Denk T. Neukum G. Roatsch Th.
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Strange N. J.

The Cassini Targeted Iapetus Flyby Will Take Place in September, 2007

SESSION: **Poster Session**
Monday, August 13, 2007
3:30 p.m.

049IA – Cassini Iapetus Targeted Flyby (Rev. 049, 10 Sep 2007)

Introduction

The Cassini group of ISS-Team member Gerhard Neukum (Freie Universität Berlin, Germany) was responsible for imaging planning of Cassini's targeted flyby at Iapetus on Sep. 10, 2007. We also helped to design the timeline during the SOST Iapetus segment (08 Sep 2007 21:50 to 12 Sep 2007 21:35 UTC/SCET), initiated a reference trajectory tweak to significantly improve closest-approach science without sacrificing the UVIS stellar occultation, and designed the spacecraft attitude (trackings, mosaics, pointings) of the VIMS_049IA_ORSHIRES001_PRIME request for all remote-sensing (ORS) and fields-and-particle (MAPS) instruments. This request covers the time frame from 55 min before to 3 hours after closest approach.

The 049IA flyby is the only Iapetus flyby within Cassini's six years long orbit tour. Iapetus is difficult to reach because it is far away from the other satellites, and because it's orbit has a significant inclination. On the other side, with 2.4 km/s or ~9000 km/h relative velocity, the Iapetus flyby is a very slow flyby, giving the scientific instruments much more time to collect data from nearby than at other satellite flybys.

Timeline

The table below shows the observation timeline during the SOST Iapetus segment. Colors indicate the prime instrument (responsible for spacecraft pointing). Format for start and end time of a request is Year-"day-of-year" T hh:mm:ss, with 2007-253T = Sep. 10, 2007.

The time window between 08:45 and 20:00 UTC on DOY 253 is designed as a "moveable block". This means that deviations from the reference trajectory can be corrected at very short notice, crucial for a correct instrument pointing near closest approach (C/A). There's a deadtime of ~5 min on either side to accomodate a potential time shift. The epoch is relative to the Iapetus closest approach time which occurs at C/A = 2007-253T14:15:40 UTC/SCET in the reference trajectory. This is equivalent to 16:15 Central European time on Monday, Sep. 10, 2007, or 07:15 a.m. Pacific Daylight time on the same day. Within the moveable block, the waypoint strategy is also not used. Instead, "custom hand-offs" organize the hand-overs of the spacecraft attitudes between the different instrument requests. This allows a much higher flexibility than many turns to and from a waypoint.

Geometry information for closest approach:
Altitude: 1615 km
Sub-S/C lat/lon: 3.4°S/155.4°W
Sub-solat lat/lon: 1.4°N/214.4°W
Phase angle: 58.9°

During the custom period, the primary axis (ISS NAC boresight) points towards Iapetus most of the time. An exception is the UVIS star occultation (request ICYEXO009), where the UVIS FUV sensor points towards Sigma Sagitarii (Nunki) for 25 minutes. The secondary axis has been chosen in favor of the MAPS instruments. Between C/A -1:45 hrs and +23 min, the NEG_X axis of Cassini points as close as possible in the direction of spacecraft motion ("S/C ram") relative to Iapetus. Then, the radiators of the ORS instruments would turn into sun, requiring a secondary axis switch. This "big turn" needs 15:44 min. of time and ends at the new secondary orientation "NEG_X to Iapetus north pole".

The request VIMS_049IA_ORSHIRES001_PRIME (C/A -0:55 to +3:00 hrs) will be the one where the most important data will be taken, including images with spatial resolutions down to ~10 m/pxl. It is subdivided into 10 tracking periods, where different parts on the surface are tracked by the Cassini IVP (Inertial Vector Propagator). Tracking of the surface is essential to not getting smeared images. This request also contains the "big turn" described above.

A small fraction of the data will be downlinked to Earth on the late evening of Sept., 10. The majority will follow overnight (US) or during daytimes on Sept., 11 (Europe). Since the Iapetus data have a particularly high priority, all data will either be downlinked twice, or received by two stations simultaneously. The intermediate downlink late on DOY 253 allows to collect about 20% more data during the flyby than would be possible otherwise.

