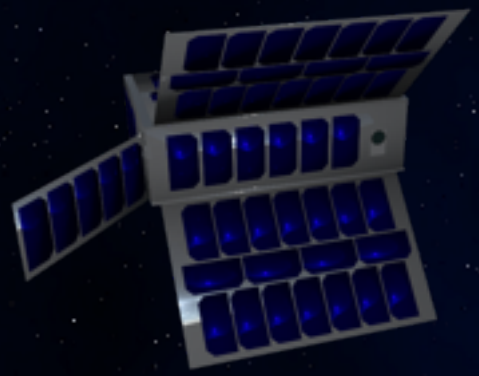


A 6U CubeSat for Lunar Orbit and Beyond

Presenter: Kathleen Morse, Ph.D. Founder of Yosemite Space, LLC and Member of Team Miles, Kathleen@yosemitespace.com

Team Miles POC: Wes Faler, Owner of Fluid & Reason, LLC and Team Lead for Miles, Wes@miles-space.com

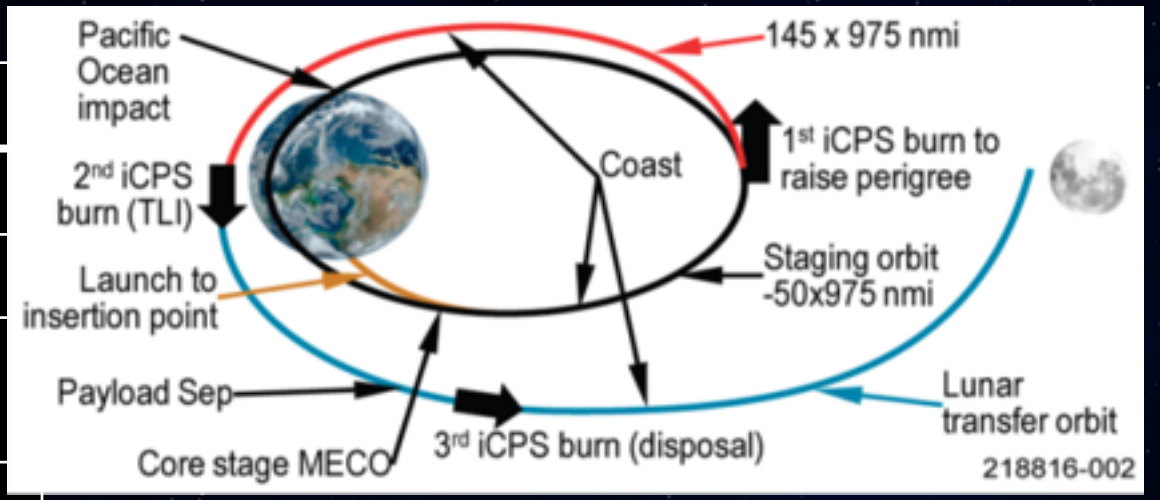
Miles Mission and NASA Cube Quest

- NASA Cube Quest is a Centennial Challenge to build flight-qualified, 6U satellites capable of advanced communication and propulsion near and beyond the moon
- Miles to compete in Lunar Derby
- Team Miles accomplishments to date:
  - Won first position in ground tournament 1
  - Finished in top 5 in ground tournament 2
  - Miles qualifies as 1 of 6 teams eligible for EM1 launch
- EM1 launch scheduled for 2018

Miles

Summary of Miles Mission

Time	Action
0s	Deployment from SLS
>30s	CDH on, internal checks
10 to 30 min.	Deploy solar panels, RF transmission remaining subsystems on
>40 min.	Attitude Stabilization
>1Hr.40min. to 8 days	Calculate and execute trans-lunar insertion plan
60 days	Lunar Derby, NASA DSN confirms orbit
> 60 days to 75 days	Calculate and execute storage orbit (Earth- Mars orbit)
>75 days	Execute kill sequence and powers down.



Mission autonomy enabled by:
- Customs mission s/w
- Open source trajectory prediction s/w
- RACP performance and reliability

