

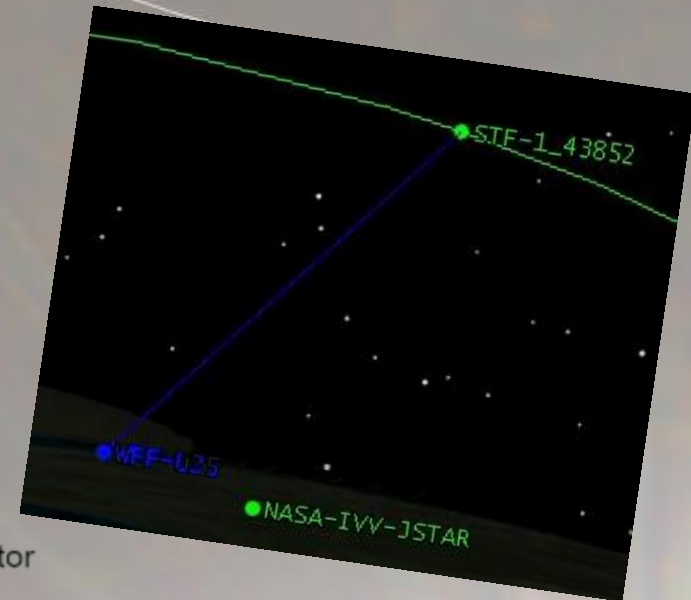


STF-1 Ground Operations

Automating the Planning, Scheduling, Assessment and Data Processing/Reduction for a Small Satellite



Mark Suder
Systems Engineer
TMC Technologies
NASA's IV&V Program





Background

- STF-1 = Simulation-to-Flight 1
 - 3-U CubeSat
 - Primary Objective: Development of NOS³ Spacecraft Simulator
 - Secondary Objectives: 4 Science Payloads
- 12/16/2018 Launch; 12/19/2018 First Contact
 - Now what?
 - How do we efficiently and effectively operate?





Pre-Launch Existing – Command and Control



- Ball Aerospace COSMOS:
 - Development:
 - Telemetry and Command Definitions created/used
 - Transitioned as-is into Operations

Interface	Connect/Disconnect	Connected?	Clients	Tx Q Size	Rx Q Size	Bytes Tx	Bytes Rx	Cmd Pkts	Tlm Pkts	View Raw
COSMOSINT	Disconnect	true	0	0	0	0	0	0	0	View Raw
CADET_INT	Disconnect	true	0	0	0	243	5078432	10	28392	View Raw

Name	Value or State	Units	Description
OFFSET:		22	Offset
DATA:	OFF	0	Data
SIZE:		1	Size

