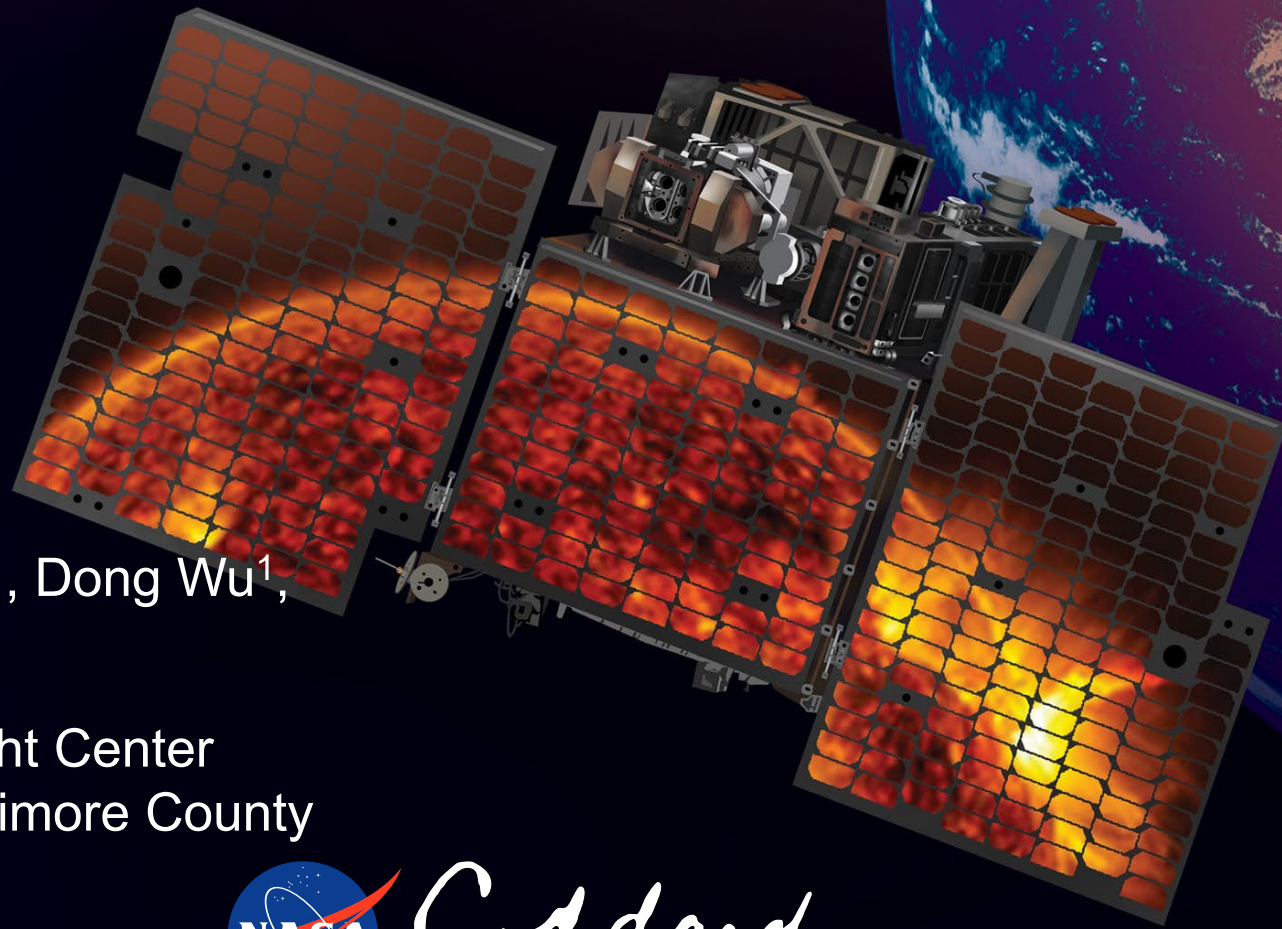
Total and Spectral solar Irradiance Sensor

TSIS 2

TSIS-2 Mission Status



Susan Breon[1], Ron Hooker[1], Dong Wu[1], Doug Rabin[1], Jae Lee[2]