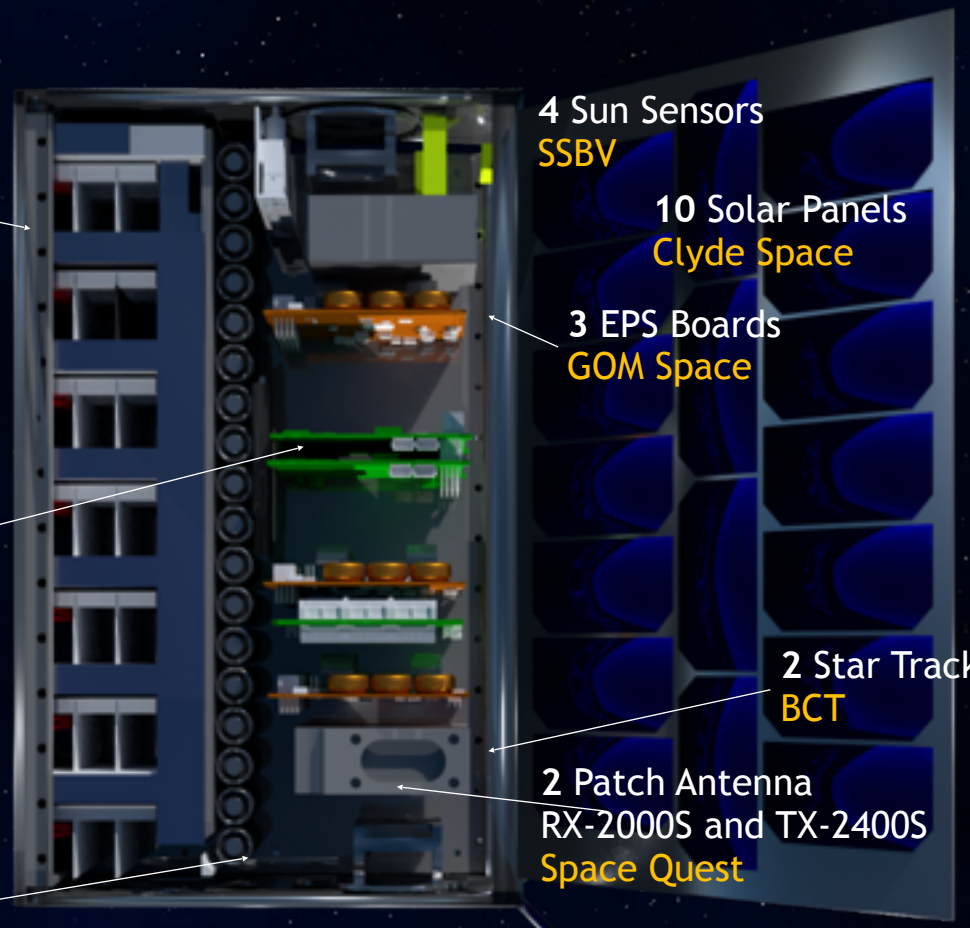
Miles

Summary of Miles Bus

14 ConstantQ Thrusters:
Iodine Plasma propulsion
> 1.1mN/W
0.5U for 4 thrusters
Fluid & Reason, LLC

RACP:
hybrid platform
scalable performance:
350MIPS at 0.8W
25k MIPS at 8.7W
9cm X 9cm size
Yosemite Space, LLC

18 Li-ion batteries
Orbtronics



4 Sun Sensors
SSBV

10 Solar Panels
Clyde Space

3 EPS Boards
GOM Space

2 Star Trackers
BCT

2 Patch Antenna
RX-2000S and TX-2400S
Space Quest

Miles Spacecraft Specs	
Size	6U
Initial Mass	14kg
Available Power	30-35W
Available Thrust	39.5mN
Position Accuracy	1-10km

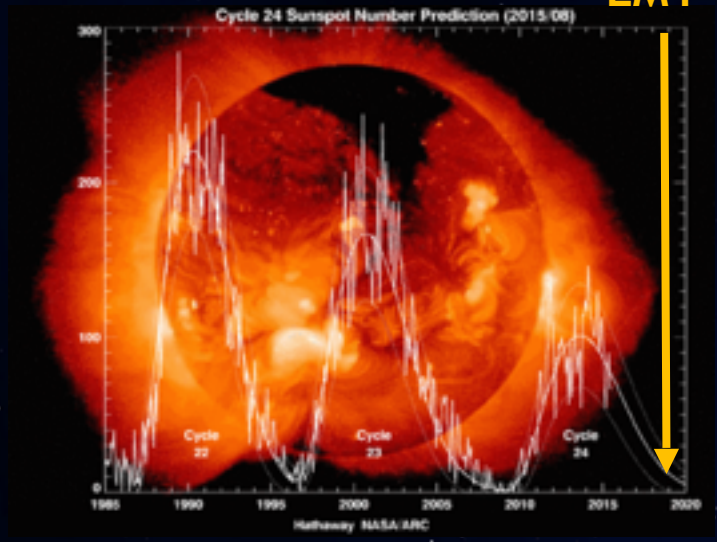
Miles

Miles Design Mitigates Radiation Effects

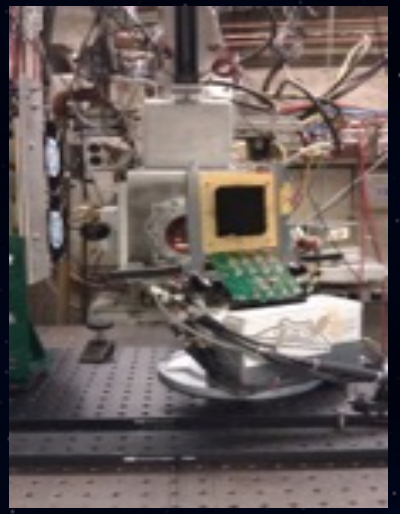
- Screen electronics with ground based radiation testing
  - Catastrophic failures
  - TID radiation hardness (10X margin for mission)
- Shielding
- SEE detection and protection
- Redundancy
- Health Monitoring and Management system

