



TFAWS
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SCIFLI Artemis II Ascent Imagery

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Thermal & Fluids Analysis Workshop

TFAWS 2026

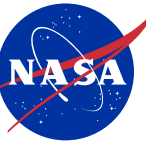
August 31 – September 4, 2026

NASA Marshall Space Flight Center

Huntsville, AL



Introduction



- What is SCIFLI
- Schedule
- Artemis II Ascent
- Ground Based Imaging
 - Requirements
 - Mission Planning
 - Training and simulations
 - Launch observation
- Airborne Imaging
 - Mission Planning
 - Launch Observation
- Imagery Applications
- What can be done.
- Conclusion





What is SCIFLI



What We Have Done:

- SCIFLI evolved from HYTHIRM (Hypersonic Aerothermodynamic Infrared Imaging) following a series of airborne observations to obtain calibrated thermal imagery of the Space Shuttle (2009-2011)
- Supported certification of SpaceX Dragon parachutes for crewed flight with about 50 ground based and airborne observations.
- Supported reentry and recovery with airborne thermal and visual imaging of all NASA Commercial Crew Program (CCP) missions (SpaceX and Boeing) through 2024 as well as SpaceX Private Astronaut Missions.
- Supported NASA Orion reentry imagery for EFT-1 and Artemis I.
- Have supported a diverse set of missions with several major US Commercial Space Companies and international entities.

What We Do:

- Deliver reliable high-fidelity flight test data for NASA, Commercial, & DoD Partners
- Provide engineering model validation for exploration vehicles and subsystems
- Support rapid performance assessment and in-flight anomaly detection

Core Capabilities:

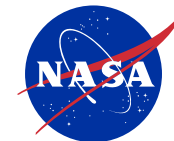
- Live video streaming
- Ultra high-resolution & high-speed video
- Radiometrically calibrated thermal & visible imagery
- Image enhancement, deconvolution, 3D-mapping
- Hyperspectral / multispectral imaging

SCIFLI Mission Statement:

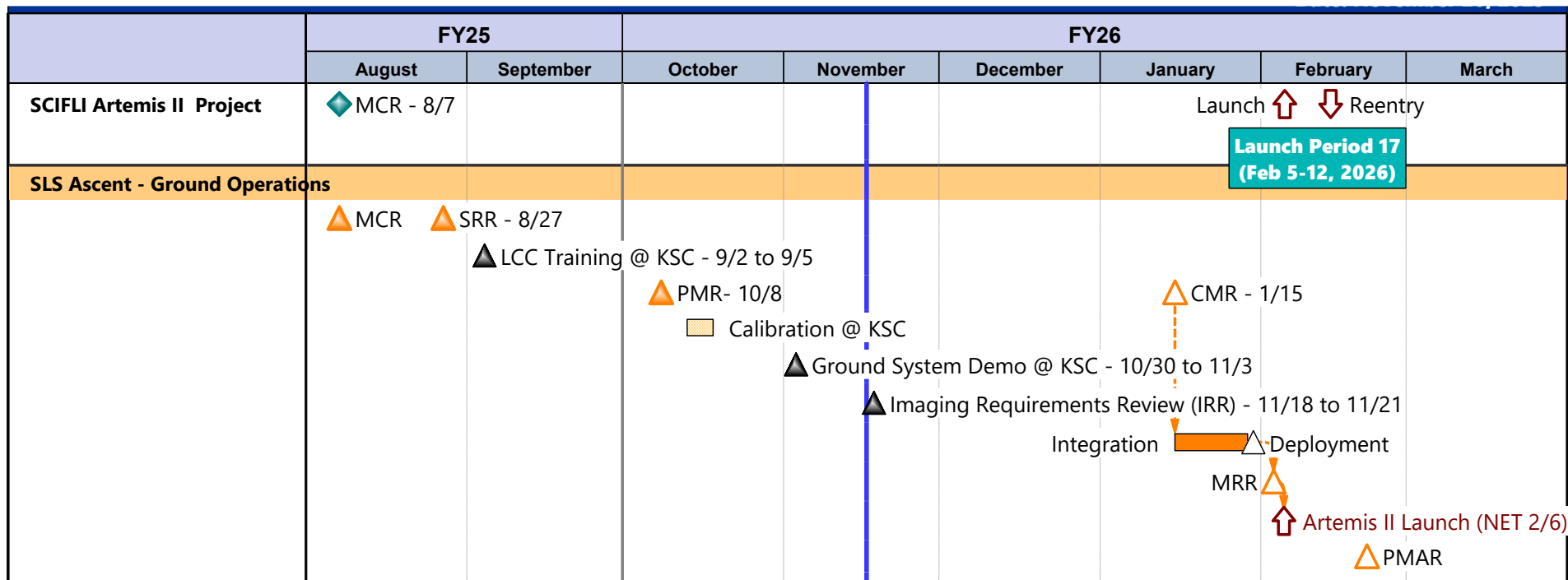
SCIFLI provides high-quality engineering imagery to help investigators understand the behavior of vehicles under extreme conditions.



