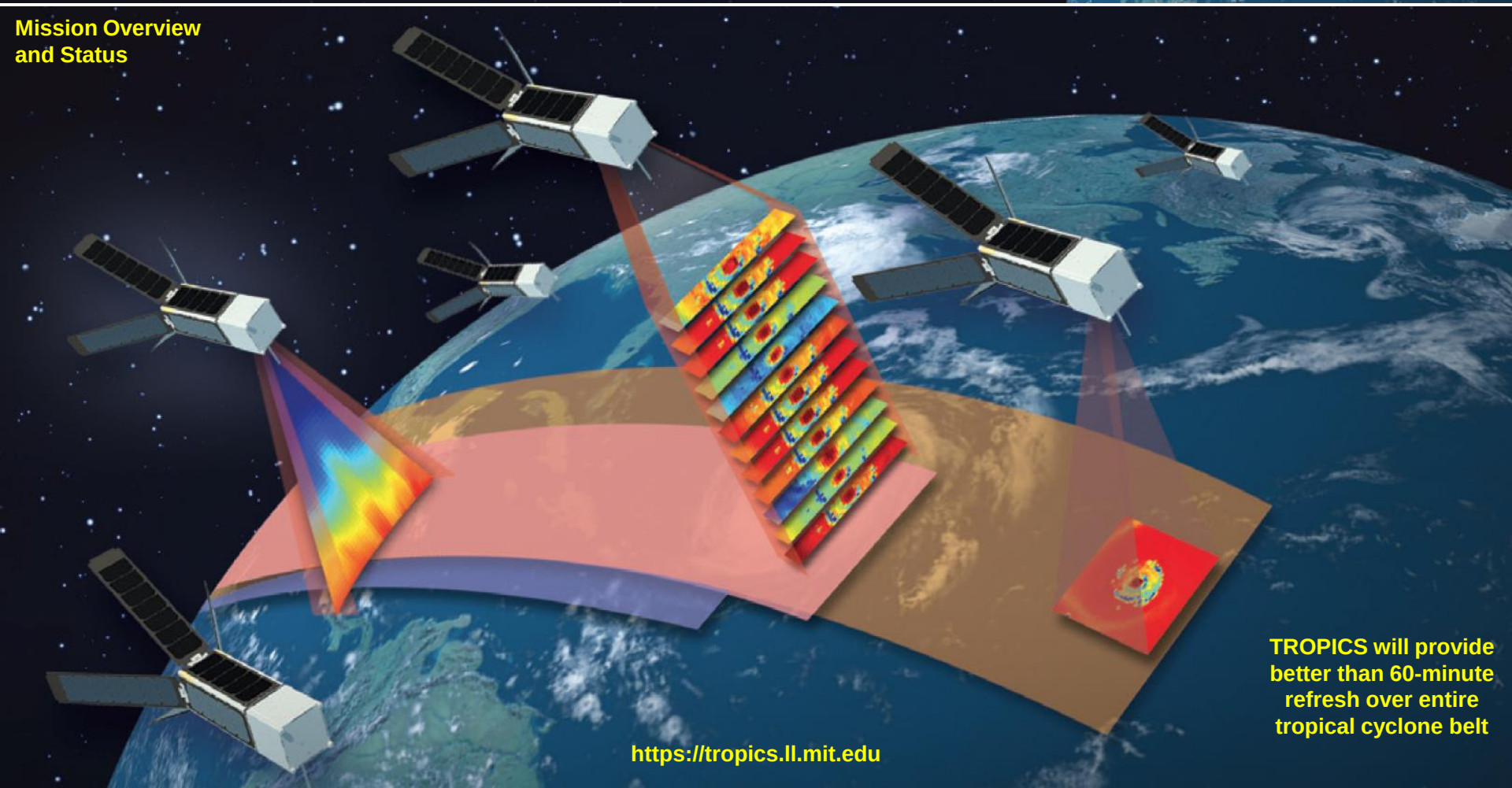
Time-Resolved Observations of Precipitation structure and storm Intensity with a Constellation of Smallsats

MIT Lincoln Laboratory (lead organization)

William J. Blackwell, Principal Investigator. Scott Braun (NASA GSFC), Project Scientist

