About the Occultation

- S78 Rev 189 Saturn atmospheric & rings occultations
  - Atmospheric ingress, rings egress
  - Telemetry OFF, Ranging OFF, 2-way/3-way mode
  - Covered by Canberra (uplink only) and Madrid (uplink and downlink)

- From Essam Marouf:

  Radio occultations on Cassini Rev 189 include an ingress atmospheric occultation of Saturn's southern polar region and an egress ring occultation that partially covers the ring system. Both occultations will be conducted in the 2-way mode. The ingress atmospheric occultation is the second of only two in the Cassini Solstice Mission that probe high southern latitudes (~71.6 degrees South, measured at the top of the troposphere). The egress ring occultation will be the first 2-way ring occultation in the Cassini mission conducted without locking the S/C transponder to the uplink signal over a free-space time period preceding the start on the ring occultation. Spacecraft transponder lock will have to be achieved over the dense Ring B mixed with the atmosphere, a challenging task. The ring opening angle is ~17.6 degrees, a range not probed neither in the Cassini Prime nor Equinox Mission.

  Measurements of the power, phase, and spectral broadening of three monochromatic downlink signals (Ka-, X-, and S-band) will provide high spatial resolution profile of the thermal structure of the neutral atmosphere, dispersive microwave absorptivity profiles of the neutral atmosphere, electron density profiles of the ionosphere, and profiles of probed ring radial structure and information about the structure physical properties. The profiles complement those from previous Cassini occultations, providing potential information about temporal and/or seasonal variability of the atmosphere, as well as variability of macro and micro structure of dense ring regions with ring longitude and opening angle, critical for characterization of ongoing dynamical processes.

DSN Antennas

- DSN Coverage

	Pre	BOT	EOT	Post					
13 130	1640	1740	1910	1925	DSS-45 CAS	RS189-RI/SA	OCC	5702 0624	1A1
13 130	1740	1840	0210	0225	DSS-63 CAS	RS189-RI/SA	OCC	5702 1639	1A1
13 130	1820	1950	0210	0225	DSS-55 CAS	RS189-RI/SA	OCC	5702 N750	1A1

- Canberra for partial uplink support only
- DSS-43 is down, so DSS-45 will be used instead for uplink

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

*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

S78 Rev 189 Open-Loop Assignment

DSS Prdx Mode	Operator	Station	Open-loop Receiver	Channels	Subchannels	Bandwidths KHz
63 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
63 1-way (3-way w 2)	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 (3-way w 2)	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)

* Start 3-way w/ 45, then switch to 1-way, and finally to 2-way

** Start 3-way w/ 45, then switch to 1-way, and finally to 3-way

- VSR is backup
- Danny – Check WVSR/VSR availability
- Aseel – VOCA
- Elias - Ops Room Displays
- RSSG will be in Ops Room at 9:15 am on Friday, May 10 (130/1615)

Predicts

- DSS-63 uplink (ETX) predicts should compensate for Doppler shift due to Saturn's atmosphere on both ingress and egress
- NAV delivered an OD on Wed, 5/1
  - No more deliveries before the OCC
- SPS provided DSS-63 ETX on Friday, 5/3
- RSS (Paul Schinder) applied the Doppler shifts to the ETX file, modified file was sent to the NOPEs on Sat, 5/4
- Elias is working on the generation of the downlink predicts
- Elias and Danny will do the usual predicts checks and comparisons
- 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 (unmodified) ETX
  - 1-way coherent:1-way predicts generated using PREDICTS and the Doppler file produced by Paul, offset in real-time to coherent downlink frequency
  - 1-way (no offset): For the times when the DST is no in lock on the uplink

ORTs

Completed

ORT on DOY 110 (April 20) over DSS-55, X- and Ka-band

13 110 1845 2015 0515 0530 DSS-55 CAS   RS187-OCCORT MC 5682 N750   1A1

- No improvement in power when monopulse was enabled (at 9.65 degrees elevation)
- Ka-band fluctuations
- DR N108789

ORT on DOY 124 (May 4) over DSS-55, X- and Ka-band

13 124 1745 1915 0245 0300 DSS-55 CAS   RS188-OCCORT MC 5696 N750   1A1

- 1.5 dB improvement in power when monopulse was enabled (at 10.2 degrees elevation)
- Ka-band fluctuations
- Monopulse disable, offsets cleared, then re-enabled. No improvement
- Station conducted short on-point phase cal. Reported that new and previous values were both good
- DR M107284

Gregory to send DOY 124 monopulse data to David (DOY 110 data already sent)

Misc

Uplink Strategy

- DSS-45, 18 kW, ramped, sweep
- DSS-63, 18 kW, ramped, sweep
- Uplink gap due to transmitter elevation limits
  - View periods file:
  - 13 130/18:53:26 TRX OFF LIM LOW 082 45
  - 13 130/19:01:30 TRX ON LIM LOW   082 63
  - Timeline:
  - DSS-45 transmitter off 130/18:53:15
  - DSS-63 transmitter on 130/19:02:00

Use RSS timeline - DKF and RSS timeline have the same uplink times this time, but other times may differ, and more details in RSS timeline
  - S-band on is 30 seconds later in RSS timeline – Checking why that is

Problematic DSS-55 Ka-band

- Was good during occultation on DOY 102. What was different?
- David Rochblatt is investigating
- Switching to DSS-54 not possible without impacting multiple projects

Misc cont'd

Plan for Cassini Specific 4th Order Pointing Models
-       Important to have DSS-55 good pointing models since we can't utilize monopulse at egress

NOPEs - Equipment Status?

Test uplink optimization during uplink period from DSS-45?

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