Real-Time Operations Scenario

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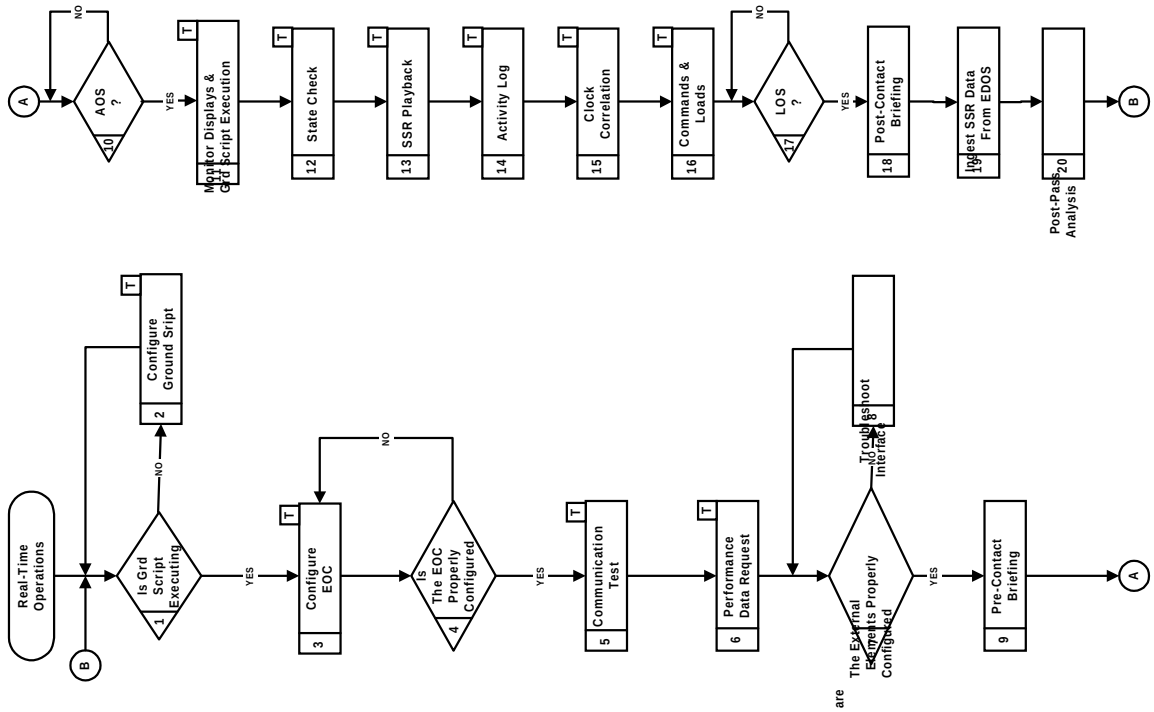
Real-Time Operations Description

- Scenario describes the Real-Time Operations of the Ground System and Online Flight Operations Team
  - Covers pre-contact, contact and post-contact tasks.
- Online FOT responsible for S/C Bus & Instrument health & safety.
- Real-Time contacts supported in EOC Mission Operations Room
  - IOT's have option of participating as needed via IST
- Ground Script, Spacecraft and Instrument Loads are available 24 hours prior to contact.
- FOT performs 28 (10 minutes) nominal AM-1 contacts per day

Real-Time Scenario Tasks

	TASK	TIME
Pre-Contact	- Check ground script execution - Configure EOC - EDOS Communication Test - NCC Communication Test - NCC Performance Data Request - Confirm IST Connectivity (as applicable) - Pre-Contact Briefing	Contact - 20 minutes
Contact	- Monitor S/C & Instrument Subsystem Telemetry - Monitor State Check - Perform/Monitor SSR Playback - Monitor SCC Activity Log / Dump - Monitor Clock Correlation, Updates - Uplink ATC Load - Uplink S/C & TDRS Ephemeris Loads - Uplink Microprocessor Loads - Monitor Maneuvers - Respond to Command Request	10 minute Contact
Post-Contact	- Post-Contact Briefing - Ingest SSR Data From EDOS - Post-Contact Analysis	Contact + 20 minutes

Real-Time Operations Flow Chart



Is Ground Script Executing?/ Troubleshoot Interface

<u>PRE-CONTACT</u>

Precondition: Logical String already established

Step 1

- **Command Activity Controller uses *Command Control Window* to make sure current day ground script is active**

Step 2 (optional)

- **Command Activity Controller uses *Command Control Window* to enter directive to initiate the ground script on Command Line: Spacecraft ID, Start Time, Stop Time**