Stats on Cmd/Tlm Sent/Received;
Comforting to see Tlm #s Increase

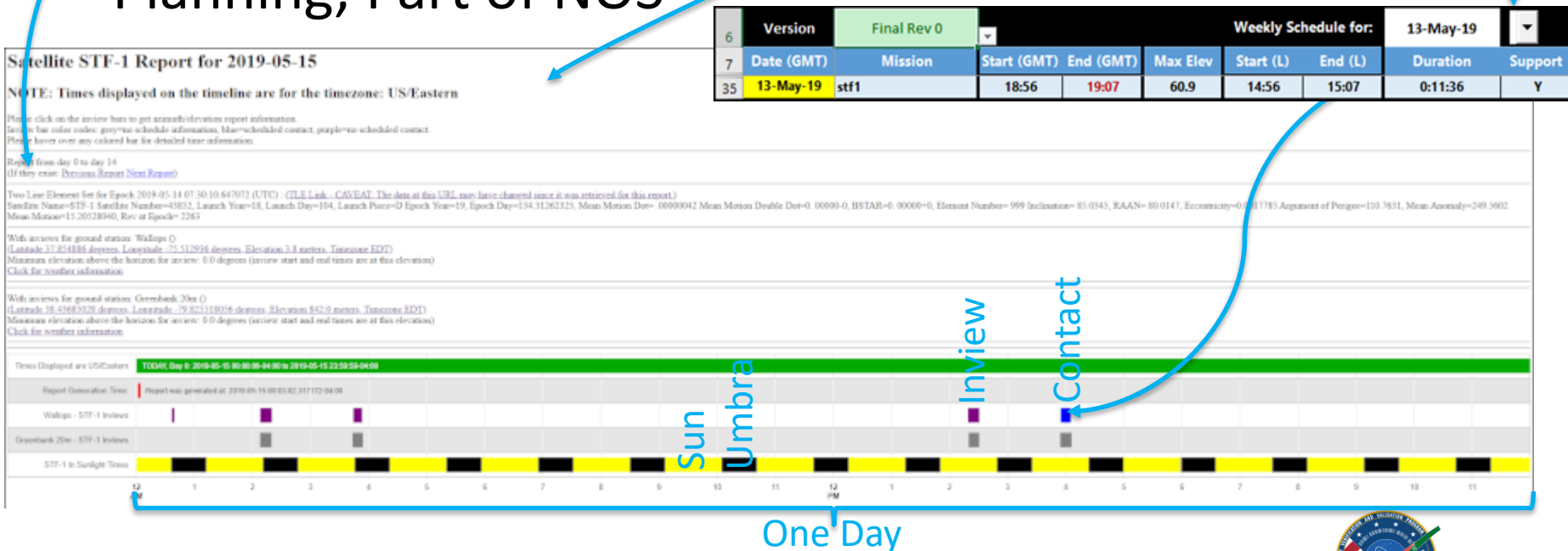
Command Sender to
Send Commands





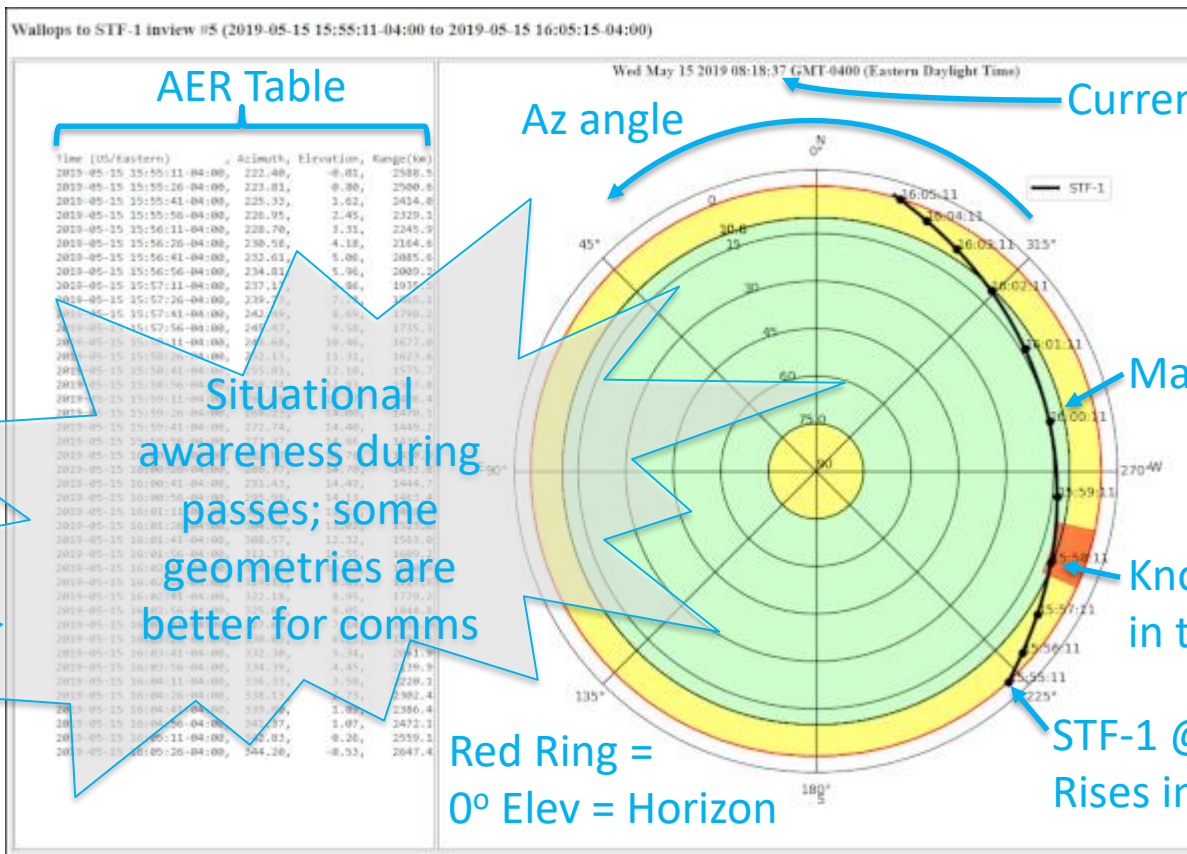
Pass Planning

- NASA Wallops UHF Antenna – Shared Resource, Weekly Spreadsheet Schedule
- STRATCOM TLEs
- Feed homegrown tool – Orbit Inview and Power Planning, Part of NOS³