Mission Overview and Status



TROPICS will provide better than 60-minute refresh over entire tropical cyclone belt

https://tropics.ll.mit.edu

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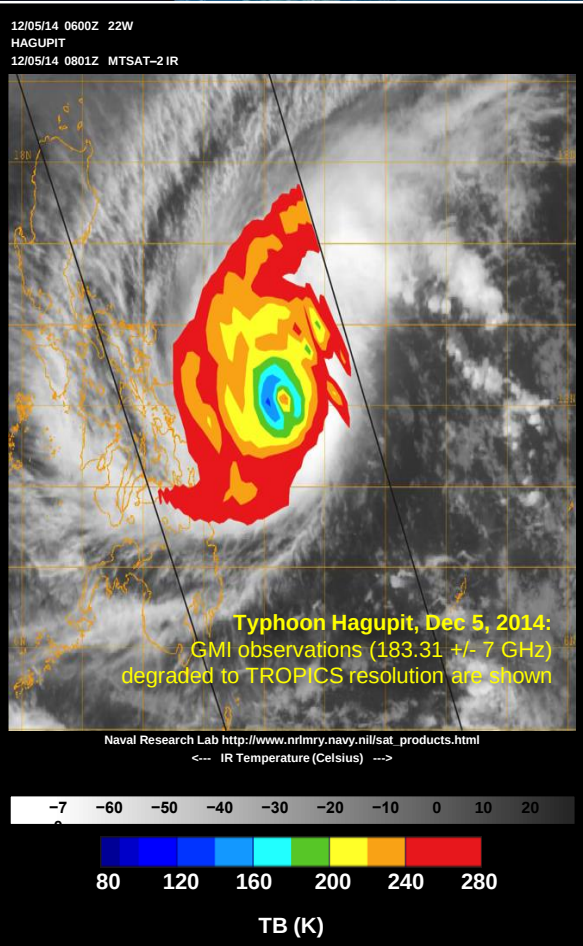
- **TROPICS will be the first demonstration that science payloads on low-cost CubeSats can push the frontiers of spaceborne monitoring of the Earth to enable system science.**
- **TROPICS will fill gaps in our knowledge of the short time scale—hourly and less—evolution of tropical cyclones. Our current capabilities are almost an order of magnitude slower.**
- **TROPICS will complement CYGNSS by making direct measurements of temperature, humidity and precipitation, in rapidly developing tropical cyclones.**
- **TROPICS has the potential to make frequent precipitation measurements, expanding on the coverage of the GPM mission.**



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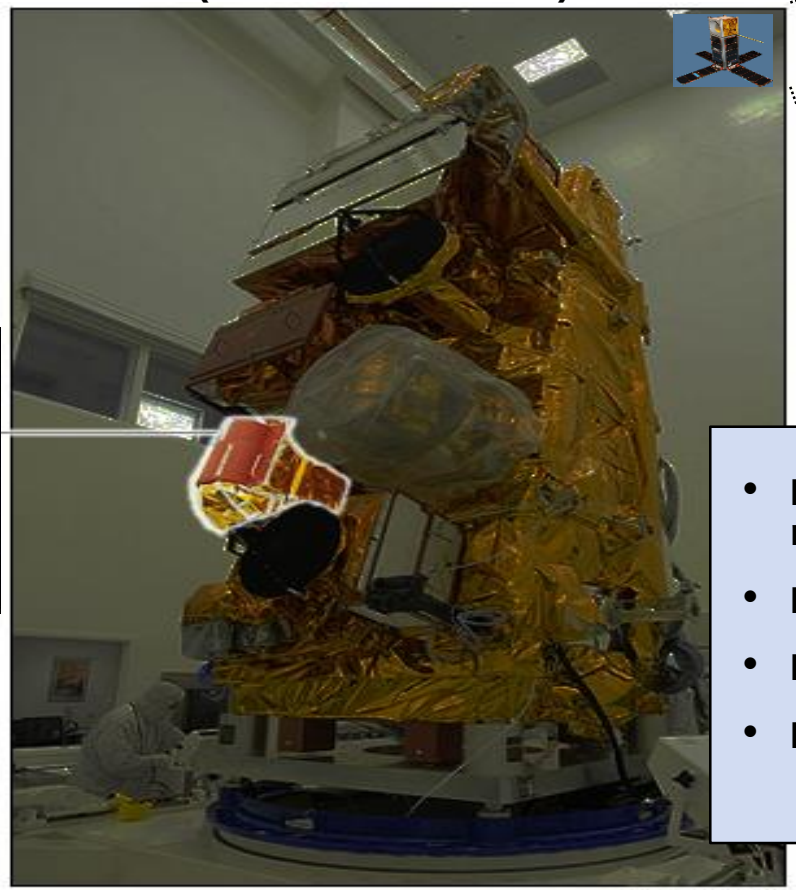
New Approach for Microwave Sounding

