



space structures laboratory

**AAReST Attitude Determination and
Control System (ADCS):**

**Operational Modes, Mission Chronology, and
Sensor Locations**

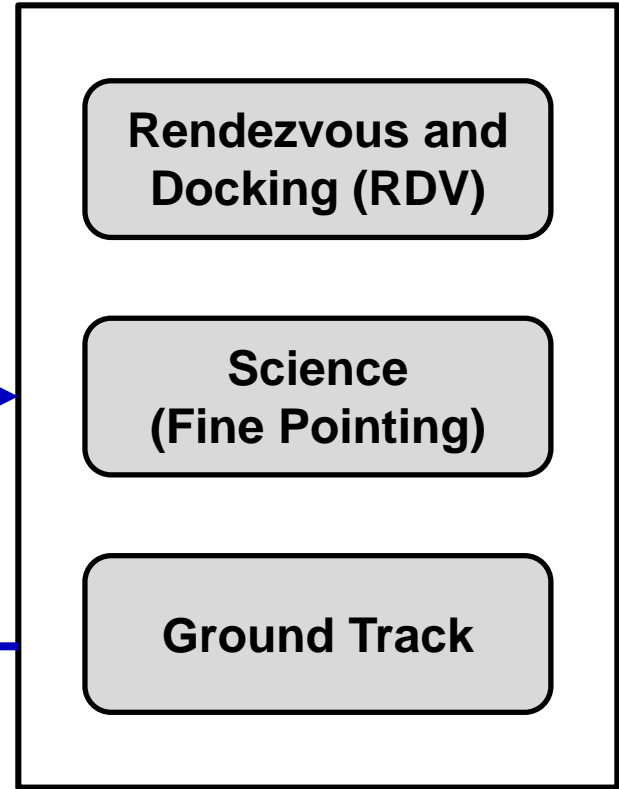
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November 5th, 2018

Caltech

ADCS Operational Modes

Shaded modes are 3-axis stabilized



Ground Testing

Idle

Detumble

Configuration Change

Slew

Survival** (Default)

