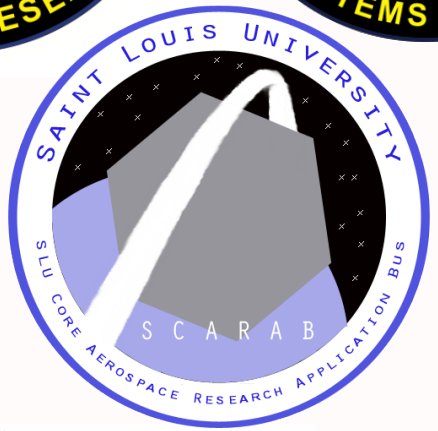
SCARAB: Integration of the COPPER and Argus Spacecraft

Space Systems Research Lab
Saint Louis University
http://astrolab.slu.edu



Saint Louis University
Space Systems Research Lab

Parks College of Engineering, Aviation and Technology

- 36 full-time faculty, 600 students
- AE, ME, EE, BME, Civil, Aviation, Physics
- SSRL organized in 2009

Joined AFRL's University Nanosatellite in 2009

- COPPER, Nanosat-6, 2009-2010
- Argus-High, Nanosat-7, 2011-2012

COPPER and Argus manifested through NASA CubeSat Launch Initiative

COPPER Overview

Argus Overview

SCARAB Conception

SCARAB Overview

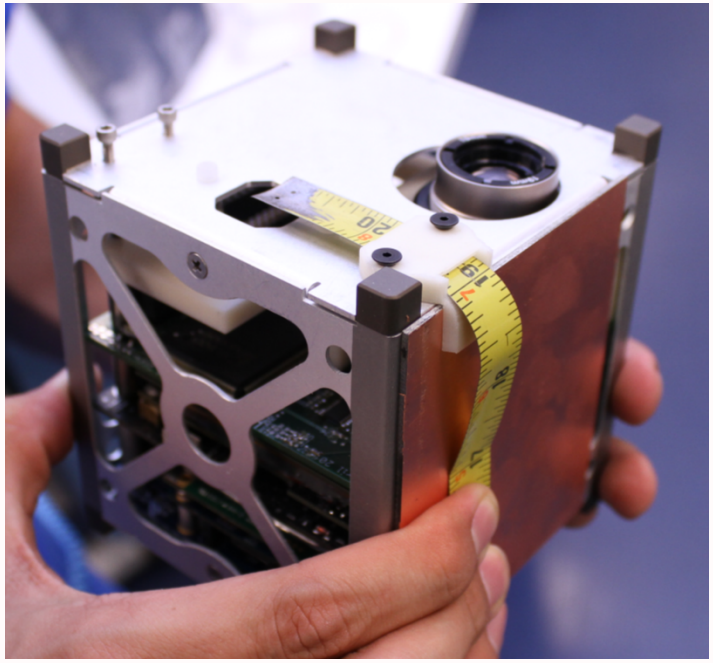
Future Development

The COPPER Mission

Imaging Mission:

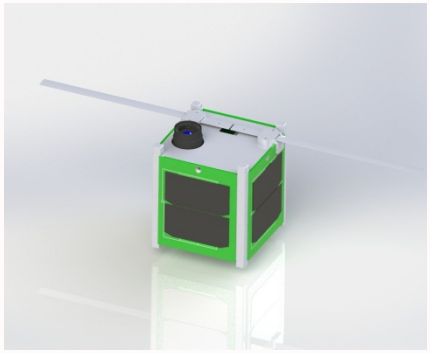
Utilize a commercially available compact uncooled microbolometer array to:

1. Capture infrared video of co-manifested satellites during separation phase
2. Capture infrared images of Earth's oceans and atmosphere



Radiation Mission:

Improve the predictive performance modeling of radiation effects on small, modern space electronics devices by collecting radiation particle collision data from electronics monitoring experiments and relaying the data to the ground