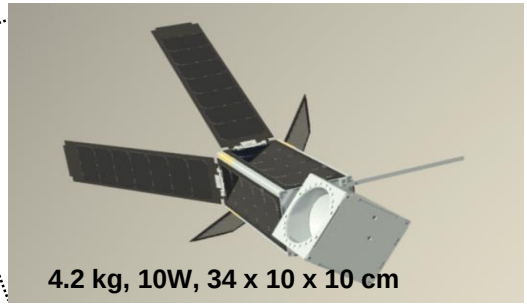
Suomi NPP Satellite (Launched Oct. 2011)



2100 kg

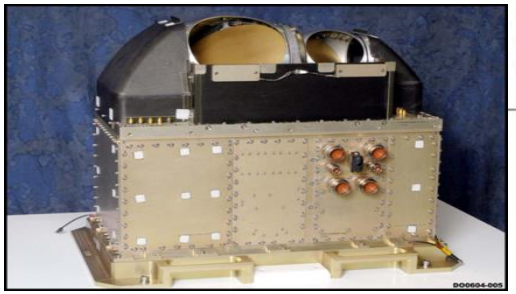
NASA/GSFC

MicroMAS Satellite



4.2 kg, 10W, 34 x 10 x 10 cm

Advanced Technology Microwave Sounder (ATMS)



100 kg, 100 W

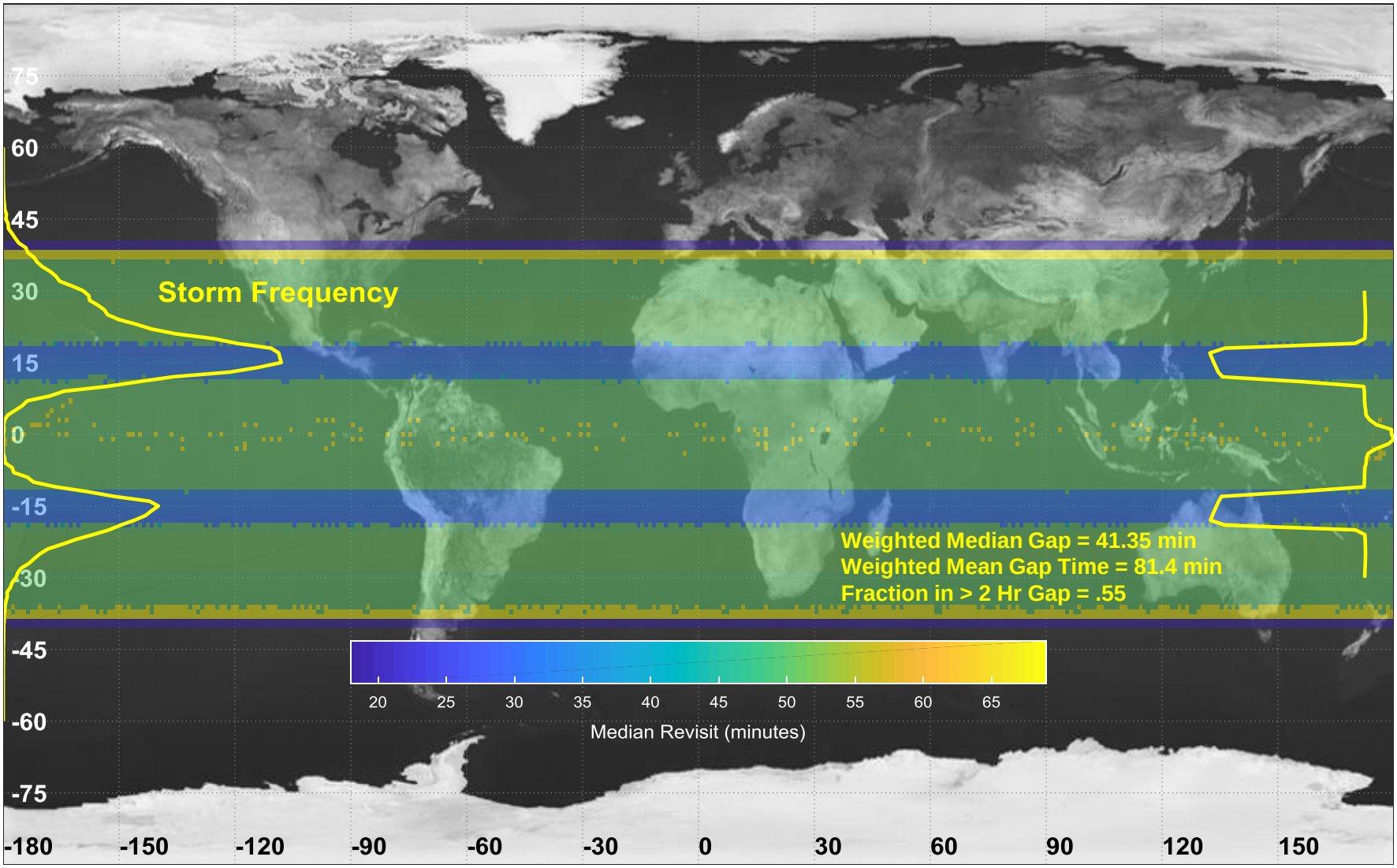
- Microwave sensor amenable to miniaturization (10 cm aperture)
- Broad footprints (~50 km)
- Modest pointing requirements
- Relatively low data rate