Request	Start (SCET)	Start (Epoch)	Duration	End (SCET)	Comments
SOST rev 49 Segment	2007-251T21:50:00		003T23:45:00	2007-256T21:35:00	
SP_049SA_WAYPTTURN001_PRIME	2007-251T21:50:00		000T00:30:00	2007-251T22:20:00	
NEW WAYPOINT	2007-251T22:20:00		000T06:29:00	2007-252T04:49:00	
VIMS_049SA_SATURN001_PRIME	2007-251T22:20:00		000T03:50:00	2007-252T02:10:00	
ISS_049SA_SATSYSFIA001_PRIME	2007-252T02:10:00		000T02:15:00	2007-252T04:25:00	Saturn plus moons from Iapetus distance
SP_049SA_WAYPTTURN002_PRIME	2007-252T04:25:00		000T00:24:00	2007-252T04:49:00	
NEW WAYPOINT	2007-252T04:49:00		001T01:11:00	2007-253T06:00:00	
ISS_049IA_M33HRS001_PRIME	2007-252T04:49:00		000T00:06:00	2007-252T04:55:00	
RADAR_049IA_SCATTRAD003_PRIME	2007-252T04:55:00		000T04:55:00	2007-252T09:50:00	
CIRS_049IA_FP1PRIMAP001_PRIME	2007-252T09:50:00		000T02:00:00	2007-252T11:50:00	
ISS_049IA_GLOBMAPG001_PRIME	2007-252T11:50:00		000T00:21:00	2007-252T12:11:00	1x2 mosaic of crescent
SP_049EA_DLTURN522_PRIME	2007-252T12:11:00		000T00:08:00	2007-252T12:19:00	
SP_049EA_DLTURN402_PRIME	2007-252T12:19:00		000T00:26:00	2007-252T12:45:00	
SP_049EA_DTSMETCTS502_PRIME	2007-252T12:45:00		000T05:49:00	2007-252T21:34:00	Downlink
SP_049IA_WAYPTTURN402_PRIME	2007-252T21:34:00		000T00:04:00	2007-252T21:38:00	
SP_049IA_WAYPTTURN403_PRIME	2007-252T21:38:00		000T00:27:00	2007-252T22:05:00	
ISS_049IA_LIMBTOPOG001_PRIME	2007-252T22:05:00		000T00:20:00	2007-252T22:25:00	1x2 mosaic of crescent
CIRS_049IA_MTPGLR250_PRIME	2007-252T22:25:00		000T01:30:00	2007-252T23:55:00	
RADAR_049IA_SCATTRAD004_PRIME	2007-252T23:55:00		000T02:50:00	2007-253T02:45:00	Dark terrain
VIMS_049IA_IAPETUS026_PRIME	2007-253T02:45:00		000T01:35:00	2007-253T04:20:00	
ISS_049IA_SATUSHINE001_PRIME	2007-253T04:20:00		000T01:06:00	2007-253T05:26:00	1x4 crescent, polar areas in 'saturnshine'
SP_049EA_DLTURN704_PRIME	2007-253T05:26:00		000T00:14:00	2007-253T05:40:00	
SP_049EA_DLTURN804_PRIME	2007-253T05:40:00		000T00:20:00	2007-253T06:00:00	
NEW WAYPOINT	2007-253T06:00:00		009T16:40:00	2007-253T22:40:00	
SP_049EA_MTMETCTS2503_PRIME	2007-253T06:00:00		000T03:44:59	2007-253T09:44:59	Downlink
SP_049NA_DEADTIME23_PRIME	2007-253T08:45:00		000T00:05:00	2007-253T08:50:00	
Begin Custom	2007-253T08:50:00		000T00:01:00	2007-253T08:51:00	
CIRS_049IA_FP1MTMAP001_PRIME	2007-253T08:50:40	-000T00:20:00	000T02:15:00	2007-253T11:05:40	ISS: Low southern latitudes equatorial
RADAR_049IA_SCATTRAD001_PRIME	2007-253T11:05:40	-000T00:10:00	000T01:25:00	2007-253T12:30:40	Best RADAR of dark terrain
ISS_049IA_CASSREG001_PRIME	2007-253T12:30:40	-000T01:45:00	000T00:01:00	2007-253T12:31:40	Ridge at high-resolution
UVIS_049IA_ICYMAP003_PRIME	2007-253T12:31:40	-000T01:44:00	000T00:24:00	2007-253T12:55:40	ISS: Northern dark-bright transition zone
UVIS_049IA_ICYEXO009_PRIME	2007-253T12:55:40	-000T01:20:00	000T00:25:00	2007-253T13:20:40	UVIS star occultation, WAC of crescent
VIMS_049IA_ORSHIRES001_PRIME	2007-253T13:20:40	-000T00:55:00	000T03:55:00	2007-253T17:15:40	ISS: 252 images; res. down to 10 m/pxl
CIRS_049IA_FP1DAYMAP001_PRIME	2007-253T17:15:40	+000T00:00:00	000T02:30:00	2007-253T19:45:40	ISS: Mid- to high-lat. southern terrain
VIMS_049IA_IAPETUS013_PRIME	2007-253T19:15:40	+000T00:00:00	000T00:44:00	2007-253T19:59:40	ISS: Big basin + equat. transition zone
End Custom	2007-253T19:59:40	+000T05:44:00	000T00:01:00	2007-253T20:00:40	
SP_049NA_DEADTIME453_PRIME	2007-253T20:00:00		000T00:05:00	2007-253T20:05:00	
SP_049EA_DTMETUNG604_PRIME	2007-253T20:05:00		000T02:15:00	2007-253T22:20:00	Inserted downlink Canberra + Goldstone
SP_049IA_WAYPTTURN453_PRIME	2007-253T22:20:00		000T00:20:00	2007-253T22:40:00	
NEW WAYPOINT	2007-253T22:40:00		001T25:25:00	2007-255T22:05:00	
ISS_049IA_REGMAPTRL001_PRIME	2007-253T22:40:00		000T02:00:00	2007-254T00:40:00	Global trailing side; high-res. color
CIRS_049IA_SATPOLR2001_PRIME	2007-254T00:40:00		000T01:40:00	2007-254T02:20:00	
ISS_049IA_REGCOLTRL001_PRIME	2007-254T02:20:00		000T00:40:00	2007-254T03:00:00	High-res. multi-color
RADAR_049IA_SCATTRAD002_PRIME	2007-254T03:00:00		000T02:10:00	2007-254T05:10:00	Bright terrain
SP_049EA_DLTURN804_PRIME	2007-254T05:10:00		000T00:20:00	2007-254T05:30:00	
SP_049EA_MTMETUNG205_PRIME	2007-254T05:30:00		000T01:20:00	2007-254T13:20:00	Downlink Madrid (66M-B: A partial)
SP_049EA_DTMETUNG604_PRIME	2007-254T13:20:00		000T07:05:00	2007-254T20:25:00	Downlink Goldstone (66M-B: A rest)
SP_049IA_WAYPTTURN504_PRIME	2007-254T20:25:00		000T00:20:00	2007-254T20:45:00	
VIMS_049IA_IAPETUS010_PRIME	2007-254T20:45:00		000T02:15:00	2007-254T23:00:00	ISS: Full-disk global multi color
CIRS_049IA_FP1FLYBYMAP001_PRIME	2007-254T23:00:00		000T04:55:00	2007-255T03:55:00	
RADAR_049IA_SCATTRAD005_PRIME	2007-255T03:55:00		000T03:05:00	2007-255T06:50:00	
ISS_049SA_STRMOVIE002_PRIME	2007-255T06:00:00		000T04:35:00	2007-255T10:35:00	Saturn atmosphere
ISS_049IA_LIMBTOPO5001_PRIME	2007-255T10:35:00		000T00:30:00	2007-255T11:05:00	Global coverage
NAV_049SK_OPNAV551_PRIME	2007-255T11:05:00		000T01:29:00	2007-255T12:34:00	Optical navigation
NAV_049EA_DLTURN551_PRIME	2007-255T12:34:00		000T00:01:00	2007-255T12:35:00	
SP_049EA_DTMETUNG606_PRIME	2007-255T12:35:00		000T06:00:00	2007-255T18:35:00	Downlink (via: 66M-A from flyby apart)