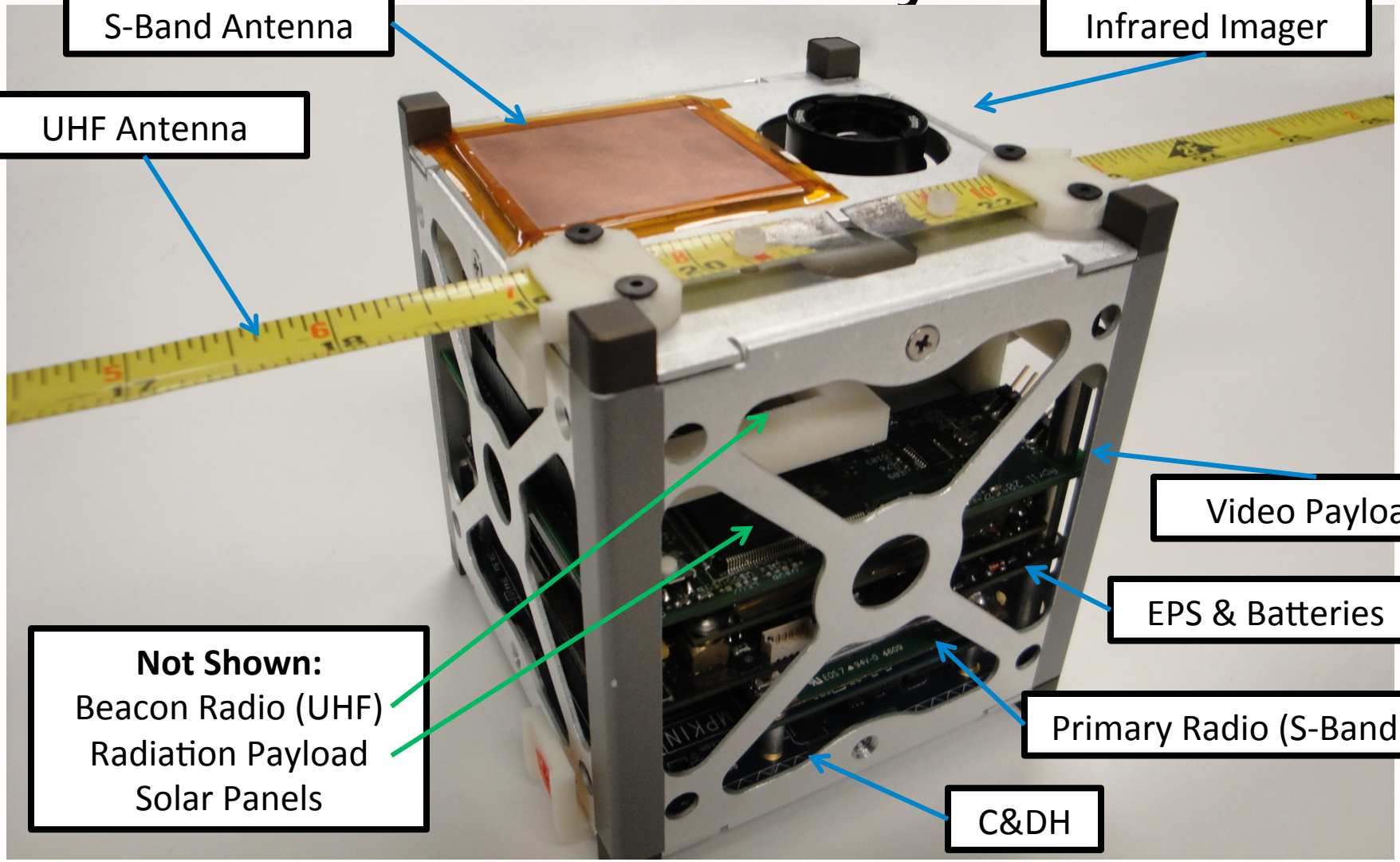
Project Duration: 2009-2013

Initial concept: 2009-2010 Nanosat competition