Reaction Wheel Desaturation

ADCS Calibration

Telescope Calibration

Boom Deployment, Frangibolt Separation

**Includes 3-axis stabilized Sun Pointing Mode; Survival Mode is Safe Mode

Using RWs or Torque Rods

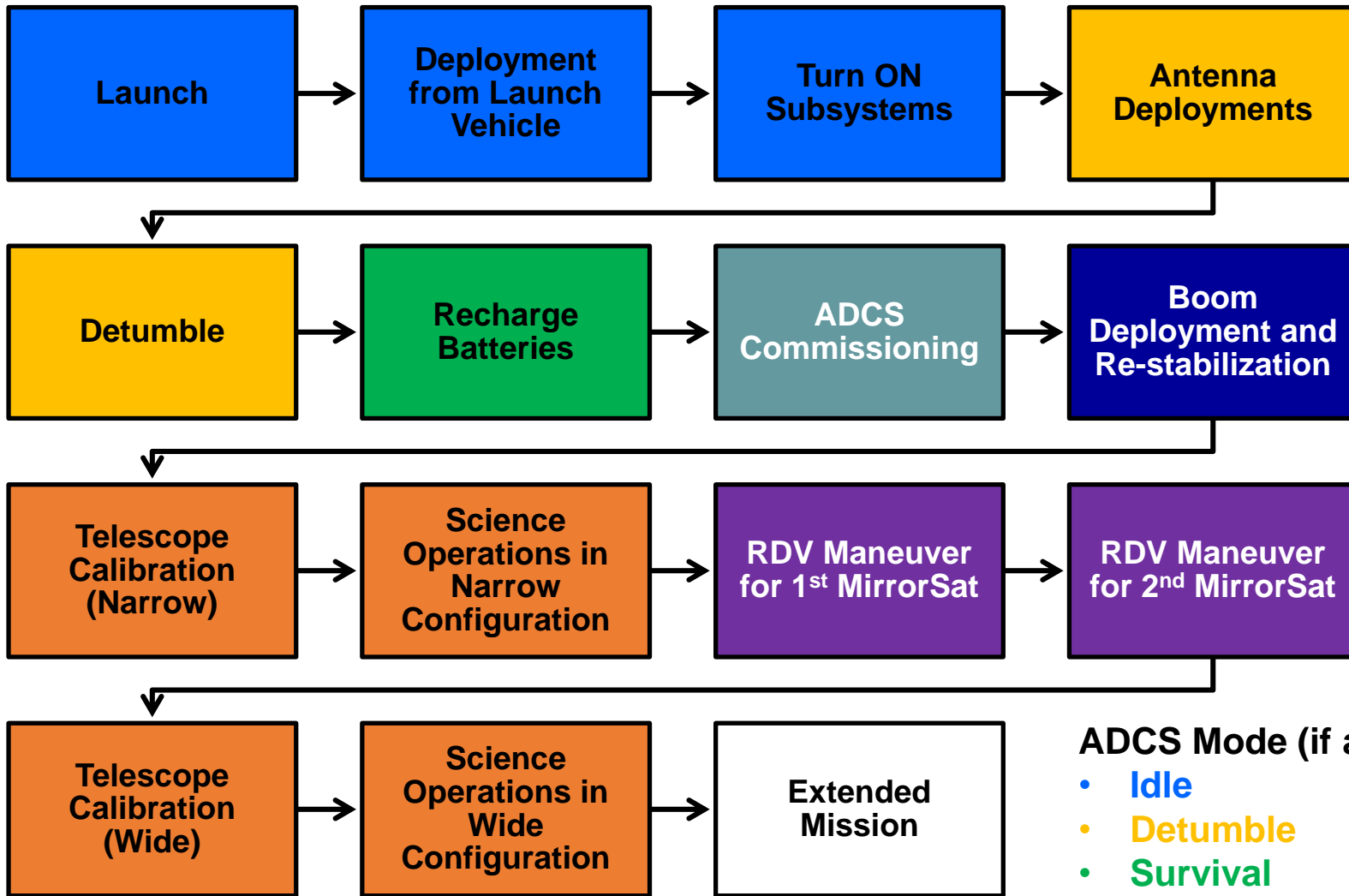
Operational Modes Mapping

- Table defines mapping between ADCS operational modes and CubeSpace ADCS control and estimation modes

Operational Mode	ADCS Control Mode(s)	ADCS Estimation Mode(s)
Ground Testing	N/A	N/A
Idle	No Control	No Estimation
Detumble (w/Torque Rods**)	Detumbling	MEMS Rate Sensing or Magnetometer Rate Filter
Survival (Default)	R-Wheel Sun Tracking Control	Full State EKF w/Minimum Sensor Complement
Configuration Change	No Control	Full State EKF
Reaction Wheel Desaturation	XYZ Wheel Control	Full State EKF
ADCS Calibration	Varies – see ADCS Commissioning Manual	Varies – see ADCS Commissioning Manual
Telescope Calibration	R-Wheel Target Tracking Control	Full State EKF
Slew	XYZ-Wheel Control	Full State EKF
Rendezvous and Docking (RDV)	TBD	Full State EKF
Science (Fine Pointing)	R-Wheel Target Tracking Control	Full State EKF
Ground Track	R-Wheel Target Tracking Control	Full State EKF

**A 2nd Detumble Mode uses reaction wheels 3

AAReST Nominal Mission Chronology



Note: AAReST returns to Survival Mode and recharges batteries after every step in chronology before proceeding to next step.

