Baranovichi (Belarus) is undergoing tests and is expected to begin operations in 2002. The Don-2N radar of the Moscow ABM system also seems to take part in the early warning network.

EARLY WARNING SATELLITES

According to a plan which was drafted in the beginning of the 1970s, the early warning system was to include a space-based component in addition to the network of above-the-horizon and over-the-horizon radars. Satellites were necessary to extend the capabilities of the early warning system, for they were capable of detecting ballistic missiles almost immediately after launch.

Initially, work on the space-based component of the early warning system was assigned to the design bureau headed by A. I. Savin. In 1973, this design bureau was reorganized into the TsNII Kometa (Central Scientific Research Institute Kometa), which became the primary developer of the space-based component of the early warning system.[30] Development of spacecraft platform was assigned to the S. A. Lavochkin Design Bureau.

According to the design developed at TsNII Kometa, the space-based early warning system, known as "Oko" or US-KS, included a constellation of satellites deployed on highly elliptical orbits and a command and control center near Moscow. The satellites were equipped with infrared and visible-spectrum sensors capable of detecting a burning missile motor against a background of space (but not against a background of Earth surface). The system began limited operations in 1978 and was placed on combat duty in 1982.[31]

As the work on the US-KS (Oko) system progressed, the military produced a set of requirements for a new space-based system, designated US-KMO (in the West, this system usually referred to, somewhat incorrectly, as Prognoz). This system was to provide coverage of possible SLBM launch areas in the oceans, as well as missile launches from U.S. and Chinese territory. In order to do so, the satellites had to have a so-called look-down capability, which is an ability to detect missile launches against a background of Earth surface. Development of the US-KMO system was ordered by a Central Committee and the Council of Ministers decree of 3 September 1979.[32]

Work on the new system, however, was delayed by problems with the old one. The Oko program was plagued by spacecraft malfunctions and software problems.[33] Although the system was able to begin operations in 1982, the problems continued after that. In 1983 the system almost generated a serious false alarm, which was later attributed to problems with the software being

unable to cope with sun reflections properly.[34] The satellites continued to suffer from explosive disintegration until 1984.

Deployment of the US-KMO (Prognoz) system did not begin until February 1991, when the Soviet Union launched its first second-generation satellite. The satellite reportedly had genuine look-down capability, which means it could detect missiles against the background of the Earth surface. However, the breakup of the Soviet Union slowed development of the system. Although it was reported that in 1996 the military accepted for service the first tier of the US-KMO system,[35] in 2002 it still remains an essentially experimental program.

FIRST-GENERATION SATELLITES

Spacecraft and Ground Support Systems

A first-generation (Oko) spacecraft consists of three main compartments: an engine block, instrumentation, and an optical compartment. All the systems are mounted on a cylindrical frame that is 2 m long and has diameter of 1.7 m.[36] The total mass of a satellite at launch is estimated to be 2400 kg, of which 1250 kg is dry mass (i.e. without the fuel).[37] The engine compartment of an Oko satellite includes fuel and oxidizer tanks, four orbit correction liquid-fuel engines, and 16 orientation and stabilization liquid-fuel engines.[38] The stabilization engines provide active 3-axis attitude control, necessary for telescope orientation.[39]

The telescope system of a first-generation satellite includes a telescope with a mirror of about 50 cm diameter.[40] The detection system includes a linear or matrix infrared-band solid-state sensor that detects radiation from missiles.[41] In addition to this, the satellite has several smaller telescopes that most likely provide a wide-angle view of the Earth in infrared and visible parts of spectrum, which is used by operators of the system as an auxiliary observation channel.[42]

The satellite transmits images formed by its telescopes directly to the ground control station in real time. The control station facility Serpukhov-15 is located near a village of Kurilovo in the Kaluga region, about 70 km southwest of Moscow. The facility includes antennas that are used for communication with the satellites and the data storage and processing facility.[43] The center was built as a dedicated facility, the only mission of which was to control the early warning satellites.

Launches of early-warning satellites into highly elliptical orbits are performed by Molniya-M launchers from the Plesetsk launch site in northern Russia. To support the launches, the space forces built a dedicated technical facility at the site and upgraded one of the Molniya launching pads.[44] Launches