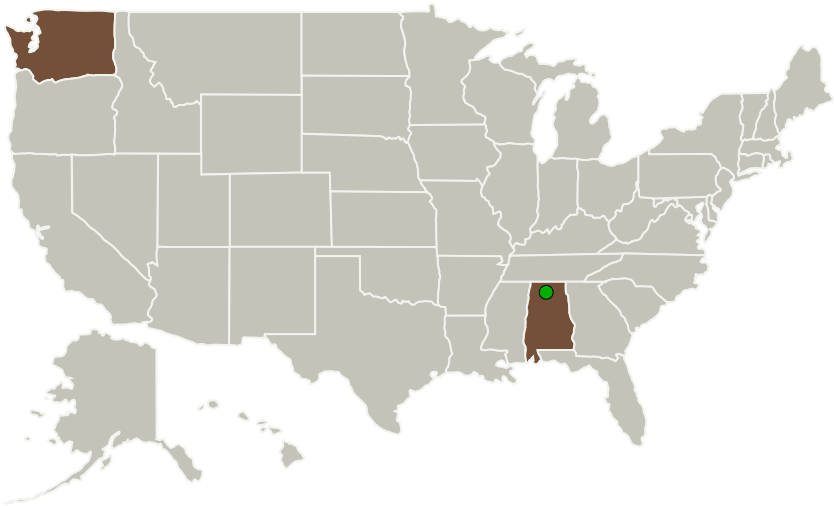
COARSE: Convex Optimization Based Autonomous Control for Asteroid Rendezvous and Sample Exploration, Phase I

Completed Technology Project (2013 - 2013)

Project Introduction

Sample return missions, by nature, require high levels of spacecraft autonomy. Developments in hardware avionics have led to more capable real-time onboard computing platforms, which allow for the implementation of more sophisticated algorithms. A real-time convex optimizer named COARSE (Convex Optimizer for Asteroid Rendezvous and Sampling Return) is proposed in order to efficiently guide path planning operations as well as spacecraft guidance and control. COARSE consists of a series of high level goals with specific set of execution steps, rather than complex interaction with ground control. This proposal plans to develop and simulate a basic optimizer for the purpose of a robotic spacecraft in proximity operations to an asteroid for a sample return mission, and implement in a spacecraft avionics software environment. If follow on Phase II work is awarded, the optimizer can be matured to expand higher levels of system complexity and constraints, potentially dealing with tasking multiple spacecraft working in coordination.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
Planetary Resources Development Corporation	Lead Organization	Industry	Bellevue, Washington
Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

Primary U.S. Work Locations	
Alabama	Washington

Project Transitions

May 2013: Project Start

November 2013: Closed out

Closeout Documentation:
- Final Summary Chart*(https://techport.nasa.gov/file/138042)*

Images

Project Image
COARSE: Convex Optimization based autonomous control for Asteroid Rendezvous and Sample Exploration
(https://techport.nasa.gov/image/129601)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Planetary Resources Development Corporation

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

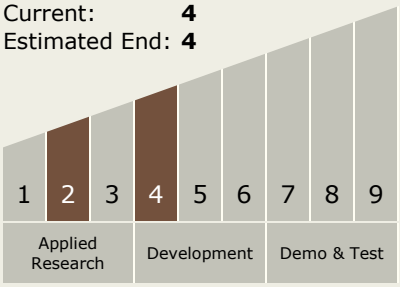
Carlos Torrez

Principal Investigator:

Ray Ramadorai

Technology Maturity (TRL)

Start: **2**
Current: **4**
Estimated End: **4**



Technology Areas

Primary:

- TX10 Autonomous Systems
  └ TX10.2 Reasoning and Acting
    └ TX10.2.4 Execution and Control

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System