ISS observation requests: detailed information

Request name	Part	Resolution	# of images	Notes
ISS_049SA_SATSYSFIA001_PRIME	Saturn	196 km/pxl	19	Saturn (WAC)
	moons	13-27 km/pxl	23	7 largest moons (except Iapetus)
	rings	20 km/pxl	90	Rings NAC mosaic (30 panels)
ISS_049IA_M33HRS001_PRIME		1.7 km/pxl	7	Iapetus crescent 1x1 mosaic
ISS_049IA_GLOBMAPG001_PRIME		1.3 km/pxl	15	Crescent 1x2
ISS_049IA_LIMBTOPOG001_PRIME		800 m/pxl	11	Crescent 1x2 + saturnshine
ISS_049IA_SATUSHINE001_PRIME		490 m/pxl	16	Crescent 1x4
		470 m/pxl	18	High southern and northern latitudes 1x3 each
		460 m/pxl	6	Ridge stereo
		450 m/pxl	10	Landslide crater saturnshine attempt
ISS_049IA_FP1NITMAP001_CIRS		235 m/pxl	2	Crescent at low southern lat.
ISS_049IA_CASSREG001_PRIME		85 m/pxl	2	Ridge at 130°W
ISS_049IA_ICYMAP003_UVIS		80 m/pxl	3	1x3 mosaic at mid northern lat.
ISS_049IA_ICYEXO009_UVIS		450 m/pxl	1	WAC crescent + star (Nunki)
ISS_049IA_ORSHIRES001_VIMS	2901	30 m/pxl	30	Ridge (140°W) at high phase
	2902	20 m/pxl	24	Bright "Voyager" mountains at horizon
	2903	10 m/pxl	16	Closest approach imaging (phase from 83° to 29°)
	2904	20 m/pxl	13	Average dark terrain sample (for CIRS)
	2905	60 m/pxl	12	Transition zone (mid southern latitudes)
	2906	35 m/pxl	3	Average bright terrain sample (for CIRS)
	2907	50 m/pxl	28	1x6 mosaic of bright "Voyager" mountains
	2908	60 m/pxl	13	Average bright terrain sample (for VIMS)
	2909	80-130 m/pxl	88	4x3 + 3x3 big transition zone mosaic (equatorial)
	2910+2911	140 m/pxl	25	Terminator mapping and "moat" crater saturnshine
ISS_049IA_FP1DAYMAP001_CIRS		240 m/pxl	3	1x3 mosaic at low southern lat.
ISS_049IA_IAPETUS013_VIMS		250 m/pxl	4	Part of huge trailing-side basin
		260 m/pxl	15	Equatorial transition zone multi-color
ISS_049IA_REGMAPTRL001_PRIME		440 m/pxl	71	Hamon crater multi-color; 15 panel trail. side mos.
		470 m/pxl	6	"Moat" crater in saturnshine
		500 m/pxl	90	Latitudinal multi-color coverage
ISS_049IA_REGCOLTRL001_PRIME		610 m/pxl	3	"Moat" crater in saturnshine
		630 m/pxl	57	Local multi-color
ISS_049IA_IAPETUS010_VIMS		1.6 km/pxl	51	Global multi-color trailing side
ISS_049IA_LIMBTOPOI001_PRIME		2.3 km/pxl	19	Global view

Flyby geometry

This table shows the flyby geometry in 1-hour steps for altitudes below ~100,000 km, in 10-min steps for altitudes below ~10000 km, and in 1 min. steps for altitudes below ~2000 km.

UTC/SCET = Cassini event time; ALTITUDE = distance to surface (in km); SC_LAT/LON = sub-spacecraft latitude/longitude; Sun_LAT/LON = sub-solar latitude/longitude (all longitudes are given in degrees west); PHASE is phase angle (with 0° = fully illuminated, 90° = half moon, 180° = new moon).

UTC/SCET	ALTITUDE	SC_LAT	SC_LON	Sun_LAT	Sun_LON	PHASE
2007 SEP 10 03:00	94381	+9.7	65.1	+1.4	212.3	145.2
2007 SEP 10 04:00	85946	+9.7	65.4	+1.4	212.5	145.0
2007 SEP 10 05:00	77611	+9.7	65.8	+1.4	212.7	144.9
2007 SEP 10 06:00	69075	+9.7	66.2	+1.4	212.9	144.7
2007 SEP 10 07:00	60640	+9.7	66.7	+1.4	213.1	144.4
2007 SEP 10 08:00	52206	+9.7	67.2	+1.4	213.2	144.1
2007 SEP 10 09:00	43774	+9.6	67.9	+1.4	213.4	143.6
2007 SEP 10 10:00	35345	+9.6	68.8	+1.4	213.6	142.9
2007 SEP 10 11:00	26924	+9.5	70.2	+1.4	213.8	141.9
2007 SEP 10 12:00	18522	+9.4	72.5	+1.4	214.0	139.8
2007 SEP 10 13:00	10164	+8.9	78.2	+1.4	214.2	134.6
2007 SEP 10 13:10	8813	+8.7	80.1	+1.4	214.2	132.9
2007 SEP 10 13:20	7455	+8.5	82.6	+1.4	214.2	130.5
2007 SEP 10 13:30	6117	+8.1	86.0	+1.4	214.3	127.3
2007 SEP 10 13:40	4813	+7.5	91.1	+1.4	214.3	122.4
2007 SEP 10 13:50	3578	+6.5	99.1	+1.4	214.3	114.6
2007 SEP 10 14:00	2488	+4.4	112.8	+1.4	214.4	101.2
2007 SEP 10 14:05	2053	+2.5	123.3	+1.4	214.4	90.7
2007 SEP 10 14:06	1980	+2.1	125.8	+1.4	214.4	88.3
2007 SEP 10 14:07	1912	+1.6	128.4	+1.4	214.4	85.7
2007 SEP 10 14:08	1850	+1.1	131.1	+1.4	214.4	83.0
2007 SEP 10 14:09	1795	+0.6	134.0	+1.4	214.4	80.2
2007 SEP 10 14:10	1746	0.0	136.9	+1.4	214.4	77.2
2007 SEP 10 14:11	1704	-0.6	140.0	+1.4	214.4	74.1
2007 SEP 10 14:12	1670	-1.2	143.2	+1.4	214.4	71.0
2007 SEP 10 14:13	1644	-1.8	146.5	+1.4	214.4	67.8
2007 SEP 10 14:14	1626	-2.4	149.8	+1.4	214.4	64.6
2007 SEP 10 14:15	1616	-3.0	153.2	+1.4	214.4	61.3
2007 SEP 10 14:16	1615	-3.6	156.6	+1.4	214.4	57.8
2007 SEP 10 14:17	1622	-4.2	160.0	+1.4	214.4	54.5
2007 SEP 10 14:18	1638	-4.8	163.3	+1.4	214.4	51.3
2007 SEP 10 14:19	1662	-5.3	166.7	+1.4	214.4	48.1
2007 SEP 10 14:20	1693	-5.8	169.9	+1.4	214.4	44.9
2007 SEP 10 14:21	1733	-6.3	173.1	+1.4	214.4	41.9
2007 SEP 10 14:23	1779	-6.8	176.2	+1.4	214.4	39.1
2007 SEP 10 14:23	1833	-7.2	179.1	+1.4	214.4	36.3
2007 SEP 10 14:24	1893	-7.5	181.9	+1.4	214.4	33.7
2007 SEP 10 14:25	1959	-7.9	184.7	+1.4	214.5	31.3
2007 SEP 10 14:30	2365	-9.1	196.3	+1.4	214.5	21.4
2007 SEP 10 14:40	3424	-10.1	211.5	+1.4	214.5	13.0
2007 SEP 10 14:50	4646	-10.4	220.3	+1.4	214.5	14.2
2007 SEP 10 15:00	5943	-10.5	225.8	+1.4	214.6	17.1
2007 SEP 10 15:10	7277	-10.4	229.5	+1.4	214.6	19.7
2007 SEP 10 15:20	8633	-10.4	232.1	+1.4	214.6	21.7
2007 SEP 10 15:30	10003	-10.3	234.1	+1.4	214.7	23.2
2007 SEP 10 16:00	14154	-10.2	237.8	+1.4	214.8	26.3
2007 SEP 10 17:00	22534	-10.1	241.4	+1.4	214.9	29.2
2007 SEP 10 18:00	30948	-10.0	243.2	+1.4	215.1	30.6
2007 SEP 10 19:00	39374	-9.9	244.3	+1.4	215.3	31.4
2007 SEP 10 20:00	47805	-9.9	245.1	+1.4	215.5	31.9
2007 SEP 10 21:00	56239	-9.9	245.7	+1.4	215.7	32.3
2007 SEP 10 22:00	64674	-9.9	246.2	+1.4	215.9	32.6
2007 SEP 10 23:00	73109	-9.9	246.6	+1.4	216.1	32.8
2007 SEP 11 00:00	81545	-9.8	247.0	+1.4	216.3	33.0
2007 SEP 11 01:00	89981	-9.8	247.3	+1.4	216.4	33.1
2007 SEP 11 02:00	98417	-9.8	247.6	+1.4	216.6	33.3