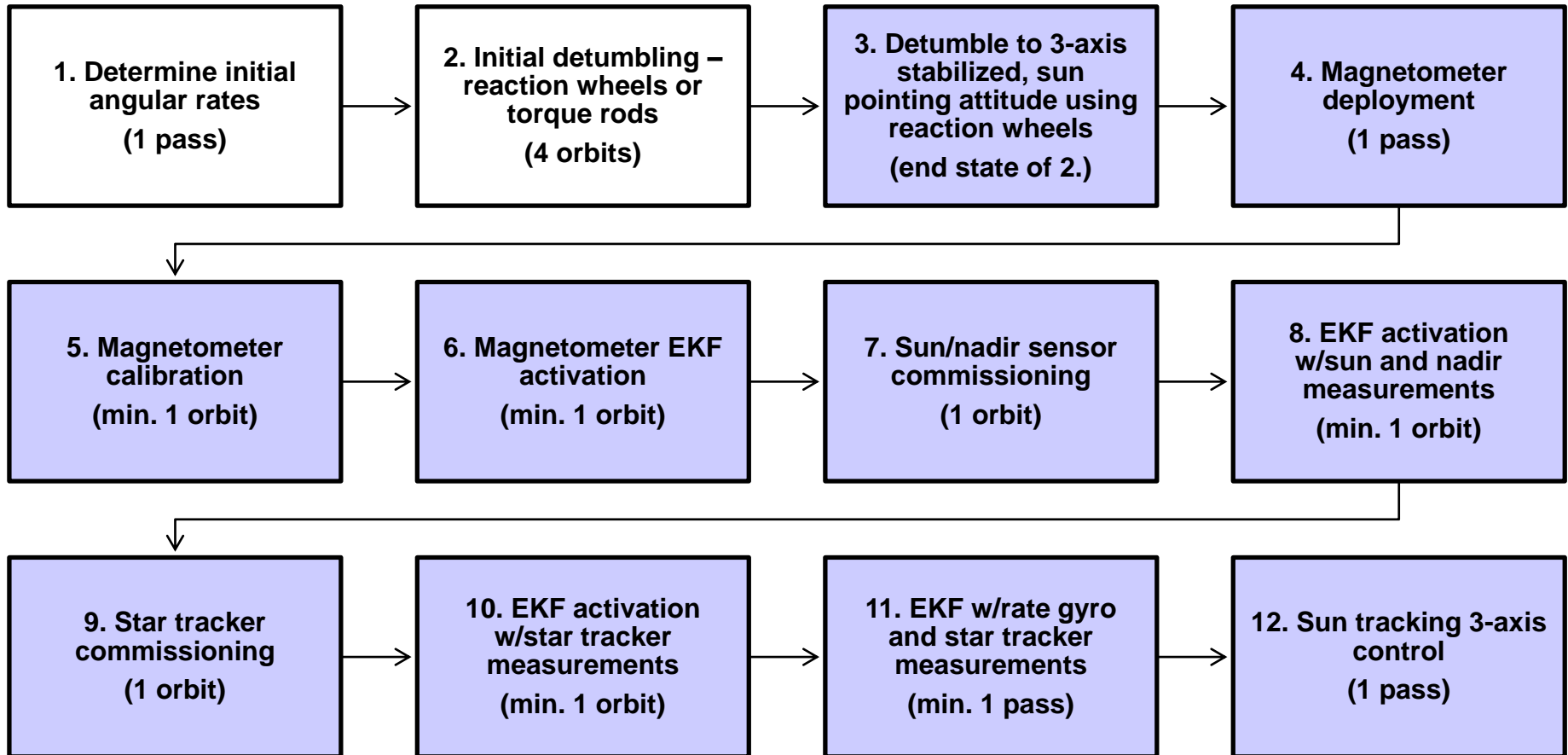
ADCS Mode (if applicable):

- Idle
- Detumble
- Survival
- Configuration Change
- ADCS Calibration
- Fine Pointing
- RDV