Command Control Window

Command Control

File Edit Config Utility Help

G/S Start Time: 166/22:53:44
G/S Stop Time: 167/13:22:14
S/C ID: AM-1
Mode: Auto
G/S Status: Active
PSC: On CV: On TV: On
Bias: 00:00:00

Time	Command/Directive	Status
167/00:02:00	#	* Comment
167/00:02:00	# Open MISR Cover	* Comment
167/00:02:00	/MICOVER OPEN	* CV, TV Pass
167/00:02:00	# Turn on the Camera	* Comment
167/00:02:15	/MICAMERA ON	* CV, TV Pass
167/00:02:15	# Enable each PS	* Comment
167/00:02:15	/MiCPSAa ENABLE	* CV, TV Pass
167/00:02:15	/MiCPSAf ENABLE	* CV, TV Pass
167/00:02:15	/MiCPSAn ENABLE	* Disable
167/00:02:15	/MiCPSBa ENABLE	* CV, TV Pass
167/00:02:15	/MiCPSBf ENABLE	* Skip
167/00:02:15	/MiCPSCa ENABLE	* Skip
167/00:02:15	#	* Skip
167/00:02:15	#	* Skip
167/00:02:15	# Wait	* Skip
167/00:02:15	#	* Comment
167/00:02:30	WAIT	* Waiting
167/00:02:30	#	
167/00:02:30	#	
167/00:03:15	/MiCPSLa ENABLE	00:00:23
167/00:03:15	/MiCPSMa ENABLE	00:00:23
167/00:03:15	/MiCPSTa ENABLE	00:00:23

Command: Allow, Override, Send, Cancel

Directive: Enable, Yes, Set Jump, Go, Disable, No, Clear Jump

Schedule: Suspend, Kill, Resume

CMD:

Configure EOC

Step 3

- **Ground Script performs necessary setup for:**
  - **Commanding**
  - **H/K Telemetry ingest**
- **May include**
  - **Changes to Limits**
  - **EOC ground equipment checkout (RTS)**
- **Command Activity Controller uses *User Configuration Page* to verify setup**

Step 4 (optional)

- **Command Activity Controller manually Issues directive to establish logical string with *Command Control Window***

User Configuration Page

User Station: US 01

RTS:	1	2
String ID:	101	201
Mission ID:	AM-1	AM-1
Data Source:	RT	RT
Mode:	OPER	OPER
Oper. Data ID:	AM01	AM01
State:	Active	Backup
Connect:	Connected	----------

Communication Test, Performance Data Request

Step 5

- **Ground Script issues communication test message directive to EDOS and NCC**
- **Command Activity Controller uses *Event Display Window* to Verify links**

Step 6

- **Ground Script issues performance data request directive to NCC:**
  - **Turns on Operational Data Messages (ODM)**
  - **Command Activity Controller uses:**

    ***Event Display Window* to verify ON**

    ***Page Display* to verify ground telemetry**

Event Display Window

External Elements

Step 7

- **Command Activity Controller uses *Ground System Configuration Page* to verify External Element configuration**
  - **Confirm IST connectivity as appropriate**
  - **ISTs initiate connection to EOC (logical string)**
  - **FOT helps trouble shoot problems**

Step 8 (optional)

- **Troubleshoot external element interfaces**

Ground System Configuration Page

RTS 1	RTS 2
STRING 01	**STRING 01**
US01	US01
US02	US02
⋮	⋮
US0n	US0n
WS01	WS01
WS02	WS02
⋮	⋮
WS0n	WS0n

Pre-Contact Briefing, Acquisition Of Signal

Step 9

- **Operations Controller gives pre-contact briefing 5 minutes before contact.**
  - **Orbit Number**
  - **Contact Start Time, Contact Stop Time, Duration**
  - **Forward and Return Channel Data Rate**
  - **TDRS-E/TDRS-W/GSTDN**
  - **etc.**
- **Broadcast to entities involved with contact on SCAMA network.**

