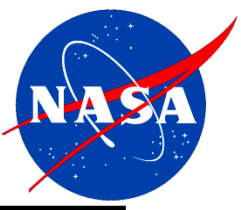




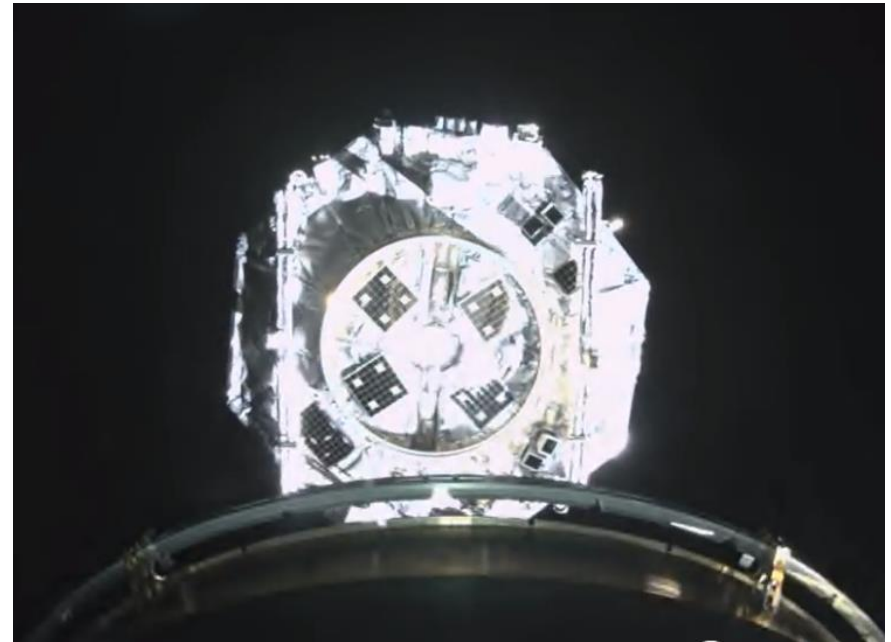
Magnetospheric MultiScale Mission (MMS) Overview

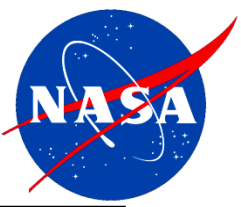
Conrad Schiff



MMS Launch

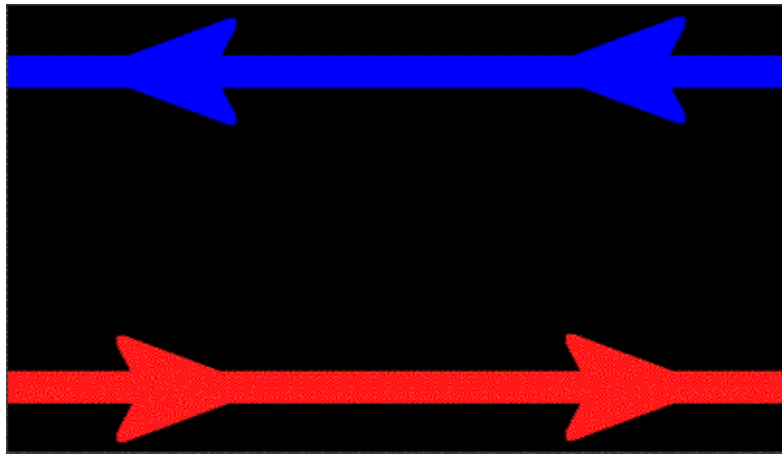
- The MMS mission was launched on March 13, 2015 aboard an Atlas V rocket from Space Launch Complex 40, Cape Canaveral, Florida
- Each of the four observatories were successfully released at five minute intervals spinning at 3 rpm approximately 1.5 hours after launch





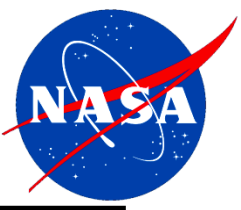
Science Goals

- Study magnetic reconnection in the Earth's magnetosphere
- Magnetic reconnection converts magnetic energy into kinetic energy
 - Oppositely directed parallel field lines are pinched
 - They join and snap apart like a breaking rubber band



