



Phaeton Early Career Hire (ECH) Development Program

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Ross M. Jones

Jet Propulsion Laboratory, California Institute of Technology

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JPL ECH = ECHs are defined to be individuals who meet the following two requirements: 1) new hires to JPL (external hires who are full time, regular benefit based employees) whose hire date is within 36 months of attaining their highest degree (Bachelor, Masters, or PhD) and 2) 3 years maximum work experience with a BS, 6 years experience with a MS or 10 years experience with a Ph.D.

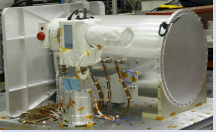
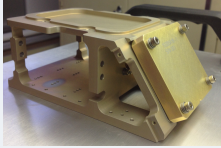
Phaeton Project Summaries

Completed

Name	Objective	Lifecycle Cost: JPL investment RY \$\$ Plan Current/final	Duration Start to launch ready, months Plan Current/Final	Status	ECH work years	# of ECH Participants
PMD 	Measure flexible body dynamics of LEO Host [DoD DSX]	\$0.8M \$2M	16 months 19 months 10/08-5/10	Launch pending August 2015	9	14 
TRaiNED 	Validate hazard avoidance algorithms via sounding rocket	\$1.0 \$1.3M	19 months 19 months 10/08-5/10	complete	10	10 
ASTRA 	Validate instruments in Mars analog env. from balloon	\$1.6M \$2.4M	13 months 24 months 8/10- 8/12	complete	13.5	10 

Phaeton Project Summaries

Active & Proposed

Name	Objective	Lifecycle Cost: JPL investment RY \$\$ Plan Current/final	Duration Start to launch ready, months Plan Current/Final	Status	ECH work years to date	# of ECH Participants
 <p>OPALS</p>	Optical telecom on ISS	\$7M \$11.6M	28 months 46 months Sept 2010 – June 2013	I&T in SAF Launch ~March 2014	45	20
 <p>RACE</p>	Water radiometer on a Cubesat	\$2.0M \$TBD	5/12-8/13 15 months TBD	Starting radiometer I&T....cubesat design/build @ UT	15	~10
STABLE*	Balloon borne pting experiment 0.1 arcs	\$5M \$5M	8/12-4/15 28 months	PDR Nov 2013	8	~10
CHIRP*	Cubesat mission partnering with GSFC for ultra-high energy cosmic ray science	\$3M	Start Pending 18 months			~10

*Proposed Mission – Pre-decisional – for Planning & Discussion Purposes Only

Program Objective

Phaeton Program Plan: [D-53556](#)

- The objective of Phaeton is to rapidly train and develop early career hires to become system-level thinkers and at the same time aid in the recruitment and retention of ECHs.
- Phaeton's small-project environment is intended to provide participating team members with hands-on, broad cross discipline exposure in a short period of time.
- ECHs are defined to be individuals who meet the following two requirements: 1) new hires to JPL (external hires who are full time, regular benefit based employees) whose hire date is within 36 months of attaining their highest degree (Bachelor, Masters, or PhD) and 2) 3 years maximum work experience with a BS, 6 years experience with a MS or 10 years experience with a Ph.D.

Program Background

Phaeton Program Plan: [D-53556](#)

