

About the Occultation

- S77 Rev 180 Saturn rings & atmospheric occultation
 - Rings: Ingress only, Atmospheric: Egress only
 - Telemetry OFF, Ranging OFF, **2-way/3-way mode**
 - Covered by Goldstone and Canberra
- From Essam Marouf:

The S77, Rev180 (2013-031), RSS observations include a ring occultation on the ingress side and an atmospheric/ionospheric occultation on the egress side. Both observations are PIEs. The egress atmospheric occultation on Rev 180 will probe a northern latitude of about 71 degrees, a range rarely probed throughout the Cassini Mission. The measurements are expected to provide high spatial resolution profiles of both large- and small-scale thermal structure of the neutral atmosphere and the electron density profile of the ionosphere at this unique high latitude.

Like its completed sister ring occultation on Rev179 (2013-018), the Rev180 ingress ring occultations samples new ring opening angle $B = \sim 19$ degrees but at different Earth-relative longitude. The occultation track covers Rings F and A, the Cassini Division, and outer Ring B. The geometry is ideally suited for profiling density and bending waves populating Ring A, and also for providing additional constraints on the kinematics of circular and non-circular Cassini Division features and outer edge of Ring B. The measurements will also be used to determine/constrain the particle size distribution of resolved ring features and physical properties of gravitational wakes in outer Ring B and throughout Ring A.

DSN Antennas

- DSN Coverage

	Pre	BOT	EOT	Post							
13 031	0800	0900	1830	1845	DSS-14	CAS	RS180-RI/SA	OCC	5602	1647	1A1
13 031	0950	1120	1830	1845	DSS-25	CAS	RS180-RI/SA	OCC	5602	N748	1A1
13 031	1230	1400	1910	1925	DSS-34	CAS	RS180-RI/SA	OCC	5603	N750	1A1
13 031	1305	1405	1815	1830	DSS-45	CAS	RS180-RI/SA	OCC	5603	0624	1A1

- DSS-14 will be providing the uplink throughout
- DSS-43 is down, so DSS-45 will be used instead for X- and S-band downlink supports
 - Karen Yetter will create new code for DSS-45 to add WVSR (current code only has RSR & VSR)
- DSS-34 has the capability to support all three bands if it's not providing the uplink. Should we try?

- Receivers scheduled

- 2 closed-loop receivers per antenna
- Open-loop receivers (RSRs, WVSRs, VSRs)
- Open-loop data are prime. Closed-loop data are backup
 - Will need ramp info in closed-loop data for processing

- Antennas Band and Polarization Capabilities

DSS-14	DSS-25*	DSS-45	DSS-34**
X-RCP X-LCP	X-RCP X-LCP	X-RCP	X-RCP
S-RCP S-LCP	X-RCP	S-RCP	K-RCP

*Either RCP or LCP

**KLCP capability exists, but cable not connected

- Only RCP will be recorded
 - 2-way/3-way and 1-way modes

S77 Rev 180 Open-Loop Assignment

DSS Prdx Mode	Operator	Station	Open-loop Receiver	Channels	Subchannels	Bandwidths KHz
14 (2-way)	Gregory/ Aseel	rsops1	RSR1	RSR1A -> XRCP RSR1B -> SRCP	1, 2, 3, 4 1, 2, 3, 4	1, 16, 50, 100 1, 16, 50, 100
14 (1-way)	Danny	rsops4	WVSR1	WVSR1A -> XRCP WVSR1B -> SRCP	1, 2, 3, 4 5, 6, 7, 8 1, 2, 3, 4 5, 6, 7, 8	1, 16, 50, 100 1, 16, 50, 100 (with offset) 1, 16, 50, 100 1, 16, 50, 100 (with offset)
25 (3-way)	Elias	rsops2	RSR2	RSR2A -> XRCP RSR2B -> KRCP	1, 2, 3, 4 1, 2, 3, 4	1, 16, 50, 100 1, 16, 50, 100
25 (1-way)	Danny	rsops4	WVSR2	WVSR2A -> XRCP WVSR2B -> KRCP	1, 2, 3, 4 5, 6, 7, 8 1, 2, 3, 4 5, 6, 7, 8	1, 16, 50, 100 1, 16, 50, 100 (with offset) 1, 2, 16, 50 1, 2, 16, 50 (with offset)
43 (3-way)	Danny/ Aseel	rsops1	RSR1	RSR1A -> XRCP RSR1B -> SRCP	1, 2, 3, 4 1, 2, 3, 4	1, 16, 50, 100 1, 16, 50, 100
43 (1-way)	Danny	rsops4	WVSR1	WVSR1A -> XRCP WVSR1B -> SRCP	1, 2, 3, 4 5, 6, 7, 8 1, 2, 3, 4 5, 6, 7, 8	1, 16, 50, 100 1, 16, 50, 100 (with offset) 1, 16, 50, 100 1, 16, 50, 100 (with offset)
34 (3-way)	Elias	rsops2	RSR2	RSR2A -> XRCP RSR2B -> KRCP	1, 2, 3, 4 1, 2, 3, 4	1, 16, 50, 100 1, 16, 50, 100
34 (1-way)	Danny	rsops4	WVSR2	WVSR2A -> XRCP WVSR2B -> KRCP	1, 2, 3, 4 5, 6, 7, 8 1, 2, 3, 4 5, 6, 7, 8	1, 16, 50, 100 1, 16, 50, 100 (with offset) 1, 2, 16, 50 1, 2, 16, 50 (with offset)