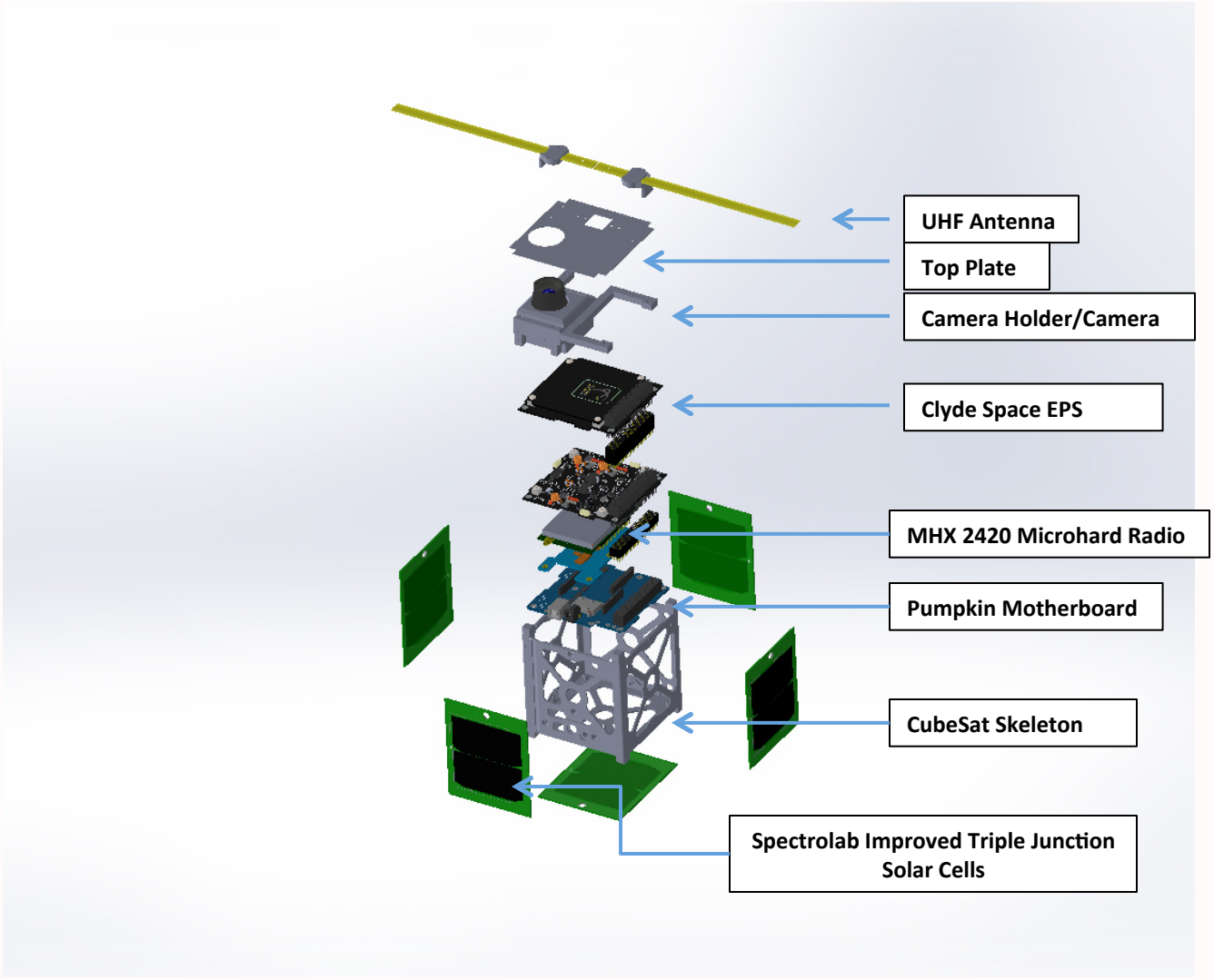
Mission Modified to Fit the CubeSat Launch Initative

