About the T46 Titan Occ & Bistat

- S45 Rev93 T46 Titan Occultation and Bistatic Experiment
  - Telemetry OFF, 1-way mode
  - First Titan Occ & Bistatic in Extended Mission
  - Covered by Goldstone, Canberra and Narrabri

- About the science – From Essam Marouf

  The T46 Radio Science observations of Titan include ionospheric/atmospheric occultations and bistatic surface scattering on both the ingress and egress sides. The observations are the first during the two years period of the Cassini Equinox Mission. The ingress occultation probes mid-southern latitude (~33 deg. South). The egress atmospheric occultation will be the first to probe the mid northern-latitude of Titan (~33 deg. North). Combined with results from eight other latitudes probed during the Cassini prime mission, the occultations will shed more light on latitudinal variability of the electron density profile of the ionosphere, temperature/pressure profile, microwave absorption profile, and small scale-structure of the neutral atmosphere (gravity waves and turbulence).

  In addition, bistatic surface scattering will be observed at low southern latitude on the ingress side (24-31 deg. South, ~90-115 deg. West) and low northern latitude on the egress side (25-30 deg. North, ~200-220 deg. West). The incidence angle for both sides is close to the Brewster angle range for likely surface compositions. Same- and cross-polarized components of mirror-like surface echoes observed at the ground receiving stations, if detectable, provide valuable information about the dielectric constant and physical state of the surface region probed.

Antennas Supporting T46

Yr	DOY	Pre-	BOT	EOT	Post-	DSS		
08	308	1300	1600	2115	2215	DSS-25 CAS	RS T46 OCC/BSTAT 4048 N748 1A1	
08	308	1300	1600	2115	2215	DSS-26 CAS	RS T46 OCC/BSTAT 4048 N750 1A1	
08	308	1315	1615	2115	2215	DSS-14 CAS	RS T46 OCC/BSTAT 4048 1639 1A1	
08	308	1430	1730	2115	2215	DSS-43 CAS	RS T46 OCC/BSTAT 4049 1639 1A1	
08	308	1440	1740	2115	2215	DSS-34 CAS	RS T46 OCC/BSTAT 4049 N750 1A1	
08	308	1700	1730	2030	2100	DSS-47		

Equipment Scheduled

- Two close-loop receivers per antenna
- All RSRs, VSRs and WVSRs
  - Plan on operating 17 total
- Open-loop data are prime. Closed-loop are backup

RSR/VSR/WVSR Assignment

DSS	Operator	Station	Open-loop Receiver	RSR Assignment
14	Elias	rsops2	RSR2 & RSR3	RSR2A -> XRCP RSR2B -> XLCP RSR3A -> SRCP RSR3B -> SLCP
25	Don	PC through rsops2	RSR1	RSR1A -> XRCP RSR1B -> KRCP
26	John	rsops3	WVSR1 & VSR1	WVSR1A -> XRCP WVSR1B -> XLCP VSR1A -> KRCP VSR1B -> KLCP
43	Danny	rsops1	WVSR1 & WVSR2	WVSR1A -> XRCP WVSR1B -> XLCP WVSR2A -> SRCP WVSR1B -> SLCP
34	Danny	rsops1	RSR1	RSR1A -> XRCP RSR1B -> KRCP
47	Don	PC thought rsops2	RSR2	RSR2A -> KRCP

-WVSR2 at Goldstone available as backup
-RSSG will be in Ops room at 4 am on Monday 11/3 (DOY 308/1200)

Bistatic Calibrations

- Calibrations will be performed during
  - Pre-cal (antennas at stow)
    - 3-hr pre-cal periods are scheduled
  - Observation (mini-cals)
    - Pre-determined and carefully selected times (during turns or while in occultation)
  - SNT Measurements
  - Post-Cal (antennas at stow)
    - 1-hr post-cal preriods are scheduled
    - Will likely start shortly after observation is over and before post-cal
- Pre-cal calibrations are the longest

ORTs

ORT#1: DOY 297 (Thu, Oct 23) over DSS-26 and DSS-25, X- and Ka-band:

