

About the Occultation

- S77 Rev 182 Saturn atmospheric occultation
 - Egress only
 - Telemetry OFF, Ranging OFF, 2-way/3-way mode
 - Covered by Goldstone and Canberra
- From Essam Marouf:

A 2-way egress atmospheric occultation of Saturn northern polar region is to be implemented on Cassini Rev 182. It captures a high northern latitude of ~64.7 degrees measured at the ~100 mbar level. This is the last is a set of 3 occultations selected to sample high northern Saturn latitudes, a region that was rarely accessible during the Cassini Prime and Equinox Missions. An uplink X-band signal from DSS-14 will provide the reference signal required to replace the one usually provided by the Cassini UltraStable Oscillator (USO). 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							
13 056	1110	1210	1655	1710	DSS-14	CAS	TP	RS182-SAOCC	5627	1647	1A1
13 056	1300	1430	1655	1710	DSS-25	CAS	TP	RS182-SAOCC	5627	N748	1A1
13 056	1300	1430	1825	1840	DSS-34	CAS	TP	RS182-SAOCC	5628	N750	1A1
13 056	1330	1430	1825	1840	DSS-45	CAS	TP	RS182-SAOCC	5628	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 supports

- 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-43	DSS-34**
X-RCP X-LCP	X-RCP X-LCP	X-RCP X-LCP	X-RCP
S-RCP S-LCP	X-RCP	S-RCP S-LCP	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 182 Open-Loop Assignment

DSS Prdx Mode	Operator	Station	Open-loop Receiver	Channels	Subchannels	Bandwidths KHz
14 (2-way)		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)		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)
45 (3-way)		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)		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)

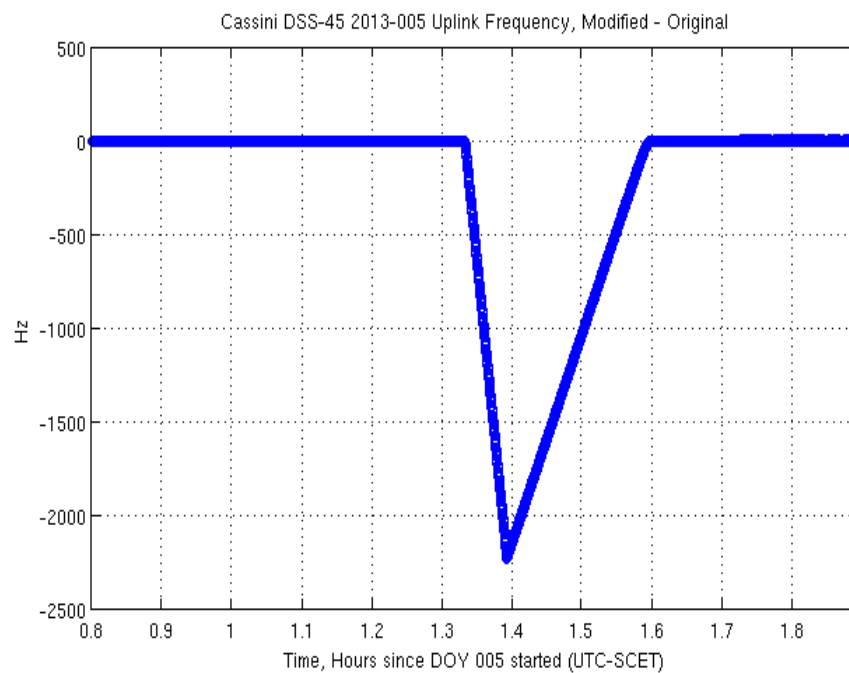
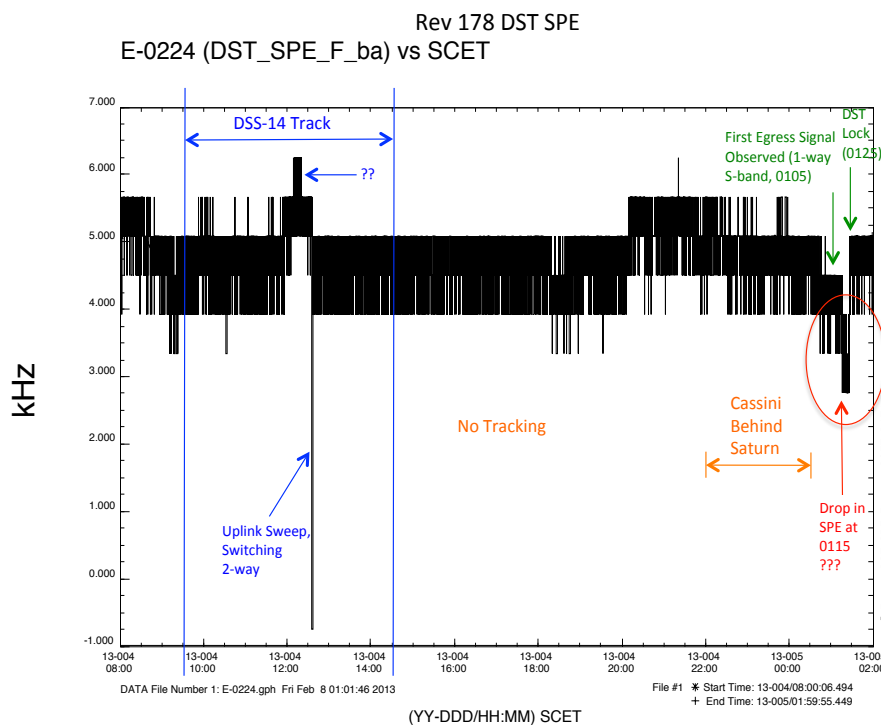
S77 Rev 182 Open-Loop Assignment Cont'd

