

Determination of orbit of geosynchronous space debris Kupon satellite using its CCD observations at 2-meter telescope at Terskol peak

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The CCD and photometric observations of geostationary Kupon (97070A) satellite were performed using the astronomical complex of the two-meter telescope located at the Terskol peak in the Northern Caucasus at 3127 m altitude. The observations were performed at the different stages of the satellite operation, namely, at the launch and transition orbits (since November 12, 1997 till December 3, 1997), at the controlled orbit (since January 17, 1998 till March 17, 1998) and at the libration orbit (since April 18, 1998 till February 14, 2000). The satellite became a space debris object after an on-board failure took place on March 18, 1998. The small size of the CCD camera field required using the Guide Star Catalogue in astrometric processing of star and satellite coordinates. The root-mean square (rms) errors of the satellite spherical coordinates are 0.5-1.0". The satellite orbit was derived using all the collected observations. The rms errors of the satellite coordinates are 50-200 m at 2-100 day orbital arcs without orbit corrections. The regular monitoring of Kupon allowed us to detect another geosynchronous satellite Arabsat 1C (92010B) on January 18, 1998 at 4-5' distance from Kupon. Arabsat 1C was moved from 31° E to 55° E about 1-2 days before our "discovery". The regular CCD observations and orbit determination of both satellites allowed us to predict and observe five close encounters of Kupon and Arabsat 1C at 1.3-4.2 km happened in February - March, 1998. Such close encounters are dangerous for communication satellites since they can lead to their collision. Using the observations of Kupon obtained on April 18 - July 28, 1998 we derived that the satellite would librate between 55.0° and 94.8° E with the libration period equal to 769 days. On April 24, 2000 Kupon will return to the longitude 55.0° E from which it escaped. The most of the results presented in the paper were derived almost in the real time, i.e. one to three days after the observations were performed.