ADCS Commissioning

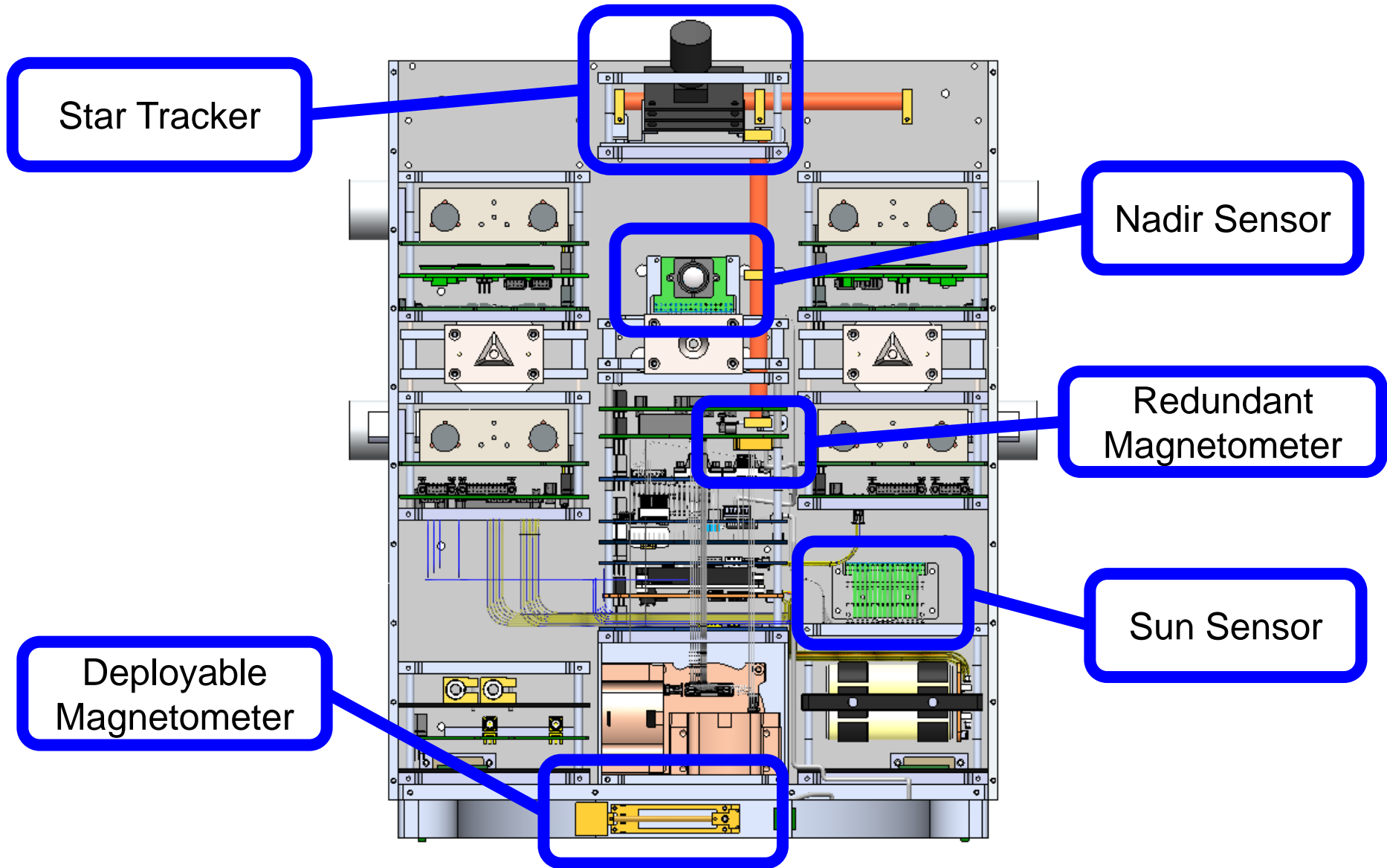
 3-axis stabilized

AAReST bypasses pitch-axis control and goes directly to a 3-axis stabilized, sun pointing attitude using reaction wheels



Note: Steps 1-3 occur during Detumble in the Nominal Mission Chronology.

