

# SN Beams Display Tool

# Launch Acquisition Data

- During a launch, the FDF supplies acquisition data to WSC, based on vectors derived from the nominal launch trajectory.
- WSC then commands the TDRS antennas to point to the orbiter, and then transmits Tracking Data Messages (TDMs) to the FDF that indicate . . .
  - Where the TDRS antennas are pointing (for TDRS-8,9, and 10)
  - Where the TDRS antennas have been commanded to point (for TDRS-1 through 7)

# Launch Acquisition Data

- Challenges:
  - Involves software at the FDF, WSC, and on board the TDRS.
  - The software and algorithms can differ depending on which TDRS is supporting the event.
  - Communication links between the FDF, WSC, TDRS.
- Problems/discrepancies at any step could result in an off-pointing TDRS.

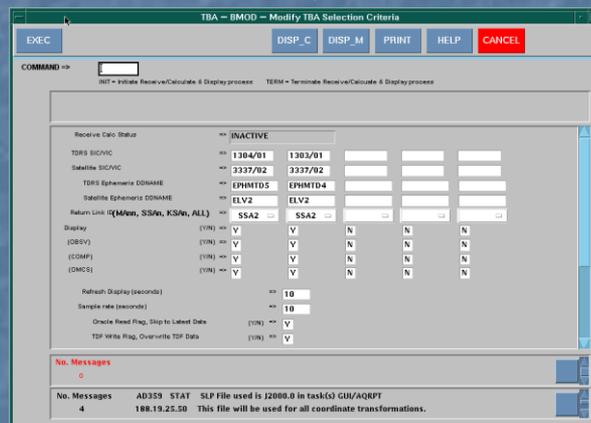
# Tracking Data Monitoring

- Traditionally, the TDMs have been monitored in the FDF with a text display, known as the TDRS Beam Angle (TBA) display.
  - Monitors the difference between the *computed* angles and the *observed* angles of the TDRS.
    - Computed: based on the nominal ephemeris, shows the angle of the antenna if it were pointing at the ideal trajectory.
    - Observed: based on the tracking data messages, shows exactly where the TDRS is pointing (or where it has been commanded to point).

TDRSS Ephemerides

Tracking Data Messages (TDMs)

Spacecraft Ephemerides



TDRS BEAM ANGLES		134/19:27:22	
SAT NAME	ATLAS V	ATLAS V	
SIC/VIC	3332/02	3332/02	
TDRS NAME	TDRS-7	TDRS-5	
SIC/VIC	1306/01	1304/01	
MODE	TWO-WAY	TWO-WAY	
RETURN LINK	SSA2	SSA2	
ORIENT/BEAM	VAL/VAL	VAL/VAL	
TIME	134/19:12:50	134/19:27:06	
AZIMUTH (C)	3.1369	-2.4947	
ELEVATION (C)	-5.1042	-6.1802	
AZIMUTH (O)	3.1423	-2.4879	
ELEVATION (O)	-5.1022	-6.1730	
AZIMUTH (O-C)	.0054	.0068	
ELEVATION (O-C)	.0020	.0072	
SPATIAL BEAM (O-C)	.0057	.0099	
YAW (O)	.3323	.3268	
ROLL (O)	.0357	359.9918	
PITCH (O)	359.9753	.0027	

Observed Angles  
(from TDMs)

Computed Angles  
(from Ephem)