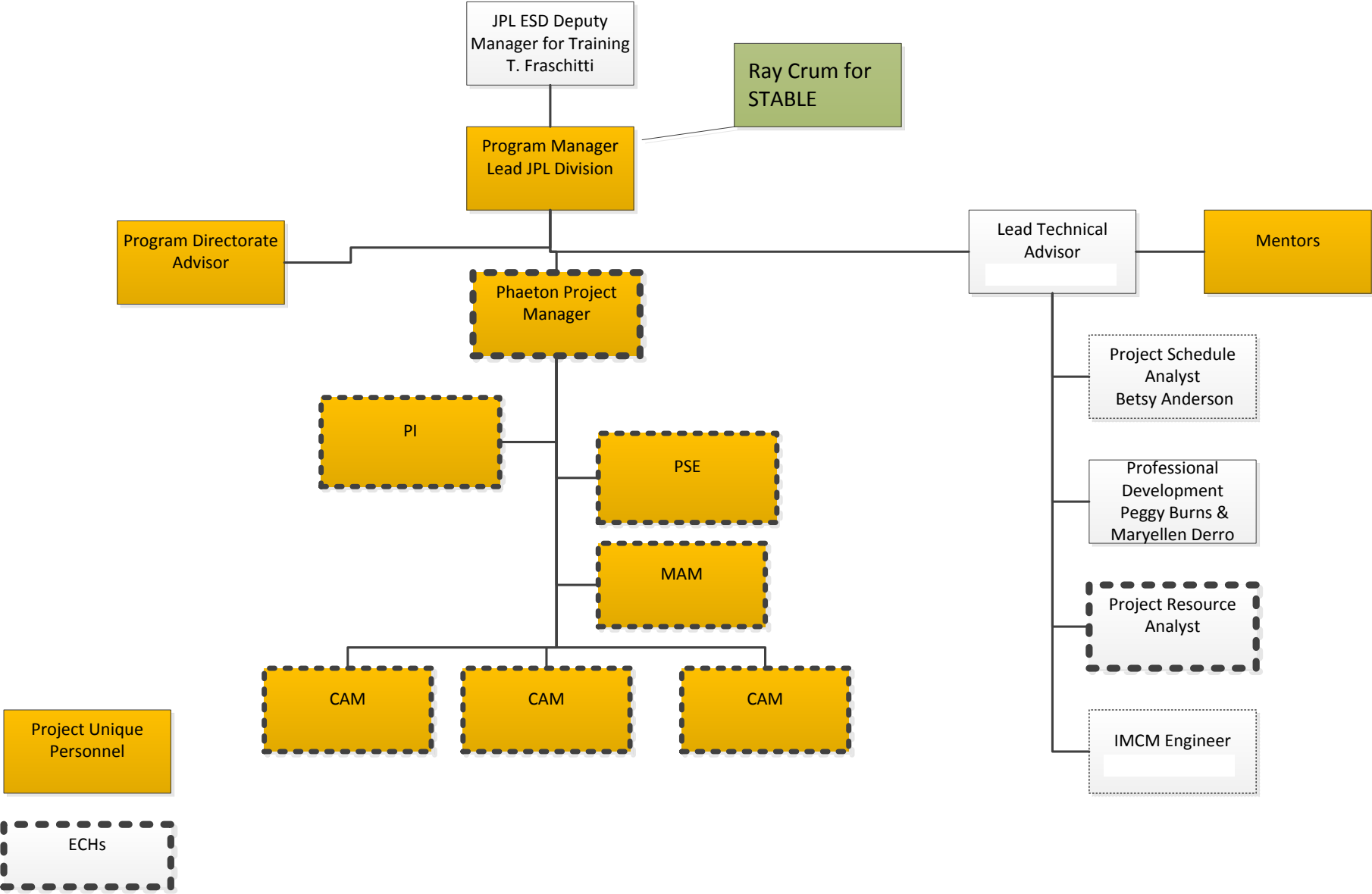
- **The Phaeton program was established in June 2008.** The program concept started in the fall of 2007 when a group of seven ECHs asked Dr. Charles Elachi to use JPL facilities to compete in the Google Lunar X Prize. Elachi took their shoot-for-the-moon enthusiasm and channeled it instead into creating a one-of-a-kind training program.
- **The first group of ECHs expressed a desire for:**
 - 1) hands on flight hardware/software experiences early in their careers,
 - 2) full life cycle experience,
 - 3) efforts staffed and managed by ECHs and
 - 4) efforts small enough to enable the participants to know and understand it top to bottom.

