



European Space Agency

Science &amp; Technology

06-Jan-2004 10:04:42

## No. 13 - Largest Weekly Increase in Orbit

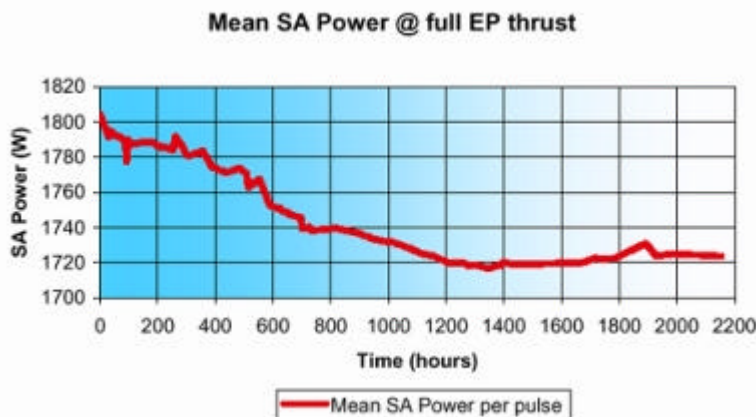
30 Dec 2003

### Overall status, current activities and planned activities

The spacecraft is now in its 169th orbit, in good status and with all functions performing nominally. The spacecraft has been functioning in electric propulsion mode for the whole week, continuously thrusting since the flame-out and subsequent entry into safe mode last week. This has allowed SMART-1 to perform its largest orbit increase since the start of the mission: 2000 km added to the semi-major axis in one week!

The total cumulated thrust so far is more than 1313 hours (consuming 20.8 kg of Xenon) and has provided a velocity increment of about  $930 \text{ ms}^{-1}$  (equivalent to 3350 km per hour). The electric propulsion engine's performance, periodically monitored by means of the telemetry data transmitted by the spacecraft and by radio-tracking by the ground stations, continues to show a small over performance in thrust, varying from 0.9% to 1.2% over the last week.

The degradation of the electrical power produced by the solar arrays has now ceased. The power available has remained virtually constant for almost 1000 hours. The graph below displays the measured power produced by the solar arrays when the EP is operating at full power starting from the beginning of mission.



The communication, data handling and onboard software subsystems have been performing well in this period.

The thermal subsystem continues also to perform well and all the temperatures are as expected. The temperature of the star tracker optical heads has remained high, though.

### Orbital/Trajectory information

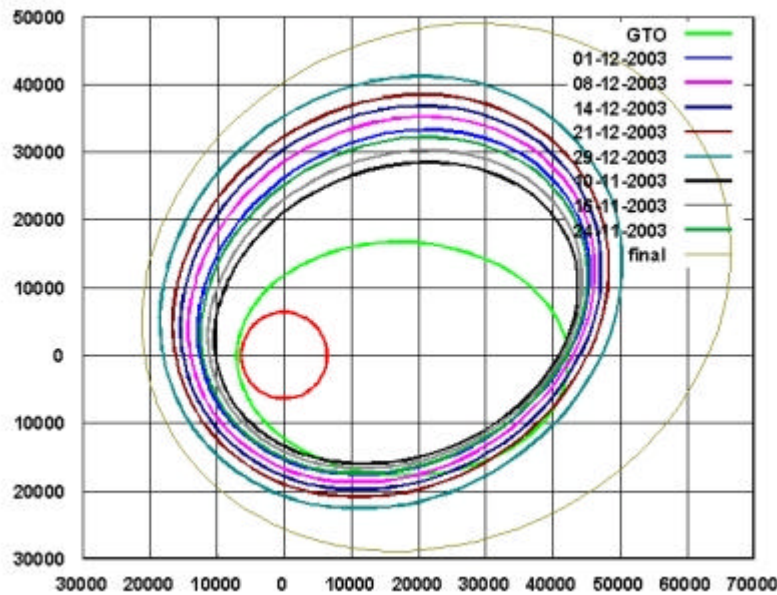
The osculating orbital elements are periodically computed by the ESOC specialists. These elements define the so called "osculating orbit" which would be travelled by the spacecraft if at that instant all perturbations, including EP thrust, would cease. So it is an image of the situation at that epoch. In reality the path travelled by the spacecraft is a continuous spiral leading from one orbit to another. The most recent osculating elements are as follows:

EPOCH (UTC) 2003/12/29 05:21:47.8

**Elements WRT Earth (J2000)**

Pericentre Distance (km)	17 235.508541
Apocentre Distance (km)	54 102.641930
Semi Major Axis (km)	35 669.075235
Eccentricity	0.516794
Inclination (deg)	6.847919
Asc. Node (deg)	151.389366
Arg. of Pericentre (deg)	210.386482
True Anomaly (deg)	179.997027
Osc. Orbital Period (h)	18.622855

In this diagram the osculating orbits at launch (GTO) and at different times are plotted. The large orbit, marked 'final', is the one we expect to achieve at the end of the radiation belt escape (pericentre larger than 20 000 km) likely to be reached next week. From the start, the electric propulsion system has managed to increase the semi-major axis of the orbit by 11 039 km, increasing the perigee altitude from the original 656 km to 10 857 km and the orbital period by about 8 hours, from the initial 10 hours 41 minutes to the present 18 hours and 37 minutes.



**Contact Point**

Giuseppe Racca  
 SMART-1 Project Manager  
 ESA/ESTEC - SCI-PD  
 Keplerlaan 1 - 2200 AG Noordwijk, The Netherlands  
 E-mail: Giuseppe.Racca@esa.int

For further information please contact: SciTech.editorial@esa.int