- VSR is backup
- Danny – Check WVSR/VSR availability
- Aseel - VOCA
- Elias - Ops Room Displays
- RSSG will be in Ops Room at 3:00 am on Monday, February 25 (056/1100)
 - Possibly two shifts

Rev 178 Jan 5th Occ – Mystery Solved

- We finally understand why it took the 20 minutes for the DST to lock up on Jan 5th!
- As with previous atmospheric occultation, RSS modified the DSN's uplink predicts to compensate for Saturn's atmosphere
- Due to a coding error, the modifications for Rev 178 started late

First 1-way signal	005/0105
Drop in SPE	005/0115
Start atmospheric modifications	005/0124
DST Lock up, Switch to 2-way/3-way	005/0125



Rev 182 Uplink Strategy

- Before understanding what happened with Rev 178, RSS team was considering doing an uplink sweep at egress to avoid/minimize DST delay in locking up
 - Maybe +/- 3 KHz
 - However,
 - Impact to egress data
 - Introduces new risks
- Now that we know what happened, RSS wants to continue with the same uplink strategy that was used during the previous three egress atmospheric occultations and not sweep the uplink
- The RSS code was fixed
- **Rev 182 Uplink strategy: 18 kW, ramped, no sweep**
- Note: Last coherent tracking prior to experiment ends at 056/0835 ERT
 - ! 082 63 16150 056 070416 TRK D63 TXR OFF, LOW, X
 - ! 082 63 16189 056 083500 TRK D63 EOT
- Egress expected ~056/1519 ERT
 - ~7 hrs between with no coherent tracking before occ

Predicts

- Uplink (ETX) predicts should compensate for Doppler shift due to Saturn's atmosphere
- NAV will deliver the final OD on Wednesday, 2/20, 3 pm PST
- RSS (Paul Schinder) will apply the Doppler shifts to the ETX file, and expects to send the modified file to the NOPEs on Thursday morning
- Elias and Danny will generate the downlink predicts on Thursday and will do RSS and DSN predicts comparisons
 - **Include comparing RSS modified predicts with SPS unmodified predicts, and comparing against Essam's timeline to ensure that the modifications start at the right time**
- 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

ORTs

Upcoming

ORT on DOY 053 (February 22) over DSS-25 and DSS-34, X- and Ka-band

13 053 0615 0745 1645 1700 DSS-25 CAS RS182-OCCORT MC 5624 N748 1A1

13 053 1105 1235 1645 1700 DSS-34 CAS RS182-OCCORT MC 5625 N750 1A1

ORT on DOY 054 (February 23) over DSS-25 and DSS-34, X- and Ka-band

13 054 0615 0745 1645 1700 DSS-25 CAS RS182-OCCORT MC 5625 N748 1A1

13 054 0645 0745 1630 1645 DSS-14 CAS TKG PASS 5625 N003 1A1

13 054 1100 1230 1645 1700 DSS-34 CAS RS182-OCCORT MC 5626 N750 1A1

Note:

ORT on DOY 051 (February 20) over DSS-55, X- and Ka-band

13 051 2245 0015 0650 0705 DSS-55 CAS RS182-GRVORT MC 5623 N750 1A1

Is a gravity ORT in preparation for Rhea gravity on DOY 068 (March 9)

Misc

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 for DSS-25 and DSS-34 to have good pointing models since we can't utilize monopulse at egress
 - Most of egress experiment will be done in blind pointing
 - Enable monopulse at end to check pointing
 - Timeline has DSS-25 enable monopulse at 056/1653 ERT
 - Elevation angle is 6.55 degrees, so monopulse may not work properly
- Update on DSS-34 pointing problem?
- DSS-25 pointing model?
- Danny to send pointing data to David (also from T89 gravity)

NOPEs - Equipment Status? (DSS-14, DSS-25, DSS-45, DSS-34)

SNT

- Enable X only at DSS-25 and DSS-34 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