Program Implementation

Phaeton Program Plan: [D-53556](#)

- The approach for the program is to design, build, test and fly small payloads in the range of \$2 to \$5 million [burden \$\$] each with development life cycles of 1 to 3 years and start dates separated by about one year.
- The projects are organized and implemented as flight projects.
- The quality class is usually D as defined in NPR 8705.4.
- JPL Flight Project Practices apply and participants learn what the FPPs and DPs are, how to apply them and how to seek waivers as applicable for small class D projects.
 - The Phaeton Program office has negotiated with the JPL Office of the Chief Engineer a smaller more applicable set of FPPs as the starting point for Phaeton projects, see Appendix B.
- ECHs manage and staff the projects, supplemented by senior staff where an ECH is not available.
- Mentors [1 or more] are assigned to each ECH.

Phaeton Organization Chart



Program Manager Role

- The role of the project unique Phaeton Program Manager (PPM) is to ensure their project is implemented consistent with:
 - 1) the Phaeton Plan
 - 2) the project's implementation plan [PIP]
 - 3) the technical objectives of the lead technical division
 - 4) the project specific requirements and constraints in the project's appendix to the Phaeton Program Plan.

Lead Technical Advisor Role

- Attend key proj meetings
- Attend MMRs and other reviews
- Facilitates Class A waivers
- Reviews documents meant for PPM's approval
- Facilitates CoFR
- Approves WAs, HRCRs, SRCRs
- Approves PFRs
- Meets 1 on 1 with team members circa once per quarter to get feedback on the program
- Provide guidance for implementing projects per the FPPs and the established line org practices
- Approve purchase requisitions
- Provide recommendations on technical quality, potential risks and early mitigation approach
- Defines and plans implementation of training with the Phaeton Training Lead
- Recruit and maintain relationships with mentor and supervisors
- Operates program facilities [office and lab]
- Participate in selection, assignment, "care" and transition of phaeton personnel
- Reviews convening memos for project convened reviews
- Capture program/project cost history
- Maintains the program wiki
- Maintains the program internal and external www sites
- Convenes technical peer reviews as needed
- Provide IM/CM services to all projects
- Facilitates project interfaces with organizations outside of the project
- Maintains the program list of Phaeton participants
- Conducts surveys of Phaeton ECHs, mentors and supervisors to gather data with which to improve the program operations
- Perform other tasks as assigned by the PPM
- Support the ESD Deputy Manager for Training in implementing the Phaeton Program

Expectations of Mentors

- Guide the ECH in the performance of their Phaeton activities.
 - Guide/answer questions.....don't do work
- Frequently and regularly engage the ECH in technical and procedural topics and discussions of the risk of their current activities.
- Maintain technical cognizance of the ECH's activities and help the program office do the same.
- *Understand and concur with the commitment [as documented in the WA] the ECH is making to the Phaeton project.*

Expectations of Supervisor

- Represent the value of the ECHs training in all applicable section activities
- Provide, as needed, guidance to enable the ECH to successfully complete their assigned Phaeton task[s].
- Work with the program to manage the ECH's transition on/off the program and to effectively utilize the lab's investment in the ECH.
- *Understand and concur with the commitment [as documented in the WA] the ECH is making to the Phaeton project.*

Expectations of Phaeton ECHs

- Observe the program “cultural norms”.
 - 1) manage and meet the expectations others have of you,
 - 2) work unseen, is work undone,
 - 3) plan the work and work the plan and
 - 4) understand and respect the jobs/role/function of everyone.
- Strive to learn the JPL way of doing flight projects and to implement the same.
- Frequently and regularly engage their mentor.
- Attend all Phaeton training and complete training surveys.
- Strive to learn from and teach their peers.
- Be open to cross training into unfamiliar disciplines.
- Act to both successfully implement their Phaeton project, and also enhance the Phaeton program.