Credit: European Space Agency

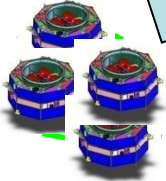
- Benefit: understanding of how the Earth lives with the Sun (e.g. Class X Flash 0156 GMT Tuesday, Feb. 15, 2011)
 - Power grid problems
 - Communications disruption
 - Aurora formation



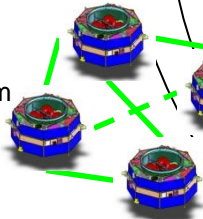
Flight Dynamics Concept

Use the formation as a 'science instrument' to study the magnetosphere

Need to prevent close approaches



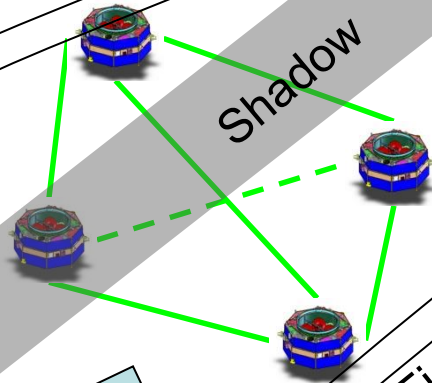
10-160 km



Formation scale matches science scale

Shadow

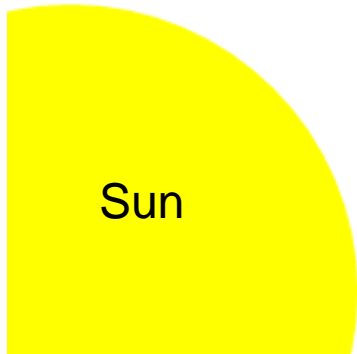
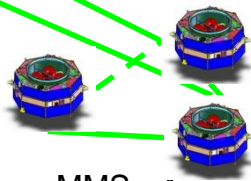
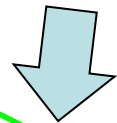
30-400 km



Magnetic Field Lines

Night-side science (neutral sheet) bound by power (limits shadow duration)

Maneuvers used to maintain formation against relative drift (ΔV) and to maintain attitude pointing (ΔH)