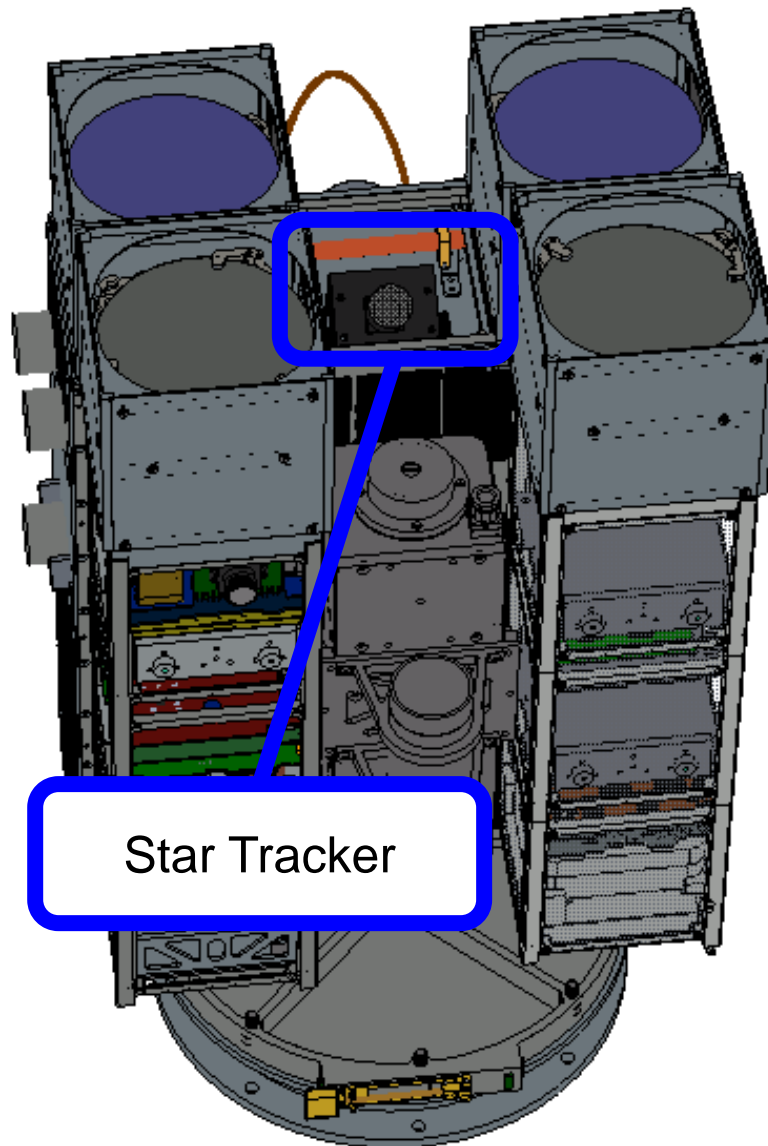
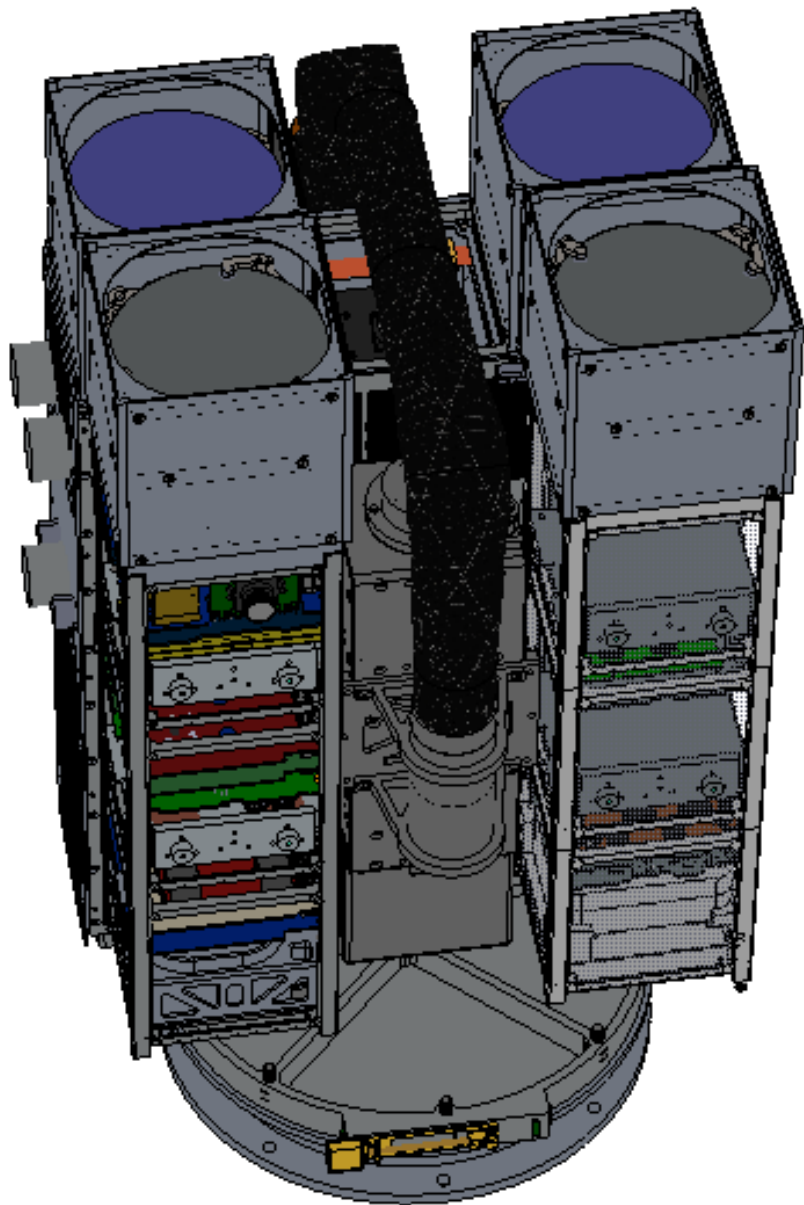
ADCS Sensor Locations