Staffing of Phaeton Projects

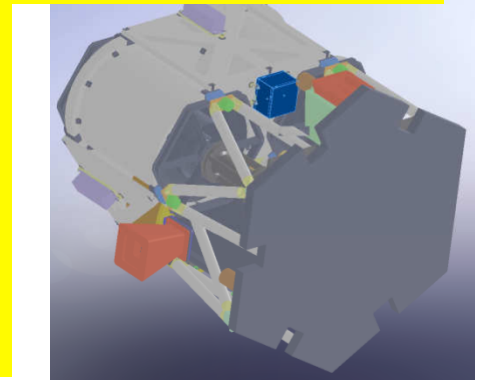
1. ECHs apply to the phaeton www site.
2. The LTA and PM create task descriptions for new openings
3. When a phaeton project has an opening, that opening is posted on the www site and all ECHs that have applied are informed of the opening.
4. All JPL ECHs, their GSs and SMs are informed of the opening
5. The project picks a candidate pool from those who have applied on the www site using their criteria and applies program level criteria, i.e. have 18 months of ECH eligibility remaining and will benefit from the phaeton training.
6. The project, Phaeton Lead Technical Advisor, a representative from the doing org and others, interview the candidates.
7. The project makes a selection.
8. The project informs the GS of the successful candidate to offer the job from the GS to the ECH.
9. The LTA informs and debriefs the unsuccessful candidates.

PMD Overview

Design, Build, and Deliver a sensor package to measure on-orbit mast vibration for the purpose of characterizing the dynamics of a mast.

PMD will be launched with NuSTAR in August 2011

- Non-mission critical instrument



Caltech Collaboration (WBS 04.01)

- Working with S. Pellegrino
- PMD budget plans for up to 0.4 FTE until delivery in March of 2010
- Analysis and testing to be completed with Caltech
- Only ITAR approved information will be provided

Funding/ECH Labor Profile (\$K/FTE):

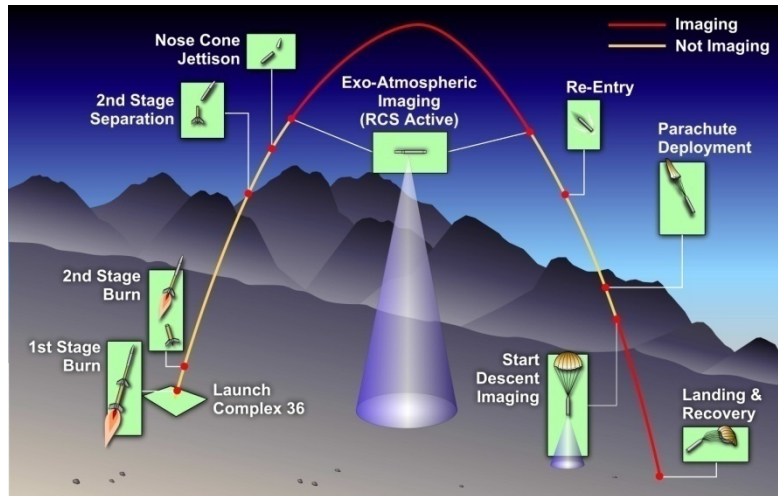
Fiscal Yr	'09	'10	'11+
Phaeton Project Funds, \$K Real Yr, Burden	502	283	60
Phaeton Project Workforce, Work Years, ECH	2.78	1.65	0.25

Major Milestones :

- PMSR – 10/30/2008
- SRR – 11/2008
- PDR – 1/2009
- CDR – 5/2009
- TRR – 10/2009
- HRCR – 2/2010

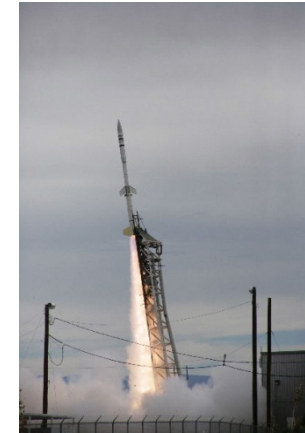
TRaiNED Project Snapshot

TRaiNED Mission Overview



Objectives:

- Capture Exo-Atmospheric and Descent Imagery, IMU and GPS Data Sets During a Sounding Rocket Flight
- Archive and Document Data Set for Future Engineering Analyses
- Validate Existing TRN Software with Recorded Data



41.068 NT/Seybold launching from White Sands Missile Range
5 April 2006

Funding Profile (\$K)