Sun

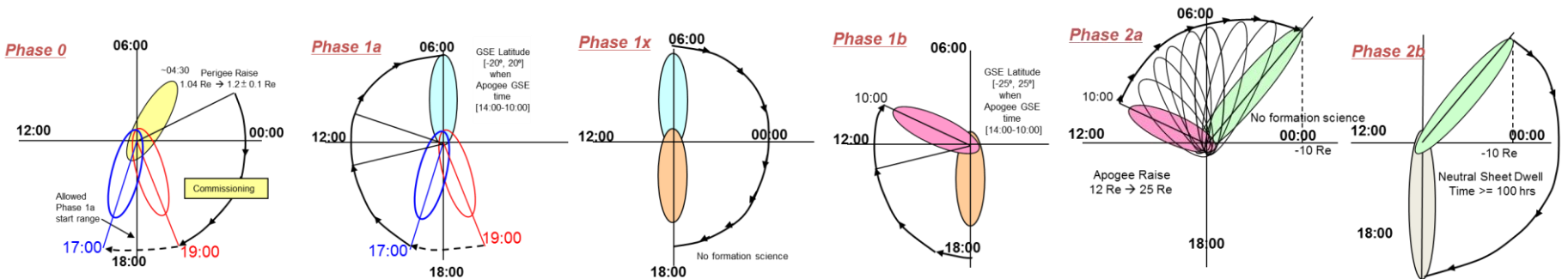
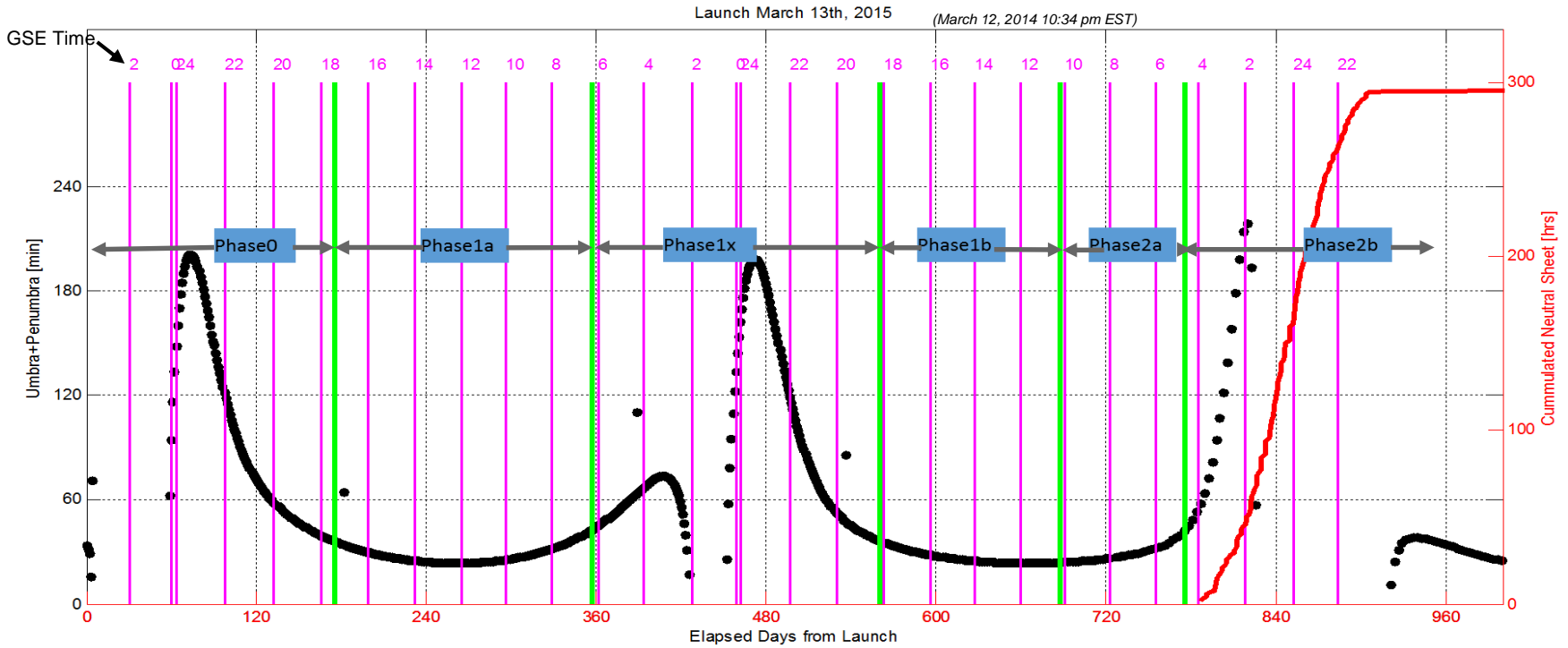
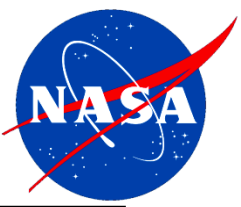
Oct. 19-23, 2015