Solar Cycle

EM1



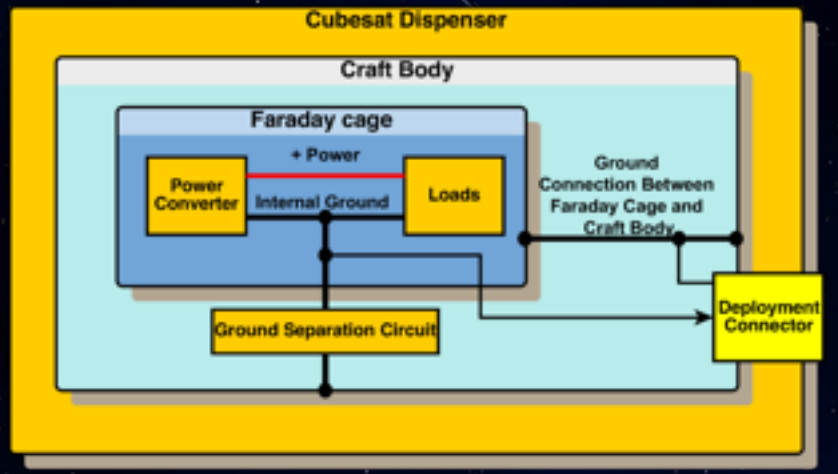
Proton Testing- MGH



VPT RAD

Miles Design Mitigates Space Charging Effects

- Faraday Cage
- Grounding controlled by thyristor that only conducts when voltage is above its set point.
- Leaky dielectric coatings prevent charge build-up on dielectric surfaces



Miles

ConstantQ Thruster

ConstantQ Thruster Properties	
Thrust	2.4mN (observed), 4-5mN (2016 Q2)
I_{sp}	>250s (observed)
Power	2.2W per thruster
ΔV	327m/s (1kg iodine propellant)
Dry Mass	39 grams
Volume	0.5U for 4 thruster system

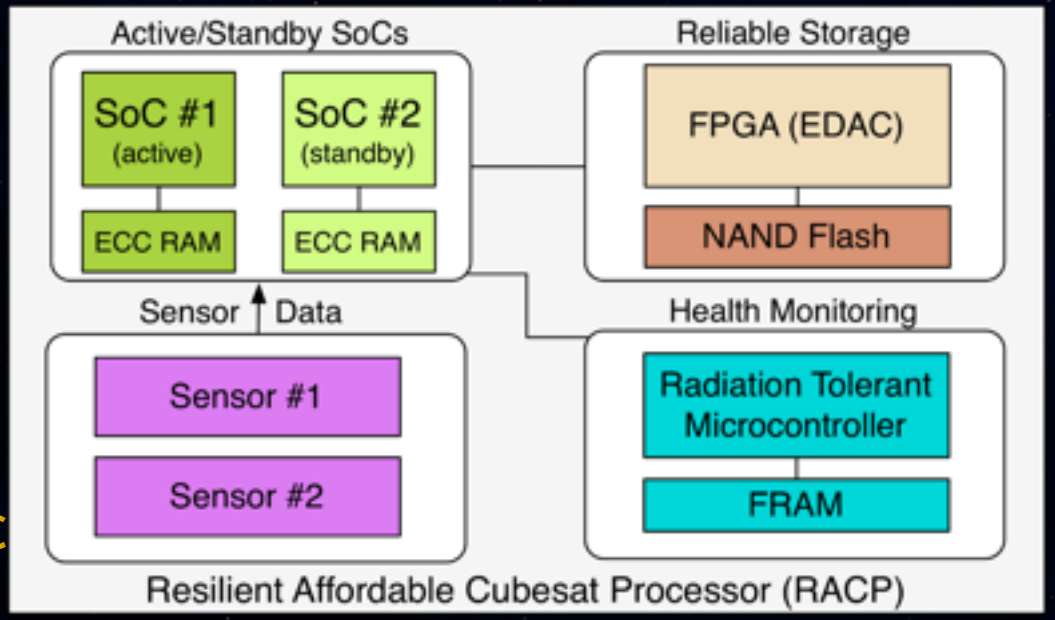
Prototype firing with Xenon

- Engine performance validated using a static thrust stand at 10^-6 Torr with Xenon.
- Propellant options include solid iodine, traditional ablated solid propellant, and noble gases.
- Custom tank and delivery systems are available.

POC: Wes Faler
Wes@miles-space.com

Resilient Affordable Cubesat ProcessorRACP

- Multi-processor fault tolerant space computer that integrates current generation SoC
- Compatible with existing CubeSat products
- Designed for graceful degradation and minimal interruptions in processing
- Supports multiple sensor platforms
- Components screened through ground and spac radiation testing



"Other upcoming hybrid platforms share some of the same concepts, but the degree of adaptability and performance capabilities of RACP is superior."- NASA SBIR review

POC: Kathleen Morse
Kathleen@yosemitespace.com


DRI
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YOSEMITE
SPACE


PIEDMONT PRECISION
AEROCULTURE

Thank you


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Becomes Discovery


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