Deployable Magnetometer

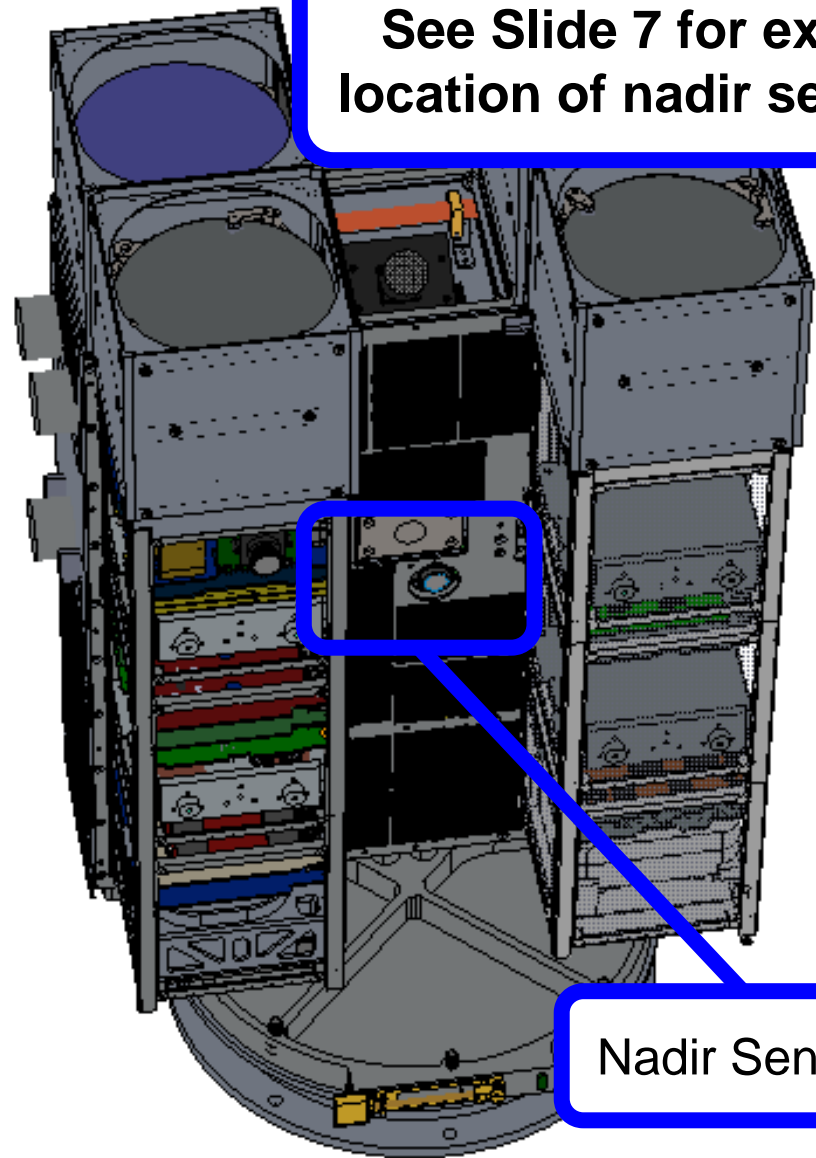
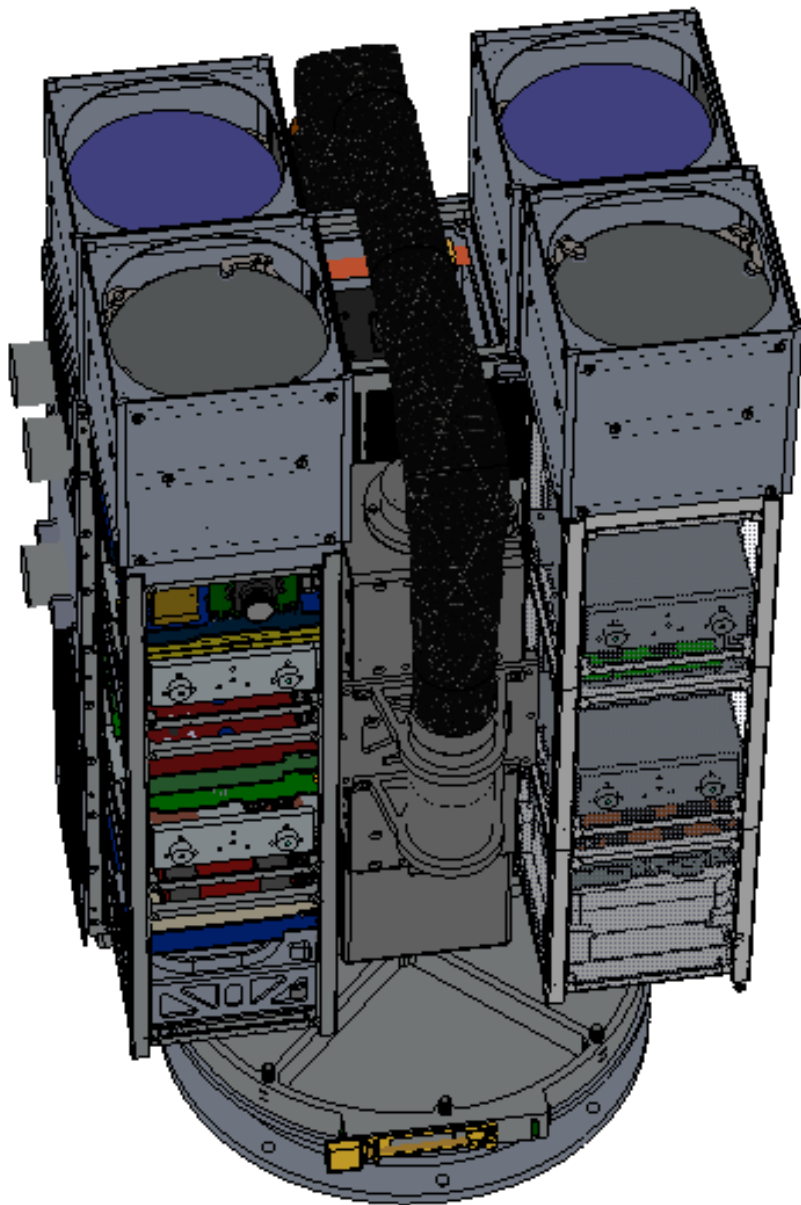
Flight-like Launch/Stowed Configuration