[1]NASA Goddard Space Flight Center
[2]University of Maryland Baltimore County

NASA Goddard SPACE FLIGHT CENTER

TSIS-2

- The Total and Spectral Solar Irradiance sensor – 2 (TSIS-2) mission was approved to begin formulation in March 2019.
- TSIS-2 was approved to continue into Phase C development in May 2022 with a launch date of February 2025
- Mission Objectives
  - Acquire total solar irradiance (TSI) and spectral solar irradiance (SSI) measurements to determine the direct and indirect effects of solar radiation on climate
  - Extend a >44-year uninterrupted measurement record of TSI and >20-year record of SSI beyond ISS/TSIS-1
    - Maintaining solar irradiance data continuity is one of the “Most Important” objectives in the 2017 Decadal Survey
    - Overlapping TSIS-2 with TSIS-1 is a high priority in NASA Earth Science Division mission development
    - ISS/TSIS-1 mission was recently extended to 2026 following Senior Review
  - Provide accurate SSI measurements for better understanding of wavelength-dependent solar energy deposition in Earth’s atmosphere and surface

Level 1 Science Requirements

Science requirements were derived to reflect on-orbit performance of TSIS-1

- Provide continuity of TSI measurements and maximize the chance of overlap and intercomparison with existing on-orbit climate sensors
  - TSI requires 3-month minimum overlap with TSIS-1 with a goal of 6 months
  - SSI requires 6-month minimum overlap with TSIS-1 with a goal of 12 months
- Put all measurements that make up the record on the same calibration scale

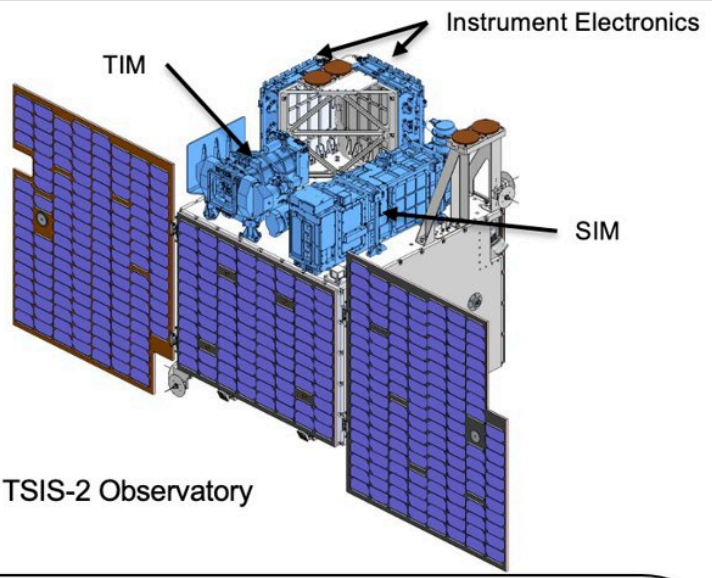
Parameter	TSI Requirement		SSI Requirement	
	Baseline	Threshold	Baseline	Threshold
Spectral Range	Total Integrated Spectrum		200 – 2400 nm	
Accuracy	≤200 ppm	≤350 ppm	≤1.0% (200 – 400 nm) ≤0.5% (>400 nm)	≤1.0% (over full spectral range)
Stability	≤10 ppm/yr	≤20 ppm/yr	≤0.05%/yr (<400 nm) ≤0.01%/yr (>400 nm)	≤0.1%/yr (<400 nm) ≤0.02%/yr (>400 nm)
Spectral Resolution	Not Applicable		≤2 nm (<280 nm) ≤5 nm (280 – 400 nm) ≤45 nm (>400 nm)	
Reporting Frequency	4 six-hourly averages per day		2 spectra per day, sampled every 12 hours	

NOTE: 1 ppm – 0.0001%

Mission Overview

TSIS-2 Science

Measure total solar irradiance (TSI) and spectral solar irradiance (SSI) to determine the direct and indirect effects of solar radiation on the Earth system and its climate. Provide continuity with measurements from TSIS-1 operating aboard the ISS