08 297 1045 1215 2115 2130 DSS-25 CAS   TP RSR90-RIKDWN1 4037 N748 1A1

08 297 1100 1230 2115 2130 DSS-26 CAS   TP RSR90-RIKDWN1 4037 N750 1A1

- DSS-26 prime
- Collected pointing data (monopulse) to update the 4th order pointing model

ORT#2: DOY 299 (Sat, Oct 25) over DSS-26, DSS-14, DSS-43 and DSS-34, X-, S, and Ka-band:

08 299 1045 1215 2115 2315 DSS-26 CAS   TP RSR90-RIKDWN2 4039 N750 1A1

08 299 1115 1215 2115 2315 DSS-14 CAS   TP RSR90-OCCORT3 4039 1639 1A1

08 299 1645 1815 2115 2315 DSS-34 CAS   RS RTS ENG DEMO   4040 N750 2C3

08 299 1705 1805 2115 2315 DSS-43 CAS   TP RSR90-OCCORT3 4040 1639 1A1

- SPS predicts problems
- DSS-26 oscillations problems
- Collected pointing data (monopulse) at DSS-26 and DSS-34
- DSS-26 high monpulse offsets – Degraded pointing model
- Practiced bistatic calibrations at all four stations during post-cal

DSS-26 DOY 299 Ka-band Oscillations
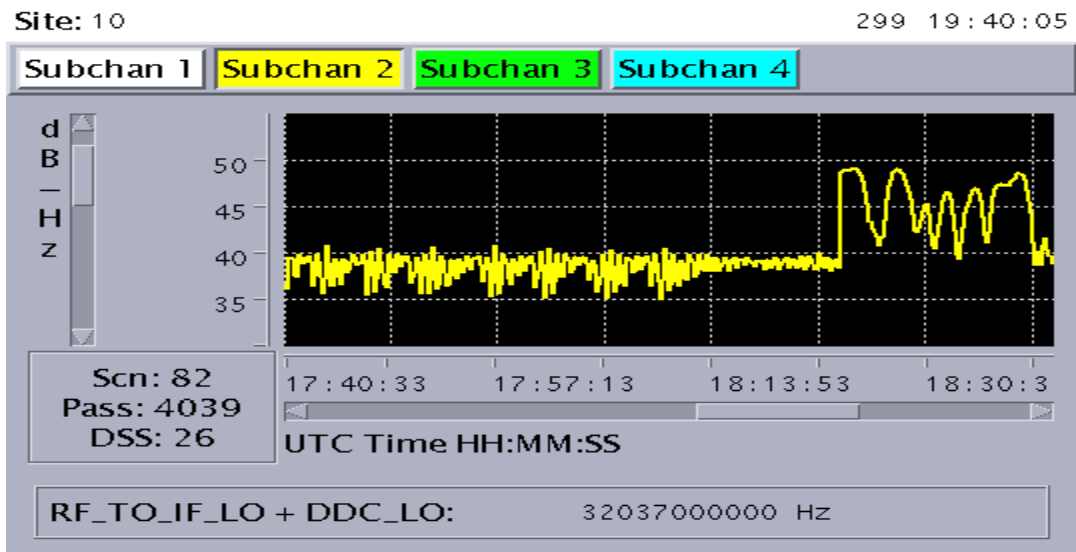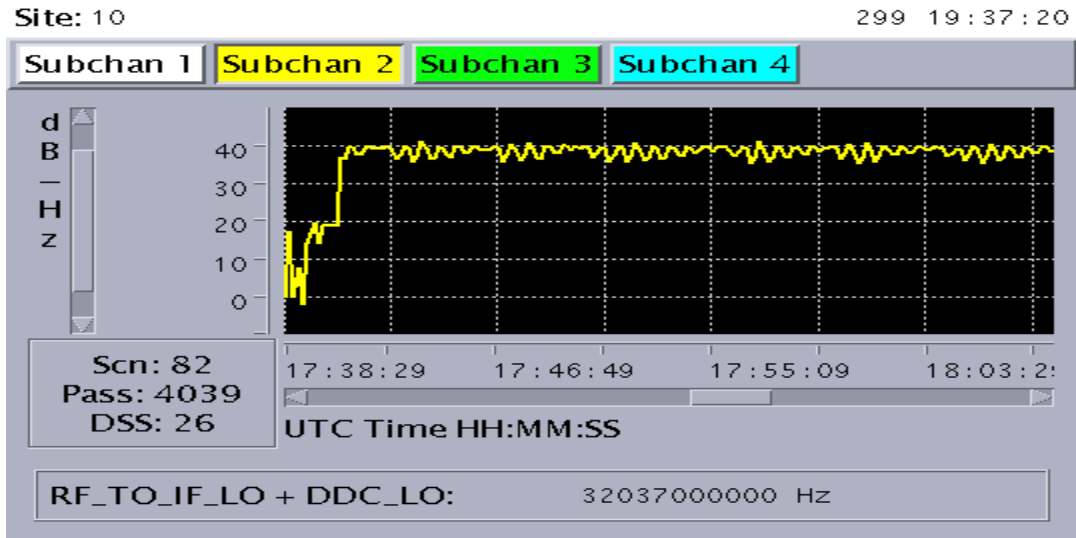
ORTs continued

