SSC21-XIII-02

Design and Overview of the Solar Cruiser Mission

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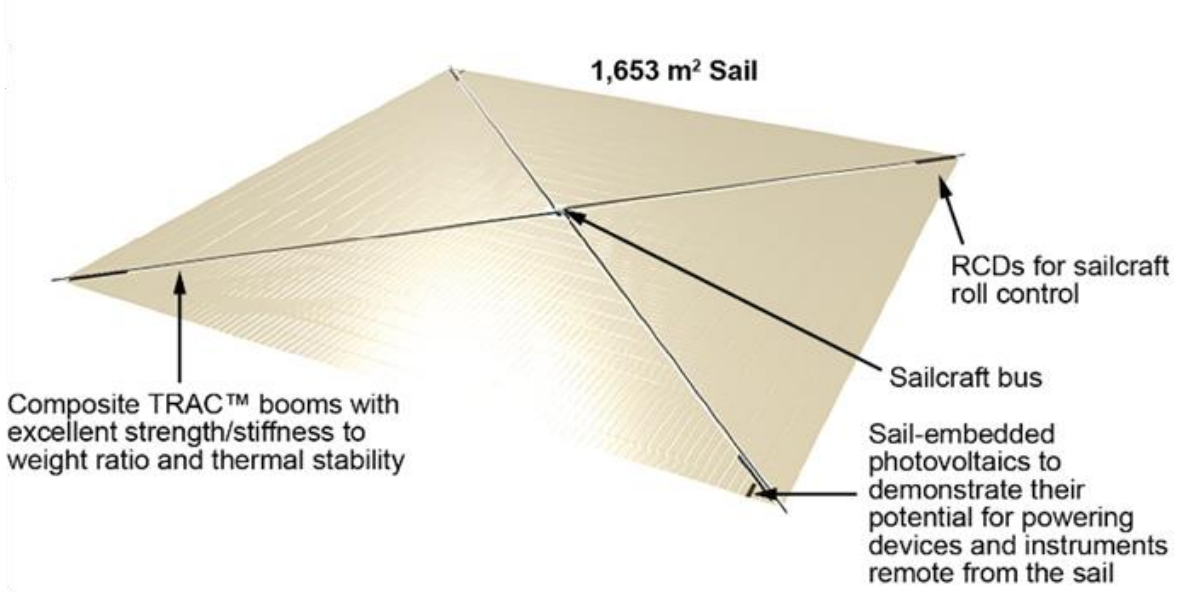
Solar Cruiser: Sailing on Sunlight

Solar Cruiser is a Small Satellite Technology Demonstration Mission (TDM) of Opportunity to mature **solar sail** propulsion technology to enable near-term, high-priority breakthrough science missions.

- Solar Cruiser will demonstrate "sailcraft" operation (acceleration, navigation, station keeping, inclination change) immediately applicable to near-term missions.
- Show scalability of sail technologies including:
  - Boom
  - Membrane
  - Deployer
  - Reflectivity Control Devices (for roll momentum management)



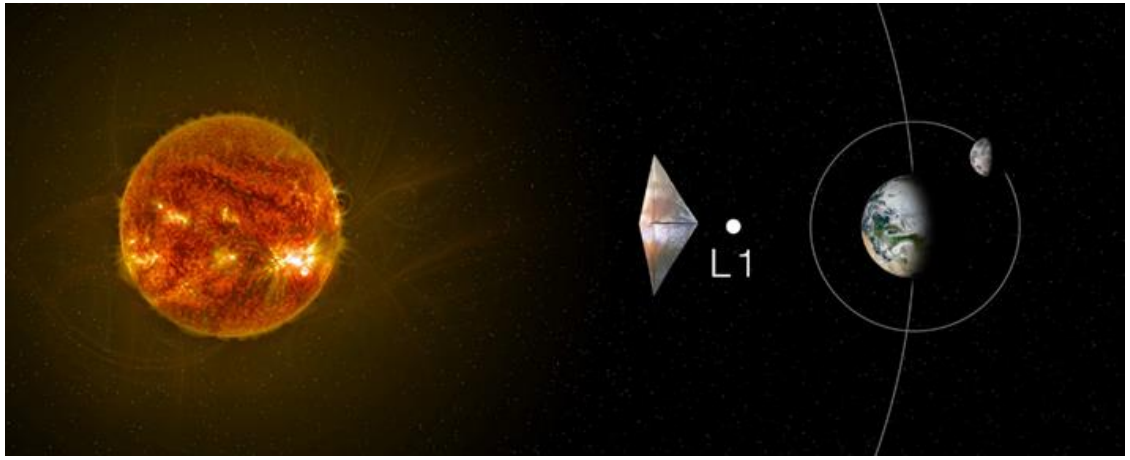
- Manifested for 2025 launch as a secondary payload with IMAP