Manifested for Launch: August 2013

COPPER Layout



COPPER Layout-Detailed



Past and Future Milestones

Date	Milestone
August 2011	P-POD integration fit check
April 2012	*Critical Design Review*
June 2012	Near-space operational test
Summer 2012	**Complete engineering unit integration and SSRL testing**
September 2012	Engineering Unit Design Review
October 2012	**Complete flight unit integration and SSRL testing**
(Launch-120 days)	Mission Readiness Review
(Launch-90 days)	Delivery to Cal Poly for testing
(Launch-30 days)	Cal Poly delivers COPPER to NASA facilities for integration
August 2013	**Launch**
(Launch + 360 days)	COPPER Deorbit and End-Of-Life

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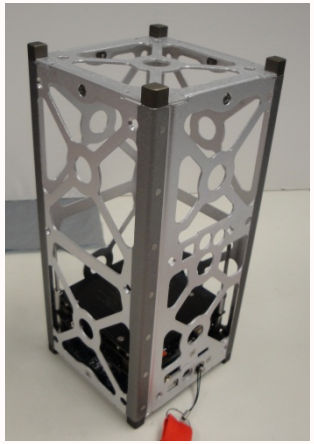
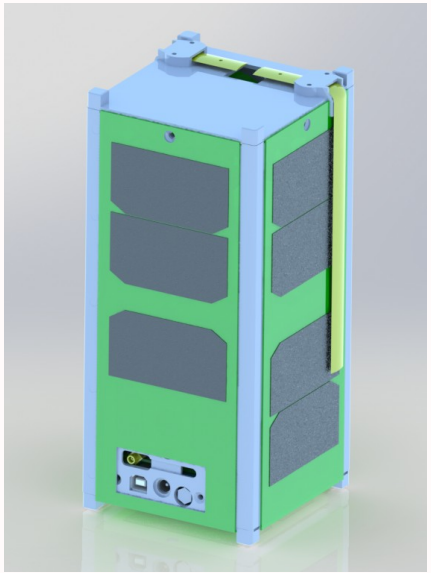
Radiation Mission:

1) Improve the predictive performance modeling of radiation effects on small, modern space electronics devices by collecting radiation particle collision data from electronics

2) Includes three separate radiation experiments to accomplish this:

- Single Event Latchup Experiment (SELE)
- Low Energy Proton Experiment (LEPE)
- Particle Environment Monitor Experiment (PEME)





