IMAGING OBSERVATION PLANNING FOR DIONE, RHEA, IAPETUS, AND PHOEBE IN THE CASSINI PRIMARY MISSION. T. Denk1, Th. Roatsch2, and K.-D. Matz2, 1Freie Universität Berlin, Germany (Tilmann.Denk@gmx.de), 2DLR (German Aerospace Center), Berlin, Germany.

Introduction: Advised by the ISS team in 2000, team members Steve Squyres, Peter Thomas (Cornell Univ.), and Gerhard Neukum (DLR Berlin) agreed to split the upcoming planning task for Cassini Imaging (ISS) observations of the mid-sized icy moons between the two groups. (Excluded were observations for orbit dynamic purposes and optical navigation.) Since this time, Mimas, Enceladus, Tethys, and Hyperion became "Cornell moons", while Dione, Rhea, Iapetus, and Phoebe are the "DLR moons" for ISS. This discrimination is not considered strict, and mutual support between the two groups worked extremely well throughout the mission. The Cornell group is also responsible for ISS observation planning of the small inner moons, and the DLR/FU Berlin groups later took over the ISS observations of the irregular moons.

Prime mission concept: For the icy mid-sized moons (and to a lesser degree for distant Iapetus), the observations were subdivided into the following six categories: (A) Targeted flyby observations; (B) Regional mapping, geodesy, regional color; (C) Limb topography; (D) global multi-color; (E) Spectrophotometry; (F) miscellaneous (like pre-SOI, photo opps, zero phase, or eclipse imaging).

The targeted flybys (there was one for each "DLR moon" in the prime mission) were treated most important. As a general scheme, the agreement was to stay ≥ 2 min at each location ("footprint") to allow VIMS to take data at the same field-of-view as the ISS Narrow Angle Camera (ISS-NAC). In the meantime, ISS took 3 or 4 color images (Uv3, green (Grn), infrared-1 (Ir1) and/or Ir3) in 2x2 binning (summation) mode, followed by a full-resolution image in the clear filter.

REGMAP: Second most important was regional mapping which followed the same scheme.

REGGEOD: The purpose of these is stereo imaging; they can be combined with regional mapping or other "geodesy" observations.

Limb topography: Except for Iapetus LIMB-TOPOs, these observations were usually not planned separately because all global and many regional images contain the limb and are thus useful here.

For global multi-color observations (GLOCOLs) which were taken at spatial resolutions so that the full disk of the moon roughly fills the field-of-view of the NAC, a consistent filter scheme was developed. Uv3, Grn, Ir1, and Ir3 ("N04" filter sets) were used jointly with the BI1 (blue), Red, Ir2, and Ir4 broadband filters (N08) plus the 3x3 polarizer filters (P0,P60,P120) x (Gmr,Uv3,Mt2) (NP09 filter set). Mt2 (methane-2) is the filter with the longest wavelength usable with the three polarizer filters. As a maximum, up to 24 different color filters (N24) plus NP09 were used with the NAC for satellite multi-color imaging.

The spectrophotometry task had four variables to deal with: sub-spacecraft (sub-S/C) location, distance to the moon, phase angle, and position of the illuminated side (left, right, top, bottom). Since control of all four was not practical, we chose to observe five of the mid-sized moons (Mimas to Rhea) mainly during equatorial orbits at sub-S/C longitudes of 22°W, 94°W, 166°W, 238°W, and 310°W, while the lit side was pointing towards bottom right (north up). The phase angles of the available data range from almost zero to 168°. The request naming scheme contains the sub-S/C longitude and the phase angle. For example, a Dione observation at 310°W and 64° phase angle in orbit 15 is named 015DI_310W64PH.

Tools: Critical tools used for planning are pdt ("pointing design tool", from JPL), ISSPT ("ISS planning tool", from the Imaging team), and ckView ("cKernel Viewer", from DLR). Pdt computes the command files required to control the S/C's attitude for general pointing and detailed mosaics. With ISSPT, the camera command files ("IOIs") are built. CkView is extremely valuable and capable to visualize the pointings created with pdt. It is also used for many other missions like Dawn, Rosetta, or JUICE.

Phoebe 000PH: The sole targeted flyby of an outer satellite took place at 11 June 2004 at a minimum altitude of 2070 km over the lit side. Approach took place at 87° phase, departure around 93°. Complete rotations of Phoebe (9.3 h) were observed twice in-bound and once outbound.

Iapetus 049IA: The sole targeted Iapetus flyby took place at 10 September 2007 at a closest-approach distance of 1615 km. The inbound trajectory allowed high phase observations and included a "Saturn system view from Iapetus", a stellar occultation and a cool ride over the giant equatorial ridge. Outbound imaging at low phase showed the bright trailing hemisphere at great detail. About 15 min after downlink start, a cosmic-ray hit triggered a switch and forced the S/C to go into safe mode. The S/C was recovered within a few hours, and the data downlink and a large orbit-trim maneuver were executed properly. However, all lower resolution outbound data was lost. More details and a brief history of the Iapetus flyby are described in [1].