Ground Operations Schedule



- SCIFLI was initially approached by EGS in the spring of 2025 for a targeted November 2025 launch date.
- SCIFLI worked on an accelerated schedule

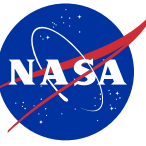


Launch Period	Opens	Closes
LP-17	2/6/26	2/11/26
LP-18	3/6/26	3/11/26
LP-19	4/1/26	4/6/26
LP-20	4/30/26	5/3/26
LP-21	5/24/26	5/30/26

Launch occurred on 4/1/26 at 6:35:12 p.m. EDT
(22:35:12 UTC)



Artemis II SLS Ascent Trajectories



Trajectory dispersion and inclinations change day to day

SRB Sep
SRB Sep
LAS Jet Sep
LAS Jet Sep

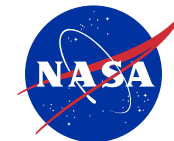
Opening of launch window

MECO
MECO
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Close of launch window

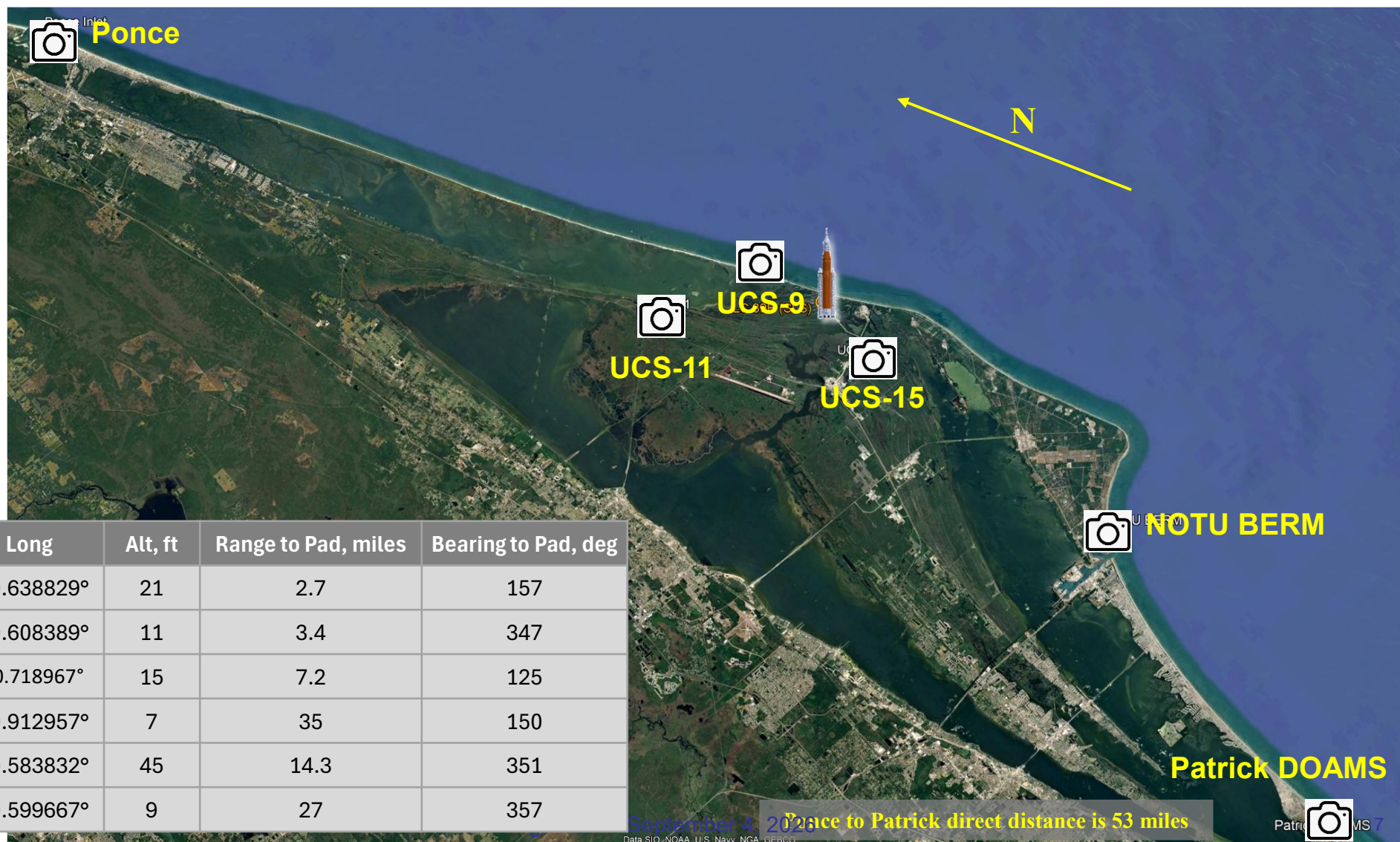


Artemis II Mid- and Long-Range Tracker Sites



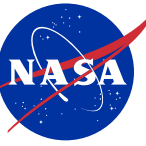
- Mid and long Range Sites used by SCIFLI for the observation.
- Designed to see both sides of the rocket and mitigate cloud obscuration

Site	Lat	Long	Alt, ft	Range to Pad, miles	Bearing to Pad, deg
UCS-9	28.663611°	-80.638829°	21	2.7	157
UCS-15	28.578150°	-80.608389°	11	3.4	347
UCS-11	28.686776°	-80.718967°	15	7.2	125
Ponce	29.066989°	-80.912957°	7	35	150
NOTU Berm	28.420027°	-80.583832°	45	14.3	351
Patrick DOAMS	28.227168°	-80.599667°	9	27	357