ISSFD 2015 – MMS Session

MMS - 4



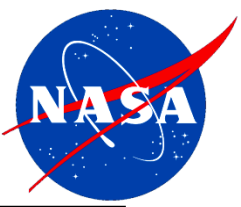
MMS Flight Summary



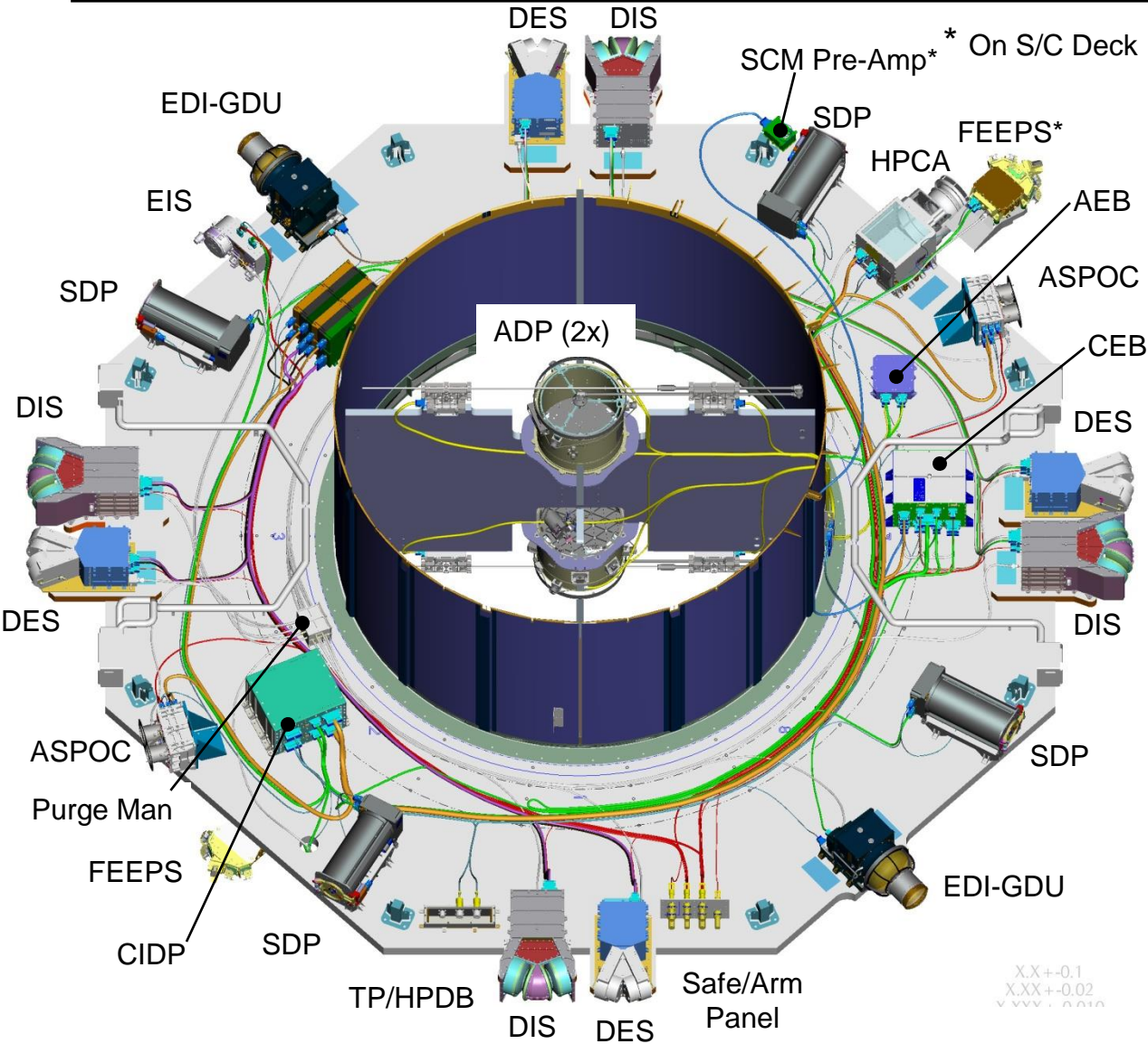
Multiple opportunities for joint observations with THEMIS and Van Allen Probes



