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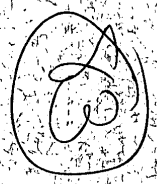
imagery analysis report

Ionospheric Research At Dushanbe, USSR (S)



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IONOSPHERIC RESEARCH AT DUSHANBE, USSR (S)

1. (S/WN) One of the principal activities at the Dushanbe Astronomical Observatory 25X1
5.7 nautical miles (nm) southwest of Dushanbe in the Tadzhik SSR, USSR, is ionospheric research 25X1
related to long-range communications. The Dushanbe facility consists of a probable communications research area with a collocated ionospheric heater array, a special ionospheric research station, and a visual and photographic observation station and collocated astronomical observatory (Figure 1).

Probable Communications Research Area

2. (S/WN) The probable communications research area (Figure 2) is in a separately secured northern portion of the Dushanbe facility and was added to the observatory in the early 1970s. Military-related communications research is conducted in this area. The area contains two highly directional, rotatable, high-frequency (HF) antennas, a collocated ionospheric heater array, ten Yagi antennas, one SIDE NET radar, one SIDE NET radar van without the antenna sail, one FORK REST antenna, a control building, a vehicle storage building, and four support buildings.

3. (S/WN) Research in one or all of the following is probably performed in the area: ionospheric ducting, meteor trail scattering, and conjugate point studies. In ionospheric ducting research, radiation from the ionospheric heater is used to disturb the lower region of the ionosphere, causing a tunnel or channel to be formed. A secondary signal at a lower frequency is then injected through the tunnel into the higher regions of the ionosphere, where it can be propagated around the world.[1]

4. (S/WN) In meteor trail scattering research, the ionized trails from meteors in the ionosphere are used to reflect HF communications signals.[1] In conjugate point studies research, the earth's magnetic field is used to carry radio communications between two widely separated points on the earth's surface.[2]

5. (S/WN) The two rotatable HF antennas in this area were first observed under construction in November 1973 and had been completed by May 1976. The rotatable antennas are used with the ionospheric heater in ionospheric ducting experiments. By the use of such highly directional antennas in ionospheric ducting, a signal can be sent to a specific receiver. This makes secure long-range point-to-point communications possible. Each rotatable antenna consists of two rows of eight four-element arrays arranged in an over-and under configuration in front of a large back-screen reflector. The individual elements are apart. The two rows are apart and the element supports are 225X1
apart. Each antenna rotates on two concentric concrete tracks. The outside track is 53 meters in diameter, and the inside track is 26 meters in diameter. Feedlines extend from the control building to the center of each antenna.

6. (S/WN) The ionospheric heater is served by the same control building as the rotatable HF antennas. The heater was first observed under construction in May 1976 and was completed in August 1980. It consists of 25 masts, each arranged in five rows of 5 masts each, with feed lines 25X1
down the center of each row. The outer rows of masts are and the center rows are 45 25X1
meters apart. The masts support a series of symmetrical dipole antennas arranged in an undetermined configuration. When the heater is turned on, there is an interaction between the beam of radio waves produced by the heater and the electrons in the ionosphere at the point where the beam is directed. This interaction causes the ionospheric electrons to absorb energy from the beam and, as a result, to be pushed away from the point of disturbance. This creates a hole in the ionosphere. A communications signal is then beamed into this hole and propagated for long distances.[1]

7. (S/WN) The ten Yagi antennas and the FORK REST antenna were added to the facility between 1976 and 1981. They are probably used in frequency mixing experiments in conjunction with the heater. The SIDE NET radar was added in July 1976 and may be used to track meteor trails through the ionosphere, perhaps as an adjunct to the special ionospheric research station discussed below.

Special Ionospheric Research Station

8. (S/WN) The special ionospheric research station (Figure 3) is in the eastern portion of the Dushanbe facility. It consists of 4 square antenna arrays, a curtain array, 2 Yagi antennas, a tower, 5 control buildings, and 12 housing/support buildings. The station is involved in meteor radio electronics research. It was here that the drift of meteor trails and ionospheric irregularities was measured during 1968, 1969, and 1972 by a radio method.[3] As meteors burn up in the ionosphere they leave ionized trails. The winds in the ionosphere can be measured by tracking these ionized trails with radio echoes. Ionospheric irregularities can be created naturally, by sunspot activity for example, or they can be man-made through various means, including the use of ionospheric heaters such as the Dushanbe heater.