Project Duration: 2011-2013

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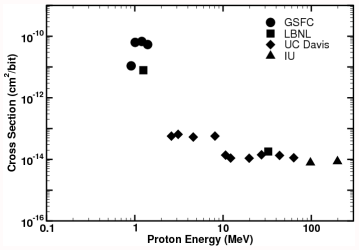
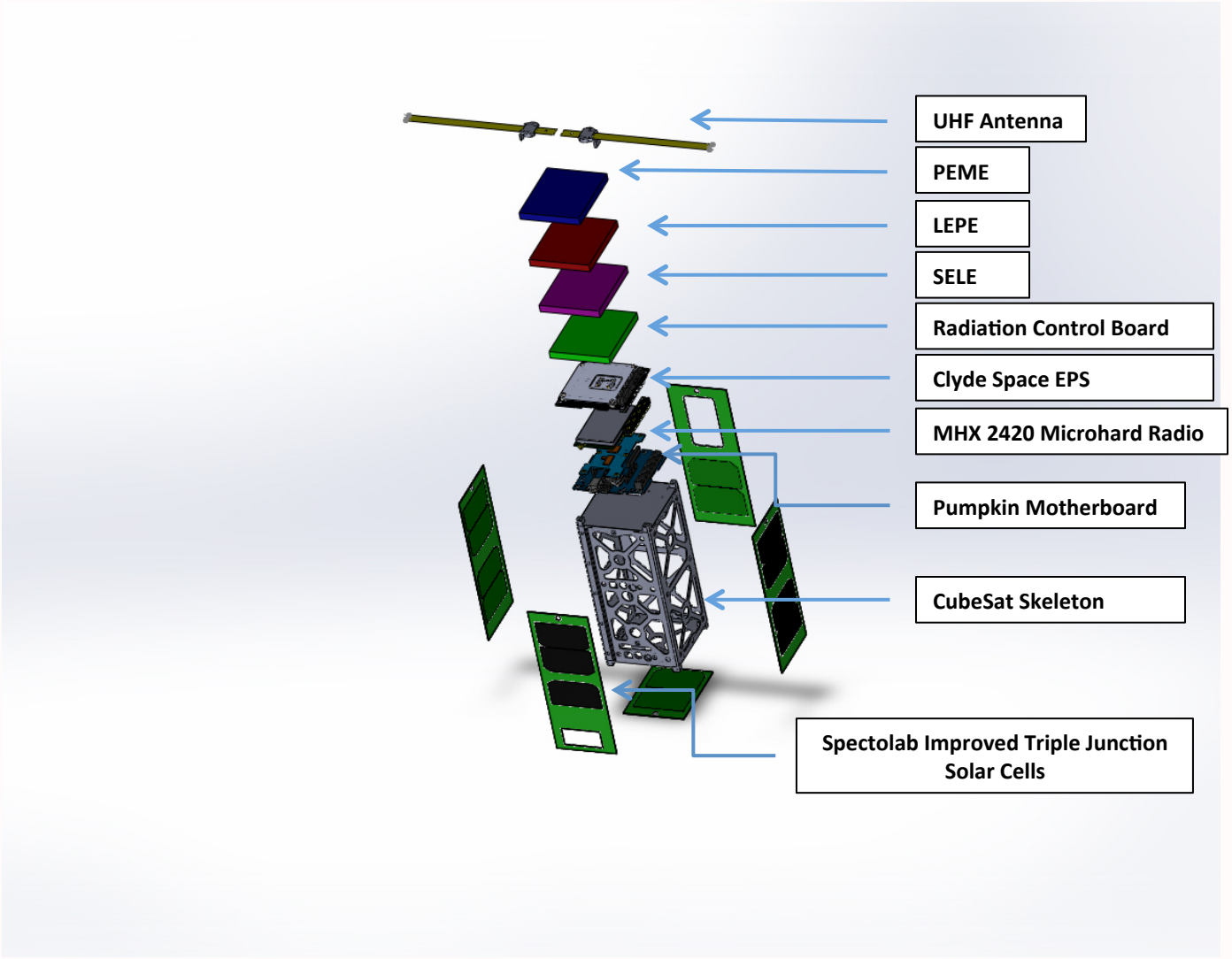
Mission Modified to Fit the CubeSat Launch Initiative

Manifested as backup for Launch: October 2013



600 km, polar orbit, solar maximum, 1 mm Al shielding	Average Flux (#/cm^2-s)	SEU Cross section* (cm^2)	Approx. SER (upsets/bit/day)
1-1.4 MeV Protons	0.05	$5x10^{-11}$	$2.1x10^{-7}$
> 10 MeV Protons	31	$1x10^{-14}$	$2.6x10^{-8}$
Heavy Ions (LET > 0.1)	0.0035	$8x10^{-9}$	$1.1x10^{-8}$

Argus Layout- Detailed



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October 2013	**Launch (Tentative)**
(Launch + 15 Years)	Argus Deorbit and End-Of-Life

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How to Make Two Satellites at Once?

