



2002 Space Ops Conference

Developing a Cross-Project Support System During Mission Operations: Deep Space 1 Extended Mission Flight Control

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DS1

- Testing New Technology
- Science Mission
- Small Team
- Multi-Mission Teams
 - S/C Teams
 - Flight Control



Flight Control Team

- Cross-Project Dedicated Aces VS Multi-Mission Support
 - Number of S/C Tracked at one Time
 - Where the tracks were run from
 - Track Complexity
- Galileo and Cassini
- Aces-Turned-Managers



Tracking Schedules

- Comparing across Projects
- DS1 track configuration
- Choosing dedicated Aces vs. multi-mission Aces

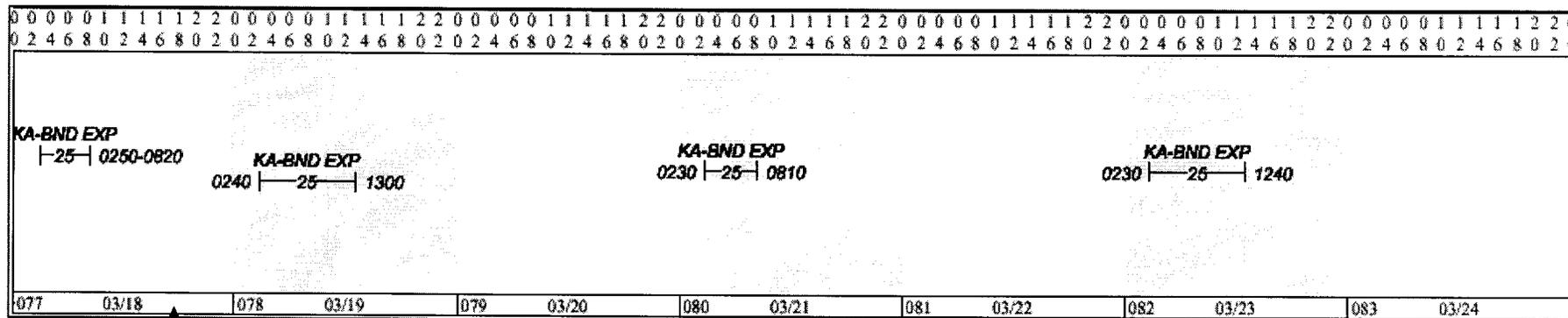
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Space Ops

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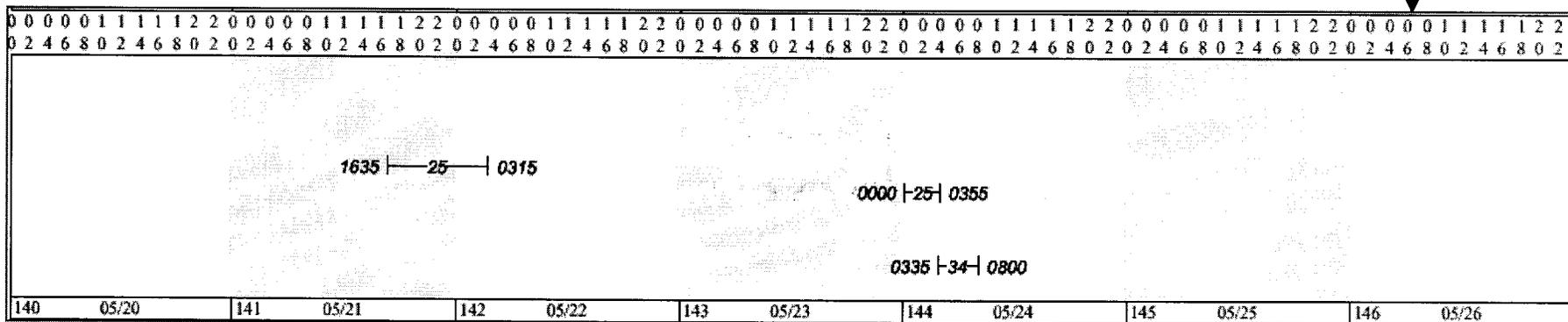
Tracking Schedules (cont.)