Mission Goals

Solar Cruiser Technology Goals

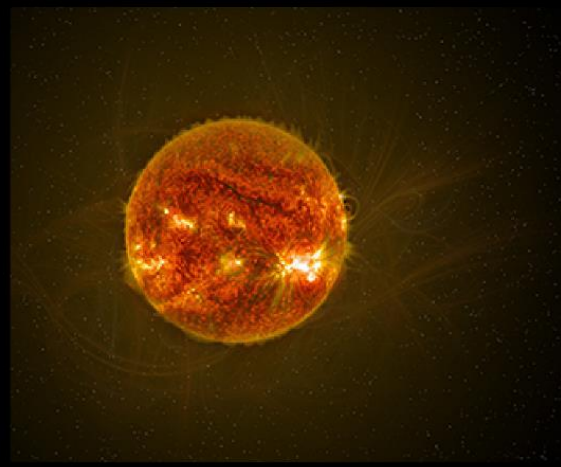
Demonstrate solar sail propulsion technology to enable near- and mid-term Heliophysics science missions up to and including high solar inclination orbits, sub-L1 halo orbits, non-Keplerian solar and other planetary orbits. This is achieved through demonstration of the below four specific objectives.

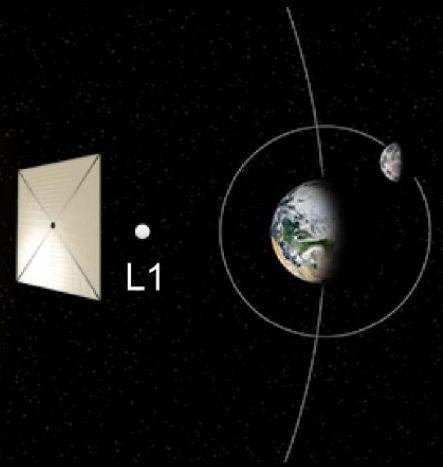
- Solar sail operation
- Scalability of sail technologies
- Sailcraft pointing control and stability
- Sail-embedded photovoltaic power generation

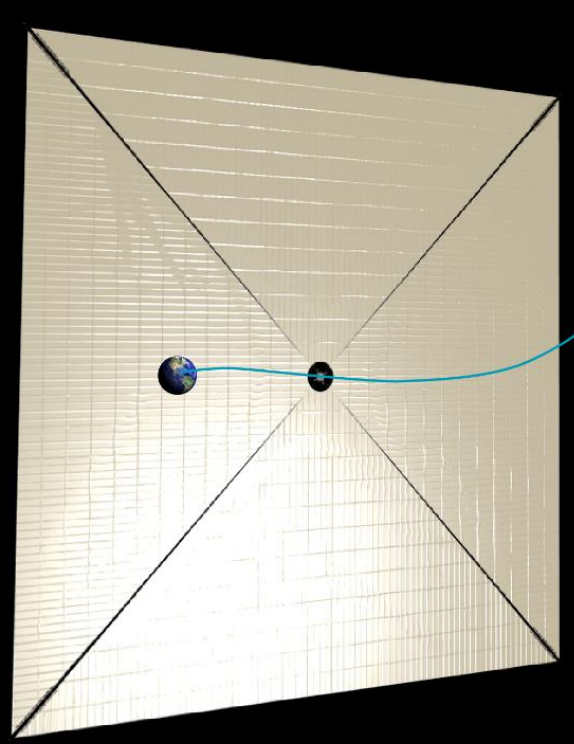


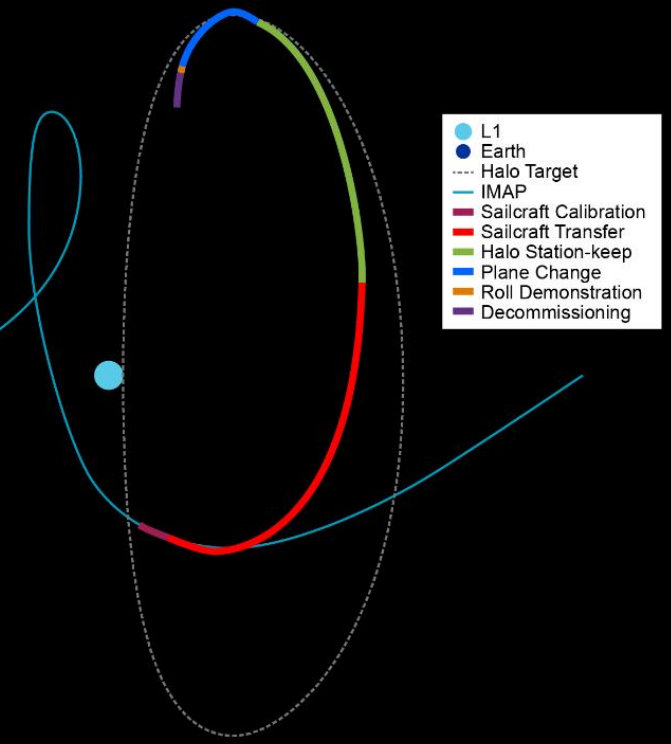
Timeline & Events

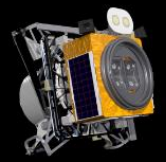
*Notional Timeline. Overall mission duration is approximately 11 months.