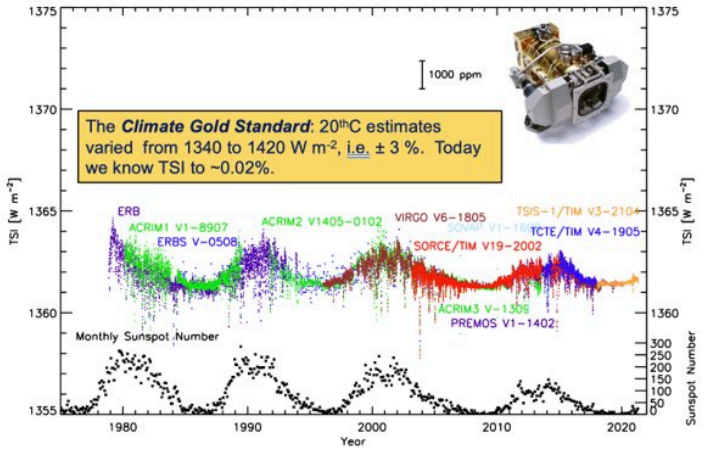


TSIS-2 Observatory

Key Mission Parameters

Directed free-flyer mission
Solar viewing, ≥40 minutes/orbit
98° inclination, 600 km altitude
Sun synch, 17:00 LTAN
Category 3/Class D
Mission Life: 3 years
MA LRD: 2/13/25

TSI Data Continuity



Mission Elements

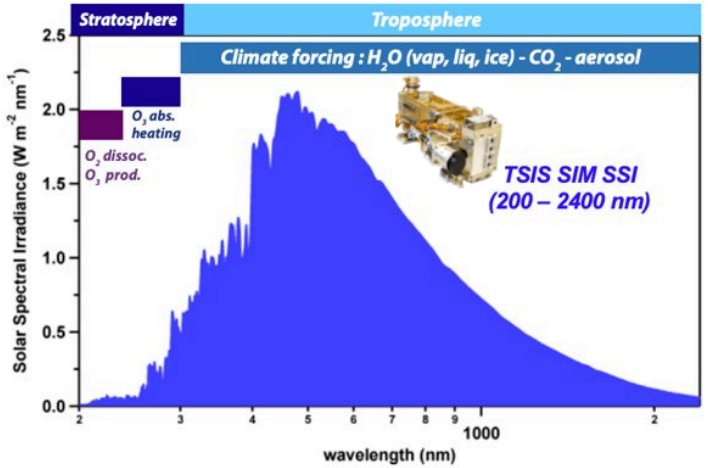
NASA Goddard Space Flight Center
- Project Management
- Data Archive (GES DISC)

Laboratory for Atmospheric and Space Physics (LASP)
- Total Irradiance Monitor (TIM)
- Spectral Irradiance Monitor (SIM)
- TSIS-2 Science and Operations Center (TSOC)
- TSIS-2 Science Data System (TSDS)

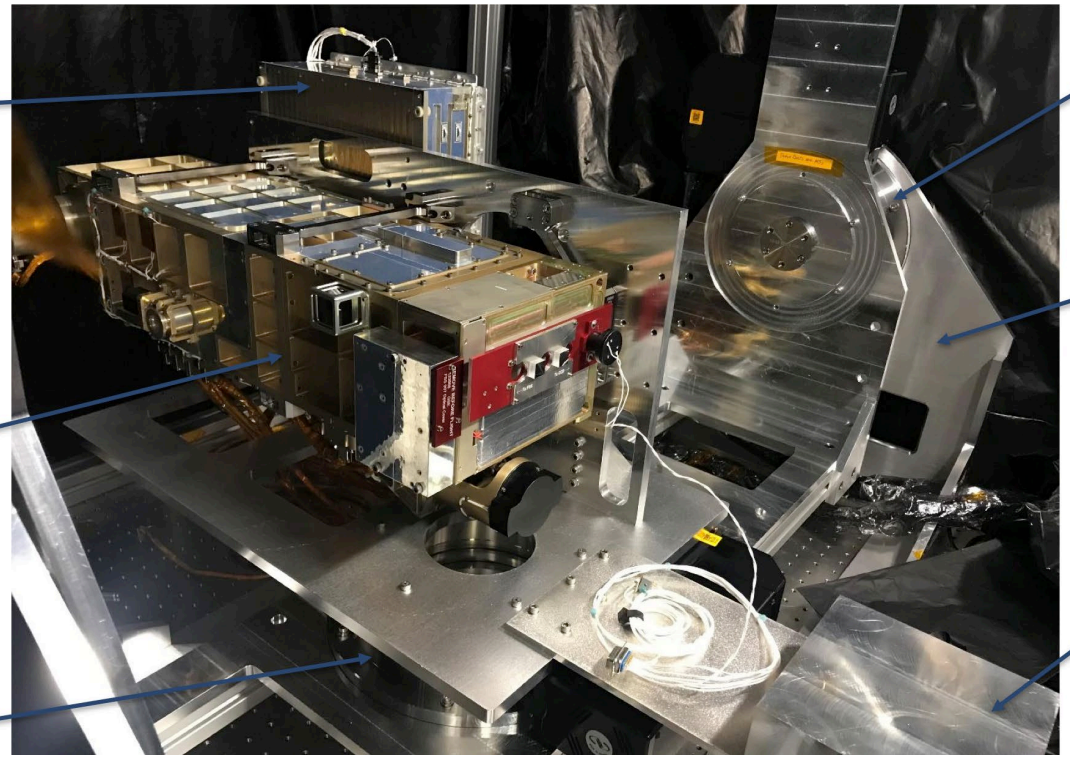
General Atomics – Electromagnetic Systems (GA)
- Spacecraft/Observatory Integration and Test
- Mission Operations Center (MOC) and ground station