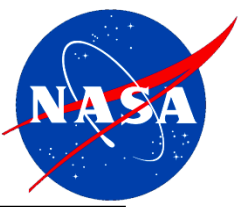
MMS Instrument Suite Components



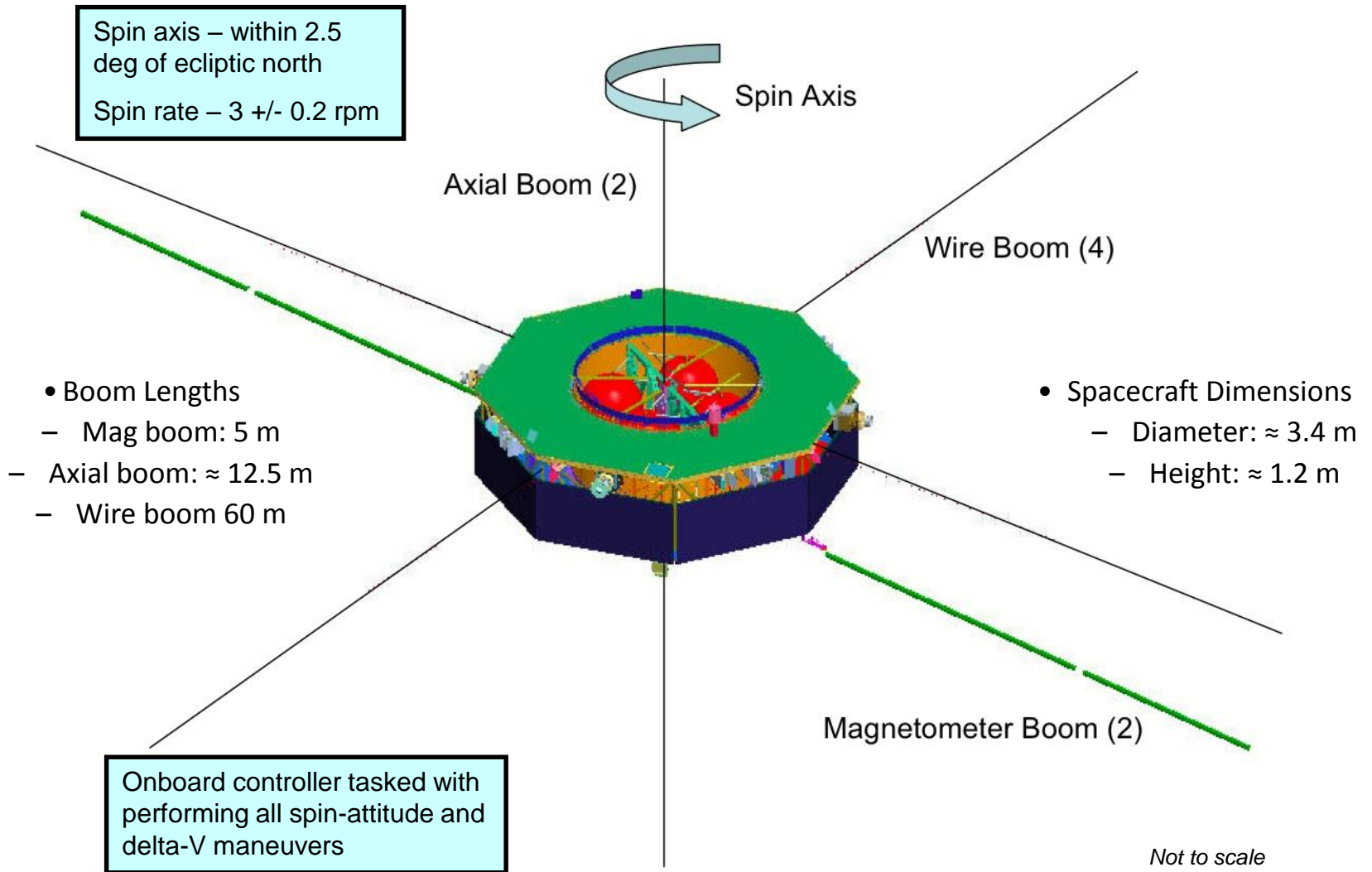
(view looking from the bottom of the IS Deck)



- ADP - Axial Double Probe**
- AFG - Analog Flux Gate Magnetometer (mounted on boom)**
- ASPOC - Active Spacecraft Potential Control**
- CEB - Central Electronics Box (Fields)**
- CIDP - Central Instrument Data Processor**
- DES - Dual Electron Spectrometer**
- DFG - Digital Flux Gate Magnetometer (mounted on boom)**
- DIS - Dual Ion Spectrometer**
- EDI/GDU - Electron Drift Instrument/ Gun Detector Unit**
- EIS - Energetic Ion Spectrometer**
- FEEPS - Fly's Eye Energetic Particle Sensors**
- HPCA - Hot Plasma Composition Analyzer**
- IDPU - Instrument Data Processing Unit (FPI)**
- SCM - Search-Coil Magnetometer (mounted on boom)**
- SDP - Spin-Plane Double Probe**
- TP/HPDB - Test Panel Heater Power Distribution Box**