More information on the web:

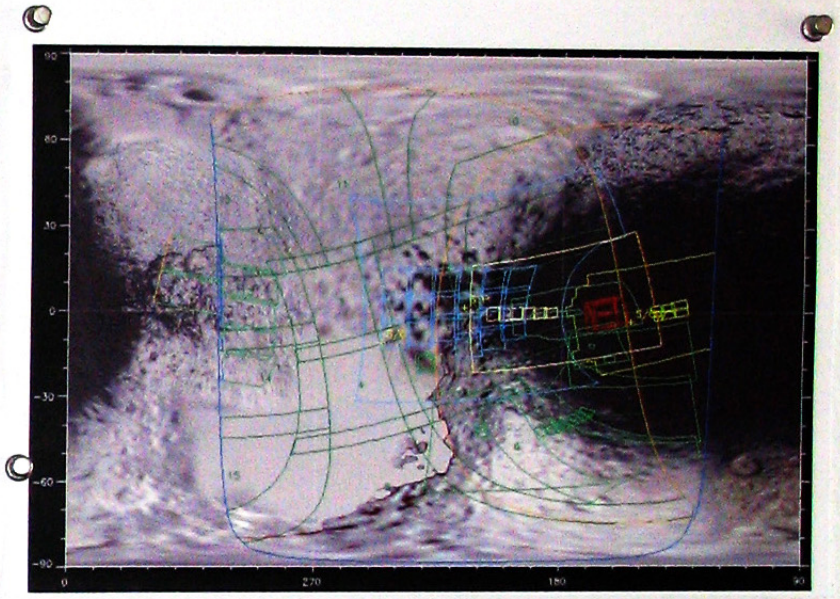
(available about end-of-August)

http://www.geoinf.fu-berlin.de/dev/projekte/cassini/cassini_fu_iapetus_flyby.php

Or "Quick Links" from main home page of FU Berlin planetology:
www.fu-berlin.de/planeten

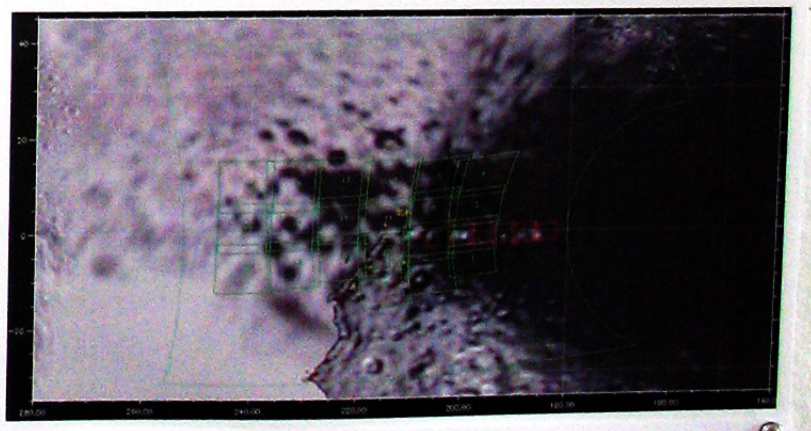
Iapetus hemispheres in Cassini data.
Left: sub-Saturn side. *Right:* anti-Saturn side.

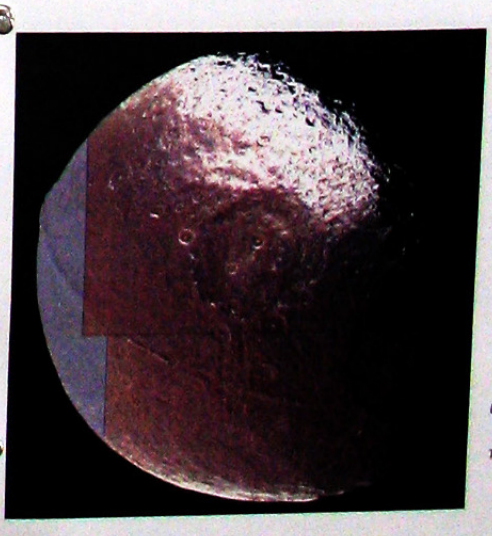
The large, ~500 km sized basin on the lower right in the two middle images is located on the southern trailing hemisphere.
The linearily arranged bright dots (image to the right) are huge mountains located quite exactly on Iapetus' equator.



Top: **Plot of top-priority footprints**
(requests ISS_049IA_ORSHIRES001_VIMS and mapping part of ISS_049IA_REGMAPTRL001_PRIME)

Bottom: **Low-phase observations of the "Voyager mountains" and the equatorial transition zone**
(red: "trigger" 2907; green: "trigger" 2909; see list to the left)





Left: **Leading side with equatorial ridge**
(~1 km/pxl, from Cassini ISS "B/C" flyby)

Top: **Voyager 2 data of big mountains**
(8 - 10 km/pxl, visible at the upper limb)
The bright "Voyger mountains" are found to be an eastern extension of the ridge.

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The Cassini Targeted Iapetus Flyby Will Take Place in September, 2007

SESSION: Poster Session
Monday, August 13, 2007
3:30 p.m.

049IA – Cassini Iapetus Targeted Flyby (Rev. 049, 10 Sep 2007)

Introduction

The Cassini group of ISS-Team member Gerhard Neukum (Freie Universität Berlin, Germany) was responsible for imaging planning of Cassini's targeted flyby at Iapetus on Sep. 10, 2007. We also helped to design the timeline during the SOST Iapetus segment (08 Sep 2007 21:50 to 12 Sep 2007 21:35 UTC/SCET), initiated a reference trajectory tweak to significantly improve closest-approach science without sacrificing the UVIS stellar occultation, and designed the spacecraft attitude (trackings, mosaics, pointings) of the VIMS_049IA_ORSHIRES001_PRIME request for all remote-sensing (ORS) and fields-and-particle (MAPS) instruments. This request covers the time frame from 55 min before to 3 hours after closest approach.

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Timeline

The table below shows the observation timeline during the SOST Iapetus segment. Colors indicate the prime instrument (responsible for spacecraft pointing). Format for start and end time of a request is Year-"day-of-year" T hh:mm:ss, with 2007-253T = Sep. 10, 2007.