O-C Beam Angles

Spatial Beam Angles

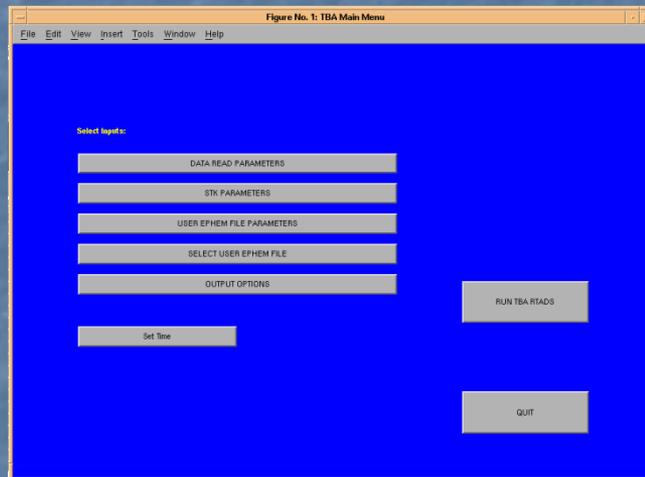
# SN Beams Display

- The SN Beams display presents a graphical representation of the observed and computed angles.
  - Computed angles are displayed as a green beam.
  - Observed angles, from the actual TDMs, are displayed as a white beam.
- Provides a quick display of . . . .
  - Where the TDRS is pointing.
  - Where the TDRS *should* be pointing.
  - How close the orbiter is to the edge of the 3-dB beam width.
  - The general geometry of the situation.

TDRSS Ephemerides

Tracking Data Messages (TDMs)

