Aerospace Engineering Design Symposium 2012

When? → Friday, April 20, 2012, 8:00 am – 4:00 pm.

Where? → Discovery Learning Center (DLC), http://engineering.colorado.edu/dlc/

Department of Aerospace Engineering Sciences, http://www.colorado.edu/aerospace/

Questions? → patti.gassaway@colorado.edu, claire.yang@colorado.edu

Agenda:

Session 1: Senior Projects. Session 2: Graduate Projects. Session 3: Joint Graduate/Senior Projects

8:00 am	Registration	
8:30 am	Welcome by Chair Jeff Forbes	
Presentations		
	TEAM	**Sponsor/s**
Session 1, 8:45 am	PACRAT	Lockheed Martin
9:00 am	STARR	NASA-JPL
9:15 am	CASTOR	LASP
9:30 am	DAYSTAR	SWRI
9:45 am	ICECUBE	BALL Aerospace
10:00 am	IMPULSE	Pedalectric Inc.
10:15 am Coffee Break		
Session 2, 10:45 am	Dream Chaser	Sierra Nevada Corp
11:00 am	cTIDE	LASP/NSF/NASA
11:15 am	Hyperion	Boeing/eSpace
Session 3, 11:30 am	GOJETT-FENIX	CU-AES, eSpace
12:00 am	HYSOR-SPEAR	ULA
~12:30 pm Lunch		
Poster Session		
1:00 pm	Attendees and Students of all projects	
3:00 pm	AES undergraduate students view posters	
4:00 pm	Adjourn	

Registration form is available from http://aeroprojects.colorado.edu/

Please RSVP or register a few days ahead of April 20 (before April 15 is suggested).

Hotels in walking distance: Millenium Harvest House (www.millenniumhotels.com)
Best Western Boulder Inn (www.boulderinn.com)

Symposium announcement may be distributed to all interested parties

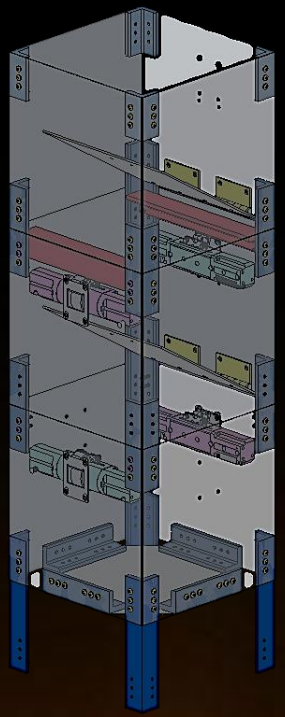
Senior / Graduate Design

Project Name	Explanation of Acronym (Sponsor)	Brief Description
PACRAT	Progress and Advancement for the Capture & Removal of Aerospace Trash (LMCO)	*To design, build, test and evaluate an earth-based system to de-orbit debris with diameters ranging from 5-15 cm from Low Earth Orbit*
STARR	Sample Targeting And Retrieval Rover (JPL)	*To design, build, and test a Rover System that will identify and retrieve a sample based on color.*
CASTOR	CubeSat for Atmospheric STudies in Orbit and Re-entry (LASP)	*CASTOR will design and build a CubeSat bus EDU to support the QB50 mission.*
DAYSTAR	Diurnal Star Tracking for Balloon-borne Attitude Determination (SWRI)	*The DayStar team will develop a prototype star tracking system capable of providing pointing knowledge to a diurnal, lighter-than-air platform.*
ICECUBE	Investigation of Cryogenic Emissivity by CU and Ball Engineers (BALL)	*ICECUBE will design, build and validate a testbed to determine the cryogenic emissivity for a given surface and determine the uncertainty of the emissivity.*
IMPULSE	Investigation of Motor Performance Under Low-frequency Shock Environments (Pedalectric Inc.)	*The purpose of the IMPULSE project is to develop a test bed that measures the effects of a force imparted by the test bed on a hubmotor/wheel system.*
Dream Chaser	(SNC, NASA)	*Designs the cockpit displays and controls for a human rated spacecraft*
cTIDE	Cubesat for Thermosphere Ionosphere Dynamics Experiment (LASP)	*To design, build, and test a CubeSat that will measure airglow in the UV spectrum of the Earth's upper atmosphere*
Hyperion	(Boeing, eSpace)	*Designs and builds a hybrid engine powered UAV with an autonomous flight capability*
GOJETT	(eSpace)	*Design and build a supersonic unmanned aircraft with a mass less than 50 kg*
FENIX	Fluid Extraction for Nozzle Injection eXperiment (EEF, UROP)	*Design an experimental test bed to facilitate experiments for thrust vectoring and supersonic throat constriction*
HySoR	Hybrid Sounding Rocket (ULA)	*Designs and builds a hybrid sounding rocket to launch and deploy a 2 kg payload at a 10 km altitude*
SPEAR	Sounding Payload Ejection And Recovery (ULA)	*The goal of the SPEAR project is to design, build and validate a payload ejection and recovery system for the HySoR launch vehicle.*

Symposium announcement may be distributed to all interested parties

Progress & Advancement to Capture & Remove Aerospace Trash

PACRAT



LOCKHEED MARTIN

◊ Goal: To design, build, test and evaluate an earth-based system to demonstrate a method to capture multiple pieces of debris from Low Earth Orbit.

