ANNIVERSARIES

A. Borisov. "Novosti Kosmonavtiki"

Sometimes you hear from journalists that ten years ago "we celebrated our last victory in space."

Yes, indeed, on November 15, 1988, the reusable orbital spacecraft "Buran" made its first and only flight. But now, perhaps, it is no longer the time to mock domestic cosmonautics. Since that memorable flight, both "Buran" itself and its creators have had their fill: everyone and their dog tried to kick them - from journalists who had risen to the crest of glasnost to retired former chief designers.

0 So much has been written about "Buran" and "Energia" that there is no need to repeat myself.

There are hundreds (if not thousands) of newspaper and magazine publications, radio programs, television films, and excellent books describing all stages of work on these systems - from concept to implementation. However, it seems worth recalling some details that remained behind the scenes not even for reasons of secrecy, but simply because they were forgotten at the time. Work on a heavy transport and space system with a reusable orbital ship began in 1974 after V.P. Glushko was appointed chief designer of NPO Energia. As an alternative to the N-1 rocket, which "did not live up to expectations", they proposed a "comprehensive rocket and space program" that envisaged the development of launch vehicles for the deployment and support of a lunar base. However, the military showed much greater interest in a system similar in capabilities and characteristics to the American project 5race ZiNe. Government Resolution No. 132-51 "On the creation of a reusable space system consisting of an accelerating stage, an orbital aircraft, an interorbital tug-ship, a system control complex, a launch and landing and repair and recovery complexes and other ground-based facilities that ensure the launch of payloads weighing up to 30 tons into north-eastern orbits at an altitude of 200 km and the return of payloads weighing up to 20 tons from orbit" was issued on February 12, 1976. This same document opened the financing and determined the main customer (the USSR Ministry of Defense) and the lead developer (NPO Energia). From the many proposed options, a two-stage launch vehicle with a parallel arrangement of stages and lateral attachment of the payload was chosen. The versatility of the scheme made it possible to realize the long-standing dream of all developers - to create a series of modular launch vehicles, including the Groza medium, Buran heavy and Vulcan super-heavy class rockets. Each launch vehicle included a central block (the second stage is the same for all types of launch vehicles) and a different number of side blocks (the first stage). In particular, Groza was to have two boosters, Buran - four, and Vulcan - six to eight. In addition, on the basis of the side block, it was supposed to create the Zenit launch vehicle, replacing the Soyuz in terms of payload capacity. The work began quite quickly. (The next Government Decree No. 1006-323 of November 21, 1977, already clearly defined the cooperation and set the dates and tasks of the launches. The enterprises of the Ministry of General Machine Building, developing the launch vehicle, interacted widely with the institutes and plants of the Ministry of Aviation Industry, which were responsible for the orbital aircraft. In order to achieve the design characteristics of the system, it was necessary to completely re-equip all the enterprises of the industry, equipping them with high-performance (including imported) equipment - which was not done under any previous programs. Taking into account the experience of the N-1, funding for the work was carried out rhythmically and in the required volumes. Information on the development of the Zrasse 5Nie system was coming in a wide stream, so in order to speed up the work (our program lagged behind the American one by seven years) when designing the orbital aircraft, the characteristics of the American analogue were taken as the reference parameters. Information on wind tunnel tests of models and flight tests of the shuttle analogue - the Epegrise orbital stage (0\-101) - were especially useful. However, despite the external similarity, the main design and technological solutions adopted on the Buran can be considered domestic know-how, since it was even theoretically impossible to transfer American technology to our industry (in fact, no one tried to do this). It was supposed to reach the stage of flight tests of the system by 1983, having carried out two launches of the ML-1 and ML-2 mock-up flight products without a control system and even without standard heat protection. At the first stage, when the main burden was on the shoulders of the carrier developers, they were eager to test the rocket. It was proposed not to separate the ML from the central block during the first flights, but they did not dare to do this. The standard Buran without a crew was supposed to fly in 1984. By the first flight of Columbia, it became clear that we would not have time and the launch date of our system was moved to the anniversary year of 1987. Even this deadline seemed unachievable, and it was proposed to simplify all systems as much as possible for the first flight.

The Americans trumpeted about their difficulties with the oxygen-hydrogen cruise
propellant rocket engines, heat shielding, and control system.

Oddly enough, things were going quite well with our heat shielding. True, by the time the first launch vehicles were assembled, the first-stage engines were not yet ready, and there were serious comments on the orbital aircraft, but still...

