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Author: Mr. Donald Merritt
Spain

Mr. MIGUEL PEREZ AYUCAR
European Space Agency (ESA), Spain
Mr. Raymond Hoofs
European Space Agency (ESA), Spain

SCIENCE PLANNING CYCLES: PLANETS VERSUS COMETS

Abstract

The European Space Agency (ESA) has sent scientific spacecraft to Mars (2003) and Venus (2006), as well as Comet CG 67P (2015). Earlier science operations for the Venus Express spacecraft (as well as the similar Mars Express spacecraft) formed the baseline for planning science operations at comet 67P for Rosetta. The different operating environment and target dynamics soon required changes to the scientific planning process for the Rosetta mission.

For planetary missions to targets with well-known gravity fields and good orbit predictions, the science planning concept consists of three parts: long, medium and short term planning. These had different durations and distinct start and end times with no overlap.

Long term planning (LTP) was performed for each period of operations which was approved: either nominal mission or a mission extension. High-level plans were made for this entire period which would contribute to the science goals of the mission. For each 28-day period within the long term period, a medium term plan (MTP) was developed which translated the high level science objectives for the period into fixed, executable observations. The planning files for the observations, once checked against constraints and agreed, were then frozen for a period of 3 weeks until the start of the Short Term Planning (STP process). The STP process started two weeks before the scheduled execution date of the observation files when the detailed commanding and spacecraft resources were finalized. The overall planning for a given period of observation, from start of MTP to end of STP, was approximately 4 months. The planning process contained significant margin to allow for unexpected planning issues.

This planning cycle was the basis for the Rosetta science operations planning. However, the approach towards the Sun soon changed a passive target into an active one. This necessitated changes to the previous planning cycles. The medium-term and short-term planning were compressed and overlapped and done concurrently. At the expense of a higher risk of observation cancellation with short notice, the reduced planning margins greatly improved the responsiveness of the science planning to changes in the target environment.

Soon after this operational concept was incorporated it proved itself very useful in reacting to the increased dust environment around the Comet. With the re-awakening of the Philea lander, the concept was quickly employed to execute a Lander search campaign by changing the orbit with a minimum impact on science operations.