◊ Primary Objectives:

- Capture multiple pieces of debris between 5-10 cm in diameter
- Design to Interface with LM1200 Satellite Bus
- Demonstrate Capture in 1G environment

◊ Concept of Operations:

1. PACRAT integrates with bus in array configuration
2. System launches into orbit and rendezvous with debris
3. PACRAT Capture pods activate, capture orbital debris & system De-orbits

Brett Tobey ◊ Customer
Dr. Xinlin Li ◊ Advisor
David Hamel ◊ Advisor

Stephen Bell
Nellie Haghbin
Mark Riley
William Russell
Ashton Schrage
Jamey Graham
Chris Kopacz
Shunsuke Miyazaki
Anirudh Sarsam

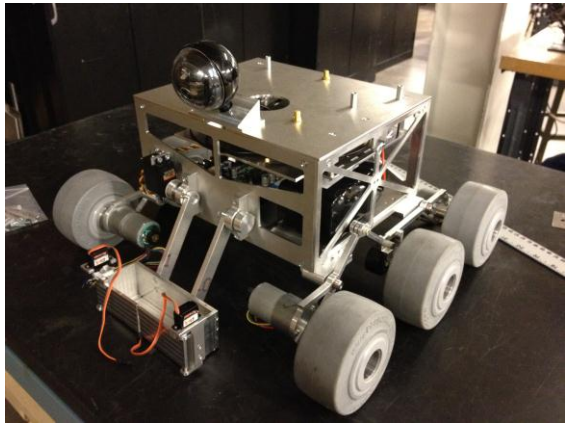
STARR
SAMPLE TARGETING AND RETRIEVAL ROVER

GOAL:

The STARR team will design, build and test a multi-vehicle Rover System that will be capable of identifying a sample based on color, collecting the sample and 2D navigation. STARR will also retain the capability to drive over 3D terrain.

PURPOSE:

- Multi-rover system proof of concept
- Determine feasibility of sample collection with child rovers
- Assumptions
  - Earth-based
  - No communication delay
  - Previous reconnaissance mission to map terrain



Team Members:

Michael Murry, Sam Houser, Pierce Martin, Logan Finch, Kyle Wolma, Melanie Dubin, Greg Nelson, Brady Phillips , Andrew Haynes

Customer:

Barbara Streiffert, *Jet Propulsion Laboratory (JPL)*

Advisor:

Dr. Scott Palo, *University of Colorado, Aerospace Engineering Sciences*

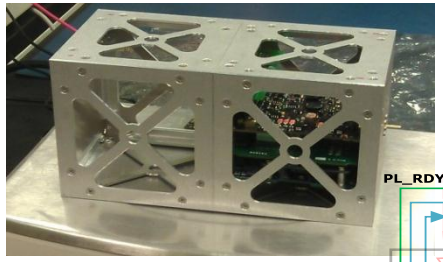
CubeSat for Atmospheric STudies in Orbit and Re-entry

Objective

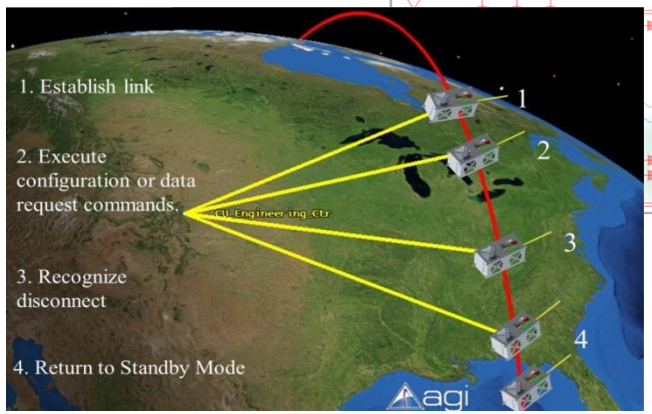
To design and build an **EDU of a CubeSat** with the purpose of **validating the data path** required to support the QB50 mission **between the CubeSat and the ground** in a **near-flight configuration**.