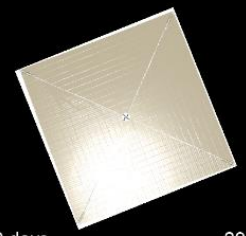












2 days	20 days	135 days	136 days	140 days	215 days	260 days	290 days	291 days	298 days	340 days
L+2 days *Launch Ops*	18 days *Initialization and Checkout*	115 days *Ballistic Transfer*	1 day *Solar Sail Deployment*	4 days *Sailcraft Commissioning*	75 days *Solar Sail Transfer*	45 days *Station Keeping*	30 days *Plane Change*	1 day *Roll Control Demonstration*	7 days *Decommisioning*	
Launch Ops		**Solar Sail Technology Demonstration**							**Decommisioning**	

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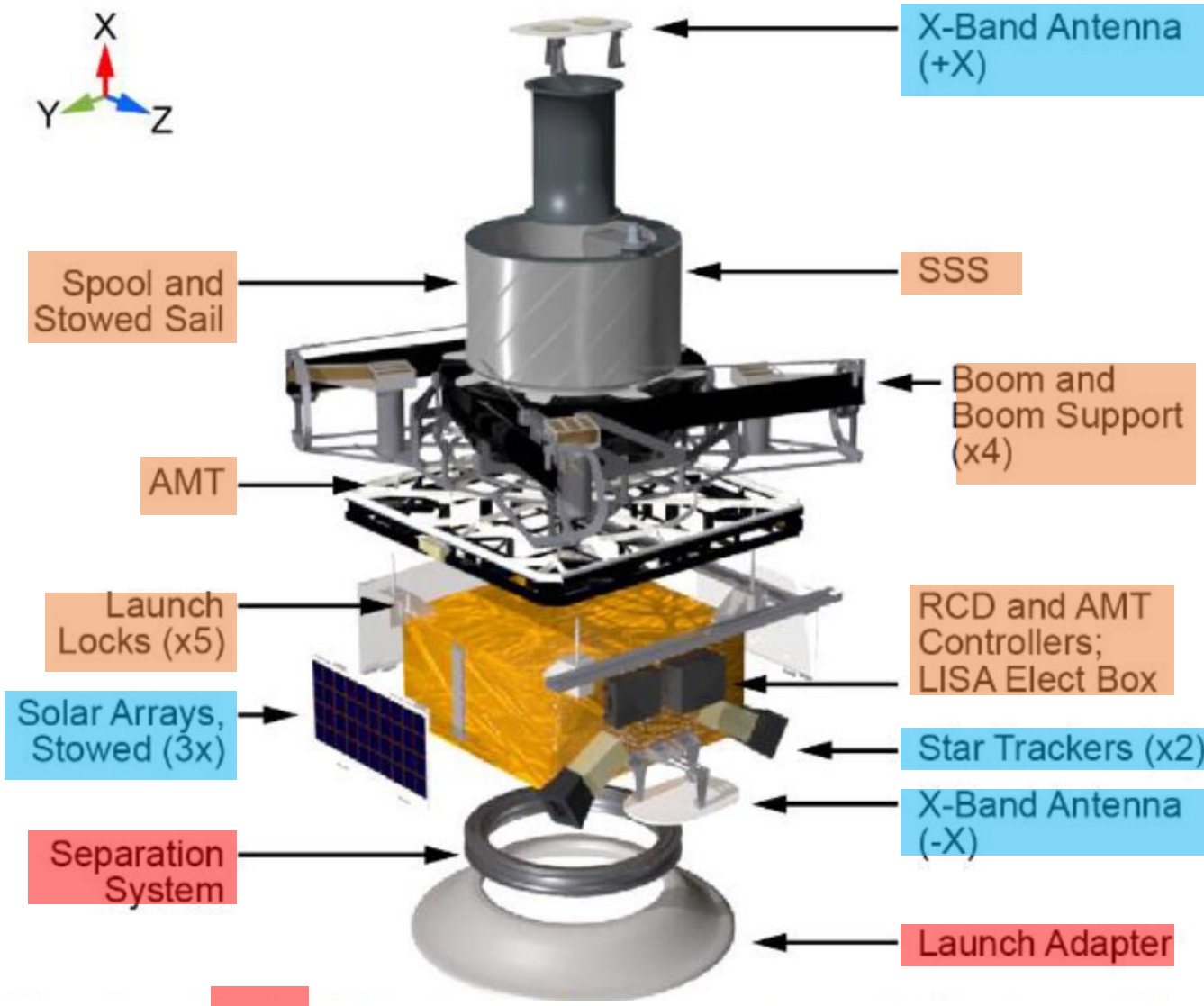
Sailcraft Overview

