Pegaso: an ultra-light long duration stratospheric payload for polar regions flights

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Launched from the Mario Zuccelli Station (Baia Terra Nova) in Antarctica during the 2005/06 austral summer, the PEGASO-D payload lifted into the stratospheric anticyclone over the southern polar region. This effort marks the first Long Duration Scientific payload to be launched from this location and is the fourth such payload launched in the polar regions. Performing in the framework of the NOBILE/AMUNDSEN collaborative LDB development between ASI-ARR. The Italian Institute of Geophysics and Volcanology (INGV), with the sponsorship of the Italian Antarctic Program (PNRA) and the Italian Space Agency (ASI),designed and built the Ultra-Light system together with three Universities in Italy. The Pegaso program has been created to investigate the Earth magnetic field and provide a precursor series of small payload launches for the bigger LDB program such as OLIMPO, BOOMERanG and BArSPOrt through this collaboration between ASI and ARR. The Italian scientific community, aware of the big advantages that LDB balloons can offer to their experiments, proposed to extend the LDB program to Southern polar regions, besides performing launches from the newly initiated Nobile/Amundsen Stratospheric Balloon Center in Svalbard, Norway.Three PEGASO (Polar Explorer for Geomagnetics And other Scientific Observations) payloads have been launched from the Svalbard (No) in collaboration with Andoya Rocket Range, ASI and ISTAR (Operations and logistics) during the past two northern summers. These stratospheric (altitude m.35000) small 10kmc balloons have floated in the stratosphere between 14 to 39 days measuring the magnetic field of polar regions, by means of a 3-axys-fluxgate magnetometer, during a three year campaign. The study of the magnetic field and its variations is done through permanent observatories. They provide us with high quality data but their spatial distribution is not quite regular, specially in Antarctica due to logistic difficulties. The coverage is improved through marine and aeromagnetic surveys, and also through satellite missions. There exists nevertheless a gap in the wavelengths of the magnetic field represented by these kind of measurements. Satellite data are too far away from Earth's surface to individuate wavelengths lower than 1000 km, and near-ground sur-

veys are not able to represent wavelengths longer than the dimensions of the surveyed area. Moreover, there is a region empty of data around the geographical pole for the satellite measurements. The size of these gaps depends on the orbital parameters, but it can reach up to 10 degrees around the pole. PEGASO allows to bridge this gap in the measurements of the magnetic field. Surveys carried out at 35 km height allow the study of crustal anomalies in the range between, we can say, 60 and 1000 km. Taking into account that pathfinders (smaller non-recoverable balloon systems) are usually sent to explore the atmospheric currents, the use of PEGASO as pathfinder allows us to obtain all these results at a very affordable cost. The PEGASO payload was also developed as a single source system integrating science, housekeeping and operational control of the entire balloon borne configuration.Satellite telemetry sent the scientific (magnetometric) data, house-keeping (temperature, solar panel voltage and current, altitude and time) and telecommand (four ballast, two parachute release system, system reset), and powered the terminate system. Data flows through the IRIDIUM telephone service. The onboard systems were kept inside a vessel (white painted and pressurizzed vessel due to power dissipation) except for external flexible solar panels and magnetometer, attached to an external boom. Two redundant tracking systems have been used: a first GPS was integrated inside the on-board telemetry system, necessary to reconstruct position and time of scientific data, while an independent GPS-ARGOS system gave the balloon trajectory, including its descent. Continuous trajectory predictions were made during the missions; they have been necessary, in particular, for the flight safety requirements of the northern hemisphere. The evaluation of the statistical error is proposed. The PEGASO payload was developed to be a light, cost effective way to explore the potential of Ultra-Light Long Duration Ballooning for science as well as an introduction to the earth-space possibilities for students.