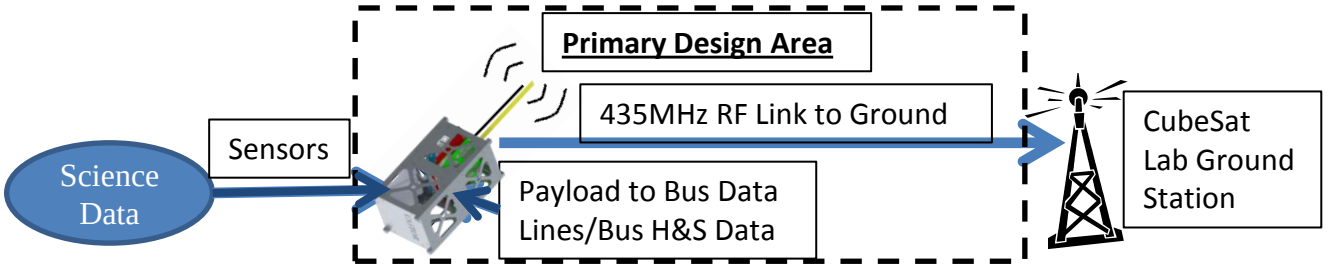
Customer: Dr. Palo | CU/LASP **Advisor:** Dr. Lawrence | CU **Mentor(s):** Dan Hall | FIRST RF, Paul Fagerburg | CU, David Gerhardt | CU

Assembled structure with board stack inside

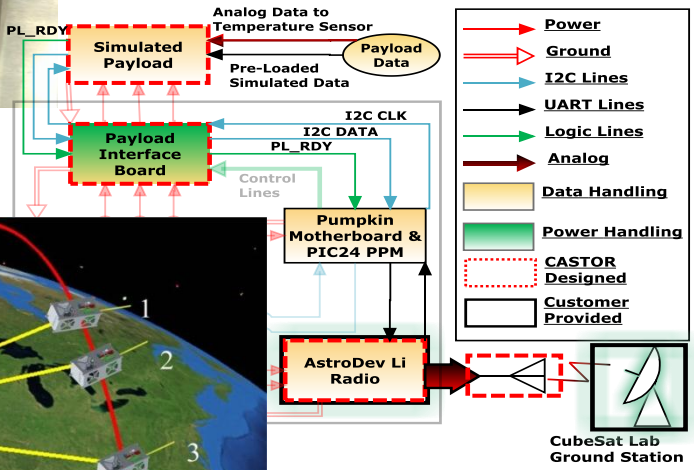


COMM Mode: Duration ~ 6.5 min



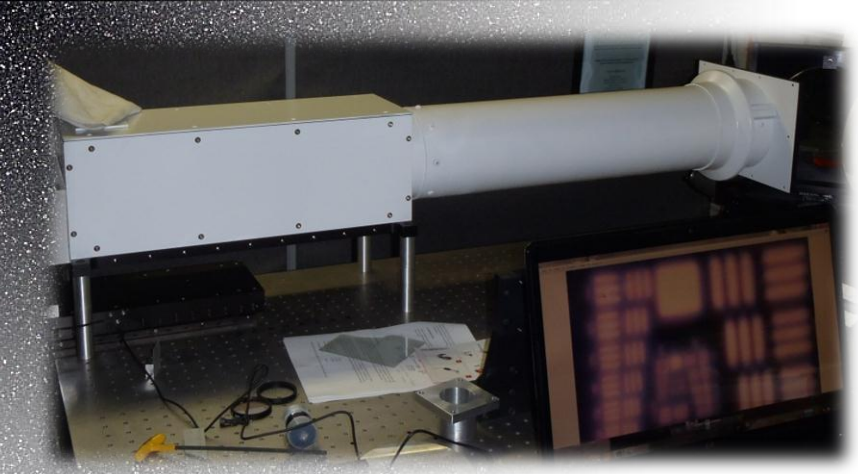


Data Path



Design Focus

- SW/Elec. interface to communicate with payload
- Support payload's electrical and data requirements
- Design simulated payload board since the actual payload is not manufactured
- Control payload power based on H&S data
- Communicate payload data to ground station
- Interface CubeSat Subsystems
- Mount hardware to test RF characteristics
- Design of subsystem interfaces
- All spacecraft modes: Start-up, Standby, First
- House all components in flight configuration
- Act as antenna ground plane
- Design to launch system requirements



Customer:
Dr. Eliot Young
Southwest Research Institute

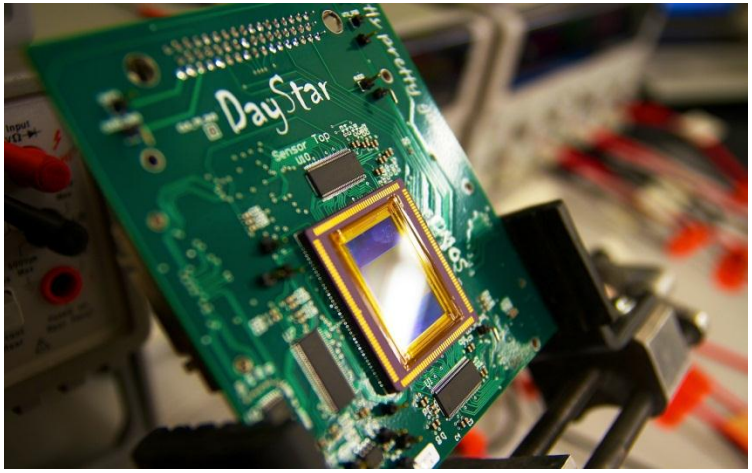
PAB Advisor
Dr. Scott Palo

Optics Design
Equinox Interscience, Inc.