The time window between 08:45 and 20:00 UTC on DOY 253 is designed as a "moveable block". This means that deviations from the reference trajectory can be corrected at very short notice, crucial for a correct instrument pointing near closest approach (C/A). There's a deadtime of ~5 min on either side to accomodate a potential time shift. The epoch is relative to the Iapetus closest approach time which occurs at C/A = 2007-253T14:15:40 UTC/SCET in the reference trajectory. This is equivalent to 16:15 Central European time on Monday, Sep. 10, 2007, or 07:15 a.m. Pacific Daylight time on the same day. Within the moveable block, the waypoint strategy is also not used. Instead, "custom hand-offs" organize the hand-overs of the spacecraft attitudes between the different instrument requests. This allows a much higher flexibility than many turns to and from a waypoint.

Geometry information for closest approach:
Altitude: 1615 km
Sub-S/C lat/lon: 3.4°S/155.4°W
Sub-solat lat/lon: 1.4°N/214.4°W
Phase angle: 58.9°

During the custom period, the primary axis (ISS NAC boresight) points towards Iapetus most of the time. An exception is the UVIS star occultation (request ICYEXO009), where the UVIS FUV sensor points towards Sigma Sagitarii (Nunki) for 25 minutes. The secondary axis has been chosen in favor of the MAPS instruments. Between C/A -1:45 hrs and +23 min, the NEG_X axis of Cassini points as close as possible in the direction of spacecraft motion ("S/C ram") relative to Iapetus. Then, the radiators of the ORS instruments would turn into sun, requiring a secondary axis switch. This "big turn" needs 15:44 min. of time and ends at the new secondary orientation "NEG_X to Iapetus north pole".

The request VIMS_049IA_ORSHIRES001_PRIME (C/A -0:55 to +3:00 hrs) will be the one where the most important data will be taken, including images with spatial resolutions down to ~10 m/pxl. It is subdivided into 10 tracking periods, where different parts on the surface are tracked by the Cassini IVP (Inertial Vector Propagator). Tracking of the surface is essential to not getting smeared images. This request also contains the "big turn" described above.

A small fraction of the data will be downlinked to Earth on the late evening of Sept., 10. The majority will follow overnight (US) or during daytimes on Sept., 11 (Europe). Since the Iapetus data have a particularly high priority, all data will either be downlinked twice, or received by two stations simultaneously. The intermediate downlink late on DOY 253 allows to collect about 20% more data during the flyby than would be possible otherwise.

Request	Start (SCET)	Start (Epoch)	Duration	End (SCET)	Comments
SOST rev 49 Segment	2007-251T21:50:00		003T23:45:00	2007-255T21:35:00	
SP_049SA_WAYPTTURN251_PRIME	2007-251T21:50:00		000T00:30:00	2007-251T22:20:00	
NEW WAYPOINT	**2007-251T22:20:00**		**000T06:29:00**	**2007-252T04:49:00**	
VIMS_049SA_SATURN001_PRIME	2007-251T22:20:00		000T03:50:00	2007-252T02:10:00	
ISS_049SA_SATSYSFIA001_PRIME	2007-252T02:10:00		000T02:15:00	2007-252T04:25:00	Saturn plus moons from Iapetus distance
SP_049IA_WAYPTTURN252_PRIME	2007-252T04:25:00		000T00:24:00	2007-252T04:49:00	
NEW WAYPOINT	**2007-252T04:49:00**		**001T01:11:00**	**2007-253T06:00:00**	
ISS_049IA_M33HRS001_PRIME	2007-252T04:49:00		000T00:06:00	2007-252T04:55:00	
RADAR_049IA_SCATTRAD003_PRIME	2007-252T04:55:00		000T04:55:00	2007-252T09:50:00	
CIRS_049IA_FP1FP3SCN001_PRIME	2007-252T09:50:00		000T02:00:00	2007-252T11:50:00	
ISS_049IA_GLOBMAPG001_PRIME	2007-252T11:50:00		000T00:21:00	2007-252T12:11:00	1x2 mosaic of crescent
SP_049EA_DLTURN252_PRIME	2007-252T12:11:00		000T00:08:00	2007-252T12:19:00	
SP_049EA_DLTURN452_PRIME	2007-252T12:19:00		000T00:26:00	2007-252T12:45:00	
SP_049EA_G70METOTB252_PRIME	2007-252T12:45:00		000T08:49:00	2007-252T21:34:00	Downlink
SP_049IA_WAYPTTURN452_PRIME	2007-252T21:34:00		000T00:04:00	2007-252T21:38:00	
SP_049IA_WAYPTTURN552_PRIME	2007-252T21:38:00		000T00:27:00	2007-252T22:05:00	
ISS_049IA_LIMBTOPOG001_PRIME	2007-252T22:05:00		000T00:20:00	2007-252T22:25:00	1x2 mosaic of crescent
CIRS_049IA_NITPOLRIZ001_PRIME	2007-252T22:25:00		000T01:30:00	2007-252T23:55:00	
RADAR_049IA_SCATTRAD004_PRIME	2007-252T23:55:00		000T02:50:00	2007-253T02:45:00	Dark terrain
VIMS_049IA_IAPETUS006_PRIME	2007-253T02:45:00		000T01:35:00	2007-253T04:20:00	
ISS_049IA_SATUSHINE001_PRIME	2007-253T04:20:00		000T01:06:00	2007-253T05:26:00	1x4 crescent, polar areas in 'saturnshine'
SP_049EA_DLTURN754_PRIME	2007-253T05:26:00		000T00:14:00	2007-253T05:40:00	
SP_049EA_DLTURN854_PRIME	2007-253T05:40:00		000T00:20:00	2007-253T06:00:00	
NEW WAYPOINT	**2007-253T06:00:00**		**000T16:40:00**	**2007-253T22:40:00**	
SP_049EA_M70METNON253_PRIME	2007-253T06:00:00		000T02:44:53	2007-253T08:44:53	Downlink
SP_049NA_DEADTIME253_PRIME	**2007-253T08:45:00**		**000T00:05:00**	**2007-253T08:50:00**	
Begin Custom	**2007-253T08:50:00**		**000T00:01:00**	**2007-253T08:51:00**	
CIRS_049IA_FP1NITMAP001_PRIME	2007-253T08:50:40	-000T05:25:00	000T02:15:00	2007-253T11:05:40	ISS: Low southern latitudes snapshot
RADAR_049IA_SCATTRAD001_PRIME	2007-253T11:05:40	-000T03:10:00	000T01:25:00	2007-253T12:30:40	Best RADAR of dark terrain
ISS_049IA_CASSREG001_PRIME	2007-253T12:30:40	-000T01:45:00	000T00:01:00	2007-253T12:31:40	Ridge at high-resolution
UVIS_049IA_ICYMAP003_PRIME	2007-253T12:31:40	-000T01:44:00	000T00:24:00	2007-253T12:55:40	ISS: Northern dark-bright transition zone
UVIS_049IA_ICYEXO009_PRIME	2007-253T12:55:40	-000T01:20:00	000T00:25:00	2007-253T13:20:40	UVIS star occultation; WAC of crescent
VIMS_049IA_ORSHIRES001_PRIME	**2007-253T13:20:40**	**-000T00:55:00**	**000T03:55:00**	**2007-253T17:15:40**	**ISS: 252 images; res. down to 10 m/pxl**
CIRS_049IA_FP1DAYMAP001_PRIME	2007-253T17:15:40	+000T03:00:00	000T02:00:00	2007-253T19:15:40	ISS: Mid- to high-lat. southern terrain
VIMS_049IA_IAPETUS013_PRIME	2007-253T19:15:40	+000T05:00:00	000T00:44:00	2007-253T19:59:40	ISS: Big basin + equat. transition zone
End Custom	**2007-253T19:59:40**	**+000T05:44:00**	**000T00:01:00**	**2007-253T20:00:40**	
SP_049NA_DEADTIME453_PRIME	**2007-253T20:00:00**		**000T00:05:00**	**2007-253T20:05:00**	
SP_049EA_C70METUNQ253_PRIME	2007-253T20:05:00		000T02:15:00	2007-253T22:20:00	Intermed. downlink Canberra + Goldstone
SP_049IA_WAYPTTURN253_PRIME	2007-253T22:20:00		000T00:20:00	2007-253T22:40:00	
NEW WAYPOINT	**2007-253T22:40:00**		**001T23:25:00**	**2007-255T22:05:00**	
ISS_049IA_REGMAPTRL001_PRIME	2007-253T22:40:00		000T02:00:00	2007-254T00:40:00	Global trailing side; high-res. color
CIRS_049IA_DAYPOLRIZ001_PRIME	2007-254T00:40:00		000T01:40:00	2007-254T02:20:00	
ISS_049IA_REGCOLTRL001_PRIME	2007-254T02:20:00		000T00:40:00	2007-254T03:00:00	High-res. multi-color
RADAR_049IA_SCATTRAD002_PRIME	2007-254T03:00:00		000T02:10:00	2007-254T05:10:00	Bright terrain
SP_049EA_DLTURN254_PRIME	2007-254T05:10:00		000T00:20:00	2007-254T05:30:00	
SP_049EA_M70METNON255_PRIME	2007-254T05:30:00		000T07:50:00	2007-254T13:20:00	Downlink Madrid (SSR-B; A partial)
SP_049EA_G70METNON254_PRIME	2007-254T13:20:00		000T07:05:00	2007-254T20:25:00	Downlink Goldstone (SSR-B, A rest)
SP_049IA_WAYPTTURN254_PRIME	2007-254T20:25:00		000T00:20:00	2007-254T20:45:00	
VIMS_049IA_IAPETUS010_PRIME	2007-254T20:45:00		000T02:15:00	2007-254T23:00:00	ISS: Full-disk global multi color
CIRS_049IA_FP1FP3MAP001_PRIME	2007-254T23:00:00		000T04:00:00	2007-255T03:00:00	
RADAR_049IA_SCATTRAD005_PRIME	2007-255T03:00:00		000T03:00:00	2007-255T06:00:00	
ISS_049SA_STRMOVIEE002_PRIME	2007-255T06:00:00		000T04:35:00	2007-255T10:35:00	Saturn atmosphere
ISS_049IA_LIMBTOPOI001_PRIME	2007-255T10:35:00		000T00:30:00	2007-255T11:05:00	Global coverage
NAV_049SK_OPNAV551_PRIME	2007-255T11:05:00		000T01:29:00	2007-255T12:34:00	Optical navigation
NAV_049EA_DLTURN551_PRIME	2007-255T12:34:00		000T00:01:00	2007-255T12:35:00	
SP_049EA_G70METNON255_PRIME	2007-255T12:35:00		000T09:00:00	2007-255T21:35:00	Downlink (incl. SSR-A from flyby again)