9. (S/WN) Each of the four square antenna arrays at the station consists of five towers (four corner towers and a central tower), with a control building at the base of each of the central towers. Three of the arrays are identical in size while the fourth is slightly larger. The three identical arrays are 53 meters square and have 22-meter-tall towers. The fourth array is 65 meters square with 26-meter-high corner

towers and a 54-meter-high central tower. An additional tower, 26 meters high, with a control building at its base, is near the center of the four antenna arrays. A Yagi antenna has been on one of the corner towers of the easternmost square antenna array since May 1976. A second Yagi antenna is near the curtain array. Yagi antennas have also been observed on the central towers in each square antenna array at various times. A Soviet source described the antennas used in measuring the winds in the lower ionosphere using meteor trail drift as "four pairs of receiving and transmitting antennas oriented in the N/S and E/W directions".[4] The four antenna arrays at the special ionospheric station are oriented exactly on a north/south and east/west axis and were the only ones present from 1968 through 1969, and in 1972. They are probably the ones used to track meteor trail drift in the ionosphere. The function of the Yagi antennas has not been determined.

10. (S/WN) The curtain array consists of two 43-meter-high towers, 35 meters apart, each with five horizontal cross arms. Each cross arm is [redacted] long, and the cross arms are [redacted] apart. This antenna was added between August 1977 and June 1978. The function of this antenna has not been determined. 25X1

Visual and Photographic Observation Station and Astronomical Observatory

11. (S/WN) The visual and photographic observation station, designated station 1068 of the Soviet Astronomical Council, and the collocated Astronomical Observatory of the Academy of Sciences Tadzhik SSR[5] (Figure 4) are in the western portion of the Dushanbe facility. Station 1068 consists of one large optical tracking building with a VAU (high-precision astronomical apparatus) camera, two triple-position optical-tracking buildings, five small, single-position optical-tracking buildings, two [redacted] 25X1 parabolic dish antennas (one covered by a movable building), and one mast with an unidentified antenna on top. There are also ten support buildings, one control building, three computer vans, and six generator vans. The 35-ton VAU camera is an improved device for optical observation of satellites and is similar to the US Baker-Nunn camera.[6] The collocated astronomical observatory consists of three domes housing optical telescopes used in the study of celestial mechanics and phenomena.

12. (S/WN) Station 1068 is devoted primarily to optical and photographic tracking of satellites and secondarily to ionospheric research. The optical tracking positions contain cameras which photograph satellite tracks against a star background. This is usually done just after sunset when the sky is dark but the satellites are still illuminated by sunlight. The same cameras are used in ionospheric research projects, such as photographing the behavior of barium clouds that have been injected into the ionosphere by rockets.[7]

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IMAGERY

(S/WN) All relevant satellite imagery acquired from January 1970 through December 1981 was used in the preparation of this report.

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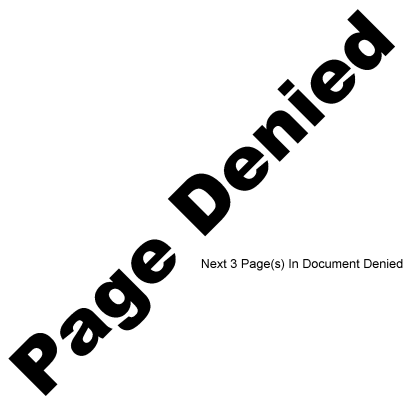
*Extracted information is UNCLASSIFIED.
**Extracted information is classified CONFIDENTIAL [redacted] 25X1

(S) Comments and queries regarding this report are welcome. They may be directed to [redacted] Soviet 25X1
Strategic Forces Division, Imagery Exploitation Group, NPIC, [redacted] 25X1



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