FY '09	FY '10	WFF Bypass
398	877	800

FY09 Key Milestones

HOPE Proposal Submitted (3/2/09)
TRaiNED Selected (4/28/09)
Project Initiation Conf (5/6/09)
MIC (5/27/09)
SRR (7/9/09)
RDM (8/6/09)

FY10 Key Milestones

PDR (10/1/09)
WFF DR (10/27/09)
CDR (12/15/09)
PIR (3/17/10)
PSR (4/22/10)
WFF MRR (4/30/10)
JPL MRR (5/4/10)
Launch Attempt #1 (Jun 10)
Launch (Sep 10)

Contribution to TRL Advancement

Earth Imaging	Planetary Imaging	Planetary Entry
High G	Earth Entry	Flight Quality Data
Descent Imaging	Kalman Filter	Exo-Atmospheric Imaging
Entry Dynamics	Feature Tracking	Map Matching

41.068 & TRaiNED

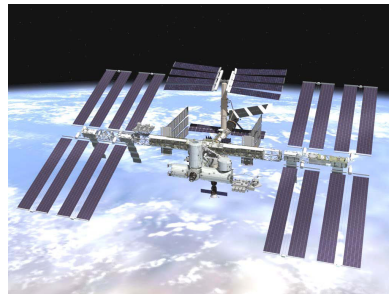
New From TRaiNED

Simulations Remaining For TRL5

OPALS Summary

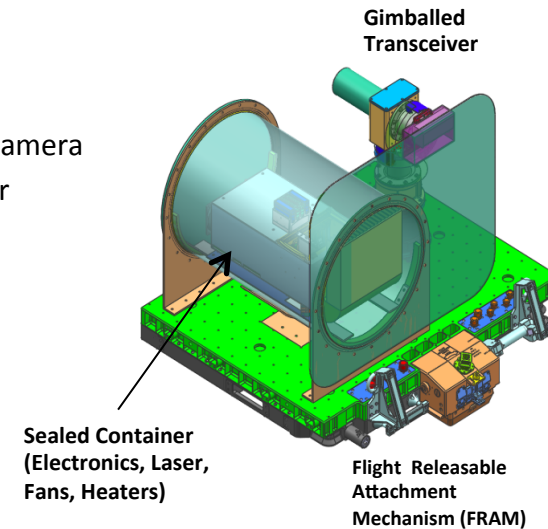
Objective: Deliver video from ISS to optical ground terminal via an optical communications link.

- ❑ JPL Phaeton/Early Career Hire (ECH) training project
- ❑ Implemented as Class-D payload
- ❑ Downlink at ~30Mb/s



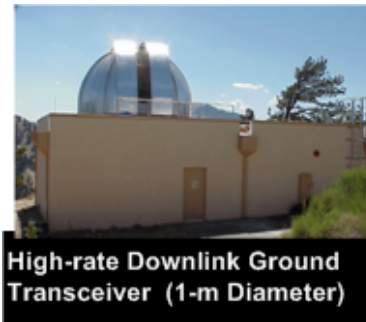
Flight System

- ❑ Optical Head
 - Beacon Acquisition Camera
 - Downlink Transmitter
 - 2-axis Gimbal
- ❑ Sealed Container
 - Laser
 - Avionics
 - Power distribution
 - Digital I/O board



Implementation

- ❑ Ground Station - Optical Communications Telescope Laboratory at Table Mountain Facility
- ❑ Flight System mounted to ISS
 - FRAM as standard I/F
 - Attached externally on Express Logistics Carrier



Life cycle budget*	'09	'10	'11	'12	Total
\$M Real Yr, Burden	0.2	2.2	4.0	3.3	9.7

Major Milestones:

- ✓ ΔMCR – 10/19/2009
- ✓ SRR – 02/23/2010
- ✓ DR1 – 06/24/2010
- ✓ DR2 – 08/31/2011
 - TRR – 05/15/2012
 - PSR – 9/25/2012
 - Delivery – 9/28/2012

Launch: **March, 2014**

*Phaeton budget only. Launch integration and operations costs still being negotiated