COPPER Schedule

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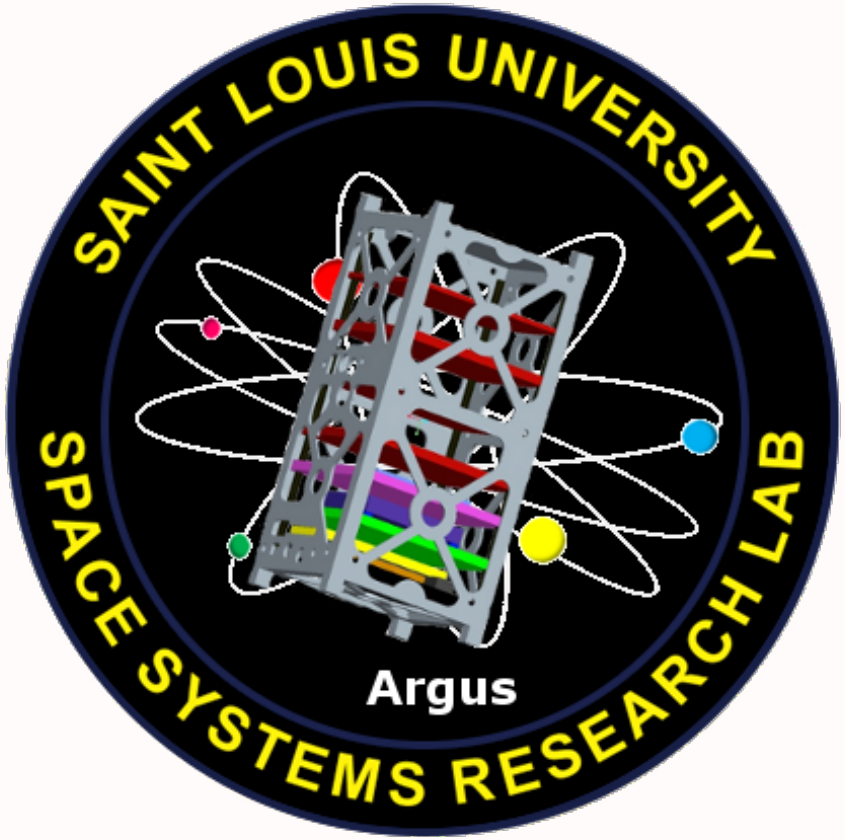
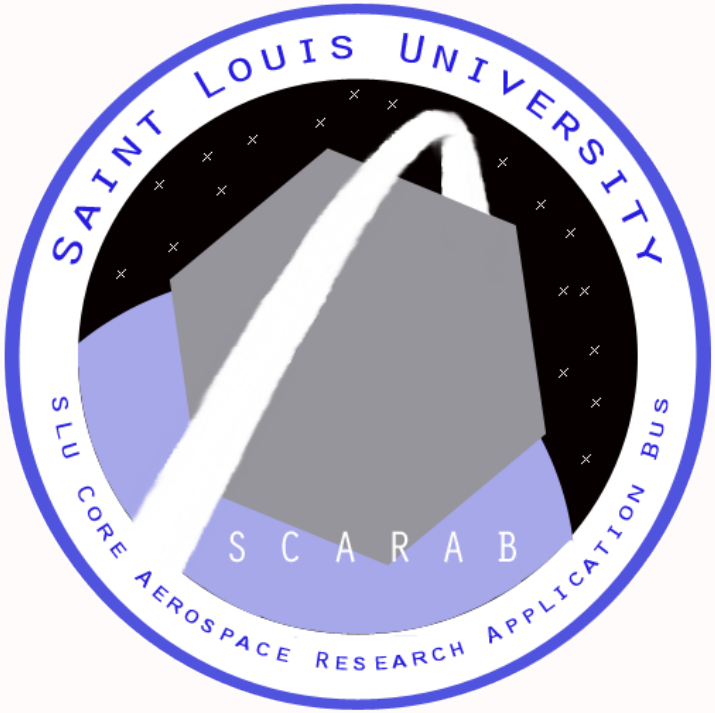
Production Problems