Pass Support

- Azimuth/Elevation/Range Table and Graph



Situational awareness during passes; some geometries are better for comms

Current time updates every second

Max elevation ~15°; ~16:00:11

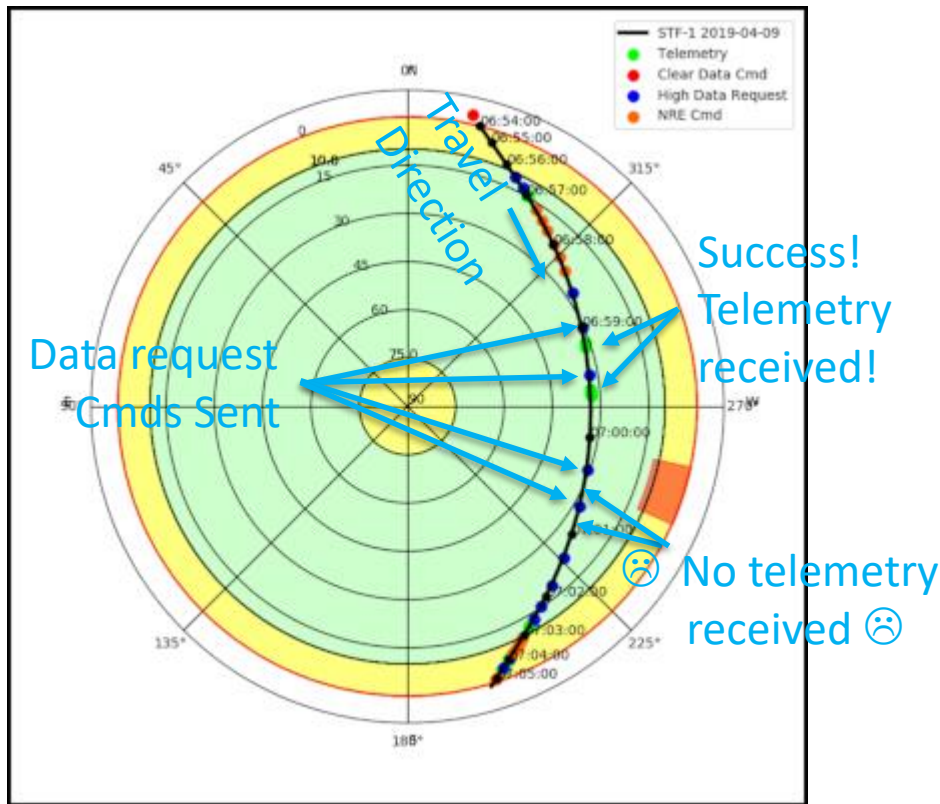
Known R/F interference source in this red Az/El region

