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AUSTRIAN STATEMENT 58. STSC

(19. – 30. April 2021)

ITEM 7

"Space Debris"

Madame Chair, Dear Colleagues, Ladies and Gentlemen,

Space Debris Laser Ranging allows to measure the distance to space debris objects with an accuracy of about 1 metre. Unlike satellites with retro-reflectors, diffusely reflected laser light is captured by the whole body. Since these photons statistically come from all parts of the body, conclusions can be drawn about the size and orientation of space debris objects. From the analysis of the rotation period and the detection of the reflected sunlight of such objects, the attitude - the orientation of the rotation axis in space - can be determined. Until now, laser ranging of space debris was only possible within a few hours after sunset or before sunrise, when it is dark at the observation station and the space debris objects are illuminated by sunlight.

Orbit predictions of space debris objects have inaccuracies of up to a few hundred metres. Since a pass of a Low Earth Orbit object over a station typically takes only a few minutes, space debris objects must be visualised for successful laser ranging. Inaccuracies are corrected by centering the object in the field of view of the Laser Ranging receiving telescope. It is then only necessary to scan a much smaller area in the sky.

Madame Chair, we would like to inform about recent scientific developments in Austria:

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Scientists at the Space Research Institute (IWF) ***of the Austrian Academy of Sciences*** have recently shown in a **paper published in *Nature Communications*** that distance measurements to space debris are also possible during the day. The space debris objects were made visible during the day using a small telescope and a CMOS [Complementary metal–oxide–semiconductor] camera with a filter that blocks the sky light. Software calculates offsets in real time from the predicted orbit and these offsets are applied directly during tracking to correct the orbit. In this way it was possible to perform space debris measurements on 4 different rocket upper stage bodies.

These results are a starting point to **increase the performance of Space Debris Laser Ranging** in the near future. The observation time in Graz, Austria potentially increases to a maximum of 22 hours if full daylight can be utilised.

A future worldwide Space Debris Laser Ranging network could significantly improve orbital predictions, which would be useful for avoidance manoeuvres, conjunction warnings or removal missions. With regard to a higher accuracy of orbit predictions of space debris, the goal here should be that many stations - distributed across the globe - work together. In this respect, the *Space Research Institute of the Austrian Academy of Sciences* is currently involved in an ESA project: "Expert Centre Deployment and Demonstration”. Together with ESA, experts for Space Debris Laser Ranging (the IWF in Graz) and for optical measurements (the Astronomical Institute of the University of Bern, Switzerland) provide interfaces and give other stations the possibility to validate their space debris measurements. This involves checking measurement accuracy, planning measurement campaigns, but also providing various tools that are needed to observe space debris.

Thank you for your attention.

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