S77 Rev 177 Open-Loop Assignment Cont'd

- VSR is backup
- Danny – Check WVSR/VSR availability
- Aseel - VOCA
- Elias - Ops Room Displays
- RSSG will be in Ops Room at 11:30 pm on Wednesday, January 30 (031/0730)
 - Most likely two shifts, maybe three

Predicts

- Uplink (ETX) predicts should compensate for Doppler shift due to Saturn's atmosphere
- NAV will deliver the final OD on Monday, 1/28, afternoon
- RSS (Paul Schinder) will apply the Doppler shifts to the ETX file, and expects to send the modified file to the NOPEs on Tuesday morning
- Elias and Danny will generate the downlink predicts on Monday and Tuesday
- RSS will be using three sets of downlink predicts in the open-loop receivers:
 - Coherent with atmospheric compensation: generated using Nicole's PREDICTs software and SPS nominal ETX (preferred for rings occs)
 - 1-way coherent: 1-way predicts generated using PREDICTS and the Doppler file produced by Paul, with the 1-way to 2-way/3-way offsets applied in real-time (preferred for atmospheric occs)
 - 1-way (no offset): when the DST is not in lock on the uplink

DST Lock – What Happened During Rev 178 Occ?

- Still investigating why it took ~18 minutes for the DST to lock up on the uplink during the Rev 178 egress atmospheric occ on January 5th
- One reason was probably that the uplink was provided by a 34-m instead of a 70-m (~6 dB lower gain)
 - Uplink power on the day of the experiment 16.8 kW
- Another was possibly that it was a stand-alone egress occ (no ingress) and the last track ended over 10 hours before egress
 - 004/1600 was EOT of last tracking pass. Occultation egress was 005/0230
- Recent discussion with Jim Shell (SCO)
 - During OTMs, DST is in lock at low signal levels after OTM completes, but it's off-Earth point for 1 to 2 hours, unlike Rev 178 occ
 - Should we adjust the BLF before the occ, just for the occ track?
 - Reluctant to change the BLF
 - VCO drifts a lot, and most of the times, it tend to drift up
 - This also depends on temperature, and now USO is OFF
 - However, at last egress occultation, it was low before we locked up, and when DST locked up, it pulled the frequency up
 - Usually other way around
 - If he was to guess prior to the occ based on data, he would've raised it, and that would've made things worse
 - Unless it permanently drifts in one direction, reluctant to change the BLF
 - If RSS and NOPEs want to track SPE and adjust BLF for that track only, SCO may be OK with it
 - Consider doing a sweep +/- 1 kHz (normal +/- 5 KHz_)?

ORTs

Completed

ORT on DOY 022 (January 22) over DSS-14 and DSS-45, X- and S-band

13 022 0845 0945 1320 1335 DSS-14 CAS TP RS179-OCCORT 5593 1647 1A1

13 022 0845 0945 1405 1420 DSS-15 CAS TKG PASS 5593 N006 1A1

13 022 1330 1430 1845 1900 DSS-45 CAS TP RS179-OCCORT 5594 0624 1A1

- Nominal supports. X- and S-band signals verified

Upcoming

ORT on DOY 027 (January 27) over DSS-25 and DSS-34, X- and Ka-band

13 027 0800 0930 1830 1845 DSS-25 CAS RS180-OCCORT MC 5598 N748 1A1

13 027 1300 1430 1830 1845 DSS-34 CAS RS180-OCCORT MC 5599 N750 1A1

ORT on DOY 028 (January 28) over DSS-25 and DSS-34, X- and Ka-band

13 028 0745 0915 1815 1830 DSS-25 CAS RS180-OCCORT MC 5599 N748 1A1

13 028 1245 1415 1740 1755 DSS-34 CAS RS180-OCCORT MC 5600 N750 1A1

Misc

Uplink Strategy

- DSS-14, 18 kW
- DSK shows uplink transfer from DSS-65 to DSS-14 at 0915. Will not do transfer

DKF – Does not have the correct uplink or AOS/LOS times. Use times in RSS timeline

Plan for Cassini Specific 4th Order Pointing Models

- Update on DSS-34 pointing problem
- DSS-25 pointing model?
 - Last time DSS-25 supported an occultation experiment was June 4 (2012/156)!
- Danny to send pointing data to David

NOPEs - Equipment Status?

SNT

- Enable X only at DSS-25 and DSS-55 throughout
- Conduct SNT measurements

Open-loop Recording bandwidths

- All except Ka-band 1-way: 1, 16, 50, 100 KHz
- Ka-band 1-way: 1, 2, 16, 50 KHz