Isayev, Bereznyak, Pilyugin, Chertok, Voskresenskiy, Tikhonravov and others, and myself. We quickly traced out from the pieces the layout of the rockets and the pneumatic systems, and calculated trajectories; our mathematician, Yuriy Konovalov, was outstanding in this task. Unfortunately, both he and a large part of our group,

including the NII-1 director, Lieutenant General Fedorov, died on their way to the site: Their aircraft crashed near Kiev.... It was pure chance that I was not aboard. They would not give me clearance because at that time my father was in prison. True, he was not living with us. I was brought up in my childhood by my grandfather.

[Tarasov] So why was he in prison?

[Mishin] Because he was a worker.... He listened to anecdotes. But somehow or other I moved in with the rocket people, and after the war in Germany, when studying German rocket technology and the archives, I met Korolev. Actually I was studying in the archives in Prague, and when I had already written my report and was about to return home I finished up in Berlin instead of Moscow—at Korolev's request. I got to know him late in November 1945.

He suggested that I work with him but I wanted to go home to my wife and two daughters, but I gave in and agreed. This was the task: To restore a full set of documentation from the blueprints found in Prague. Then to work on trajectory questions, organize observations, take pictures with a cine- theodolite.... We returned, and from that time until Korolev's death we worked in the special design bureau. Well, you know that there was a protracted struggle between the aviation people and the "gunners," each trying to push the other away from rocket technology. We started at the remains of a gun factory and we really wondered "can we really make rockets here?" Then we got our own Ministry of General Machine Building.

[Tarasov] How did you take your leave of Korolev?

[Mishin] In a very ordinary way, by telephone. For no one was expecting the outcome. On 5 January Sergey Pavlovich was to have his operation and I had remained behind to cover for him. On 7 January after the accountability report in the ministry collegium, the minister, Afanasayev, gave our firm a good dressing down. After the collegium meeting, Korolev telephoned:

"What are you doing?"

"Writing the report. It is hard enough to work with you, but with him there is no way."

"Tear up the report," he responded, "ministers come and ministers go, but we stay in our own business."

He made another, quite ordinary, everyday call before the operation. And then... it was a shock for all of us....

[Tarasov] At what level were you appointed chief?

[Mishin] At the same level at which I was removed. With this difference: When I was appointed Brezhnev received me and listened to me, but when I was fired he did not. In general, I was not too eager for the post. A group of Korolev's co-workers sent a letter to the Central Committee at that time asking that I be appointed. That is what they told me. True, there were later other letters but that is how it is here.

[Tarasov] Forgive me, Vasiliy Pavlovich, was your dismissal in fact connected with the run of accidents? What was your own attitude here?

[Mishin] What can one's attitude be toward misfortune, the loss of remarkable and brave people, to the great pain of their nearest and dearest? I still have a vivid memory of how Yuriy Gagarin wept in the aircraft after Komarov's death. It was a real blow, for when we were flying to the landing site we were convinced that Volodya was sitting comfortably because they had reported from the helicopter that they had seen the parachute deploy, and the soft landing.

It was even more painful when tragedy could have been prevented. The only time that the valve failed to operate normally—the explosive bolts used for the separation produced an overload and the ball joint was displaced from its seating. The cosmonauts heard the air whistling in and Patsayev unbuckled and tried to block it with his finger, but he failed. But there was a manual drive—they could have protected the capsule. But they forgot, or did not know, or it had been omitted during training....

The mission was very complex. I had complicated conversations with Volkov and he said that he was the crew commander. A cable caught fire and the lads lost their heads and wanted to land, and I calmed them down. They made it through to the end of that program... and then in those terrible minutes....

[Tarasov] But was not the main mistake that the cosmonauts had removed their pressure suits?

[Mishin] I believe now that even if they had donned their suits it would have done no good. It was not even a question of reliability. Before the pressure suits were removed there had been about a thousand successful landings of recovery vehicles, up to the time that the soft-landing motor appeared, and crews had become accustomed to landing inside the vehicle. I think that this decision of Korolev was right, and afterward there was no need to think about improving personal survival aids but rather about the entire apparatus, and collective means. We did have ideas—creating another pressurization loop, having a backup for every gap—everyone knew about them.

[Tarasov] So why was the decision otherwise if you, the chief designer, did not think that way?

[Mishin] A government commission headed by Ustinov decided. In principle the recommendations were right, and further work was done on the design of the valves and separation mechanism. It is common knowledge that on passenger aircraft there are no personal survival aids for either crew or passengers. Here another path is chosen—collective aids and backup systems.