NPP: National Polar-orbiting Partnership

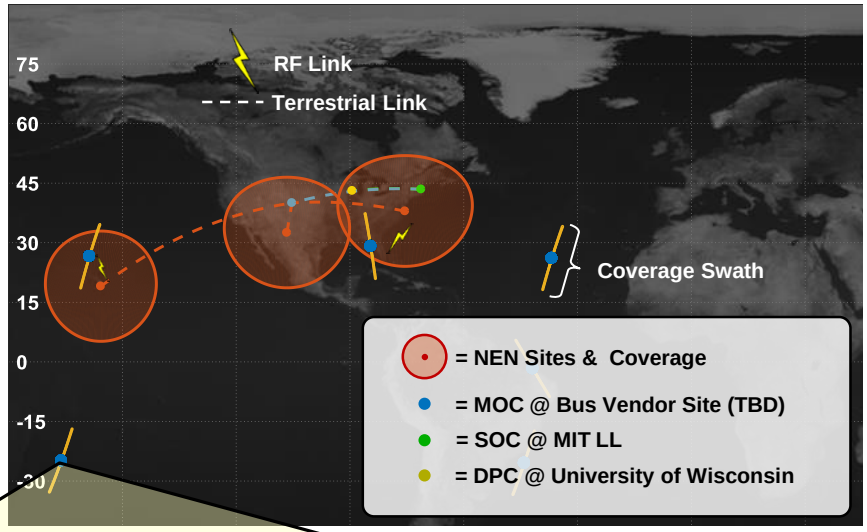
TROPICS Products and Expected Performance

Product	Threshold Requirement (Uncertainty)	Baseline Requirement (Uncertainty)	Expected Performance (Uncertainty)
Temperature Profile	2.5 K	2.0 K	1.6 K
Moisture Profile	35 %	25 %	16 %
Rain Rate	50 %	25 %	25 %
Min Sea-Level Pres.	12 hPa	10 hPa	8 hPa
Max Sustained Wind	8 m/sec	6 m/sec	5.5 m/sec

TROPICS Revisit (6 sats, 3 planes, 30° inc., 550 km alt.)



TROPICS Mission Implementation



Science Community

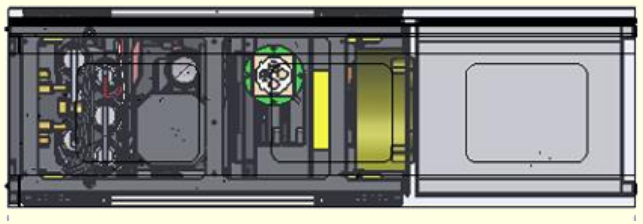
TROPICS Science Team

NASA Distributed Active Archive Center

Space Vehicle

BUS
(Blue Canyon Technologies)

Payload
(MIT LL)



Ground

Ground Network
(KSAT Lite)