DayStar

Diurnal Star Tracking for Balloon-borne Attitude Determination

Photo:
http://laspace.lsu.edu



The DayStar team will develop a prototype star tracking system capable of providing pointing knowledge to a diurnal, lighter-than-air platform. DayStar will improve on current attitude determination devices used on balloon payloads by providing daytime operational capabilities and an improved nighttime accuracy of 0.1 arcseconds RMS.

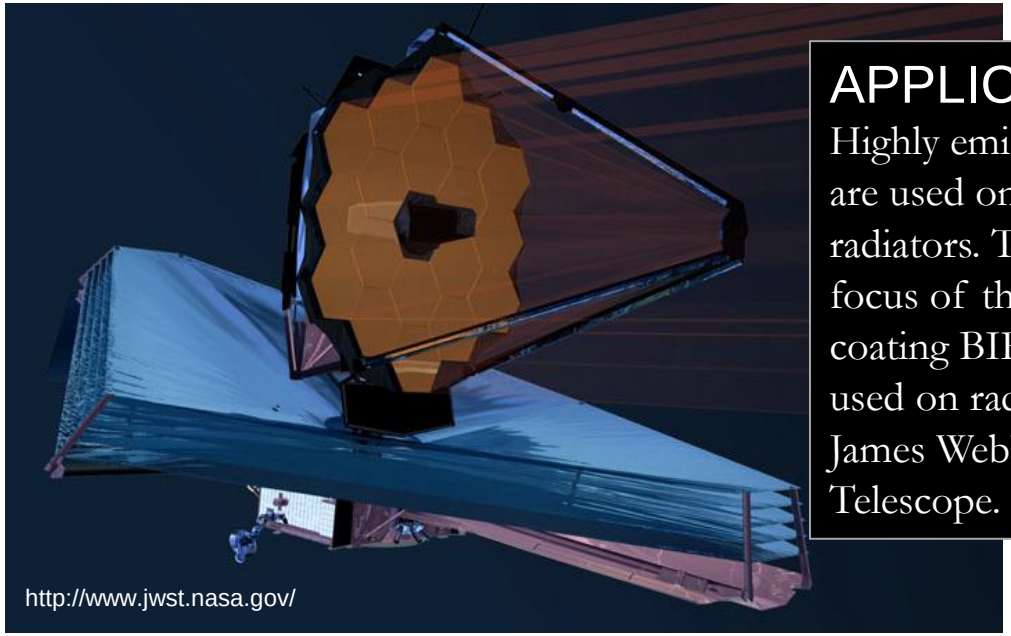
Jed Diller
Kevin Dinkel
Zach Dischner
Aaron Holt
Tyler Murphy
Sara Schuette
Michael Skeen
Nick Truesdale
Andrew Zizzi

ICECUBE

Investigation of Cryogenic Emissivity by CU and Ball Engineers

GOAL

ICECUBE will design, build and validate a testbed to determine the cryogenic emissivity for a given surface and determine the uncertainty of the emissivity.

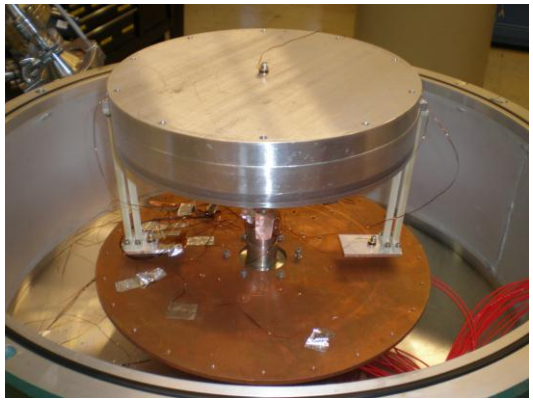


APPLICATIONS

Highly emissive coatings are used on space radiators. The primary focus of the project, the coating BIRB™, is being used on radiators for James Webb Space Telescope.

OBJECTIVES

- Determine cryogenic emissivity
- Design and build a testbed
- Environment: 12 K & 10^{-7} torr
- Uncertainty: 2% on emissivity
- Coatings: BIRB™ and BR-127



CUSTOMERS

Eric Marquardt
Randy Franck
BATC

ADVISOR

Dr. Xinlin Li

TEAM

Gabriel Bershenyi
Nicholas DiOrio
Lance Markovchick
Katelynn McCalmont
Eric Schaub
Thomas Snow
Robert Stillwell
Jake Varey
Chris Warren

IMPULSE

Investigation of Motor Performance Under Low-frequency Shock Environments

Kyle Cummings
Alex Harvey
Huy Le
Chris Locke
Emily Logan
Dan McCarty
Logan Wright
Joshua Yeaton

Project Adviser:
Dr. Dale Lawrence

Customer:
Pedalectrics Inc.
(Don Missey, John Gains)

Team IMPULSE
(Investigation of Motor Performance Under Low-Frequency Shock Environments)

Goal: The purpose of the IMPULSE project is to develop a test bed that measures the effects of a force imparted by the test bed on a hubmotor/wheel system.