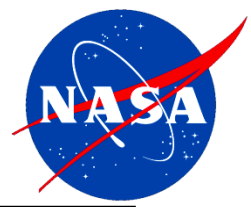


Spacecraft Fully Deployed

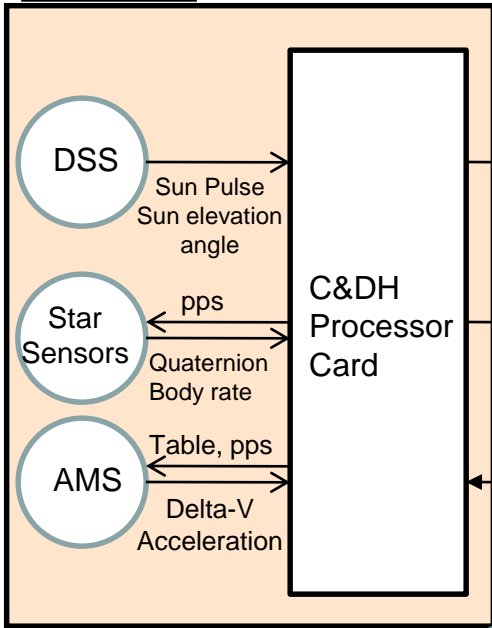




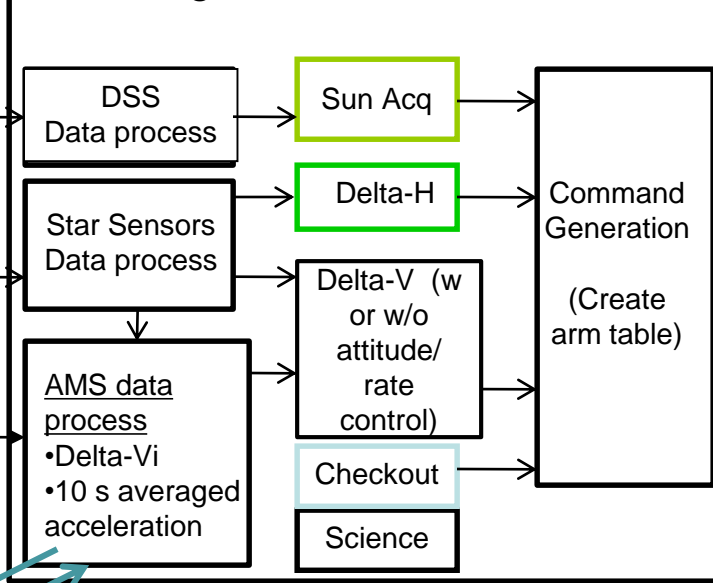
Spacecraft GN&C Block Diagram



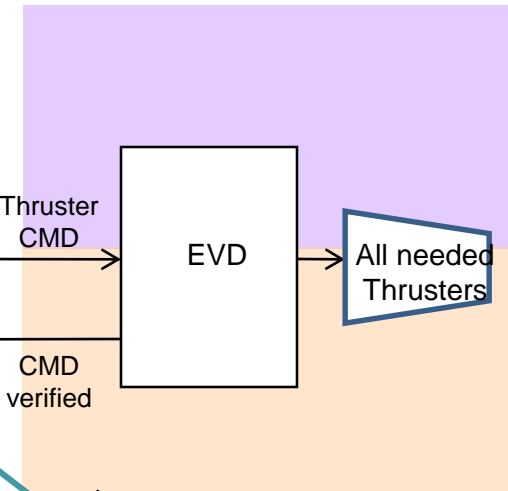
Sensors



ACS Flight SW Resides in C&DH



Actuator



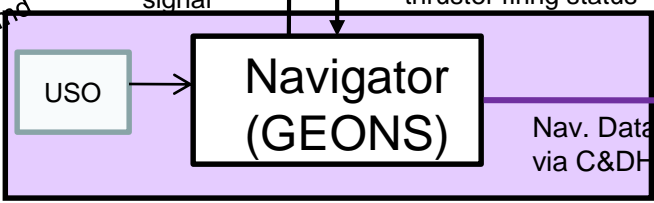
ACS sensor Data
Inertia ratio
Attitude/rate cmd

20 MHz frequency signal
10 s averaged acceleration; thruster firing status

Orbit maneuver cmd
Thrust Tim

Attitude Ground System (AGS):

- AMS parameter estimation
- Attitude maneuver planning



FD Ground Support System (FDGSS):

- GEONS monitoring
- Orbit maneuver planning, monitoring and calibration
- Orbit product generation