Step 10

- **Wait for AOS**
  - **AOS count down clock on *Status Window* display**

Monitor Displays & Ground Script Execution

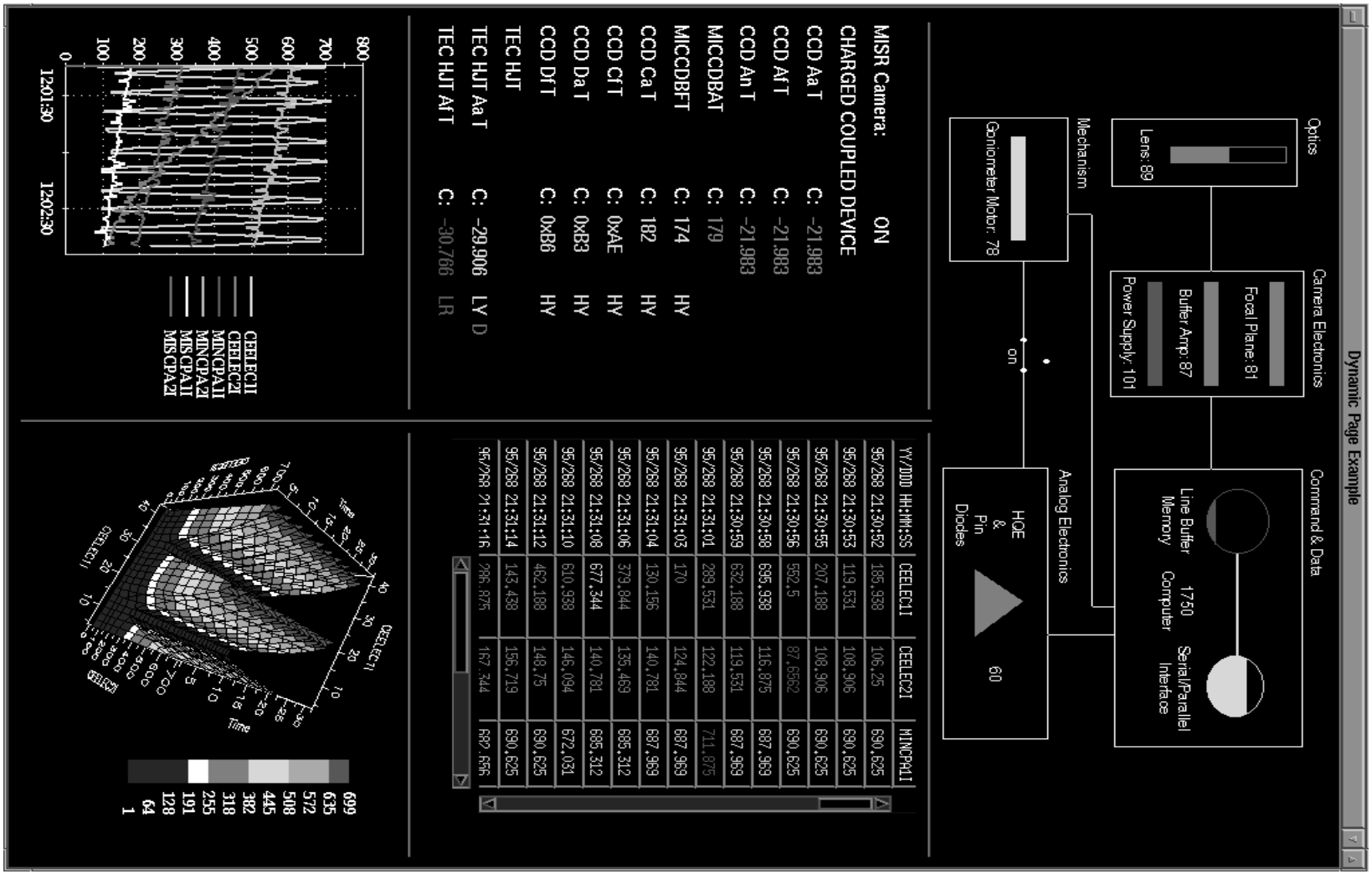
<u>CONTACT</u>

Step 11

- **FOT Operations Controller oversees support activities**
- **FOT Command Activity Controller monitors ground system**
- **FOT Spacecraft Evaluator monitors health and safety of spacecraft**
- **FOT Instrument Evaluator monitors health and safety of Instruments**
- **Optional: IOT monitors their particular instrument via IST**
- **Displays used during Support:**
  - ***Telemetry*: Alphanumeric, Graph, Table, Schematic**
  - ***Event Display Window***
  - ***Command Control Window***
  - **FDF RTADS (Real Time Attitude Display System) Displays (as applicable)**

    Note: special display provided by FDF

S/C Telemetry Page Display



State Check

Step 12

State Check compares expected state of S/C to the actual state.

- **Ground Script initiates**
- **Assists in back-orbit command verification**
- **Errors are issued as event messages**
  - **Spacecraft / Instrument Evaluators use *Event Display Window* to Observe Mismatches, determine criticality**

SSR Playback

Step 13

Ground Script issues spacecraft command to initiate SSR playback.