No matter how hard the aviators tried, the orbital aircraft was not ready by the scheduled date. The first rocket (called "Energia" by that time in honor of the parent company) was launched on May 15, 1987, as is known, with the paramilitary module "Polus" ("Skif DM") on board. The program of the first flight of the orbital aircraft, which retained the name "Buran", was revised several times. Three-day and two-orbit options were proposed. The first option had particular difficulties in that the units for opening the payload compartment doors and the thermal regime support system had not been worked out, the control system did not have command sensors, and the power plant based on fuel cells was also not ready. And the second option, in turn, made it possible to fulfill the main task - demonstrating descent in

the atmosphere and landing in automatic mode. To implement this, the following measures were taken: 1) Instead of fuel cells, batteries were installed; 2) To record the parameters of the systems and flight parameters, a mass of telemetry equipment was introduced, which, together with the batteries, was placed in a special BDP module, which was secured in the OPG;
3) It was decided not to open the doors, but to provide heat release by evaporating water.
The ship was protected by standard heat-shielding tiles, and a TV camera was installed in its cabin, which "looked" forward
through the glazing. The mass of the Buran was less than calculated and was 79.4 tons at the start.
The first flight program was fully and successfully completed, despite the difficult weather conditions.
The launch took place on November 15, 1988 at 06:00:01.25 UTC in severe weather conditions.
The ship separated from the central block at 06:08:00 and entered orbit with a conditional perigee altitude of 11.2 km and an apogee of 154.2 km. At the apogee of the trajectory, its engines generated a correction impulse of 66.6 m/s. After the second burn (44 m/s), the ship found itself in an orbit at an altitude of 263-251 km and an inclination of 51.6°. In orbit, all systems operated normally. After completing two incomplete orbits, at 08:20:00 a braking impulse of 175 m/s was generated. Entry into the atmosphere was normal; sensors in the nose of the fuselage recorded a temperature of 907°C, on the wing tips - 924°C. At 09:24:42 the ship touched the runway at a speed of 260 km/h and stopped completely at 09:25:24, having run 1620 m.
It was a triumph! Everyone was happy - both the supporters of the system and the people who did not particularly believe in it. A huge burden fell off the shoulders of the developers. It seemed that now the future of Soviet cosmonautics lay in the flights of such ships...
How unexpectedly and quickly it all ended... First, the program began to stall (and not for technical reasons), and then "macroeconomic trends clearly manifested themselves, which ultimately led to the collapse of the Soviet Union and the destruction of the socio-economic system"...
"Buran" is not just a feat of developers, designers, engineers, workers, and military personnel. It is also a symbol of the enormous potential of a country that can do anything if it wants to, but sometimes does not know what to do with what it has done...
ANNIVERSARIES
Characteristics Value
ISS launch mass, t 2375
Mass of payload launched
into the orbital station into an orbit at an altitude of 200 km:
with an inclination of 50.7°, t 30
with an inclination of 97°, t 16
Mass of payload returned from orbit to the orbital station, t 20
Carrier rocket mass, t 2270
First stage (Block A, 4 pcs.), t 1490.4
Incl.: Oxidizer reserve (oxygen), t 886.8
Fuel reserve (RG-1 kerosene), t 341.2
Second stage (Block Ts, 1 pc.), t 776.2
incl.: oxidizer supply (oxygen), t 602.3
fuel supply (hydrogen), t 100.7
Orbital spacecraft mass, t 105
incl.: oxidizer supply (oxygen), t 10.4
fuel supply (cyclin), t 4.1
Crew, persons Up to 10
Reusability:
approx 100
First stage 10
Second stage 1
Engine of block "A" (RD-171, 11D521)
thrust at sea level, tf 740
thrust in vacuum, tf 806
specific impulse at sea level, s 308.5
specific impulse in vacuum, s 336.2
Engine of block "C" (4 pcs. RD-0120, 11D122)
thrust at sea level, tf 147.6
thrust in vacuum, tf 190
specific impulse at sea level, s 353.2
specific impulse in vacuum, s 454.7
Sustainer engine OK (17D12)

thrust in vacuum, tf 8.8
specific impulse in vacuum, s 362
Geometrical characteristics of the MRKS
overall length, m 58.765
maximum width, m 23.92
maximum width on the installer, m 24.50
Geometrical characteristics of the launch vehicle as a whole
length, m 58.765
maximum transverse size, m 17.65
Geometrical characteristics of the first stage
length, m 39.46
diameter of tanks, m 3.92
Geometrical characteristics of the second stage
length, m 58.765
diameter of tanks (without thermal insulation), m 7.75
Geometrical characteristics of the orbital aircraft
length, m 36.37
wingspan, m 23.92
height on parking, m 16.35
chassis base, m 7.00
length payload compartment, m 18.55
payload compartment diameter, m 4.72???