[Tarasov] Vasiliy Pavlovich, it was precisely during "your" years that the Soviet press remained silent about two far-reaching lunar epics—ours and the Americans. Whereas the flow of information about the landing of the astronauts on the moon nevertheless with time did somehow break through, our "lunar people" were right out of luck except for the successes of the automatic Lunokhod. Even last year, a mention of our unsuccessful lunar program was struck out of my articles. Is it really a state secret or a military secret? To the point, did you have a certain attitude toward the printed word in those years? For it later "was at your expense" personally. How were those filtered reports prepared whose essential nature became clear years later?

[Mishin] I do not know, I had no part in that. A special apparatus was set up for that which carried out Ustinov's instructions. True, as one moved around one could hear disputes about the formulations about which some of the technical leaders who were too involved in politics were getting excited. For example, depending on the success of the launch, a space vehicle was said to have been sent "to the moon" or "toward the moon."

[Tarasov] Well for all that, we wanted to fly "to the moon" or "toward the moon." What was the program and how did it come about and disappear?

[Mishin) Well, you know, how is it always in such cases? There is one main reason and thousands of small reasons. Let me begin with the main reason. First of all, we had to know about and have a long-term scientific program for space exploration. Unfortunately we had a mess of separate, individual assignments that pursued either political or prestige goals. This had started even under Khrushchev. "Catch up," "Overtake," "Go, Go."

It was the same with the moon. Neither Mishin alone nor Korolev alone could initiate such a program. We needed the scope of scientific goals and national economic goals. We needed careful work with the involvement of the Academy of Sciences and many departments, and with sector science; we needed national debate. Then later there was the choice of means to reach the goals.

After the landing of the first lunar and interplanetary automatic vehicles interest fell off for some years. Then when the Americans started talking with greater insistence about the moon and when their national program was proclaimed by President Kennedy and came to life, then we also began to stir ourselves, but somewhere from about 1964, whereas they had started in 1961. But then we were behind not only in time, as everyone now acknowledges, but there was also a shortage of funding. The first successes with sputnik and Gagarin's flight were based largely on a colossal self-sacrifice from people and on the personal qualities of a leader like S.P. Korolev. The Americans with their air bases had no need of missiles, for that kind of race could go on endlessly. We were tired. There were the accidents that we have talked about.

Strictly speaking, the lunar program was made up, as it were, of two independent parts. The first was a circumlunar flyby with a manned vehicle launched by a Proton rocket. The second was the landing of a lunar module with one cosmonaut, then a launch from the moon and a docking with a vehicle where a comrade would be.

We can say that the first part was accomplished. Four automatic probes did circle the moon. Apart from the first, which was a miss. In fact, there were successful returns of recovery vehicles for a two-man crew. Their leading designer was the present leader of the Energiya Scientific-Production Association, Yu.P. Semenov. Two landed in the target area, two splashed down in the Indian Ocean. It would have been possible to switch to manned missions but it lost all propaganda meaning after July 1969 when Neil Armstrong set foot on the moon.

Now about the landing. It was possible only by using a heavy launch vehicle capable of lifting at least 100 tons. That is, equal to today's Energiya. Korolev had been thinking about this kind of launch vehicle since the early 1960's. This was the recently announced N-1 rocket. A universal, modular, multirole rocket that, depending on the choice of modules, could be used for injection of circumterrestrial or interplanetary vehicles.

It had an original and reliable configuration: 30 thruster nozzles in a module, and it could fly if two pairs of motors in the first stage failed and with the failure of one pair in the second stage. The fuel was inexpensive and ecologically clean—kerosene and oxygen—and there were no toxic components.

This launch vehicle held great promise. But here our lack of organization and, unfortunately, our general technical level, were seen. The N-1 was being made by 500 organizations in 26 departments. Of these, only nine fell within the competence of the military-industrial commission. The rest had to be begged. Resolutions from the Council of Ministers did not help at all: The tasks were just outside their competence and delivery schedules were not met. Under Korolev, for example, on 10 points; under me, by an order of magnitude more. Ministers couldn't come to agreement with each other. I would make the rounds to see them and often ran up against foul language.

But even under these conditions the Kuybyshev people did make the "number seven" - the Vostok for Korolev and were working on the N-1.