1. Not enough people.
2. Not enough space.
3. Not enough time.



The Solution…



SLU **C**ore **A**erospace **R**esearch **A**pplication **B**us

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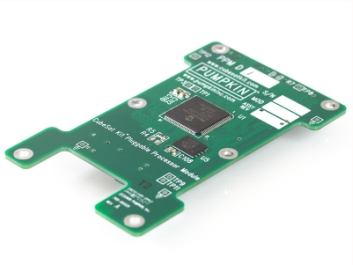
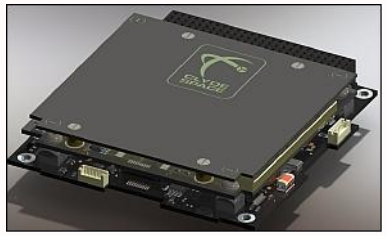
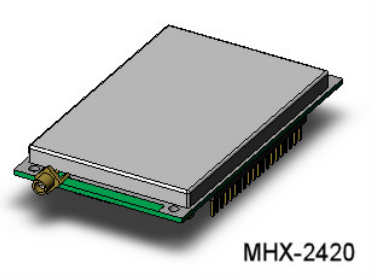
What is SCARAB?

- It is a baseline of CubeSat design, a starting point from which to develop fully functional satellites.

Includes:



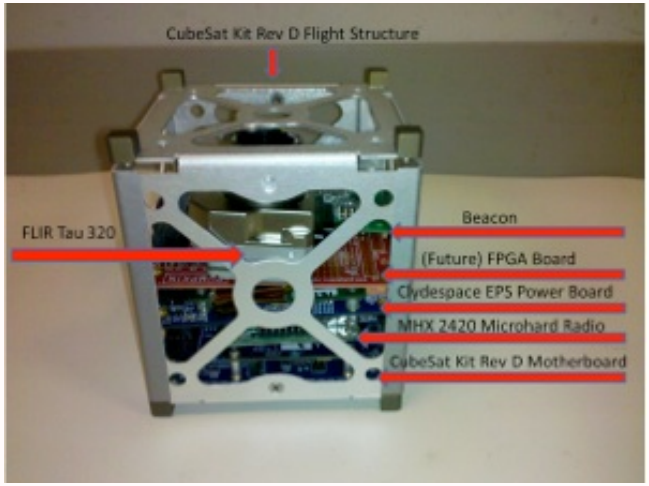


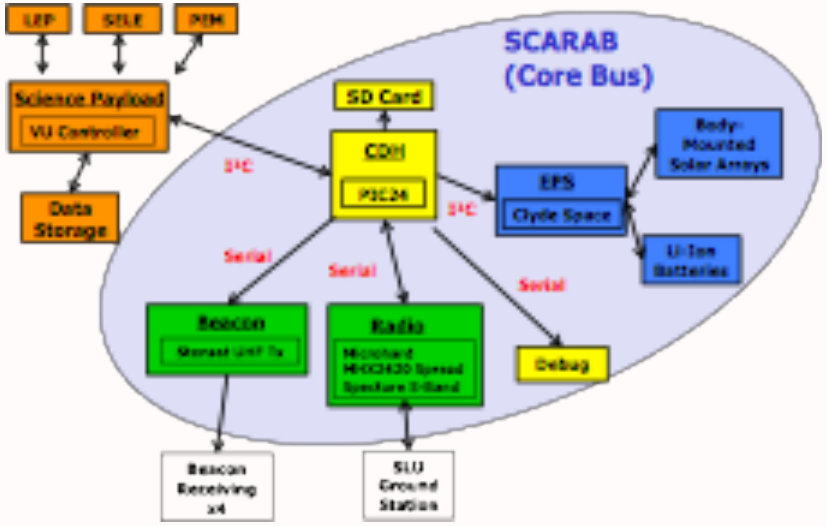


- PIC24 PPM & Motherboard from Pumpkin
- Clydespace 1U EPS & Spectrolab Solar Cells
- MHX2420 & Stensat Radio Beacon