STF-1 @ horizon @ 15:55:11; Rises in the SW at ~225° azimuth



Automated Post-Pass Assessment

- Similar az/el plot; Assess pass cmd/tlm times

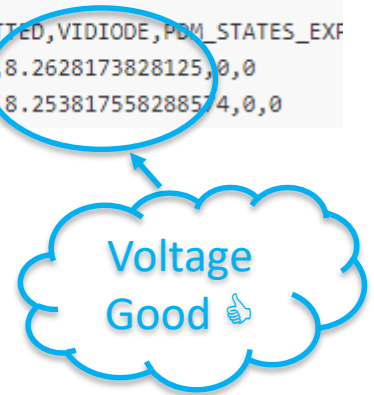


- Slack Messages:

```

IVED_TIMEFORMATTED,VIDIODE,PDM_STATES_EXP
.3 14:59:32.769,8.2628173828125,0,0
.3 14:59:34.815,8.253817558288574,0,0

```





Supporting Science

- Binary telemetry to CSV:
- Sharing via Google Drive:

Name	Date modified	Type	Size
2019-04-26T03_29_30-04_00_CFE_ES_HkPacket_t.csv	4/29/2019 10:31 AM	Microsoft Excel C...	174 KB
2019-04-26T03_29_33-04_00_CFE_EVS_Packet_t.csv	4/29/2019 10:31 AM	Microsoft Excel C...	23 KB
2019-04-26T03_29_40-04_00_CFE_EVS_TlmPkt_t.csv	4/29/2019 10:31 AM	Microsoft Excel C...	333 KB
2019-04-26T03_29_45-04_00_CFE_SB_HkMsg_t.csv	4/29/2019 10:31 AM	Microsoft Excel C...	98 KB

2019-05-14T14_55_43-04_00_EPS_hk_tlm_t.csv - Excel

as Data Review View Developer Help PDFsam Enhanced 5 Creator

_1_DB_1_TEMP

	U	V	W	X	CZ	
IE	VIDIODE	I3V3DRAW	ISVDRAW	BOARD_TEMP	BATTERY_0_DB_1_TEMP	BAT
688	8.235818	0.0185857	0.033189	13.33331299	9.702865601	
688	8.235818	0.0185857	0.033189	12.96121216	9.702865601	
688	8.235818	0.0185857	0.033189	12.58911133	9.702865601	
688	8.226817	0.0185857	0.033189	11.10070801	10.06164551	
688	8.235818	0.0185857	0.034516	11.10070801	9.702865601	

- Generated calendar
 - Science cmds sent:
 - Science telemetry received:

April 2019			
Tue	Wed	Thu	
2	3 2019-04-03T19_43_25-04_00_CSEE_exp1_tlm_t.csv 2019-04-03T19_44_45-04_00_GPS_Time_Tlm_t.csv	4	5 5P 5P GP
9 CSEE_1 CSEE_2	10 CAM	11 2019-04-11T06_33_35-04_00_CAM_Exp_tlm_t.csv	12 201 201

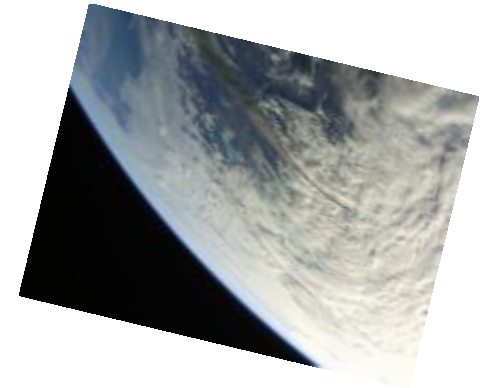




Thank You!



Questions?



mark.suder@tmctechnologies.com

www.stf1.com

www.nos3.org