Objectives:

1) Design/build a pneumatic based impact system capable of imparting approximately 2250 lbf
2) Incorporate sensors to characterize reaction of wheel system to impact
3) Create LabVIEW UI that allows user to define delivered force regimens

Engineering Excellence Fund

Dream Chaser Graduate Project

Mission Statement:

"To support the design and development of crew systems for the SNC Dream Chaser spacecraft."

Sponsors:

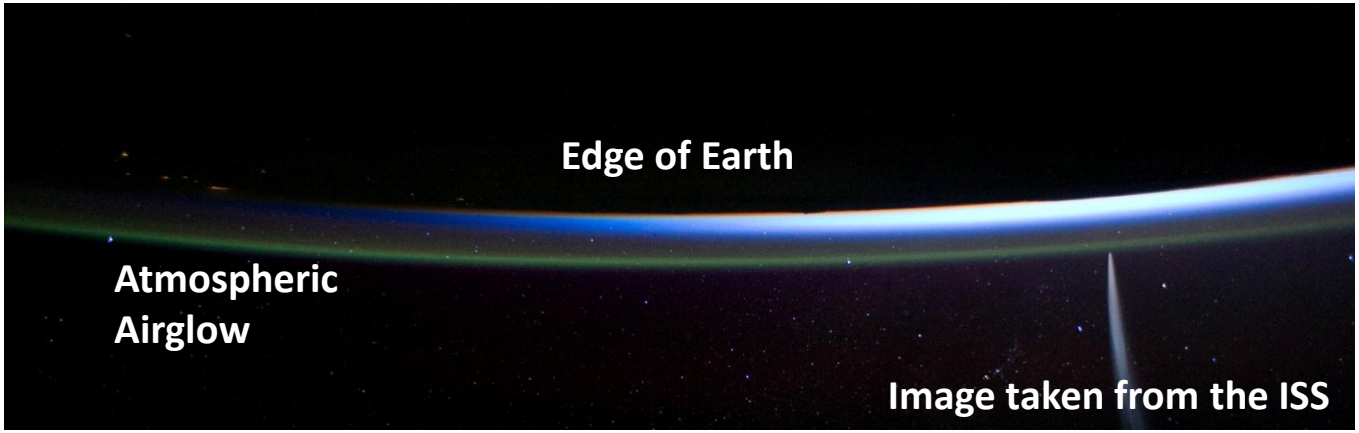
- Sierra Nevada Corporation
- University of Colorado at Boulder
- NASA

Final Deliverables:

- Cockpit displays and controls architecture and mockup
- Human factors and task evaluations in the cockpit mockup
- Cockpit and cabin lighting trade study and recommendations
- Pilot and passenger seat trade studies and recommendations

TIDE

Cubesat for Thermosphere Ionosphere Dynamics Experiment

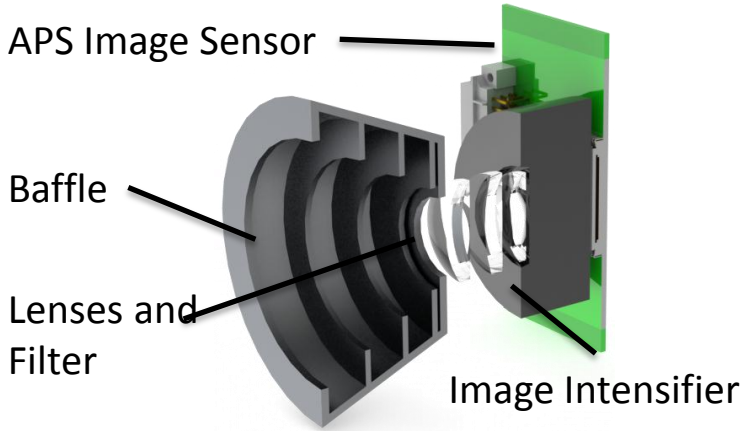


Goal: To design, build, and test a CubeSat that will measure airglow in the UV spectrum of the Earth's upper atmosphere

Science: To gain an understanding of atmospheric composition, density profile, and response to solar events

MAST: Miniature Airglow Spectral Telescope

- **Redesign of the FUVI to fit in a CubeSat**
- **Capable of capturing the O2 and N2 bands**
- **Tomographic reconstruction of atmosphere on ground**



The Team:	10 graduate students in ASEN, ECEE, and CS
PM:	James Mason
SE:	Matt Carton
Advisors:	Dr. Xinlin Li, Dr. Scott Palo
Mentors:	Dr. Tom Woods
Customer:	LASP