DS1

DSN Tracking Schedules

Cassini





Spacecraft Team Interactions

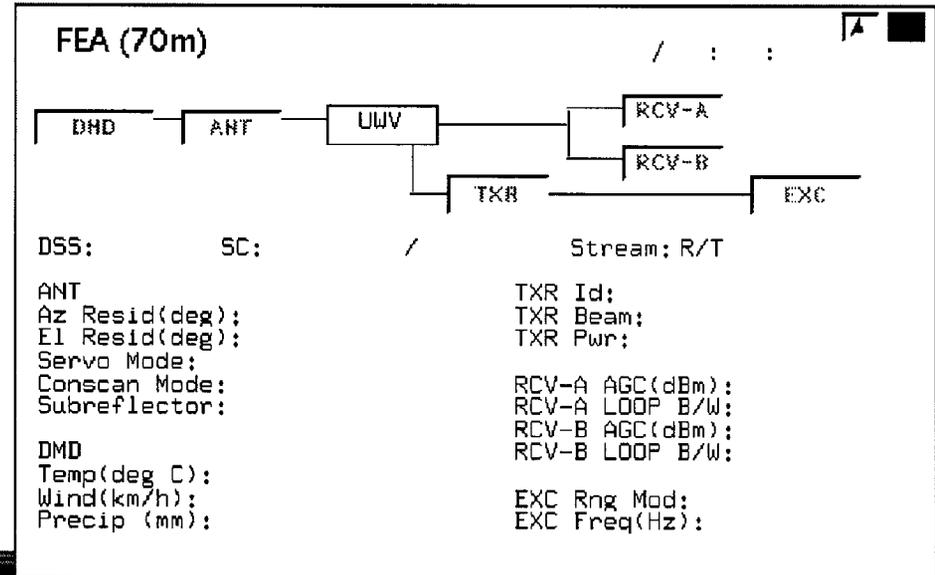
- Questions About the Track:
- The Answers:
 - Meetings
 - Discussing the tracks with the Flight Director on duty for the track.

- *What is the amount of commanding?*
- *What mode will the spacecraft be in during the track?*
- *Are any unusual occurrences/anomalies expected?*
- *Are there any spacecraft activities for the pass?*
- *What is the amount of interaction the spacecraft team wants with the Ace?*



FCT Tools

- VOCA
- NOCC RT →
- DMD
 - DSN Monitor
 - S/C Engineering



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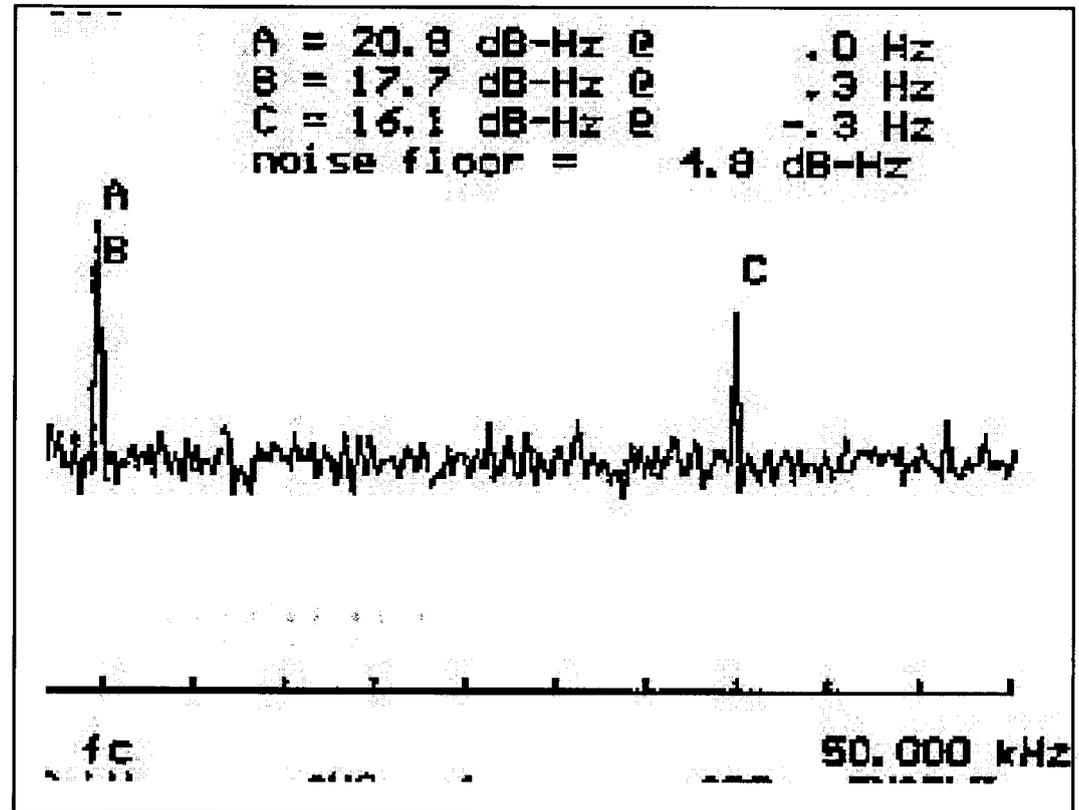
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FRT=00:00:00 F#0 M#0 D#0 D#0
SAH 0 QOC 0 PCS 0 EPS C CE 0
SIM 0 MON 0 TCS 0 RFS C VER 0
IKS 0 CBH 0 FSU 0 INK C UPL 0
CTA 0 MIPB 0 UEA 0 HDR C DNL 0
IRAC 0
  