ISS observation requests: detailed information

Request name	Part	Resolution	# of images	Notes
ISS_049SA_SATSYSFIA001_PRIME	Saturn	196 km/pxl	19	Saturn (WAC)
	moons	13-27 km/pxl	23	7 largest moons (except Iapetus)
	rings	20 km/pxl	90	Rings NAC mosaic (30 panels)
ISS_049IA_M33HRS001_PRIME		1.7 km/pxl	7	Iapetus crescent 1x1 mosaic
ISS_049IA_GLOBMAPG001_PRIME		1.3 km/pxl	15	Crescent 1x2
ISS_049IA_LIMBTOPOG001_PRIME		800 m/pxl	11	Crescent 1x2 + saturnshine
ISS_049IA_SATUSHINE001_PRIME		490 m/pxl	16	Crescent 1x4
		470 m/pxl	18	High southern and northern latitudes 1x3 each
		460 m/pxl	6	Ridge stereo
		450 m/pxl	10	Landslide crater saturnshine attempt
ISS_049IA_FP1NITMAP001_CIRS		235 m/pxl	2	Crescent at low southern lat.
ISS_049IA_CASSREG001_PRIME		85 m/pxl	2	Ridge at 130°W
ISS_049IA_ICYMAP003_UVIS		80 m/pxl	3	1x3 mosaic at mid northern lat.
ISS_049IA_ICYEXO009_UVIS		450 m/pxl	1	WAC crescent + star (Nunki)
ISS_049IA_ORSHIRES001_VIMS	2901	30 m/pxl	30	Ridge (140°W) at high phase
	2902	20 m/pxl	24	Bright "Voyager" mountains at horizon
	2903	10 m/pxl	16	Closest approach imaging (phase from 83° to 29°)
	2904	20 m/pxl	13	Average dark terrain sample (for CIRS)
	2905	60 m/pxl	12	Transition zone (mid southern latitudes)
	2906	35 m/pxl	3	Average bright terrain sample (for CIRS)
	2907	50 m/pxl	28	1x6 mosaic of bright "Voyager" mountains
	2908	60 m/pxl	13	Average bright terrain sample (for VIMS)
	2909	80-130 m/pxl	88	4x3 + 3x3 big transition zone mosaic (equatorial)
	2910+2911	140 m/pxl	25	Terminator mapping and "moat" crater saturnshine
ISS_049IA_FP1DAYMAP001_CIRS		240 m/pxl	3	1x3 mosaic at low southern lat.
ISS_049IA_IAPETUS013_VIMS		250 m/pxl	4	Part of huge trailing-side basin
		260 m/pxl	15	Equatorial transition zone multi-color
ISS_049IA_REGMAPTRL001_PRIME		440 m/pxl	71	Hamon crater multi-color; 15 panel trail. side mos.
		470 m/pxl	6	"Moat" crater in saturnshine
		500 m/pxl	90	Latitudinal multi-color coverage
ISS_049IA_REGCOLTRL001_PRIME		610 m/pxl	3	"Moat" crater in saturnshine
		630 m/pxl	57	Local multi-color
ISS_049IA_IAPETUS010_VIMS		1.6 km/pxl	51	Global multi-color trailing side
ISS_049IA_LIMBTOPOI001_PRIME		2.3 km/pxl	19	Global view

Flyby geometry

This table shows the flyby geometry in 1-hour steps for altitudes below ~100,000 km, in 10-min steps for altitudes below ~10000 km, and in 1 min. steps for altitudes below ~2000 km.