LASP
LABORATORY FOR ATMOSPHERIC AND SPACE PHYSICS
UNIVERSITY OF COLORADO AT BOULDER

SOLSTICE

Aerospace Engineering

University of Stuttgart
Germany

TIGON ENERTEC

Project Description

MISSION: *CONCEIVE, DESIGN, IMPLEMENT, AND OPERATE AN ENVIRONMENTALLY RESPONSIBLE AERIAL VEHICLE*
INSPIRED BY: *NASA GREEN AVIATION INITIATIVES*
PROJECT SIZE: *17 GRADUATES:12 AES, 3 ME, 1 EE, 1 BUS*
PROJECT CUSTOMER/ADVISER: *DR. JEAN KOSTER*
DURATION OF DEVELOPMENT: *9 MONTHS*
TEST FLIGHTS: *APRIL 2012*

Blended Wing Body

INSPIRED BY NASA/BOEING X-48B
3.2 METER WINGSPAN
CARBON FIBER COMPOSITE MATERIALS

Control System

CLOUD CAP PICCOLO AUTOPILOT
R/C OVERRIDE CAPABILITIES

International Collaboration

A GLOBAL DESIGN EFFORT
UNIVERSITY OF STUTTGART
AERODYNAMICS AND CFD ANALYSIS
CLOUD FILE SHARING

Hybrid-Electric Engine

2ND GENERATION
PARALLEL TIGON GEARBOX
VARIABLE OPTIMIZATION
QUIET-MODE OF OPERATION

HYPERION

2011-2012

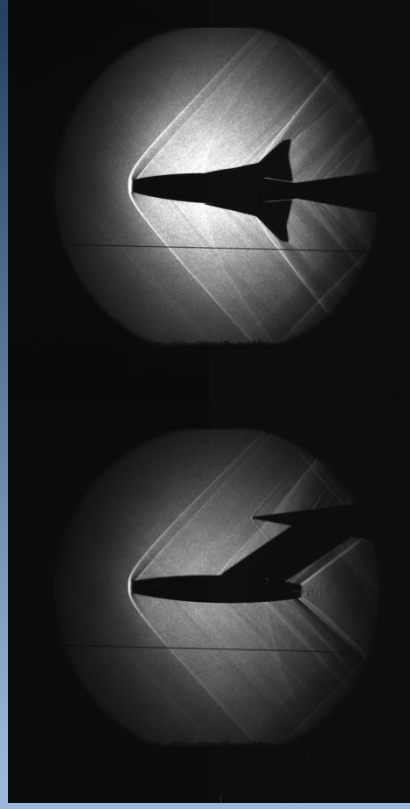
BOEING®

EBS Carbon Inc.