KSC Launch Services Program (LSP)
- Launch services – SpaceX Falcon 9 FT

SSI Distribution



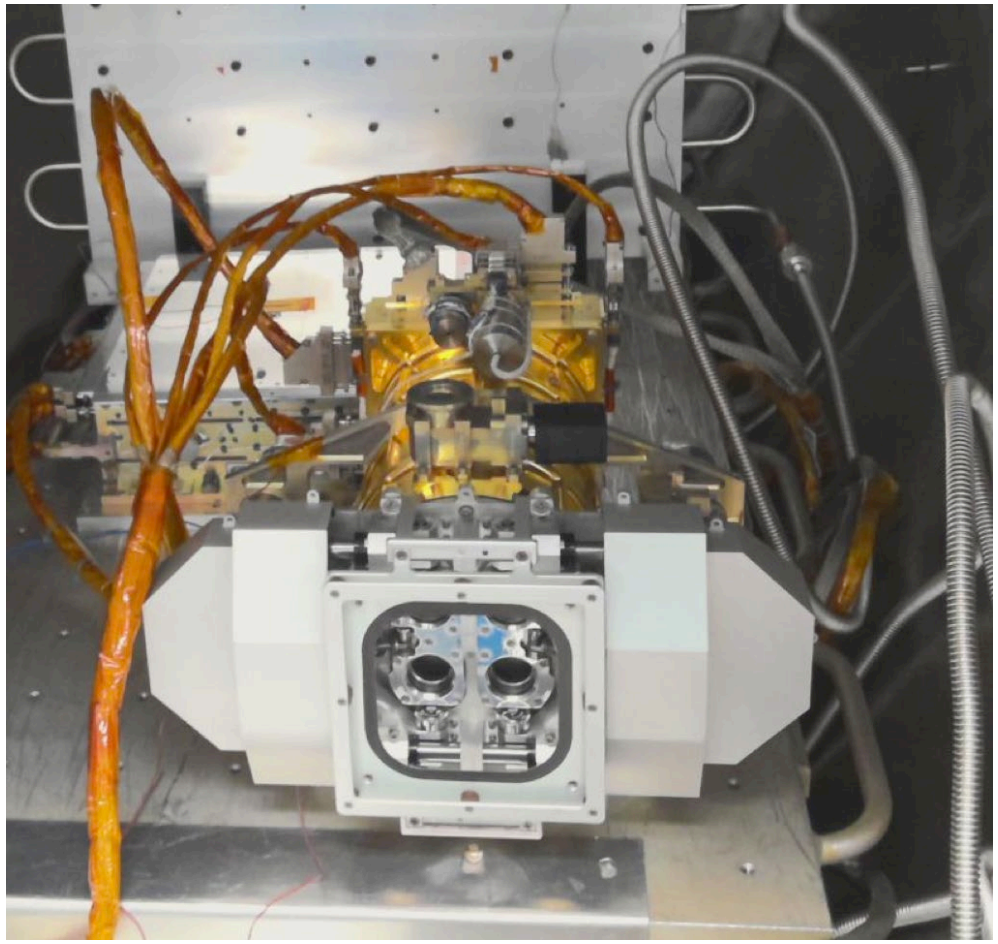
SIM Status



Spectral Irradiance Monitor (SIM)

