Once again on the actuality of international cooperation in space surveillance

A. Chervonov*, S. Veniaminov**, V. Pirozhnik**
*TSUP TSNIIMASH, **SRC “Kosmos”

In January 2011, an important event happened: reentry of the automatic interplanetary station “Phobos-Grunt” which was unable to get to the Mars-oriented orbit because of the failure. Many sensors were observing the process, however only a few of the involved scientific centers could predict and calculate the site of the fall (with different reliability and accuracy).

That was a typical case, which caused an international resonance. There were many more. It is enough to remember such events as the fall to the Earth of the fragments of the “Cosmos-954” spacecraft having onboard radioactive materials in 1978; then, the reentry of the American space laboratory “Skylab” in 1979; the “Cosmos-1402” with the onboard reactor in 1983; the orbital complex “Salyut-7” ─ “Cosmos-1686” in 1991; the transport vehicle “Progress-M17” in 1994; “Cosmos-398” in 1995; the Chinese capsule “FSW 1-5” in 1996; andthe Russian interplanetary station “Mars-96” in 1996.

The danger of such events consists not only in the facts of the fall, but also in that the regions of the fall have been predicted with a low precision. The sudden fact of their last stage - the contact with the Earth – does not remain a chance for people and the asset located just in this place. Especially non-predictable are the consequences of the possible fall of a large fragment in the vicinity of a nuclear reactor. The probability of such an event is not so close to zero.

One of the main causes of the inaccuracy of the determination of the region of the fall is the uncertainty in the forestalling calculation of the atmosphere drag on the falling mass.

For the experts, for the precise determination of the parameters of the reentry, obtaining the metric trajectory measurements of the space object (SO) motion at its last revolutions is essential. Nowadays, neither the US space surveillance system (SSS), nor the Russian one is capable of the turn-by-turn tracking of the non-controlled reentry. Meantime, the past experience of coordinated interaction of both systems exists in such extraordinary situations. We would like to remember that in December 1995 the Russian, US SSS, and ESA together conducted the operational work on the determination of the region and time of reentry of the

Russian “Cosmos-398” spacecraft. That was the spacecraft designated for delivering the cosmonauts to the Moon surface. Four of its fragments burned up just after the launch. The fifth and sixth ones remained in the transfer orbits. They had the sum mass of about 2000 kg and the size of 2,5x4 m. They had fireproof parts. These spacecraft had been tracked, since the launch in 1971, up to their reentry in 1995.

For more precise control at the last stage of their flight, the operational exchange of the orbital information was realized via e-mail between the NASA JSC, US SSS, ESOC, CNES, NASDA, and Russian SSS. The measuring information was generated by the SSS of US and Russia. ESOC and CNES were sending only the calculated results of the predicted time and place. In this case, the US metric information on the last revolutions of the spacecraft was the most valuable, because they were out of the Russian radar zones.

The next important international work was the cooperation during the last stage of tracking the Chinese capsule “FSW 1-5”. The immediate works on tracking the capsule were conducted late in February – to early in March 1996. The sources of metric information were only the Russian and US SSS. The data processing was made, besides the Space Surveillance Centers of both systems, by the SRC “Kosmos”, the Russian Mission Control Center, ESOC, JSC, NASDA, CNES, the radar complex “FGAN”, and other scientific centers.

The data exchange was performed via e-mail and fax. At the last five revolutions, the spacecraft was outside the Russian sensors and all measuring information came only from the US SSS.

The works on “Cosmos-398” and the Chinese capsule confirmed the productivity of international cooperation in such campaigns, both in terms of the increase of the accuracy and operativeness of prediction of the reentry time and place, and perfection of the relative techniques and their scientific substantiations.

In the case of AIS “Phobos-Grunt”, the situation, similar to that of AIS “Mars-96” launched in 1996, was repeated. It was supposed that “Mars-96” would be placed into a heliocentric orbit and could reach Mars in 300 days. However, the ignition of the upper stage engine occurred not as regularly planned, and the programmed transfer to the highly eccentric orbit failed. The payload and the upper stage were disconnected and stayed in low orbits. By information from Russian SSS, the fragments of the upper stage fell to the Pacific Ocean south of New Zealand. There was a significant uncertainty in the determination of the place of

the fall of the AIS. There was a discrepancy between the data from different sources – Pacific or Atlantic, or even South America.

The official estimates in the case of the “Phobos-Grunt” received from the US and Russian SSS and MCC TSNIIMASH were different as well.

These two cases show that the absence of the well-worked up coordinated international cooperation in the monitoring of reentry and other emergency situations, in principle, can lead to some unpredictable catastrophic consequences.

So, first of all, the corresponding international agreements should be envisaged and realized, the leading professional, technical, and legal experts being attracted. To begin with, the SO catalog exchange should be recommenced between Russian and US SSS.