Engineering Excellence Fund

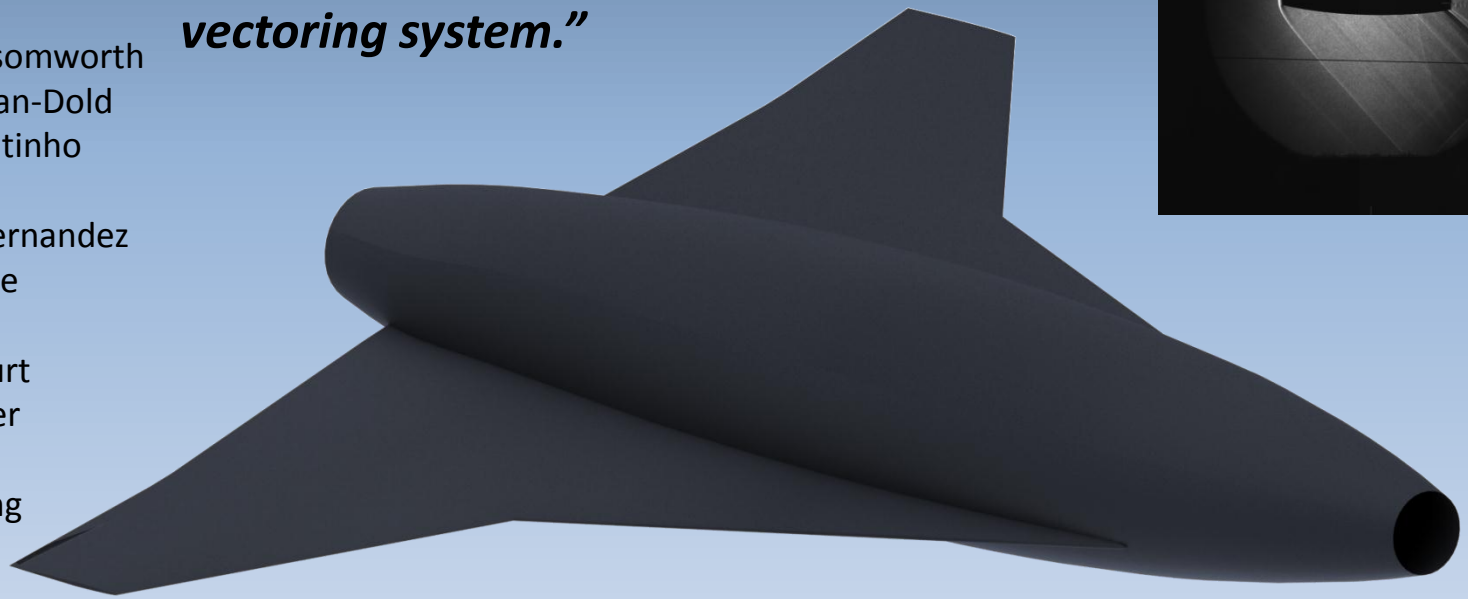
THE CENTER FOR espace ENTREPRENEURSHIP

GoJett



Mission:

"To develop an unmanned supersonic aircraft under 50 kg using a turbojet engine with custom afterburner and variable area nozzle that employs a fluidic thrust vectoring system."



'11-'12 Design Team:

- PM: George Miyata
- SE: Chad Chaffin
- Tim Beatty
- Brandon Bosomworth
- Scott Christian-Dold
- Sheldon Coutinho
- Edgar Flores
- Fernando Hernandez
- Chris LaPanse
- Paul Paret
- Greg Rancourt
- Sibylle Walter
- Brad Wyatt
- Hao-Chu Yang

Customer:

- Dr. Ryan Starkey

THE CENTER FOR espace ENTREPRENEURSHIP

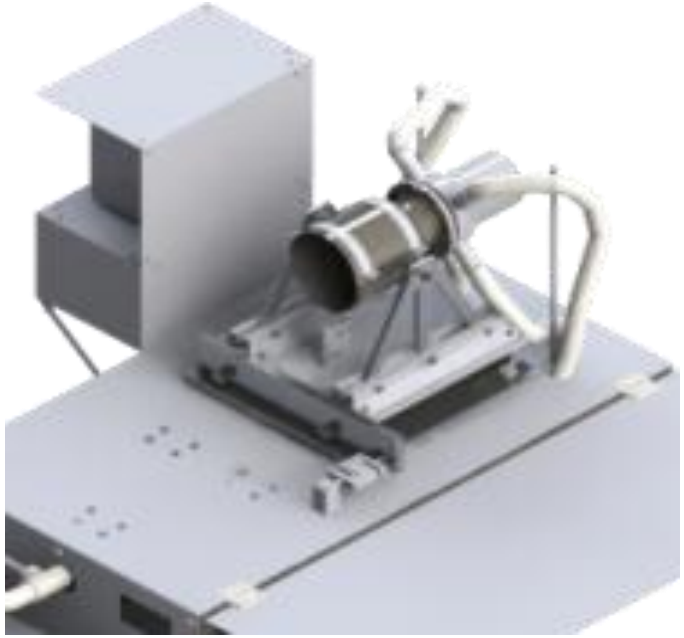
Engineering Excellence Fund

Semester Deliverables:

- Engineering Test Unit (ETU)
- Supporting Design Documentation

PROJECT FENIX

Fluid Extraction for Nozzle Injection eXperiment



Goal

FENIX will design an experimental test bed to facilitate experiments for thrust vectoring and supersonic throat constriction. FENIX will provide 3-D thrust measurement capabilities.

Michael Bonnici	Project Manager	**Joshua Veum**	Manufacturing Engineer
Wenceslao Shaw-Cortez	Systems Engineer	**Elvin Mujcin**	Fluids Engineer/CFO
Elliot Guber	Mechanical Engineer	**Naveen Penmetsa**	Test Engineer
Samuel Henney	Software/Electronics Engineer	**Trevor Schlieper**	Safety Engineer
Ryan Starkey	Customer	**Hank Scott**	Advisor

Hybrid Sounding Rocket

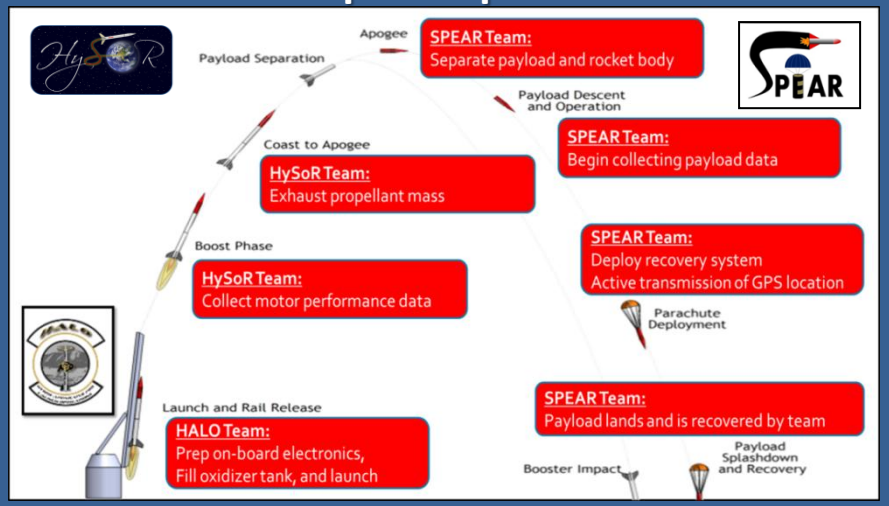
Objective

- **Design, Build, and Launch a hybrid-powered rocket that releases a 2 kg payload at 10 km**

