The Rockot lightweight launch vehicle designed subject to Governmental Decree 925-r consists of three stages. The first two stages are essentially the booster stack of the RS 18 (or, equivalently, SS 19) strategic missile and the Breeze KM is employed as the third stage. A payload fairing has been designed for this launcher to accommodate one or more spacecraft in addition to Breeze KM.

High-efficiency liquid engines using NTO as an oxidizer and UDMH as a fuel are installed on the booster stack. These engines are designed by the Khimavtomatika Design Bureau, Voronezh, a long-standing partner of KhSC from the space industry.

Stage 1 is steered by gimbaling the four cruise engines. A special-purpose four-chamber thruster is installed on Stage 2 to steer this booster.

Rockot has a good performance largely due two the Breeze KM upper stage having broad capabilities as far as injection of spacecraft into orbits with different altitudes and/or inclinations is concerned. The Breeze KM equipment can control the spacecraft attitude to a high precision and supply spacecraft with enough power during both ascent and orbital flight lasting up to 7 hrs. A special-purpose system can separate the spacecraft and the upper stage with the minimum possible disturbances.

Breeze KM includes a propulsion bay, a propellant bay, an equipment bay, a transition section ('a boattail') and an adapter. The propulsion bay accommodates a propulsion unit, the propellant bay and a hydraulic system. NTO & UDMH, long-shelf-life propellants, are employed by the propulsion unit, which includes the main engine, a vernier thruster and an attitude control thruster. The main engine used is well known for its high reliability. Designed by Isaev KhimMash Design Bureau this engine is widely used in the space industry. Breeze KM has a high degree of commonality with the Breeze M upper stage.

Typical Rockot Mission Profile

The Rockot LV is launched from a transportation-and-launch canister (TLC). Stages 1/2 separate as the LV reaches a height of some 60 km at L + 120 sec. To eliminate any undesirable impact on the environment all propellants are to be depleted by the shutdown time. The two halves of the PLF are jettisoned as the LV ascends to 119 km at L + 185 sec. Stage 2/upper stage separate at an altitude of 211 km (at L + 303 sec).

The responsibility for the remaining segment of ascent lies with Breeze KM whose main engine is fired following separation from Stage 2. This engine is gimbaled to steer the upper stage and its multiple restart capability enables a wide range of payload injection scenarios including insertion of one or more spacecraft into either one orbit or several different orbits.

A special-purpose vernier thruster ensurers a high-precision injection. Prior to separation the upper stage attitude control thrusters are fired to provide the pre-specified spacecraft attitude. The spacecraft can also be spun up if required. Online telemetry is available throughout ascent.

All work aimed at constructing a new processing facility and a ground launch facility at the Plesetsk launch base required to support routine missions of the new launcher has virtually been completed.

The Rockot processing facility is essentially a renovation of a number of structures, hardware, and transportation vehicles designed initially to support missions of the Tsiklon (‘Cyclone’) 3 and Kosmos 3M launch vehicles. The Rockot launch facility makes the maximum possible use of the structures and hardware of the Kosmos 3M pad.

Subject to a Governmental Decree, KhSC have started the construction of a new pad at Baikonyr to support commercial Rockot missions. A possibility of performing launches from a silo has been studied as part of this effort and a fairly simple modification of the silo has been proposed that would meet customers' requirements.

The features specific to foreign spacecraft have been taken account of to the maximum possible extent in the launch vehicle processing roadmap. Thus the space head (i.e., the PLF, the payload (implying a spacecraft) and the Breeze KM) is to be processed, while in a vertical position, in special "clean" rooms of the Processing Facility and is to be mated to the booster stack directly on pad. Temperature and humidity control as may be required by the particular spacecraft is envisaged in all phases of ground processing.

The Rockot launch vehicle has been successfully tested in flight.

Two successful launches of Rockot to fly suborbital trajectories while carrying out geophysical experiments were performed at Baikonyr, one on November 20, 1990 and the other on December 20, 1991.

A third and successful launch of Rockot was made from the Baikonyr launch base on December 26, 1994. Radio Rosto, an amateur radio communications satellites was placed on orbit for the first time ever during this mission. All test launches of Rockot were made using an RS 18 (SS 19) launch silo.

A demonstration launch of Rockot took place on May 16, 2000. The aim of this Rockot/Breeze KM mission was the injection of two SC simulators whose mass properties and frequency response coincided with those of the Iridium spacecraft designed to be launched by Rockot. The mission program included

- Injection of the two spacecraft simulators in a circular orbit with a height of 540 km and an inclination of 86.4 degrees, separation of the simulators and deorbiting the upper stage;
- Debugging the design of the Processing and the Launch Facilities;
- Debugging the systems designed to fuel the booster stack and the upper stage;
- Finalizing the flow sequence designed to process the space rocket or its components in the course of a launch campaign;
- Verification of normal interaction between (1) the computerized ground remote launch campaign management and mission control and (2) the onboard GN&C system during pad processing;
- Obtaining measured data that represents the dynamics of Rockot motion when launched from a ground-surface type of launch facility;
- Verification of the data acquisition and processing system;
- Obtaining measured data on dynamic, thermal or acoustic loading in the various phases of a Rockot mission; and
- Verification of the reliability of the space rocket avionics in flight.

This demonstration launch has resulted in a high-precision injection of the Iridium simulators to their target orbits. All tasks assumed by this mission have been achieved. The Rockot Space Rocket Complex is now available for use.

Rockot Space Rocket Complex

Governmental Decree 925-r states that the Khrunichev Space Center have accomplished the

creation of the Rockot Space Rocket Complex that includes the Rockot launch vehicle, the associated ground support equipment and the facilities located at the Plesetsk launch base and required to transport, receive, integrate, test, fuel or launch the Rockot Space Rocket (i.e., the Processing Facility, the Launch Facility, etc.).