Artemis II Mid- and Long-Range Tracker Sites



UCS-9



UCS-15



UCS-11



NOTU Berm



Patrick DOAMS



Ponce





Requirements for Ground Based Imaging



Tracker Site	Range	TARGETED Events	Spatial Resolution	Calibrated MWIR Thermal Imagery	High Speed Imagery
PONCE	LONG	- TOWER CLEAR - FULL STACK - BOOSTER SEP	$\geq 4K$ VIS	NA	> 60 FPS VIS
UCS-11	LONG	- TOWER CLEAR - BOOSTER SEP - LAS JETTISON	$\geq 4K$ VIS ≤ 0.5 IN/PX*	NA	> 60 FPS VIS
UCS 9	MEDIUM	- LAS JETTISON - NOZZLE SECTION - FULL STACK	$\geq 4K$ VIS	$\geq 1024 \times 1024$ ≥ 30 FPS	> 60 FPS VIS
UCS 15	MEDIUM	- LAS JETTISON - NOZZLE SECTION - FULL STACK	$\geq 4K$ VIS	$\geq 1024 \times 1024$ ≥ 30 FPS	> 60 FPS VIS
NOTU	LONG	- TOWER CLEAR - BOOSTER SEP - LAS JETTISON	$\geq 4K$ VIS ≤ 0.5 IN/PX*	NA	> 60 FPS VIS
PSFB	LONG	- TOWER CLEAR - FULL STACK - BOOSTER SEP	$\geq 4K$ VIS	NA	> 60 FPS VIS

EGS Documented Requirements

SCIFLI Requirements (supplement or exceed EGS requirements)

- Mid and long Range Sites used by SCIFLI for the observation.



Ground Tracking Mounts

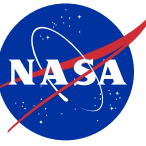


- Each site had a mobile gimbal tracking mount, deployed a few days prior to launch.
- Each site was crewed with a Site coordinator, a gimbal tracker operator and camera operator.
- The mounts are a hybrid system, tracking the target vehicle using both a predicted trajectory as well as accepting real time pointing cues from operators in the loop.
- Each system was fully self sufficient with power and Starlink communications.
- Data was saved to hard drives for delivery to a NASA centralized imagery distribution system.

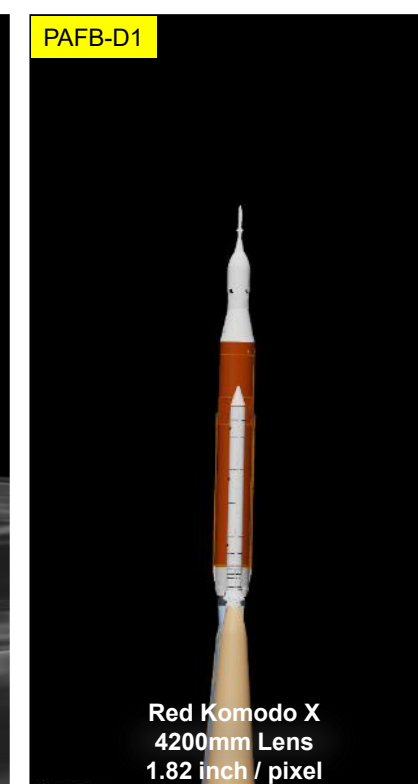
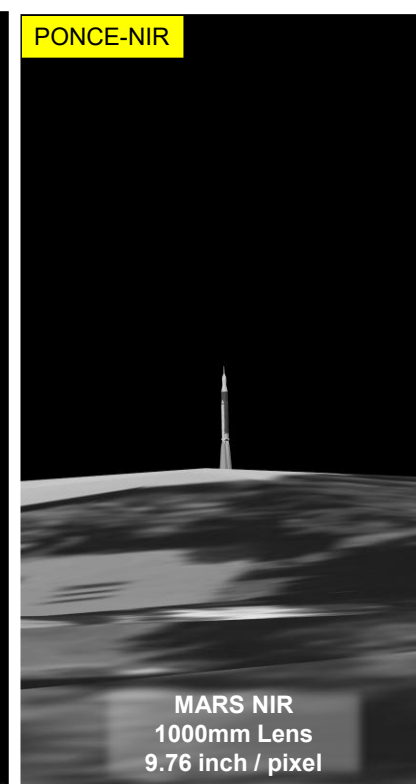
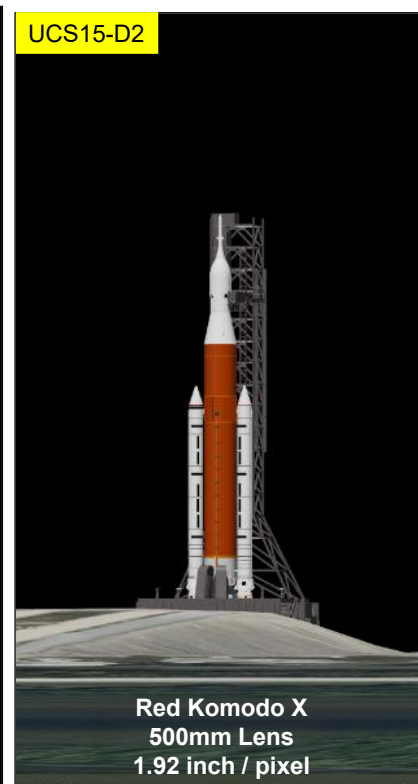
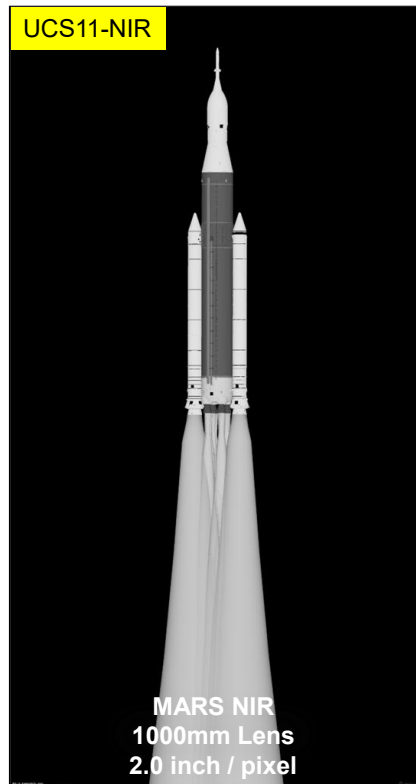
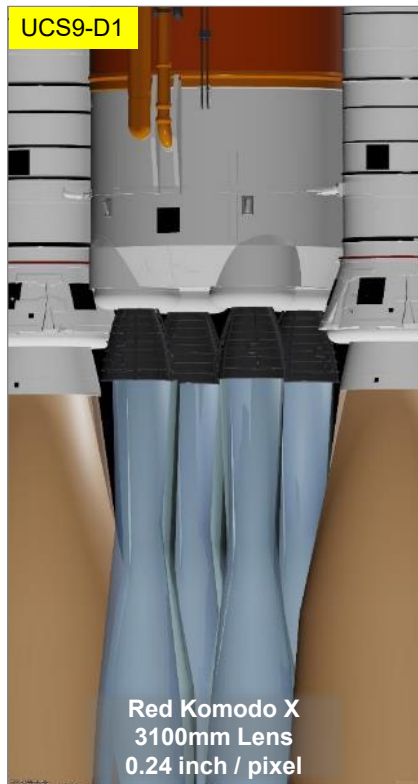