UTC/SCET = Cassini event time; ALTITUDE = distance to surface (in km); SC_LAT/LON = sub-spacecraft latitude/longitude; Sun_LAT/LON = sub-solar latitude/longitude (all longitudes are given in degrees west); PHASE is phase angle (with 0° = fully illuminated, 90° = half moon, 180° = new moon).

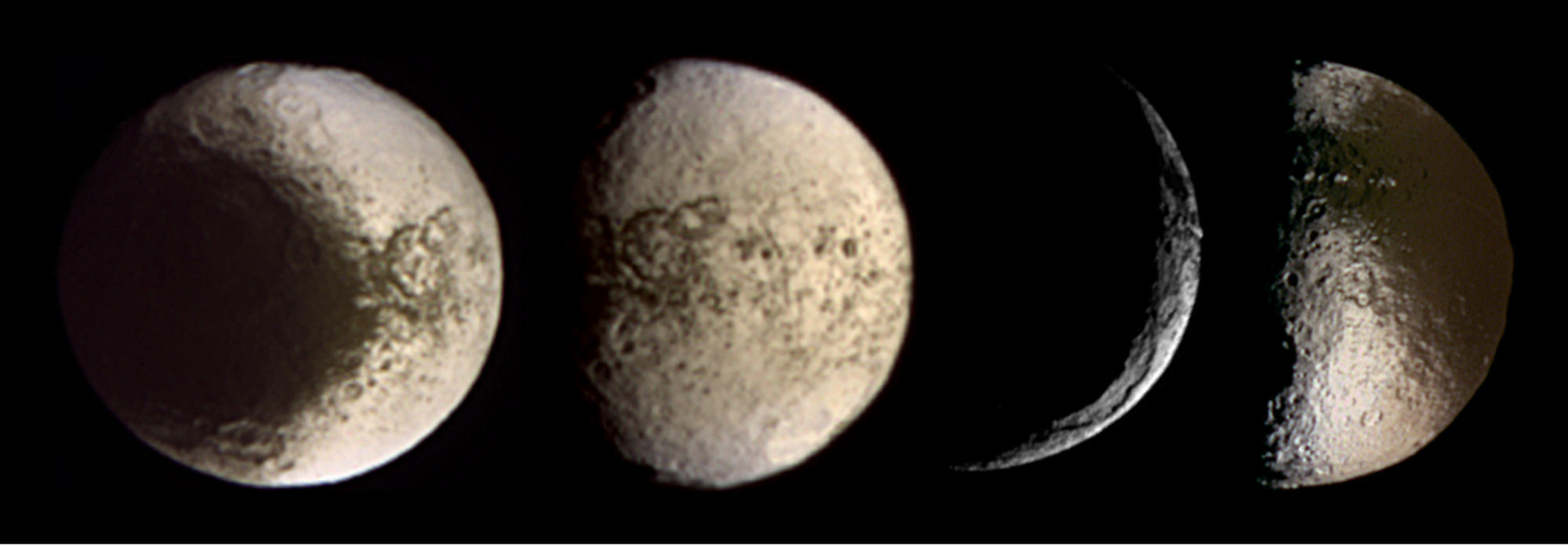
UTC/SCET	ALTITUDE	SC_LAT	SC_LON	Sun_LAT	Sun_LON	PHASE
2007 SEP 10 03:00	94381	+9.7	65.1	+1.4	212.3	145.2
2007 SEP 10 04:00	85946	+9.7	65.4	+1.4	212.5	145.0
2007 SEP 10 05:00	77511	+9.7	65.8	+1.4	212.7	144.9
2007 SEP 10 06:00	69075	+9.7	66.2	+1.4	212.9	144.7
2007 SEP 10 07:00	60640	+9.7	66.7	+1.4	213.1	144.4
2007 SEP 10 08:00	52206	+9.7	67.2	+1.4	213.2	144.1
2007 SEP 10 09:00	43774	+9.6	67.9	+1.4	213.4	143.6
2007 SEP 10 10:00	35345	+9.6	68.8	+1.4	213.6	142.9
2007 SEP 10 11:00	26924	+9.5	70.2	+1.4	213.8	141.9
2007 SEP 10 12:00	18522	+9.4	72.5	+1.4	214.0	139.8
2007 SEP 10 13:00	10184	+8.9	78.2	+1.4	214.2	134.6
2007 SEP 10 13:10	8813	+8.7	80.1	+1.4	214.2	132.9
2007 SEP 10 13:20	7455	+8.5	82.6	+1.4	214.2	130.5
2007 SEP 10 13:30	6117	+8.1	86.0	+1.4	214.3	127.3
2007 SEP 10 13:40	4813	+7.5	91.1	+1.4	214.3	122.4
2007 SEP 10 13:50	3578	+6.5	99.1	+1.4	214.3	114.6
2007 SEP 10 14:00	2488	+4.4	112.8	+1.4	214.4	101.2
2007 SEP 10 14:05	2053	+2.5	123.3	+1.4	214.4	90.7
2007 SEP 10 14:06	1980	+2.1	125.8	+1.4	214.4	88.3
2007 SEP 10 14:07	1912	+1.6	128.4	+1.4	214.4	85.7
2007 SEP 10 14:08	1850	+1.1	131.1	+1.4	214.4	83.0
2007 SEP 10 14:09	1795	+0.6	134.0	+1.4	214.4	80.2
2007 SEP 10 14:10	1746	0.0	136.9	+1.4	214.4	77.2
2007 SEP 10 14:11	1704	-0.6	140.0	+1.4	214.4	74.1
2007 SEP 10 14:12	1670	-1.2	143.2	+1.4	214.4	71.0
2007 SEP 10 14:13	1644	-1.8	146.5	+1.4	214.4	67.8
2007 SEP 10 14:14	1626	-2.4	149.8	+1.4	214.4	64.5
2007 SEP 10 14:15	1616	-3.0	153.2	+1.4	214.4	61.1
2007 SEP 10 14:16	1615	-3.6	156.6	+1.4	214.4	57.8
2007 SEP 10 14:17	1622	-4.2	160.0	+1.4	214.4	54.5
2007 SEP 10 14:18	1638	-4.8	163.3	+1.4	214.4	51.3
2007 SEP 10 14:19	1662	-5.3	166.7	+1.4	214.4	48.1
2007 SEP 10 14:20	1693	-5.8	169.9	+1.4	214.4	44.9
2007 SEP 10 14:21	1733	-6.3	173.1	+1.4	214.4	41.9
2007 SEP 10 14:22	1779	-6.8	176.2	+1.4	214.4	39.1
2007 SEP 10 14:23	1833	-7.2	179.1	+1.4	214.4	36.3
2007 SEP 10 14:24	1893	-7.5	181.9	+1.4	214.4	33.7
2007 SEP 10 14:25	1959	-7.9	184.7	+1.4	214.5	31.3
2007 SEP 10 14:30	2365	-9.1	196.3	+1.4	214.5	21.4
2007 SEP 10 14:40	3424	-10.1	211.5	+1.4	214.5	13.0
2007 SEP 10 14:50	4646	-10.4	220.3	+1.4	214.5	14.2
2007 SEP 10 15:00	5943	-10.5	225.8	+1.4	214.6	17.1
2007 SEP 10 15:10	7277	-10.4	229.5	+1.4	214.6	19.7
2007 SEP 10 15:20	8633	-10.4	232.1	+1.4	214.6	21.7
2007 SEP 10 15:30	10003	-10.3	234.1	+1.4	214.7	23.2
2007 SEP 10 16:00	14154	-10.2	237.8	+1.4	214.8	26.3
2007 SEP 10 17:00	22534	-10.1	241.4	+1.4	214.9	29.2
2007 SEP 10 18:00	30948	-10.0	243.2	+1.4	215.1	30.6
2007 SEP 10 19:00	39374	-9.9	244.3	+1.4	215.3	31.4
2007 SEP 10 20:00	47805	-9.9	245.1	+1.4	215.5	31.9
2007 SEP 10 21:00	56239	-9.9	245.7	+1.4	215.7	32.3
2007 SEP 10 22:00	64674	-9.9	246.2	+1.4	215.9	32.6
2007 SEP 10 23:00	73109	-9.9	246.6	+1.4	216.1	32.8
2007 SEP 11 00:00	81545	-9.8	247.0	+1.4	216.3	33.0
2007 SEP 11 01:00	89981	-9.8	247.3	+1.4	216.4	33.1
2007 SEP 11 02:00	98417	-9.8	247.6	+1.4	216.6	33.3