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DSN Configuration

- New Technology
 - Ka Band Telemetry
 - Beacon Tone
- Difficulties for the Ace vs. Difficulties for the Station
- Documentation as a Solution

FFT Display





Transmitting Pass Information

- Ace Binder
 - Pre-Pass Briefings
 - Track Information
 - Command Logs
 - Special Instructions
 - FCT Procedures/NOP

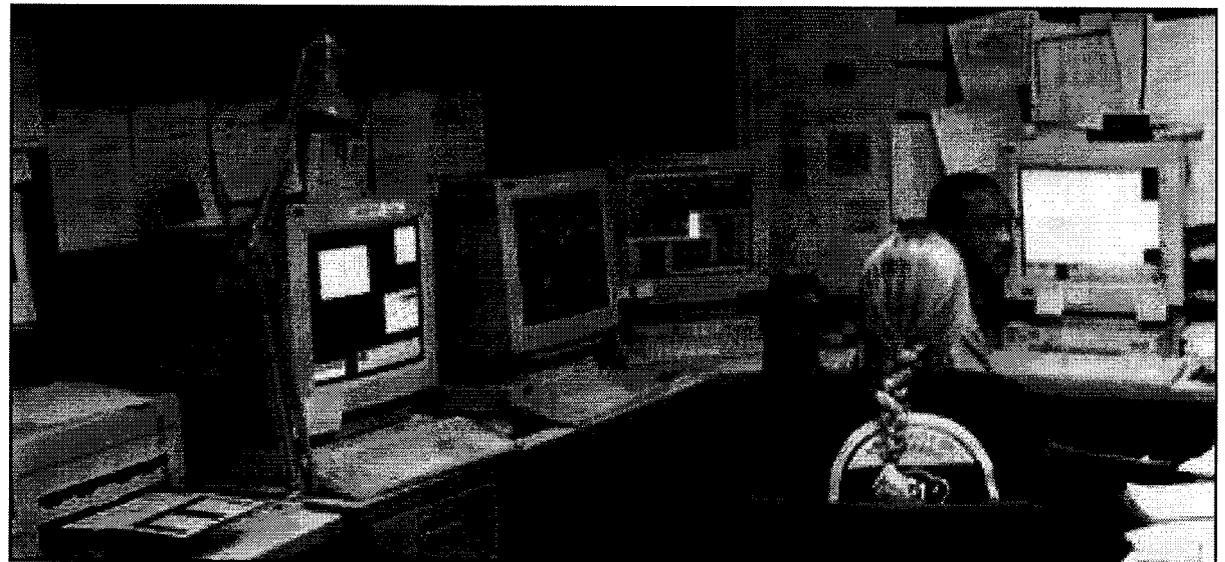
- Personal Contact
 - General passes
 - Difficult Passes

DS1 FCT PRE-PASS BRIEFING SHEET – TONE PASS			
General Spacecraft Health and Status:			DOY:
DSS-	BOA:	EOA:	
Downlink			
○ BOT is at _____ UTC and EOT is at _____ UTC			
○ Please Use BVR Table: _____			
○ Tone comes on at _____ UTC and ends at _____ UTC			
○ Spacecraft Antenna: <u>HGA</u> <u>+X LGA</u> <u>-Z LGA</u>			
○ the Downlink is <u>X-Band</u> , <u>Ka-Band</u> , the Polarization is <u>RCP</u> <u>LCP</u> , and Coding is <u>K=7 Rate= 1/2</u> <u>K=15 Rate= 1/6</u>			
○ The expected subcarrier is 35 KHz, but it may be 20 KHz			
○ Is the DSN set up to send a fax or an email of the FFT plots? (The fax and email info is also in the DKF.)			
(818-393-0530) Email (F.H.Taylor@jpl.nasa.gov)			
○ For FCT Information only (or if requested by DSN): (Mod Index = 45 Degrees)			



MSA Operability

- DS1 and DS1 workstation with Galileo
- Logins
 - AAN
 - ACT
- Commanding
- Workstations



DS1 Media Album

Photo credit: Ben Toyoshima, *DS1 Media Album*



Did It Work?

- A “flawless” encounter.
- No major anomalies caused by Aces
 - Few commanding Errors –
Timing
 - S/C anomalies were addressed
quickly



Planning in the Future

- DS1's decision to use cross-project support was worked out during the mission.
- In the Future
 - Training the Aces
 - Early participation in Spacecraft/Payload Testbed Activities
 - Increased Testing/Interaction with Flight/Ground System Integration and Testing
 - Electronic Documentation