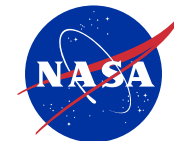
Ground Based Observation Planning



Synthetic Imagery from each sensor at each site was created to optimize location and lens selection



A sample of the sensors utilized for ascent



Launch Control Center Mission Integration

- The SCIFLI LCC Coordinator was in the LCC, room 1P2.
- 1P2 is dedicated to control of the imagery systems around LC-39B.
- Provided the bridge between SCIFLI ops and the LCC team.
- Followed a detailed mission day timeline to assure all information was distributed properly and on time.



Mission Day Timeline

For SCIFLI Tabletop Sim 2a and 2b Only				Artemis II Ascent, Feb 6, 2026				
Step	Operation/Event	Com Path	Notes	L-hh:mm:ss	T-hh:mm:ss	Time UTC	Time EST	Time CST
13	SCIFLI/LC Coord Hourly Update	Radio SCIFLI	GSCs /LC Coord Nom Tagup	6:55:00	5:45:00	2/5 22:10:00	2/5 5:10:00 PM	2/5 4:10:00 PM
14	MCC GC Confirms launch time with SCIFLI	XPL SCIFLI		6:00:00	4:50:00	2/5 23:05:00	2/5 6:05:00 PM	2/5 5:05:00 PM
15	SCIFLI/LC Coord Hourly Update	Radio SCIFLI	GSCs /LC Coord Nom Tagup	5:55:00	4:45:00	2/5 23:10:00	2/5 6:10:00 PM	2/5 5:10:00 PM
16	SCIFLI/LC Coord Hourly Update	Radio SCIFLI	GSCs /LC Coord Nom Tagup	4:55:00	3:45:00	2/6 00:10:00	2/5 7:10:00 PM	2/5 6:10:00 PM
17	T Clock Hold T Minus Count at T-3:30:00 (40 minute hold)	Radio SCIFLI	LC Informs GSCs	4:40:00	3:30:00	2/6 00:25:00	2/5 7:25:00 PM	2/5 6:25:00 PM
18	Critical Phase of launch begins			4:00:00	3:30:00	2/6 00:25:00	2/5 7:25:00 PM	2/5 6:25:00 PM
19	T Clock resumes T Minus Count at T - 03:30:00	Radio SCIFLI		4:00:00	3:30:00	2/6 00:25:00	2/5 7:25:00 PM	2/5 6:25:00 PM
20	Flight Crew Ingress begins			4:00:00	3:30:00	2/6 00:25:00	2/5 7:25:00 PM	2/5 6:25:00 PM
21	UCS-9 and UCS-15 Streaming Test to PAO	OIS / Radio SCIFLI	Confirm PAO has live stream	4:00:00	3:30:00	2/6 00:25:00	2/5 7:25:00 PM	2/5 6:25:00 PM
22	MCC GC Confirms launch time with SCIFLI	XPL SCIFLI		4:00:00	3:30:00	2/6 00:25:00	2/5 7:25:00 PM	2/5 6:25:00 PM
23	SCIFLI/LC Coord Hourly Update	Radio SCIFLI	GSCs /LC Coord Nom Tagup	3:55:00	3:25:00	2/6 00:30:00	2/5 7:30:00 PM	2/5 6:30:00 PM
24	CM Hatch Closure		LC Informs GSCs	3:20:00	2:50:00	2/6 01:05:00	2/5 8:05:00 PM	2/5 7:05:00 PM
25	SCIFLI/LC Coord Hourly Update	Radio SCIFLI	GSCs /LC Coord Nom Tagup	2:55:00	2:25:00	2/6 01:30:00	2/5 8:30:00 PM	2/5 7:30:00 PM
26	UCS-9 and UCS-15 begin continuous coverage of pad	Radio SCIFLI	View remains on pad - OTV	2:00:00	1:30:00	2/6 02:25:00	2/5 9:25:00 PM	2/5 8:25:00 PM
27	MCC GC Confirms launch time with SCIFLI	XPL SCIFLI		2:00:00	1:30:00	2/6 02:25:00	2/5 9:25:00 PM	2/5 8:25:00 PM
28	SCIFLI/LC Coord Hourly Update	Radio SCIFLI	GSCs /LC Coord Nom Tagup	1:55:00	1:25:00	2/6 02:30:00	2/5 9:30:00 PM	2/5 8:30:00 PM
29	LAS Hatch Closure		LC Informs GSCs	1:40:00	1:10:00	2/6 02:45:00	2/5 9:45:00 PM	2/5 8:45:00 PM
30	MM Poll for launch, all issues presented for resolution	OIS/DICES		1:00:00	0:30:00	2/6 03:25:00	2/5 10:25:00 PM	2/5 9:25:00 PM