More information on the web:

(available about end-of-August)

http://www.geoinf.fu-berlin.de/dev/projekte/cassini/cassini_fu_iapetus_flyby.php

Or "Quick Links" from main home page of FU Berlin planetology:
www.fu-berlin.de/planeten

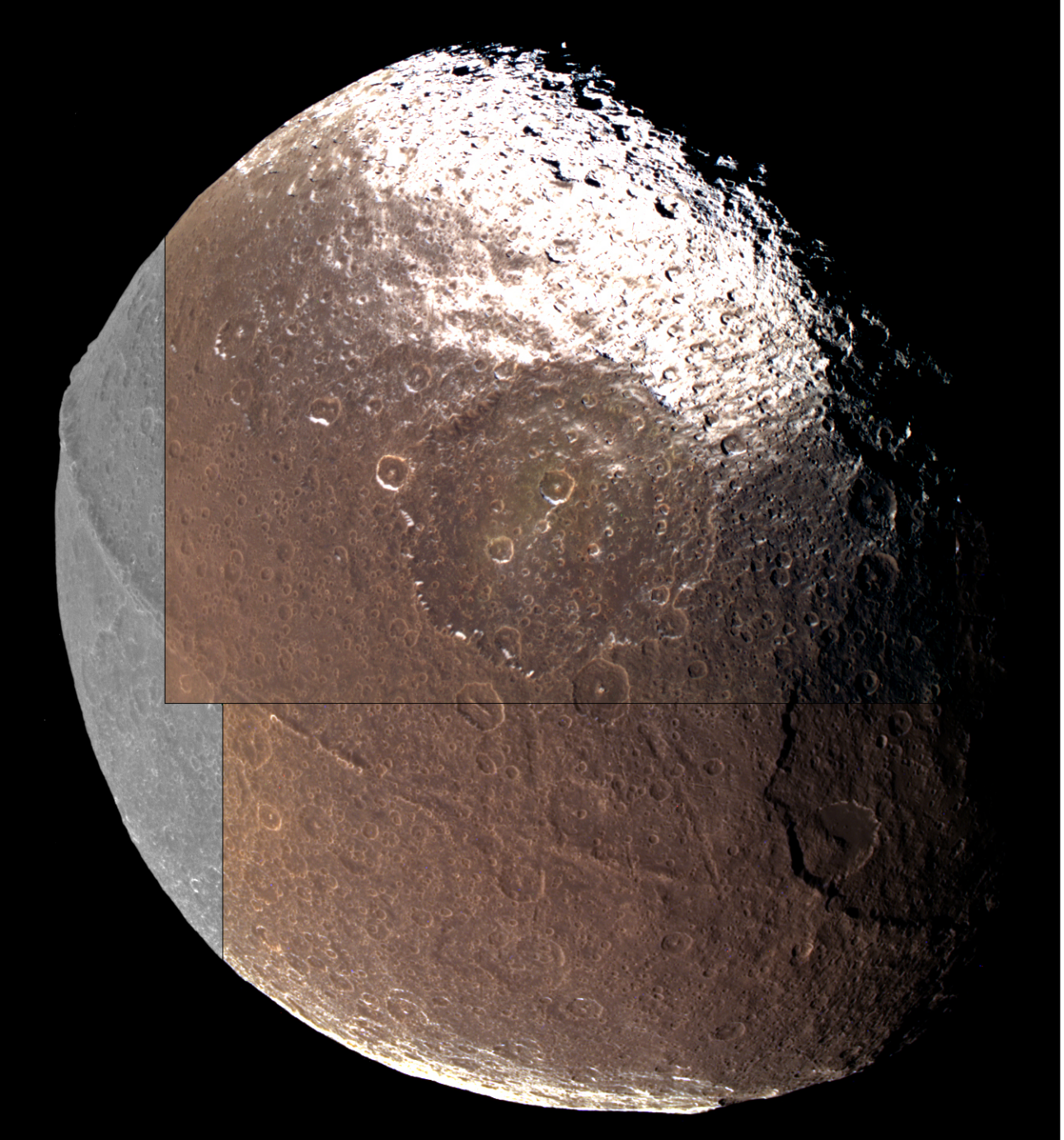


Iapetus hemispheres in Cassini data.
Left: sub-Saturn side. *Right:* anti-Saturn side.

The large, ~500 km sized basin on the lower right in the two middle images is located on the southern trailing hemisphere.
The linearily arranged bright dots (image to the right) are huge mountains located quite exactly on Iapetus' equator.

Top: **Plot of top-priority footprints**
(requests ISS_049IA_ORSHIRES001_VIMS and mapping part of ISS_049IA_REGMAPTRL001_PRIME)

Bottom: **Low-phase observations of the “Voyager mountains” and the equatorial transition zone**
(red: “trigger” 2907; green: “trigger” 2909; see list to the left)



Left: **Leading side with equatorial ridge**
(~1 km/pxl, from Cassini ISS “B/C” flyby)

Top: **Voyager 2 data of big mountains**
(8 - 10 km/pxl; visible at the upper limb)
The bright “Voyger mountains” are found to be an eastern extension of the ridge.