- Assembly, integration, and test is complete
- Calibration data is being processed
  - Performance is expected to meet requirements
- In storage pending delivery to the spacecraft
  - Undergoing monthly health checks

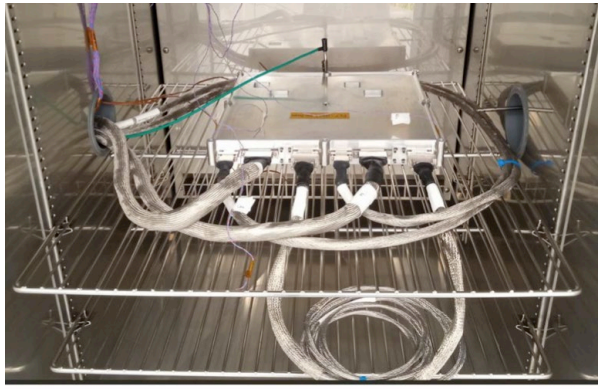
TIM Status



Total Irradiance Monitor (TIM)

- Reassembly complete following replacement of cones
  - Cone C heater wire shorted during TVAC testing
- Regression test underway
  - Vibration testing complete
  - TVAC in process
- Performance will be verified in the TRF prior to storage for delivery to spacecraft integration

Spacecraft Status

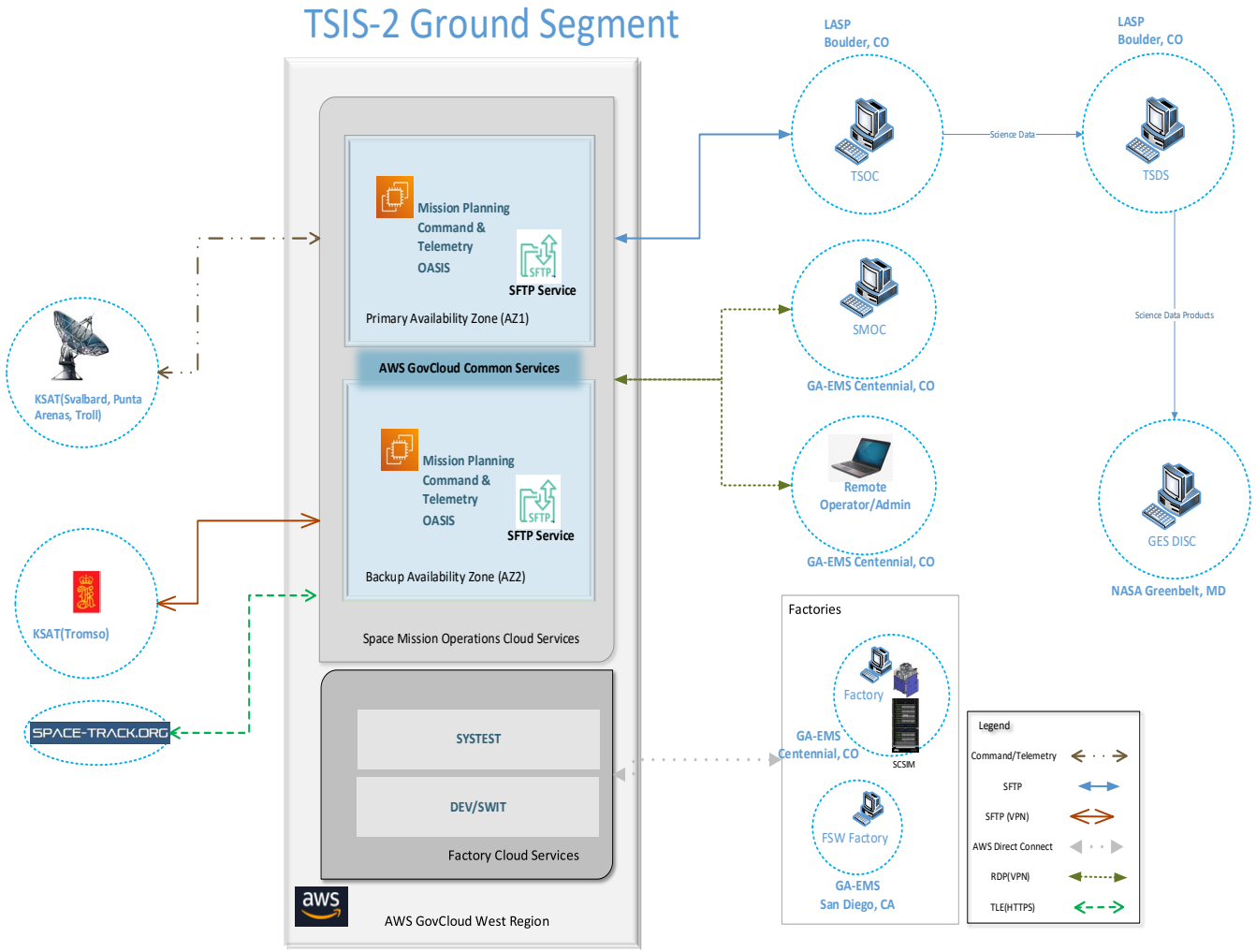


Flight PIU module in burn in chamber

Spacecraft

- Initial structural assembly complete awaiting avionics modules
- SSTL-provided modules scheduled to ship mid-October
- GA-provided modules in test
  - On-Board Computer – ready for integration
  - Payload Interface Unit – completing environmental test