But this was not all. The designer, V.P. Glushko, had a jealous and hostile attitude toward the engine developed by the Kuybyshev aviation designer N.D. Kuznetsov, who was cooperating with Korolev. Advancing his own liquid-propellant rocket engine for the Proton, Glushko spoke out against oxygen and kerosene. I still have his monograph in which it is written in black and white: "Liquid oxygen is far from the best oxidizing agent, but liquid hydrogen will never find any practical application."

[Tarasov] How does this relate to Energiya, which under the leadership of that same V.P. Glushko has been developed to fly on oxygen and hydrogen?

[Mishin] This is how. Of course, the error of the future general designer was obvious, and it was not his only one, and it had a bad effect on the fate of the Kuznetsov engine. Each failure resulted in a strong response, but without failures you can get nowhere in this business. The more so under our conditions. Construction of the production base was delayed 2 years. It was skimpy. The Americans were able to test an entire assembled engine module on their test stands and install it on the launch vehicle and fly it without a takedown inspection. But we tested in pieces and did not even dare to think of firing all 30 motors in the first stage as a full assembly. Then the pieces were assembled, without guarantees, of course, that they were properly run in.

Schedules were mercilessly squeezed. In February 1967 flight testing in space was scheduled for the launch vehicle during the second quarter of the same year.

[Tarasov] And the landing itself?

[Mishin] For the third quarter of 1968. These were the schedules laid down in a government decree. Well, in the extreme case, during the last quarter. But we tested the N-1 for the first time only on 21 February 1969. A fire in the after compartment switched off the engine after 70 seconds. I came out of the bunker—it was still flying.... The second launch was on 3 July 1970. Again an accident—an explosion in the oxygen pump when it reached nominal regime. The launch complex was destroyed. The third launch was on 27 July 1971. Because of an unconsidered gas-dynamic factor it started to spin.... But all the engines worked for the first time. But only for 7 seconds. The fourth launch was on 23 November 1972. I was in the hospital and the launch was led by B.Ye. Chertok. He was more successful; the engines ran for 107 seconds. An explosion in the after compartment occurred after the transfer to the final stage of thrust, at the end of the active part of the first stage.... Just a little bit more....

But we never got it. We found omissions and errors, we eliminated them, we moved ahead. But the Americans had invested 25 billion in the program and they reached the moon. But we had almost 10 times less, and we had to extract each million one by one.

[Tarasov] A competition between Ellochka-lyudoyedka [fictional character] and an American millionairess?

[Mishin] Something along those lines. But it ended there. After 1972 we worked on two rockets under a new technical task but they were not launched. The program was halted. Six rockets went under the pile driver, two already assembled. People who had given the best years of their lives to their development and to work on them did this with tears in their eyes. I had already been dismissed.

[Tarasov] But how would things have developed if you had had your way?

[Mishin] First, the very birth of the lunar program should have been not as a race, but for well-considered goals. The USSR Academy of Sciences Lunar Commission did not in any way set those goals. Incidentally, if you noticed, U.S. President Bush recently announced the intention to move on to the development of an industrial and interplanetary lunar base. There you have it: If we had not halted the program we could have had this base already without any anguish or haste. First of all, we would not have lost a heavy launch vehicle that had what I reckon is the best engine in the world, superior to the Saturn-5. Yes, I make no reservations. In those years, Kuznetsov, in his own interests and at his own risk, developed the engine in Kuybyshev and had it running on a test stand for 14,000 seconds. It takes only 150 seconds for injection of the rocket. Thus, there was no need to start Energiya from scratch, where Glushko's strap-on engine, which is oxygen-propelled, costs more than gold does in comparison with Kuznetsov's.

So, while continuing the work on the rocket it was necessary to think about a new lunar expedition. To investigate various scenarios: A one-shot project, two phases (with an orbit of the earth), the use of circumterrestrial and circumlunar orbits for maneuvering, docking, building up the vehicles. For example, the earth stage of a vehicle could be left in a "home" orbit and used to fly to the moon and back. There were many scenarios and we did work on all of them. Then there was the landing and the takeoff of automatic vehicles, then a manned vehicle....

But all of this was divorced from the general concept of space exploration, its real industrialization. In 1974 Kuznetsov and I compiled and sent to L.I. Brezhnev a detailed memorandum about our lagging in the field of space rocket technology and about ways to develop an industrial complex in earth orbit, and we asked for a meeting. But D.F. Ustinov soon informed us that I had been relieved of my duties and that Brezhnev had thanked me for the work that I had done.