31	MCC GC Confirms launch time with SCIFLI	XPL SCIFLI		1:00:00	0:30:00	2/6 03:25:00	2/5 10:25:00 PM	2/5 9:25:00 PM
32	SCIFLI/LC Coord Hourly Update (Final)	Radio SCIFLI	GSCs /LC Coord Nom Tagup	0:55:00	0:25:00	2/6 03:30:00	2/5 10:30:00 PM	2/5 9:30:00 PM
33	T Clock Hold T Minus Count at T-00:10:00 (30 minute hold)			0:40:00	0:10:00	2/6 03:45:00	2/5 10:45:00 PM	2/5 9:45:00 PM
34	MCC-H launch Readiness Poll	DICES/Radio SCIFLI	LC Informs GSCs	0:30:00	0:10:00	2/6 03:45:00	2/5 10:45:00 PM	2/5 9:45:00 PM
35	NTD Launch Readiness Poll	OIS 232/Radio SCIFLI	LC Informs GSCs	0:15:00	0:10:00	2/6 03:45:00	2/5 10:45:00 PM	2/5 9:45:00 PM
36	Begin Terminal Count	Radio SCIFLI	LC Informs GSCs	0:10:00	0:10:00	2/6 03:45:00	2/5 10:45:00 PM	2/5 9:45:00 PM
37	T Clock resumes T Minus Count at T - 00:10:00			0:10:00	0:10:00	2/6 03:45:00	2/5 10:45:00 PM	2/5 9:45:00 PM
38	Crew Access Arm Retract		LC Informs GSCs	0:08:00	0:08:00	2/6 03:47:00	2/5 10:47:00 PM	2/5 9:47:00 PM
39	MARS Camers Begin High Speed Recording	Radio SCIFLI	LC Informs GSCs	0:07:00	0:07:00	2/6 03:48:00	2/5 10:48:00 PM	2/5 9:48:00 PM
40	LAS Armed	Radio SCIFLI	LC Informs GSCs	0:05:20	0:05:20	2/6 03:49:40	2/5 10:49:40 PM	2/5 9:49:40 PM
41	Core Stage APU Activation		LC Informs GSCs	0:04:00	0:04:00	2/6 03:51:00	2/5 10:51:00 PM	2/5 9:51:00 PM
42	Last Moment to Hold and Resume launch			0:01:30	0:01:30	2/6 03:53:30	2/5 10:53:30 PM	2/5 9:53:30 PM
43	Launch	Loud Rumbling		0:00:00	0:00:00	2/6 03:55:00	2/5 10:55:00 PM	2/5 9:55:00 PM
44	Staging	Radio SCIFLI	LC Informs GSCs	0:02:09	0:02:09	2/6 03:57:09	2/5 10:57:09 PM	2/5 9:57:09 PM
45	SM Fairing Sep	Radio SCIFLI	LC Informs GSCs	0:03:13	0:03:13	2/6 03:58:13	2/5 10:58:13 PM	2/5 9:58:13 PM
46	LAS Jettison	Radio SCIFLI	LC Informs GSCs	0:03:19	0:03:19	2/6 03:58:19	2/5 10:58:19 PM	2/5 9:58:19 PM
47	SLS MECO	Radio SCIFLI	LC Informs GSCs	0:08:06	0:08:06	2/6 04:03:06	2/5 11:03:06 PM	2/5 10:03:06 PM
48	Approximate time of MARS LOS		LC Informs GSCs	0:08:30	0:08:30	2/6 04:03:30	2/5 11:03:30 PM	2/5 10:03:30 PM
49	GSC provide preliminary report of imaging		GSC informs LC	0:15:00	0:15:00	2/6 04:10:00	2/5 11:10:00 PM	2/5 10:10:00 PM
50	Reporting estimated time data will be ready for delivery	Radio SCIFLI	GSCs informs LC	0:25:00	0:25:00	2/6 04:20:00	2/5 11:20:00 PM	2/5 10:20:00 PM
51	Report data has departed site, estimated ETA to LCC	Radio SCIFLI	GSCs informs LC	When able				
52	Reporting estimated time site closeout will be complete	Radio SCIFLI	GSCs informs LC	When able				
53	Report Site closeout	Radio SCIFLI	GSCs informs LC	When able				

How to update this spreadsheet:

If the L time changes, make the change in this column. All times in that row will update

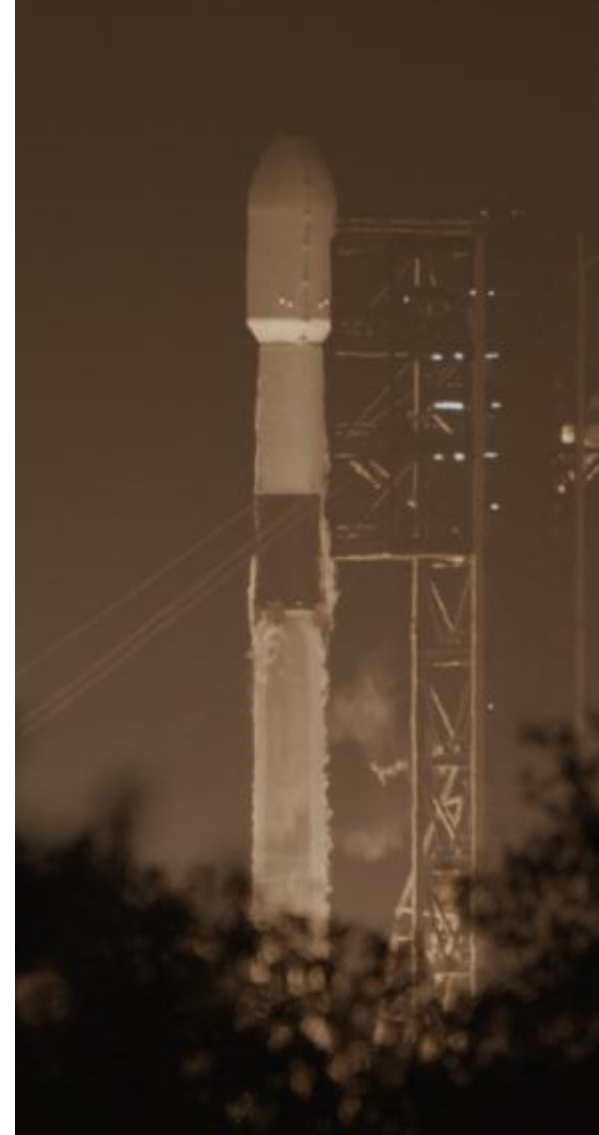
Time of Launch 2/6 03:55:00
Updating the time of launch here updates the entire spreadsheet. DO NOT change time values elsewhere