  - Active Safety Module – beginning environmental test
- Instrument integration expected ~ March 2024
- Launch Readiness Date – February 2025

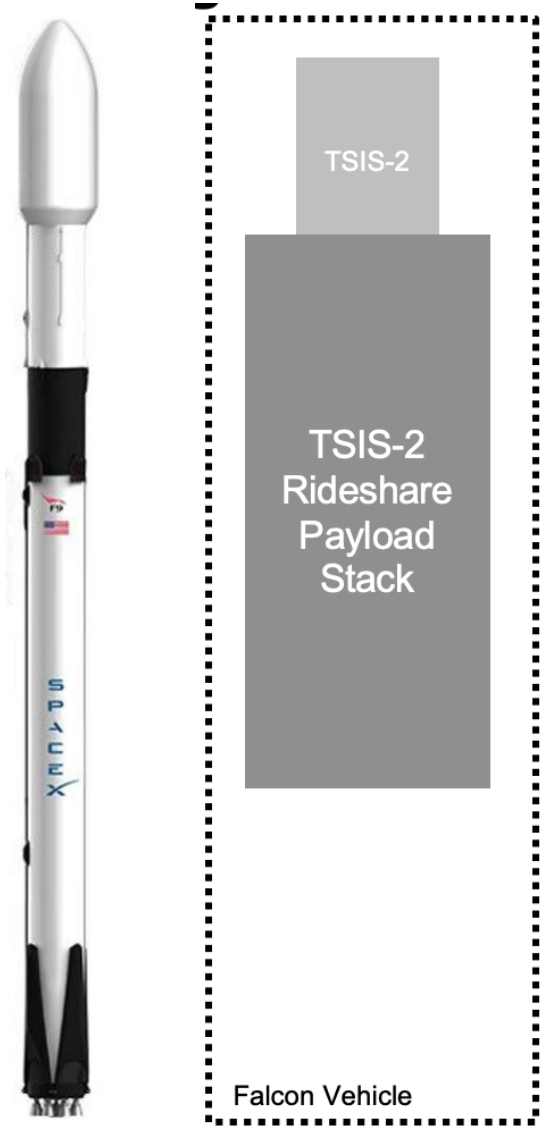
Ground System Status



Ground System

- Satellite Mission Operations Center (SMOC) is managed by GA
  - Hosted in AWS Cloud
  - Ground station provided by KSAT
  - Authorization to Operate (ATO) expected summer 2024
- TSIS-2 Science Operations Center (TSOC) and TSIS-2 Science Data System (TSDS) managed and hosted at LASP

Launch Vehicle Status



Launch Vehicle

- SpaceX selected under KSC's Venture-Class Acquisition of Dedicated and Rideshare Services (VADR) contract
- Developing Interface Control Document (LVICD)
  - NASA controls launch date
  - Cake-topper location—SpaceX can sell additional space available to Rideshare customers
  - Launch location – Vandenberg (TBC)
- Mission System Design Review planned for December 2023