

# About the Occultation

- S79 Rev 193 Saturn rings occultation on DOY 175 (June 24, June 23-24 PDT)
  - Chord rings occultation
  - Telemetry OFF, Ranging OFF, **2-way/3-way mode**
  - Covered by Goldstone (uplink and partial downlink) and Canberra (downlink, and uplink for following telemetry support)
- From Essam Marouf:

The Rev 193 rings radio occultation is the first of two sisters chord ring occultations that capture full Rings A and B, and partially Ring C. The other sister occultation is on Rev 194. In both cases, the ring opening angle is nearly equal ( $B = 17.1$  degrees). The similar chord occultation geometry for the two occultations allow separation and characterization of two distinct types of ring optical depth profile longitudinal asymmetry. The first is "real" (dynamical) and is primarily due to resonant interactions with Saturn's external and ring-embedded satellites. The second is "virtual" and is primarily due to the different geometry of observing cylindrical-like structures known to exist across most of Rings A and B (gravitational wakes). The wakes act like a 'venetian-blind' causing signal attenuation that strongly depends on the orientation of the observation line-of sight relative to the orientation of the cylindrical structure, which is different for the ingress and egress segments of the chord. Observed optical depth differences between the Revs 193 and 194 chords will be dominated by the true dynamical asymmetries since Saturn satellites will be at different locations at the two different epochs of the occultations. This facilitates separation of the 'virtual' optical depth profile asymmetry using the differences in the profiles observed over the ingress and egress segments of each chord. Revs 193 and 194 provide one of the rare opportunities in the Cassini tour where measurements over nearly identical longitudes and ring opening angle are captured over full Rings A and B, facilitating the separation above. The two occultations will be add to others already completed to help characterize both the macro and micro structure of the rings and the physical properties of such structure. The observations are conducted in the 2-way configuration with the reference X-band uplink signal provided by DSS-14 and the three downlink signals (S/X/Ka-band) observed at DSS-43 and DSS-34, and partially also at DSS-14.

# DSN Antennas

- DSN Coverage

	Pre	BOT	EOT	Post								
13	175	0130	0230	0850	0905	DSS-14	CAS	TP	RS193-RIOCC	5746	1647	1A1
13	175	0320	0450	1330	1345	DSS-34	CAS	TP	RS193-RIOCC	5747	N750	1A1
13	175	0350	0450	1230	1245	DSS-43	CAS	TP	RS193-RIOCC	5747	1647	1A1

- DSS-14 will provide uplink throughout for the occultation. DSS-34 uplink for following telemetry support

- 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-43	DSS-34*
X-RCP X-LCP	X-RCP X-LCP	X-RCP
S-RCP S-LCP	S-RCP S-LCP	K-RCP

\*KLCP capability exists, but cable not connected

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

# S79 Rev 193 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 (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)
43 3-way/14*	?	rsops2	RSR1	RSR1A -> XRCP RSR1B -> SRCP	1, 2, 3, 4 1, 2, 3, 4	1, 16, 50, 100 1, 16, 50, 100
43 1-way (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/14*	?	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 (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)

\* Start 1-way

\*\* If rsops5 is ready, then maybe Elias

# S79 Rev 193 Open-Loop Assignment Cont'd

- Danny – Check WVSR/VSR availability
- Aseel - VOCA
- Elias - Ops Room Displays
- RSSG will be in Ops Room at 6:15 pm on Sunday, June 23 (175/0115)  
Likely 2 shifts  
New RSS Engineering Team person: Dustin Buccino

# Predicts

- No need to modify the uplink predicts (ETX) since no atmospheric occultations are included
- NAV's last OD delivery prior to the occultation was delivered last week
- When can SPS provide ETX?
- Elias and Danny will generate of the downlink predicts and do the usual predicts checks and comparisons
- RSS usually uses three sets of downlink predicts in the open-loop receivers:
  - #1: Coherent (no atmospheric compensation this time): generated using Nicole's PREDICTs software and SPS nominal (unmodified) ETX
  - #2: 1-way coherent: 1-way predicts generated using PREDICTS (no Doppler file from Paul this time), offset in real-time to coherent downlink frequency
  - #3: 1-way (no offset): For the times when the DST is no in lock on the uplink
  - Essam – Is there a need to acquire set #2?
    - There was one time when there was a problem with #1 WVSR recording and set #2 provided backup. Danny, do you remember more details?
    - Option to record as backup, and no playback if #1 is nominal

# ORTs

## Completed

ORT on DOY 160 (June 9, 8-9 PDT) over DSS-34, X- and Ka-band

13 160 0500 0630 1530 1545 DSS-34 CAS RS192-OCCORT MC 5732 N750 1A1

- Verified X- and Ka-band signals
- Acquired pointing (monopulse) data
- All nominal

## Upcoming

ORT on DOY 170 (June 19, 18-19 PDT) over DSS-43, X- and S-band

13 170 0340 0440 0830 0845 DSS-43 CAS TP RS192-OCCORT 5742 1647 1A1

Shadows DSS-14 track

13 169 2230 2330 0500 0515 DSS-14 CAS TP RS192-OCCORT 5741 1647 1A1

- Verify X- and S-band signals

Gregory/Dustin already sent DOY 160 monopulse data to David, and will also send data from the DSS-34 GSE the day before the experiment:

GSE on DOY 174 (June 23, 22-23 PDT) over DSS-34, X- and Ka-band

13 174 0415 0545 1445 1500 DSS-34 CAS TP RS193-GSE 5746 N750 1A1

# Misc

## Uplink Strategy

- DSS-14, 18 kW, ramped, sweep
- The experiment is followed by telemetry support over Canberra. Have to switch the uplink to DSS-34 to keep tracking mode plan after occultation per DKF
- DKF has:

```
! 082 14 08764 175 050000 D14 U/L TRANSFER, FROM 14, TO 34, 18.0KW/LOW, X
```

which we will not do. Instead, DSS-14 should provide the uplink until 075000 and then DSS-34 can start the uplink at 075852 (for short exit 1-way baseline). However, DKF shows DSS-34 stopping the uplink and then starting again ~2hr18min:

```
! 082 34 08950 175 105257 TRK D34 TXR OFF, LOW, X
```

```
! 082 34 08965 175 131056 TRK D34 ACQ U/L, X/CH. 25, 18.0KW/LOW, COH
```

```
! 082 34 08975 175 132500 TRK D34 TXR OFF, LOW, X
```

As a result, following DSS-54 starts in 3-way mode:

```
! 082 54 09120 175 154505 TRK D54 ACQ D/L, 3W/34/ , X/CH. 25
```

```
! 082 54 09121 175 154505 TRK D54 ACQ D/L, 3W/34/CAR, K/CH. 25
```

And switches to 1-way ~14 minutes later:

```
! 082 54 09133 175 155910 TRK D54 ACQ D/L, 1W// , X/CH. 23
```

```
! 082 54 09134 175 155910 TRK D54 ACQ D/L, 1W//CAR, K/CH. 23
```

Is all that needed?

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

# Misc Cont'd

Plan for DSS-34 Cassini Specific 4th Order Pointing Model?

- During previous occultation support (DOY 151, Rev 191): small offsets during 1<sup>st</sup> half of the support, larger offsets later. Due to weather?
- Important for DSS-34 to have good pointing model since we can't utilize monopulse throughout

Reminder that DSS-34 has new controller (Monopulse will not be disabled automatically when the receivers go out of lock)

- Pointing/monopulse strategy to take this into consideration

NOPEs - Equipment Status?

- DSS-43 Dichroic plate?

SNT

- Enable X only at DSS-34 throughout
- Conduct SNT measurements