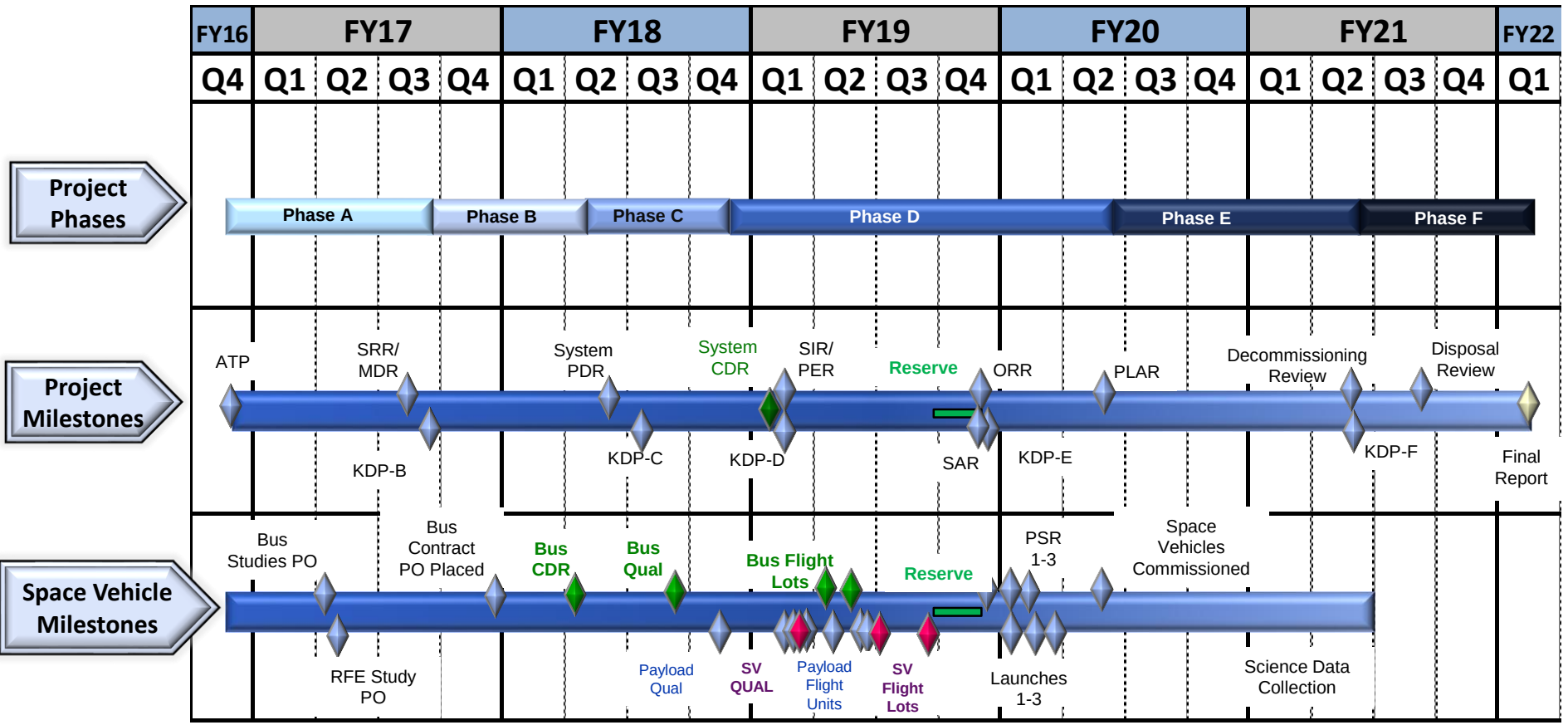
Mission Operations
(Blue Canyon)

Data Processing Center (U. Wisconsin)

Science and Payload Operations Center
(MIT LL)

MOC = Mission Operations Center
SOC = Science Operations Center
DPC = Data Processing Center

TROPICS Top Level Schedule



Abbreviations/Acronyms:

ATP	Authorization to Proceed	KDP	Key Decision Point	PSR	Pre-Ship Review
CDR	Critical Design Review	MDR	Mission Definition Review	QUAL	Qualification Module
EDU	Engineering Development Unit	ORR	Operations Readiness Review	SAR	System Acceptance Review
FM	Flight Module	PDR	Preliminary Design Review	SIR	System Integration Review
FRR	Flight Readiness Review	PLAR	Post Launch Assessment Review	SRR	Systems Requirements Review
		PRR	Production Readiness Review	TRR	Test Readiness Review

20 Nov2017