Time remaining in Launch Window
00:28:00

Launch Window Opens
Launch Window Closes
2/6 02:23:00
2/6 04:23:00

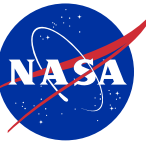
Preparing for the Observation

- Supported ascent imagery of Falcon 9 Bandwagon 4 ascent as a demonstration for EGS.
- Numerous tabletop walkthroughs and sims and simulated launch activities in the field during deployment were conducted, working through nominal and contingency events.
- First Wet Dress Rehearsal, treated as a sim for SCIFLI
- Imaged the Falcon 9 Starlink 10-44 launch from Cape Canaveral 2 days before the Artemis II launch.

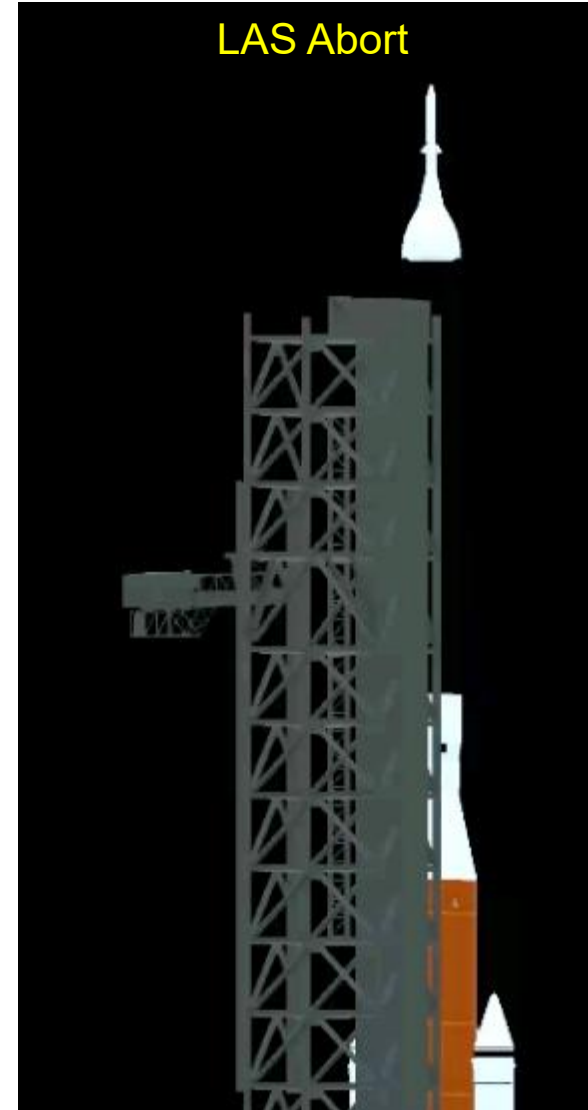




Contingencies



- In the event of a rapid pad evacuation emergency egress baskets are available. Animations depicted the events to image for the sensor and gimbal operators.
- On-pad or in-flight aborts would lead to activation of the Orion Launch Abort System. Animations and review of actual SCIFLI in flight abort video was used for crew training.







Airborne Launch Observation



TFAWS 2026 – August 31 – September 4, 2026



NASA WB-57



- SCIFLI supported planning and mission coordination for the NASA WB-57 aircraft.
- Aircraft was flown at 46K ft altitude to provide unique view not accessible from ground systems
- Mitigation for ground systems in event of clouds obscuring the ground-based systems.
- Flew a visual and Midwave infrared imaging system (DyNAMITE)
- Provided live streaming, which was fed to NASA PAO for public broadcast.

