

About the Occultation

- S76 Rev 178 Saturn atmospheric occultation
 - Egress only
 - First stand-alone coherent egress occ (no ingress)
 - Telemetry OFF, Ranging OFF, **2-way/3-way mode**
 - Covered by Canberra and Madrid

- From Essam Marouf:

A 2-way egress atmospheric occultation of Saturn northern polar region is to be implemented on Cassini Rev 178. It captures a high northern latitude of ~59 degrees measured at the ~100 mbar level. Because of the Cassini tour orbits geometry, the occultation will be one of only few during the Cassini Mission that are able to access this region of the atmosphere clear of the rings. The occultation will be only the second 2-way egress atmospheric occultations ever attempted by Cassini, a challenging prospect given the weak signal levels at the start of an egress occultation. An uplink X-band signal from DSS-45 will provide the reference signal required to replace the one usually provided by the Cassini UltraStable Oscillator (USO), which is no longer available. A ramped uplink (without any sweep) of frequency that incorporates modeled atmospheric Doppler effects will target the best lock frequency (BLF) of the Cassini transponder to attempt locking on the weak refracted signal deep within Saturn's troposphere. If successful, the measurements of signal frequency and power will provide high spatial resolution profile of the thermal structure of the neutral atmosphere, dispersive microwave absorptivity profiles of the neutral atmosphere, and electron density profiles of the ionosphere,. Comparison of results with those from other occultations completed earlier in the Cassini Mission will provide important information regarding temporal and/or seasonal variability of the atmosphere, especially at high latitude regions. Measurements at three radio wavelengths (0.94, 3.6, and 13 cm; Ka-, X-, and S-bands) will be collected throughout the observation period.

DSN Antennas

- DSN Coverage

	Pre	BOT	EOT	Post								
13 004	2215	2315	0340	0355	DSS-45	CAS	RSS	REV178	SAOCC	5576	0624	1A1
13 005	0010	0140	0340	0355	DSS-34	CAS	RSS	REV178	SAOCC	5576	N750	1A1
13 005	0140	0310	0530	0545	DSS-55	CAS	RSS	REV178	SAOCC	5576	N750	1A1
13 005	0210	0310	0530	0545	DSS-63	CAS	RSS	REV178	SAOCC	5576	1639	1A1

- DSS-43 is down, so DSS-45 will be used instead for uplink and X- and S-band downlink supports
- DSS-34 has the capability to support all three bands if it's not providing the uplink. Will try next time

- 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-45	DSS-34*	DSS-63	DSS-55**
X-RCP	X-RCP	X-RCP	X-RCP
S-RCP	K-RCP	X-LCP	X-LCP
		S-RCP	K-RCP
		S-LCP	K-LCP

*KLCP capability exists, but cable not connected

**Either KLCP (switch 43 in B position) or monopulse (switch 43 in A position)

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

S76 Rev 178 Open-Loop Assignment

DSS Prdx Mode	Operator	Station	Open-loop Receiver	Channels	Subchannels	Bandwidths KHz
45 (2-way)	Gregory	rsops1	RSR1	RSR1A -> XRCP RSR1B -> SRCP	1, 2, 3, 4 1, 2, 3, 4	1, 16, 50, 100 1, 16, 50, 100
45 (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)
63 (3-way)	Gregory	rsops1	RSR1	RSR1A -> XRCP RSR1B -> SRCP	1, 2, 3, 4 1, 2, 3, 4	1, 16, 50, 100 1, 16, 50, 100
63 (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)
55 (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
55 (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)

S76 Rev 178 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 2 pm on Friday, January 4 (004/2200)

Predicts

- Uplink (ETX) predicts should compensate for Doppler shift due to Saturn's atmosphere
- NAV delivered an OD on 12/17
 - No more deliveries before the OCC
- RSS got the ETX file on 12/21
- RSS (Paul Schinder) applied the Doppler shifts to the ETX file, modified file was sent to the NOPEs on 12/26
- Elias and Danny completed the generation of the downlink predicts
- 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
 - 1-way coherent: 1-way predicts generated using PREDICTS and the Doppler file produced by Paul, with the following offsets applied in real-time
 - 1-way (no offset): In case the DST loses lock on the uplink

ORTs

Completed

ORT on DOY 358 (December 23) over DSS-45, X- and S-band

12 358 1745 1845 0400 0415 DSS-45 CAS TP RS177-OCCORT 5564 0624 1A1

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

Ongoing

ORT on DOY 362 (December 27) over DSS-34, X- and Ka-band

12 362 1600 1730 2230 2245 DSS-34 CAS RS177-OCCORT MC 5568 N750 1A1

Upcoming

ORT on DOY 364 (December 29) over DSS-34, X- and Ka-band

12 364 1600 1730 0230 0245 DSS-34 CAS RS177-OCCORT MC 5570 N750 1A1

ORT on DOY 366 (December 31) over DSS-63, X- and S-band

12 366 0230 0330 1230 1245 DSS-63 CAS TP RS178-OCCORT 5571 1639 1A1

ORT on DOY 002 (December 27) over DSS-55, X- and Ka-band

13 002 0130 0330 0645 0700 DSS-55 CAS RSORT MC ARRAY-R 5573 N650 1A1 A

13 002 0230 0330 1135 1150 DSS-65 CAS T/P ARRAY-S 5573 N006 1A1 A

- Array with DSS-65

ORT on DOY 003 (January 3) over DSS-55, X- and Ka-band

13 003 0200 0330 1010 1025 DSS-55 CAS RS178-ORT MC SEQ 5574 N750 1A1

13 003 0940 1040 1230 1245 DSS-26 CAS TKG PASS SEQ 5574 N003 1A1

- Short overlap with DSS-26

Misc

Uplink Strategy

- DSS-45, 18 kW
- RAMPED, no sweep
- Uplink timed to start ~20 minutes before the expected AOS

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

Plan for Cassini Specific 4th Order Pointing Models

- Important to have DSS-34 good pointing models since we can't utilize monopulse at egress
- Danny to send pointing data to David

NOPEs - Equipment Status?

SNT

- Enable X only at DSS-34 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