Galileo Status: GIOVE and ongoing Preparations for Experimentation

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Intended to mitigate the Galileo project risks, the European Space Agency launched in 2003 the Galileo System Test Bed Version 2 (GSTB-V2) with the development of two satellites GIOVE-A and B (Galileo In-Orbit Validation Element) as the first step in the in-orbit validation of the Galileo system. The objectives of these two satellites are:

- to secure the Galileo frequency filings allocated within the International Telecommunications Union (ITU)
- to characterize the radiation environment of Medium Earth Orbit (MEO) that the operational satellites will occupy
- o to validate new technologies for operational use (on-board atomic clocks)
- to enable the on-ground acquisition and processing of representative Galileo signals

GIOVE-A, was launched on 28th December 2005, began transmitting navigation signals on 12th January 2006. Work has been performed to check the quality of these signals to achieve the first objective, employing the Navigation Laboratory at ESA's European Space Research and Technology Centre (ESTEC), in the Netherlands, the ESA ground station at Redu, in Belgium, and the Rutherford Appleton Laboratory (RAL) Chilbolton Observatory in the United Kingdom.

In order to take care of the last of the three aforementioned objectives, the GSTB-V2 Mission Experimentation project has been undertaken on behalf of ESA by an industrial consortium of European companies and institutions led by Galileo Industries.

The GSTB-V2 Mission Experimentation will assess technical aspects like early demonstration and performance assessment of the navigation service (including navigation message generation, uplink and broadcast), validation of critical in-orbit technology (clocks), end-to-end analysis of the Galileo Signal-In-Space, assessment of Galileo Test Receiver performance, validation of existing ground algorithm prototypes and testing of new ones (e.g. ionosphere and Broadcast Group Delay), and overall testing of timeliness and operational aspects.

The GSTB-V2 Mission Segment core infrastructure for experimentation consists mainly of a network of Galileo Experimental Sensor Stations (GESSs) worldwide distributed that acquire and collect the GIOVE satellite signals and send pseudo-range and carrier phase measurements to a Ground Processing Centre (GPC) located at ESTEC (upgraded from GSTB-V1). Each GESS consists basically of a newly developed dual GPS/Galileo receiver and a newly developed dual antenna. The receivers are normally connected to a commercial Rubidium clock. One GESS is to be installed at the Time Laboratory located at IEN, Turin, connected to an Active Hydrogen Maser, located in a controlled environment. The Ground Processing Centre (GPC) receives in addition satellite telemetry and other ancillary data from the GIOVE-A Ground Satellite Centre (GSC) located in Guiltford (UK). SLR stations

send ranging data to the GPC as well. The GSC receives from the GPC the satellite navigation message to be uplinked to the satellite and broadcast to the user.