- **Spacecraft Evaluator monitors SSR playback:**
  - **Uses *SSR Analysis Window (note: special window built for analysis subsystem)* to observe:**

    Predicted versus Actual Counters

    Predicted Start versus Actual Playback Start Time

    Predicted versus Actual Playback Duration

    Clock Present Flag
  - **Uses *Event Display Window* to observe errors:**

    Event messages for missing SSR data

    Event messages for recommended action

SSR Analysis Window

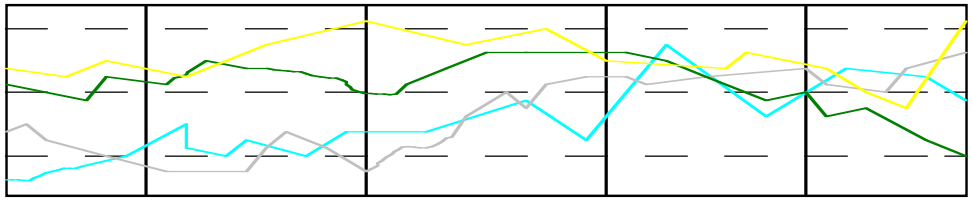
SSR Analysis

SSR Health and Safety

PB Clock Present:	On	Memory Config Ind:	On	Replay:	On
Memory Power Status:	On	Temperature:	10 C	Playback:	Off
Built in Test Ind:	On	Overwrite Status:	Off	Instant Replay:	Off
Low Power Ind:	On	Watch Dog Timer:	Off	Record:	Off
				Standby:	Off

SSR Buffer Counters

	Playback Counter	Record Counter
LRS	000	820
MISR	000	560
MODIS	630	000
ASTER	000	620
TRASH	000	700



Problems/Solutions

95/193/18:14:00.857	LCP	Forward link has failed: xxxxxxxxxx
95/193/18:14:01.030	LCS	Send a GCMR: xxxxxxxxxx
95/193/18:17:20.920	DRP	Bad data quality
95/193/18:17:22.532	DRS	Replay SSR

SSR Playback (cont.)

- **Command Activity Controller (CAC) monitors**
  - ***Ground Page Display*** **and** ***Event Display Window*** **for:**

    CODAs: EDOS Data Quality, Data Quantity

    ODMs: TDRS Communication Link Status

Activity Log

Step 14

Activity Log used by the S/C Control Computer (SCC) software for detailed logging of error conditions.

- **Spacecraft Evaluator (SE) monitors counter for new entries.**
  - **Observe Activity Log TLM mnemonics on *Page Display***
  - **If new entries ask Command Activity Controller to dump activity log**

    Select predefined function Key on keyboard

    Used to Initiates activity log dump command
  - **An activity log report complete event message will trigger the *Activity Log Report* to be displayed in front of the SE**
  - **SE browses report for new entries which will be interpreted**

    Format: Time, ID, Data, Brief Description.

Clock Correlation

Step 15

Clock will be maintained within + or - 100 usec.

- **Spacecraft Evaluator (SE) monitors the clock drift**
  - **Observe clock offset event message once a minute on *Event Display Window*.**
- **Spacecraft Evaluator observes nominal frequency adjust command from Ground Script or ATC**

Commands & Loads

Step 16

- **Ground Script initiates S/C Real-Time Commands & uplink of Loads**
  - **CAC monitors via *Command Control Window***
  - **Last minute changes can be typed on Command Line**
- **CAC & Evaluators verify S/C Real-Time commands and Load uplinks using *Event Display Window* and telemetry displays.**
  - **Transmission to spacecraft**
  - **Receipt by spacecraft**
  - **Command execution (via telemetry end-item verification)**
  - **Load uplink (via CRC status)**
- **IOT's can monitor status of their telemetry, commands and micro-processor loads via IST.**

Loss Of Signal/ Post-Contact Briefing

Step 17

- **Operations Controller announces end of event 1 minute before LOS to On-Line FOT.**
  - **LOS count down clock on Status Window display**

<u>POST-CONTACT</u>

Step 18

- **Operations Controller provides all entities with post-contact briefing over the SCAMA**

Ingest SSR Data From EDOS, Post-Contact Analysis

Step 19

- **EOC automatically receives Back-orbit telemetry data from EDOS**
- **Data Temporarily archived at EOC (7 days)**
- **Data Permanently archived at GSFC DAAC**
- **Spacecraft Evaluator verifies successful completion of the above via an event message**
- **Receive EDOS (TDRS Service Summary) and review**

Step 20

- **EOC automatically initiates analysis task to generate trending statistics**
  - **Results made available to FOT upon completion via reports and graphic plots as applicable**