Just look at the groundwork that had already been done at that time: Six space vehicles for the Soyuz-Apollo program ready to go, with the latest docking assembly, for which, incidentally, I hold a certificate of authorship. The Salyut-6 was in the factory with its two docking assemblies, a base for international cooperation in space....

[Tarasov] Incidentally, why was the station not launched immediately with two docking assemblies? Why did we make do with only one for such a long time?

[Mishin] I had immediately proposed that it have both, but again Ustinov insisted on a single assembly—in order to hasten our success. Before the Salyut-6 the line stretched into 1977. In addition, work had already started on the Soyuz-T, which made its debut in 1980. When I was there eight such vehicles had been prepared

to various stages, and the unmanned version was ready. This was not pure chance: We wanted to gain experience in various kinds of docking arrangements, assembly and installation of vehicles for the most diverse purposes—from rescue operations to production. And so....

[Tarasov] Vasiliy Pavlovich, is it true that when you came out of the hospital, on the following day V.P. Glushko ordered your pass to the enterprise to be withdrawn?

[Mishin] Yes, that is true.

[Tarasov] Can you tell us how you assess today's developments in space exploration?

[Mishin] Very little has been done about what we thought about and dreamed about 20 years ago, even 30 years ago with Korolev. It is simply vexing that so few useful and efficient space vehicles are in earth orbit. On the one hand there has been an attraction for a variety of launch vehicles that absorb enormous investments. But the various modules of our standard N- 1 could have served Soyuz and Proton and Energiya to inject payloads of 7 to 100 tons. How economically and ecologically better this would have been, particularly when you consider the Proton fuel.

On the other hand, we have become addicted to the same, monotonous long-period manned missions in the tight Salyut-Mir, which repeat each other. It is very wasteful; it is necessary to develop automatic production in space by training top-class operators to assemble and service installations, repair them, and remove output, and save it.... Science can also work on automatic vehicles without the absolute need for man to be present. I do not understand the expediency of it in this light. The Cosmonaut Training Center with its enormous staff handles only a small group....

[Tarasov] Vasiliy Pavlovich, surely you are not taking umbrage with Zvezdnyy?

[Mishin] I am taking umbrage with no one, but it would be more practical to train crews in the firm on the actual vehicles that will be used on a mission. Why maintain a special, expensive facility just for test stands and simulators and have it subordinate to a different department?

Finally, our latest system—the Energiya-Buran. It is undoubtedly a great achievement for aviation and space rocket technology. But I do not see any real application for it for the next several decades.

[Tarasov] Will there not be things to bring back from space? What a pity.

[Mishin] It is and it isn't. Much less would have been gained by returning possible valuable objects from orbit, but a reusable vehicle launched by a reusable carrier is more effective. All the rest—repairs, inspections, resupplying large projects—can be done in working orbits in special modules. I can assure you that because of this some things are costing three times as much. It is much more practical to allocate funding to improve the space vehicle itself. Our communications satellites still operate for periods of time two or three times less than the American satellites. If their service life could be extended to 5 or 10 years our communications would be unrecognizable.

Do not think this is simply talk. Way back in 1970 we were thinking about a project for a multirole orbital complex—the MOK. It was a broad program for space exploration in circumterrestrial space within the earth-moon radius, including participation in solving food, energy, and ecology problems. Using a minimum number of fully equipped, standard space facilities in ground and orbital bases, the plan was to saturate local space with numerous useful vehicles. They would even have been able to influence the climate and lighting for cities, using a system of mirrors and solar light. It was a quite realistic project. For communications is not only radio and telephones and television, it is remote control of automated factories that may be harmful or dangerous, and of nuclear power stations located in an unpopulated safety zone. Not to mention the removal of harmful production facilities into space and making full use of the opportunities in space—high and low temperatures, high vacuum, conditions close to weightless. And 90 percent of all these operations can be carried on without man. But the idea of industry in space is still talk.

[Tarasov] How can this process be accelerated?

[Mishin] We need more projects, more proposals, and the broadest involvement of science, particularly VUZ [higher educational institutions] science. Space exploration has been hampered by monopoly and secrecy, and by nepotism and political dealing in the allocation of assignments and subsidies. We need broad, open competition in projects for a unified technical task. And discussion of tasks, ideas, and proposals, and independent expert evaluations, and open selection of the winners. Only after this, in full view of everyone, should there be implementation of projects in which the whole of society is convinced of their need and soundness.

[Tarasov] Thank you for the interview, Vasiliy Pavlovich. I congratulate you on the 32nd anniversary of the launch of the first artificial earth satellite.