Spacecraft Ephemerides

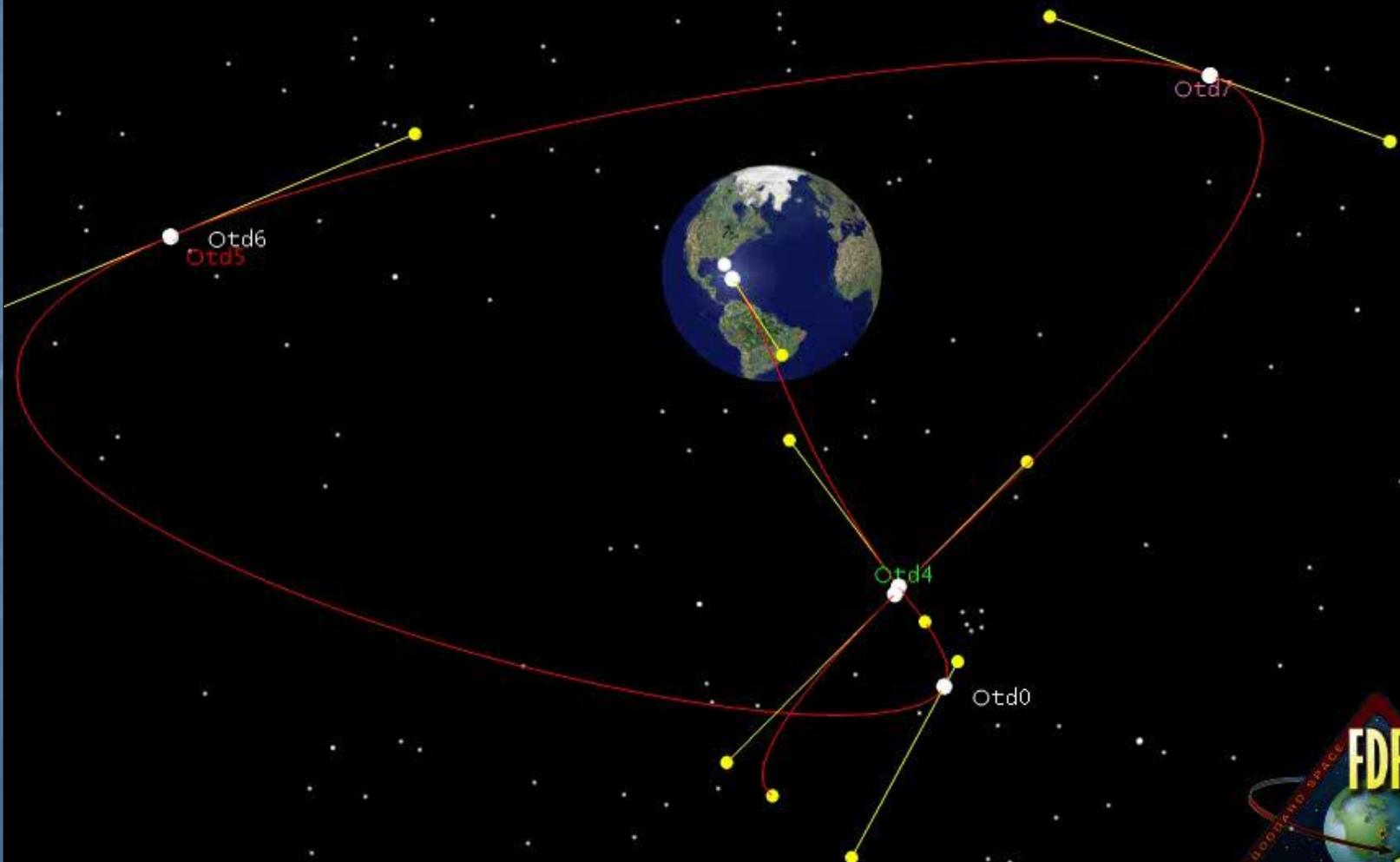


Satellite Tool Kit (STK)



FLIGHT ** TBA Display ** DYNAMICS					
UTC	20100708.134018000	Period	10	Record Number	69210
Return	TDRS-5	Tracking	ISS	8000/ 1	
Service	One-way	KuBand	SA link 2	freq 2	
TDRS Att(YRP)	359.981	0.036	359.997	Valid	
Beam angles	Observed	Calculated	0-C	Valid	
Azimuth	-3.776	-3.777	0.001		
Elevation	1.424	1.426	-0.001		
Ang. Sep.	0.002				
Doppler/Range	Valid	Invalid			
	Receiving data				