RACE Overview

Spaceborne validation of Indium Phosphide (InP) MMIC radiometer
Implementation verifies subsystem for future missions, in addition to constellation concepts

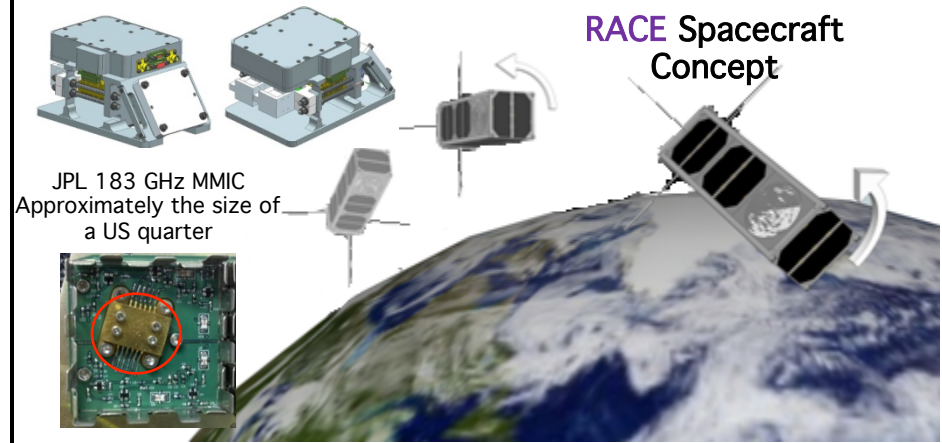
Project Objectives

- Develop a 3U cross track radiometer CubeSat for water vapor radiance measurements
- 183 GHz radiometer payload development at JPL (1.5U)
- Leverage ESTO developments (IPP, ACT, AIST and IIP) for PATH (DS tier 3) and SWOT* (DS tier 2)
- Demonstrate:
 - Low noise InP MMIC RF front ends developed at JPL
 - Radiometer measurements from CubeSat platform

Justification

- Raise the TRL (4 -> 6) of InP MMIC receiver front ends
 - PATH (DS tier 3) and SWOT* (DS tier 2)
 - Other Earth science missions (AMSU-B, HSB, SSMI/S and ATMS)
- Raise the TRL (4 -> 7) of radiometer CubeSat system
- Provide complimentary data for atmospheric observations
- Enables improved Earth science measurements for potential future missions
- Allow for end to end development of flight-like project for personnel training

RACE Payload (1.5U)



Budget & Schedule

FY 12	FY 13	Requested FY 14
\$500k	\$2100k	\$200k

FY12 Key Milestones

HOPE Proposal	12/16/11
Selection	3/30/12
Kick-Off	5/7/12
SRR	7/10/12

FY13 Key Milestones

PDR	10/25/12
CDR	2/27/13
SIR	5/1/13
FRR	8/1/13

Sub arcsecond Telescope And Balloon Experiment (STABLE*)



Objective

Demonstrate sub arc second pointing stability of high altitude observatories

- ◆ Visible spectrum
- ◆ Relatively Low SNR
- ◆ Exposure time ~ 1minute
- ◆ Nighttime
- ◆ Above 99% of the atmosphere
- ◆ Low Cost, reusable

Implementation

- ◆ Coarse Loop – U of Toronto
 - ◆ Gondola, leveraging BLAST design
- ◆ Fine Loop – JPL
 - ◆ Telescope (COTS or develop)
 - ◆ 3Axis rate sensor (COTS)
 - ◆ Camera (COTS) from UK consortium
 - ◆ Fast Steering mirror (SIM)
 - ◆ Estimation and control algorithms
- ◆ Launch – CSA/CNES

Key Milestones (preliminary)

- | | |
|-------------------|---------------|
| ◆ Project Start | October 2012 |
| ◆ Payload I&T | March 2014 |
| ◆ System I&T | November 2014 |
| ◆ Ready to Launch | April 2015 |

Changes, overall schedule length is unchanged.

Budget

- ◆ FY13 budget \$1.8M