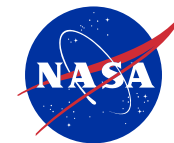


Sensor Details

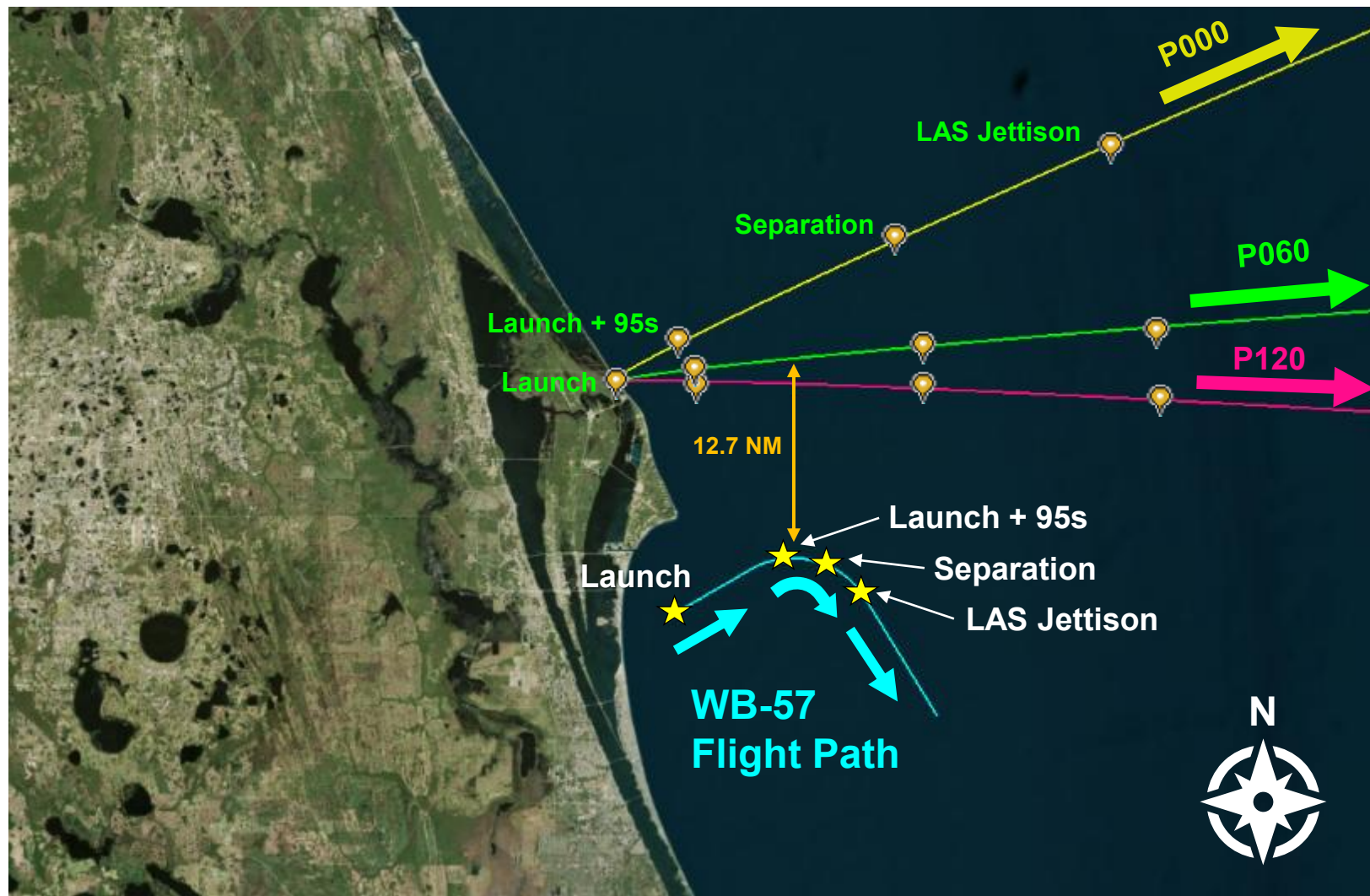
Sensor(s)	DyNAMITE payload
Wavebands	MWIR – FLIR 8303 + Custom Lens Visible – Ikegami HDL-F30 + Fujinon zoom lens
Gimbal	AIRS Gyro stabilized gimbal
Flight History	Legacy imaging payload

