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Note verbale dated 28 February 2001 from the Permanent Mission of the Russian Federation to the United Nations addressed to the Secretary-General

Further to its note verbale of 23 January 2001 (A/AC.105/759), the Permanent Mission of the Russian Federation to the United Nations has the honour to provide additional information concerning the termination of operation of the Mir manned orbital station (see annex).

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Annex

Report on the “Mir” space station

Preparations are continuing to terminate the operation of the Mir manned orbital space station.

In order to carry out the necessary manoeuvres to remove the space station from orbit and sink it safely in the ocean, the Progress M1-5 cargo vehicle was launched on 24 January 2001 and successfully docked with the Mir station on 27 January.

Given the current parameters of Mir’s orbit and the forecast of solar activity for February and March—which is a determining factor for the state of the Earth’s atmosphere and accordingly for the rate of descent of the space complex owing to natural braking in the atmosphere—the station’s removal from orbit is expected to occur on 13 March, plus or minus five days.

The Russian specialists involved in the programme are taking all possible steps to ensure safe termination of operations with the space station.

Agreement has been reached concerning cooperation between the competent organizations of Russia, the United States of America and Europe in determining the ballistical parameters of Mir’s flight, something that is particularly important if the final operations with the station are to be carried out in a reliable way.

Assuming that operations to remove the station from orbit are completed as planned, the station’s fragments will reach the surface of the Earth in an uninhabited region of the South Pacific Ocean, far from travelled sea lanes and air corridors. At present the following coordinates are being considered for the area of impact of the station on water:

(a) 53˚ S, 175˚ W;

(b) 23˚ S, 175˚ W;

(c) 23˚ S, 132˚ W;

(d) 30˚ S, 127˚ W;

(e) 30˚ S, 90˚ W;

(f) 53˚ S, 90˚ W.

All information on the process of the station’s departure from orbit will be immediately relayed from the Flight Control Centre (in the city of Korolev, Moscow Region) for subsequent dissemination through the media.

Below we provide answers to the questions most frequently asked about the forthcoming re-entry and impact of the Mir manned space station.

1. Sequence of operations to remove the station from orbit

After docking with the Progress M1-5 cargo vehicle, which supplied the fuel necessary to carry out the final operations, the orbiting station was switched to what is virtually a passive flight regime. Through natural aerodynamic braking it will

descend continuously while maintaining an orbit close to circular. This stage will continue through the first 10 days of March, after which the station will reach an orbit with an average altitude of ~250 km (the so-called pre-firing orbit). At that time the final plan of operations with the station during the concluding stage of flight will be determined, taking into account the situation as it actually evolves—first and foremost the functioning of on-board systems, the supply of fuel on board, the state of the upper layers of the Earth's atmosphere and the orbital parameters. At this stage a programme will be drawn up for the application of braking impulses designed to take the station into a so-called re-entry orbit with perigee at 160 kilometres (km) and apogee at 220-230 km. When the station is in re-entry orbit the final braking impulse will be applied—preliminary data suggest that this will be above Africa and the Caucasus range—to bring the station into its final descent orbit with perigee at 85 km, as a result of which it will enter the dense layers of the atmosphere in such a way that the fragments that remain unburned will fall into the area of the Pacific Ocean mentioned above.

2. Expected altitude of station destruction

Destruction of the station by friction-generated heat will begin at an altitude of ~90 km (the solar batteries will begin to break up at 110 km and virtually all battery components will burn up). At this altitude the station's connections with the external thruster unit will be destroyed by friction heating. The engines in that unit will break up as a result of aerodynamic deceleration, but some fragments of the engines (nozzles, certain other fittings) may reach the surface of the Earth. The most intensive break-up effects will occur at altitudes around 70 km and that is where most of the fragments will be formed that are destined to reach the Earth's surface. Destruction of most components made of aluminium alloys will most probably take place at altitudes around 70 km. The final fragment formation altitude is likely to be between 50 and 40 km. The total area of fragment fall-out along the flight path will be up to 6,000 km in length and 200 km wide.

3. Size of fragments formed during break-up of the Mir orbital station in the Earth's atmosphere

Observations on heavy space vehicles re-entering the Earth's atmosphere have indicated that the components that can reach the Earth's surface are those made of refractory materials such as steel, titanium, heat-resistant alloys, portlights and lenses of optical devices, as well as structures made of heat-shielding materials (for example, smelting kilns). Thin-walled structures made of aluminium alloys melt completely as a rule.

The table below contains preliminary analytical data on the components of the Mir station that could reach the surface of the Earth as fragments on the assumption of least favourable conditions as regards the station's descent through the atmosphere.

Number	*Designation of items*	*Maximum mass of individual fragments reaching Earth (kilograms)*	*Number of fragments formed (pieces)*	*Total mass of material reaching the Earth's surface (kilograms*
1.	Docking assemblies of the adapter module	< 500	5	800
2.	"Shuttle" docking module	< 700	5	1 200
3.	Gyrodynes	< 120	25	1 750
4.	Thruster components and fittings (high-pressure gas balloons, tubing, etc.)	< 50	~ 320	3 450
5.	Elements (parts) of station structure	< 110	~ 450	8 000
6.	Systems and equipment components	< 50	~ 100	1 800
7.	Components of optical equipment	< 50	~ 100	500
8.	Instruments, parts of scientific equipment	< 20	~ 450	3 500

The estimates suggest that the aggregate mass of unburnt structural elements from the Mir station will be 20-25 tons.

Further information bulletins will be issued as the situation evolves and new information is obtained regarding arrangements for the final operations with Mir.

Information on the orbit parameters of the station and forecasts of the time when the altitude of 250 km is likely to be reached will be found on the web site of the Flight Control Centre (www.mcc.rsa.ru), which is updated daily. Furthermore, information on the station's descent from orbit will be placed on the web site of the Russian Aviation and Space Agency on the Internet (www.rosaviakosmos.ru).