Goals

- **Deliver a flight-ready hybrid sounding rocket by end of Spring 2012 semester**
- **Kick-start a sounding rocket program at CU**

Concept of Operations



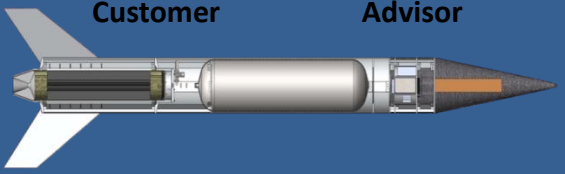
HySoR Personnel

Dr. Lakshmi Kantha

HySoR Customer

Professor Joe Tanner

HySoR Advisor



Spring 2012 Team

Zachary Grunder
Jeff Grundtisch
Bruno Lesage
Abhishek Paul
Meagan Slater
Stuart Tozer
Aaron Young

Static Test Fire
Fall 2011

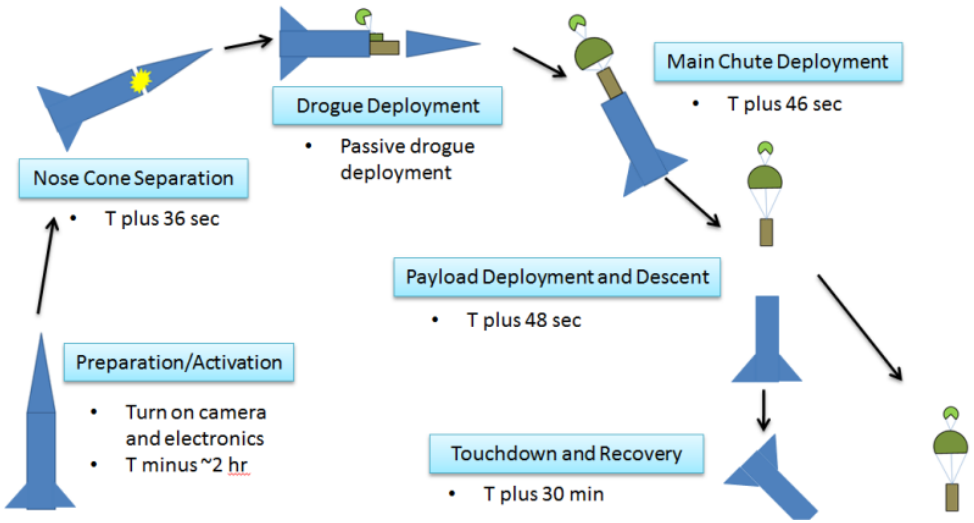
Blowdown Cold Flow Test
Spring 2012

Sounding Payload Ejection And Recovery

Dustin Buccino, Andrew Gilbert, Caleb Gradert , Alex Granrud, Carol Helfenbein, Boaz Norton, Nicholas Schlatter, Kevin Stuth, Salvador Vargas-Castro

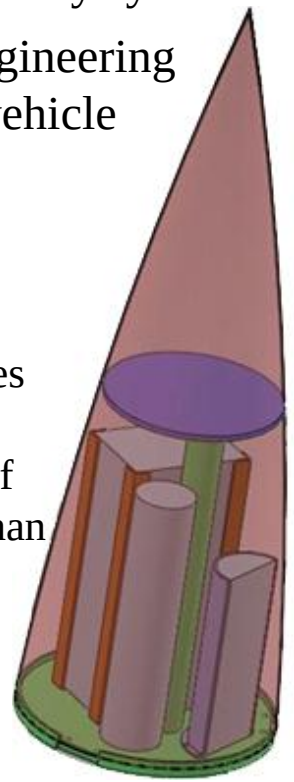
Purpose: Produce a working engineering model for the separation and recovery system

Goal: The goal of the SPEAR project is to design, build and validate an engineering model of the payload ejection and recovery system for the HySoR launch vehicle



Objectives:

- To separate the nose cone from the rocket body at ground level so that it causes no damage to the payload
- To have the descent rate of the payload be no greater than 14.5 ft/s at ground level in Boulder, CO



Acknowledgements: Dr. Jean Koster, Matt Rhode, Trudy Schwartz

Advisor:
Hank Scott

Customer:
Dr. Lakshmi Kantha