ORT#3: DOY 302 (Mon, Oct 28) over DSS-25 and DSS-34, X- and Ka-band:
08 302 1030 1200 2100 2300 DSS-25 CAS   TP RSR91-USO/ORT 4042 N748 1A1
08 302 1100 1200 1500 1515 DSS-14 CAS   TP RSR91-USOPIM1 4042 N71E 1A1
08 302 1635 1805 2100 2300 DSS-34 CAS   TP RSR91-OCCORT1 4043 N61G 1A1
- DSS-25 prime. DSS-14 for USO
- Collected pointing data (monopulse) at DSS-25 and DSS-34
- DSS-25 7 dB jump in power when monopulse enabled. Degraded pointing model!
- Practiced bistatic calibrations at all four stations during post-cal
  – DSS-34 confusion about ambient load temperature reading. Was trying to ready SNT values. Jack corrected

ORT#4: DOY 306 (Sat, Nov 1) over DSS-25 and DSS-34, X- and Ka-band (also GSEs):
08 306 1015 1145 2045 2100 DSS-25 CAS   TP RSR91-ENKDWN1 4046 N748 1A1
08 306 1045 1145 2045 2100 DSS-14 CAS   T/P MEA OPEN   4046 N103 1A1
08 306 1650 1750 2045 2100 DSS-34 CAS   TP RSR91-ORT D/L   4047 N71D 1A1
- DSS-14 prime
- DSS-25 and DSS-34 to collect more pointing data

GSE: DOY 307 (Sun, Nov 2) over DSS-26, X- and Ka-band:
08 307 1015 1145 2045 2100 DSS-26 CAS   TP RSR91-TIKDWN1 4047 N750 1A1
08 307 1045 1145 2045 2100 DSS-14 CAS   TKG PASS   4047 N003 1A1
- DSS-14 prime
- Check for oscillations at DSS-26
- Can use DSS-26 to test pointing model or acquire more pointing data
- DSN request on-point phase cal during 1-way and 3-way periods

ORTs continued

Comments about bistatic calibrations:

- Overall, stations followed procedures very well
- Mini-cals completed within allocated time (less than 8 minutes)
- Confusion about ambient load temperature reading
- Slight XM interference at Goldstone?

Misc

- Plans to update 4th order pointing models at DSS-25, -26 and -34

- Don't expect closed-loop receivers to be in lock during bistatic part

- Aseel checking with Narrabri about doing SNT measurements (don't have to report values in real-time)

- Ask DSS-34 to acquire signal a few minutes before BOT (above 6 degrees in elevation)

- DSS-47 will have 5 antennas supporting. One antenna will in weekly maintenance

- Make it clear to stations not to enable or disable monouplse, clear or unclear offsets without direction from the RSS team