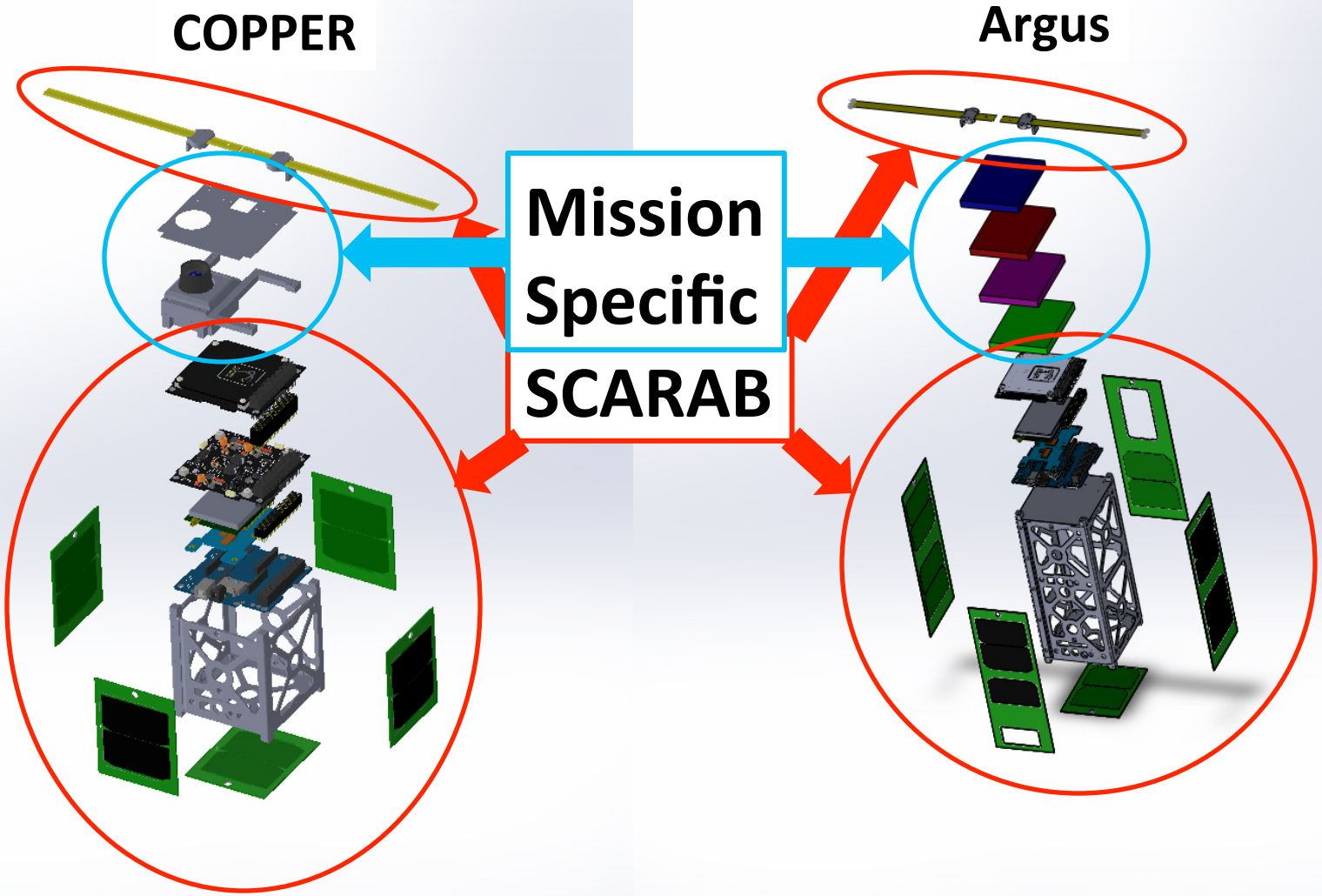
Usefulness of SCARAB

- Reusability—Use the same core bus for multiple projects.
- Many applications—OS and Solar panels are tailored to meet mission specifications.
- Work on SCARAB transfers directly to both COPPER and Argus Projects.





Scarab in Action



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Future of Scarab

- SCARAB provides a means to an end: simplifying spacecraft design and implementation.
- With this core, many satellites can be designed and implemented in only the time required to tailor the bus to the mission, along with the development of the payload itself.

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