Star Tracker

Flight-like Launch/Stowed Configuration

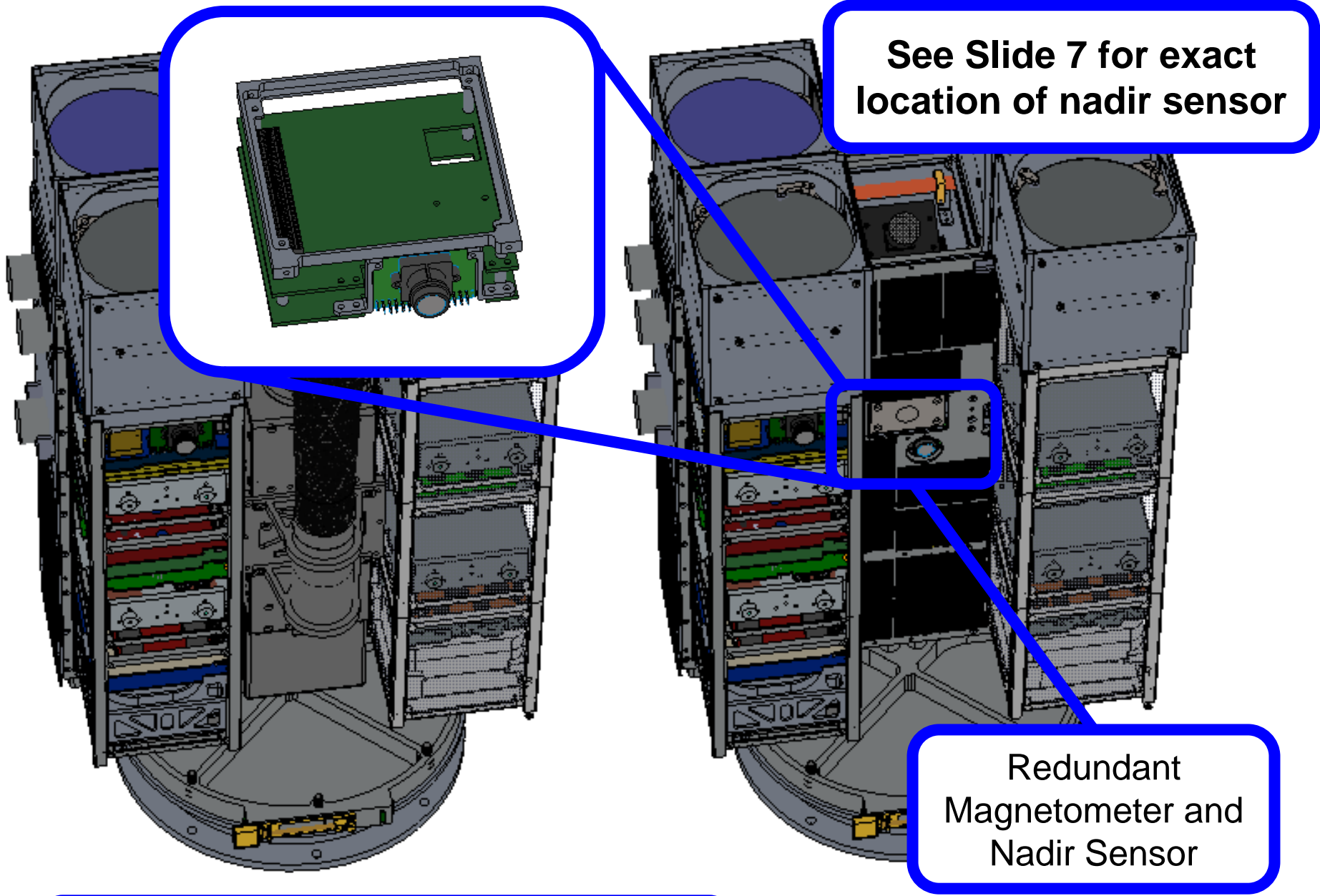
Note: star tracker baffle not shown



See Slide 7 for exact location of nadir sensor

Nadir Sensor

Flight-like Launch/Stowed Configuration

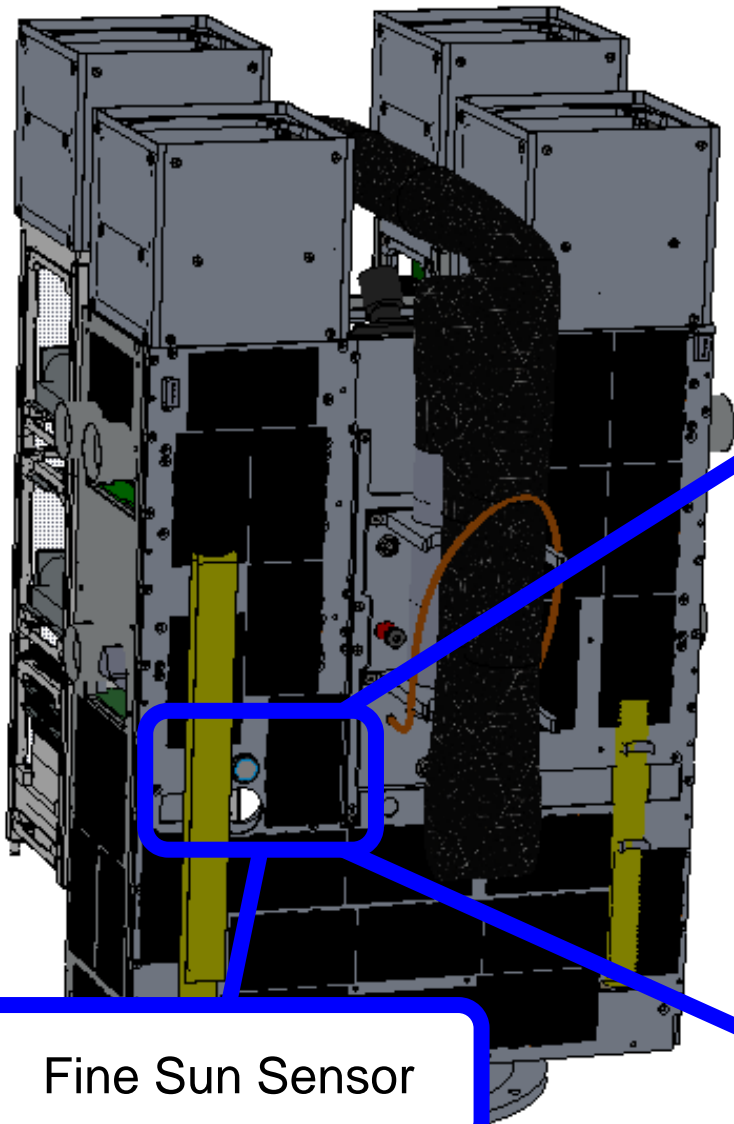