The Solar Cruiser Sailcraft is comprised of several elements:

- Solar Sail System (SSS)
  - Includes the spool, solar sail, and deployment booms
- Active Mass Translator (AMT)
- Integrated Sailcraft Bus
  - Based on a Blue Canyon Technologies (BCT) X-SAT Venus class microsat bus.
- Solar Sail Attitude Determination & Control Software (SSADCS)
  - Solar Sail control and maneuver command algorithms
- Context Camera

**Context Camera not shown*



Ball Aerospace/BCT Hardware

Roccor Hardware

NASA LSP/SpaceX provided hardware

Design Status, Schedule & Next Steps

- Preliminary Design & Phase A completed in 2020
  - Concept Study Report (CSR) submitted in summer 2020
  - Site visit completed in Fall 2020
- Program Selected in December 2020
- Currently in Phase B (2021)
  - Program System Requirements Review (SRR) completed April 2021
  - Major subcontractors and vendors on contract
  - Preliminary Design review scheduled for Q4 2021
- Phase C/D slated to begin in 2022
- 2025 Launch (rideshare on the IMAP Mission)
- 2025-2026 Mission Operations

Acknowledgements / Questions / Contact

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- *Scott Enger*
- *Amy Puls*
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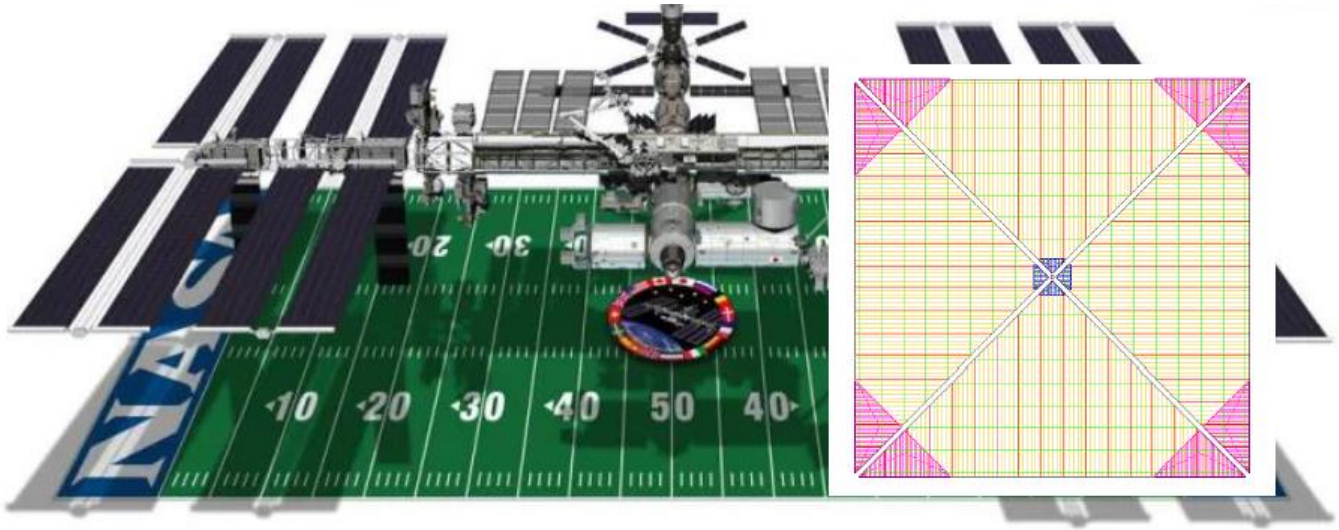
- *Jared Dervan*
- *Dana Turse*



**Size comparison: Solar Cruiser's sail will be ~1/3rd the size of a football field*

Questions? Tune-in to the Q&A session for this paper:

- ***Session:*** Future Missions/Capabilities
- ***Live Technical Q&A Session:*** *Please check the conference website, https://smallsat.org/*
- ***Manuscript/Paper number:*** SSC21-XIII-02

Solar Cruiser

Enabling New Vistas for Heliophysics