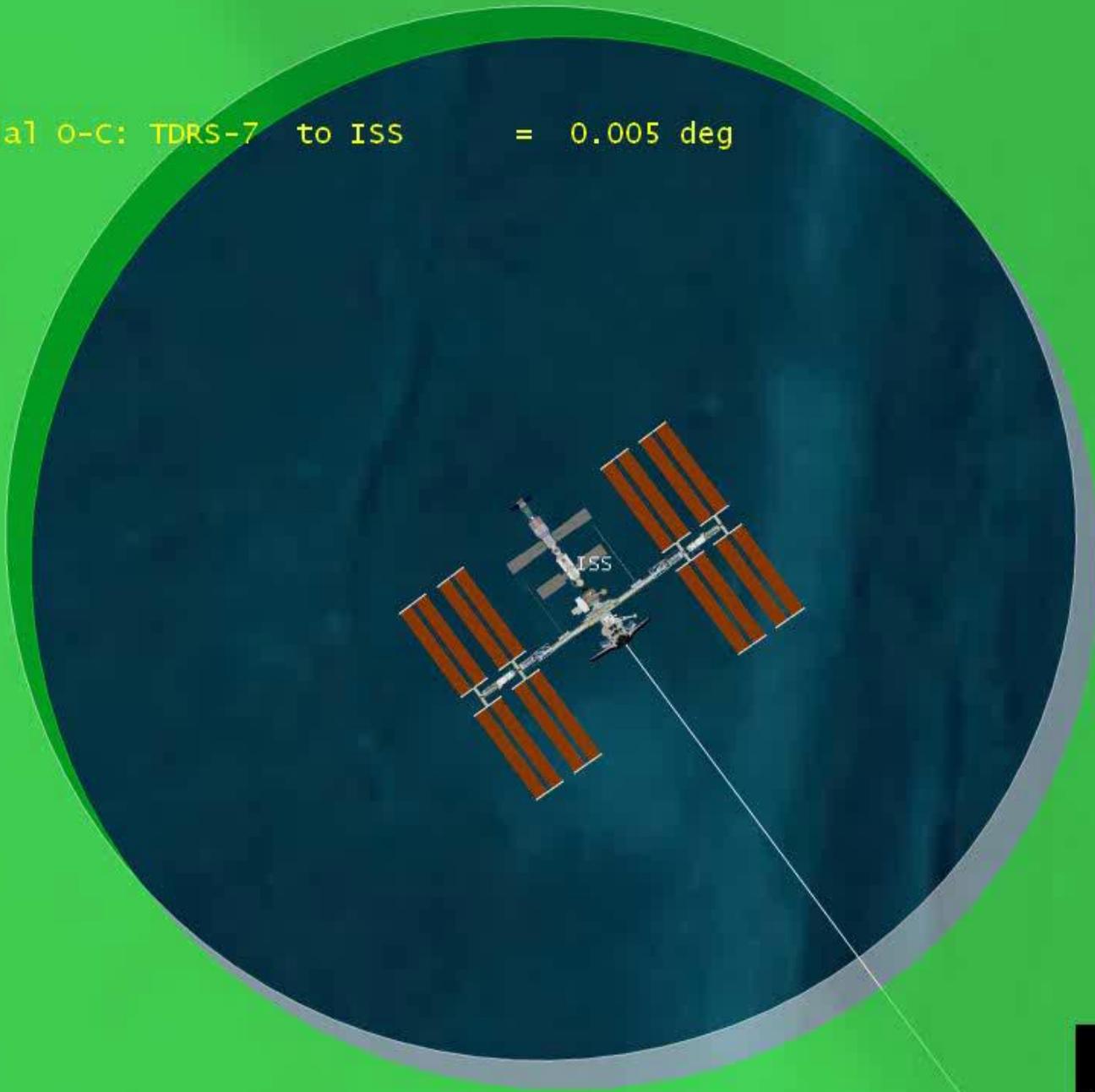
Spatial o-c: TDRS-4 to STS = 0.006 deg



14 May 2010 18:19:00.001 Time Step: 1.00 sec



Spatial O-C: TDRS-7 to ISS = 0.005 deg



# Questions - Comments

?

# Acronyms

■	ADG	Acquisition Data Generator	■	NIC	Network Integration Center
■	AFSCN	Air Force Satellite Control Network	■	NOM	Network Operations Manager
■	AOA	abort once around	■	OD	orbit determination
■	ATO	abort to orbit	■	OMS	Orbital Maneuvering System
■	DoD	Department of Defense	■	PAO	Public Affairs Office
■	ECAL	East Coast abort landing	■	PMR	Pacific Missile Range
■	EMCC	Emergency Mission Control Center	■	RTLS	return to launch site
■	ER	Eastern Range	■	SLF	Shuttle Landing Facility
■	ERBS	Earth Radiation Budget Satellite	■	SMM	STDN Mission Manager
■	EUVE	Extreme Ultra-Violet Explorer	■	SN	Space Network
■	FDF	Flight Dynamics Facility	■	STDN	Spaceflight Tracking and Data Network
■	FDO	Flight Dynamics Officer	■	STGT	Second TDRSS Ground Terminal
■	GN	Ground Network	■	STS	Space Transportation System
■	GTDS	Goddard Trajectory Determination System	■	TAL	transoceanic abort landing
■	HST	Hubble Space Telescope	■	TBA	TDRS Beam Angle
■	JSC	Johnson Space Center	■	TDRS	Tracking and Data Relay Satellite
■	KSC	Kennedy Space Center	■	TDRSS	Tracking and Data Relay Satellite System
■	MECO	main engine cutoff	■	UARS	Upper Atmosphere Research Satellite
■	MIL	Merritt Island	■	WSC	White Sands Complex
■	MTDE	Metric Tracking Data Evaluation	■	WSGT	White Sands Ground Terminal
■	ND	Network Director	■	WR	Western Range