See Slide 7 for exact location of nadir sensor

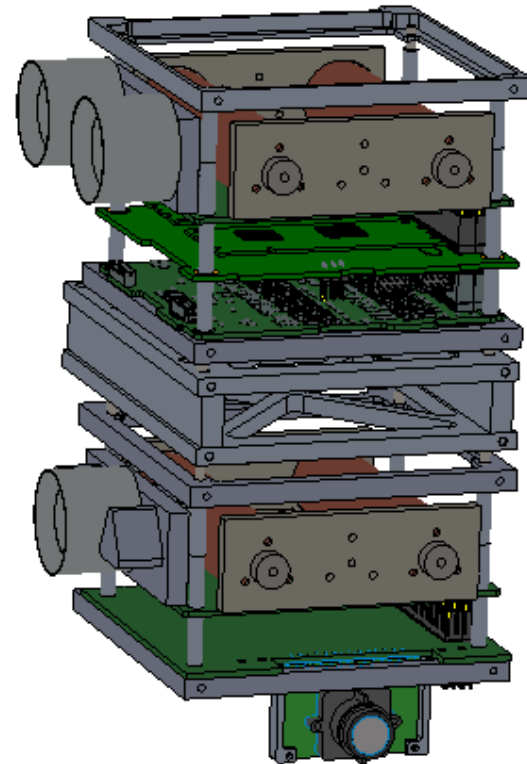
Redundant Magnetometer and Nadir Sensor

Flight-like Launch/Stowed Configuration

See Slide 7 for exact location of sun sensor



Fine Sun Sensor



Flight-like Launch/Stowed Configuration