

FINCH Satellite Parameter

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1. About FINCH

The Field Imaging Nanosatellite for Crop residue Hyperspectral mapping (FINCH) mission is a 3U CubeSat mission designed to conduct a technological demonstration of crop residue mapping from the Low-Earth Orbit.

he two primary goals for this mission are:

Performing a technological demonstration of the first Volume Phase Holographic (VPH) grism in a small form-factor	Providing a proof of concept for crop residue mapping using hyperspectral short-wave infrared (SWIR) satellite remote sensing
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Since 2020, the FINCH mission has gone through its mission scoping and high-level design phase. We are jumping into the detailed design phase now, full of rapid prototyping and proofs-of-concept in all areas of the team. FINCH is aiming to innovate with its novel payload design and integrating high-performance components in all subsystems to make sure we get the best payload data we can.

FINCH is projected to launch in Q4 2024 aboard a SpaceX Falcon 9 rocket.

2. FINCH Parameter

Orbital Parameter

FINCH will be in a Sun Synchronous Orbit at an altitude of between 500 and 550 km above Earth's surface.

ACCEPTABLE LAUNCH PROVIDER LSA PARAMETER RANGE

Parameter	Minimum	Maximum
Altitude	450 km (Prefer 500 km)	550 km
LTDN	10:00 AM / Mid-Morning (Beta angle of 60 degrees)	2:00 PM / Afternoon (Beta angle of -60 degrees)

Ranges are given for parameters because of uncertainty associated with the final launch vehicle selection.

- During negotiation of the launch contract, we will generally be promised a range of possible altitudes in which we are guaranteed to launch into. We need a wider range to get a launch.
- Even after locking in our altitude within that range, there will be variability within the performance of the rocket itself.

Keplerian Elements

Parameter	Minimum	Maximum	"AVERAGE" (use for analysis)
Semi Major Axis (SMA) [km]	6878	6928	6903
Eccentricity (ECC) [unitless]	0	0.003621614	0.003621614
Inclination (INC) [degrees]	97.40096011	97.59208909	97.49588373
Right Ascension of Ascending Node (RAAN) [degrees]	227.05566156		
Argument of Perigee (AOP)	Does not matter		0
True Anomaly (TA)			0

Other Information

Parameter	Minimum	Maximum	"AVERAGE" (use for analysis)
Orbital Period [s]	5677	5799	5708
Average Velocity [km/s]**	7.58508	7.6126	7.5988
Apogee [km]	500	550	500
Perigee [km]	500	550	550

Payload Parameter

FINCH is a hyperspectral imaging 3U CubeSat satellite for crop residue mapping. Mission science oversees determining, updating, and refining the scientific objectives of FINCH. The current FINCH EYE (FINCH Payload) is developed with the following requirements.

Parameter	Value	Unit
Dimension Lx * Ly * Lz	0.1 x 0.1 x 0.3	m
Image ground sampling distance (GSD)	8	km
Spectral resolution	10	nm
Exposure time	0.02	s
Pointing Knowledge	≤0.002	degrees
Relative Pointing Accuracy	≤0.002	degrees
Absolute Pointing Accuracy	0.6	degrees

Structure and Power Requirements for ADCS.

There are constraints for structure due to limited space in a 3U CubeSat. Current power system is also limited by the amount of hardware need to be run on board.

System	Requirements
Structure	<ul style="list-style-type: none">• ADCS shall be less than 0.5U• ADCS shall be less than 700g
Power	<ul style="list-style-type: none">• The ADCS COTS module shall consume no more than 20W peak