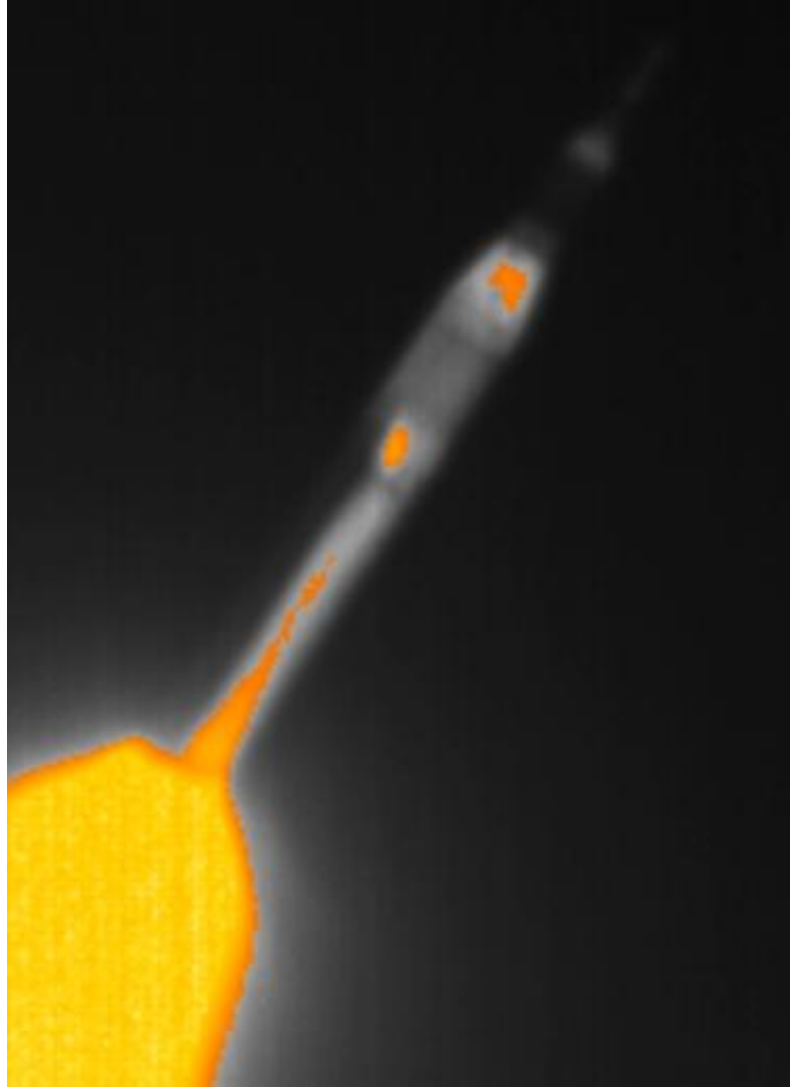


NASA WB-57 Airborne Imaging



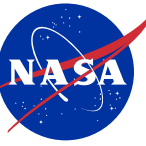
Modeling Parameters	
Imaging Platform	WB-57
Trajectory Target	Artemis I Launch Trajectories
Optimization Point	Launch + 95s
Sensors on Platform	DyNAMITE MWIR
	DyNAMITE Color Visible
Key Mission Events	Launch
	Launch + 95s
	Separation (L+131s)
	LAS Jettison (L+161s)
Notes	WB-57 will track from Launch through Separation and last possible LAS Jettison
	Current flight path planned to 12.7 NM standoff from P060 trajectory.







Applications of the Imagery

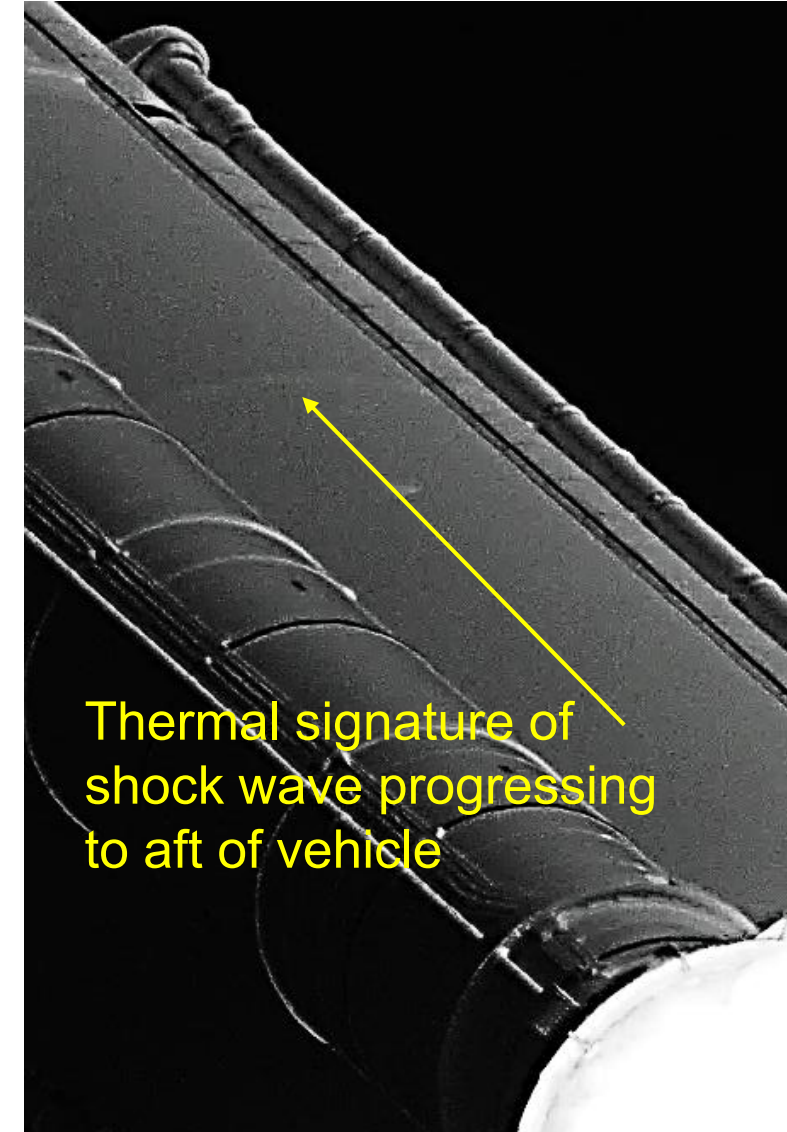


Applications of the imagery

- SLS Booster and Core Stage Engine Motor Plumes
- SLS integrity during ascent
- SLS Booster Separation
- Debris shedding and impacts on vehicle
- SAG Panel and LAS separation
- Circumferential coverage of the launch vehicle through ascent
- Orion liftoff clearances and performance through initial ascent

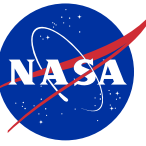
Contingencies

- LAS abort from pad or in flight
- SRB tracking in event of core stage catastrophic failure





What Can be Done



Existing SCIFLI capabilities to extend the knowledge from the data

- Thermal calibration to develop thermal maps of the vehicle
- Apply super resolution processing to enhance the spatial resolution of the imagery
- 3D trajectory reconstruction for debris or other elements seen in multiple views
- Multiband infrared imaging to determine surface temperatures through plume emissions
- Spectral imaging of plumes for system health monitoring (look for unexpected traces of metals or other elements)

Question for the audience –

- What information would help you? Perhaps there is a way to tailor future observations to obtain desired measurements.





Conclusion



- SCIFLI stood up 6 ground based mid- and long-range trackers within short notice to meet or exceed all provided requirements.
- The team supported demonstrations, simulations and training activities to be fully prepared for launch, including a variety of anomalies that would be critical to capture with imagery.
- Airborne Imaging provided additional and unique views and served as a backup in the event of cloud obscuration
- Imagery was reviewed by NASA imaging experts who commented on the quality and complimentary nature of the visible and NIR imagery.
- SCIFLI is looking for what other applications the imagery data could have for the engineering community.





Your Friendly SCIFLI Team



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