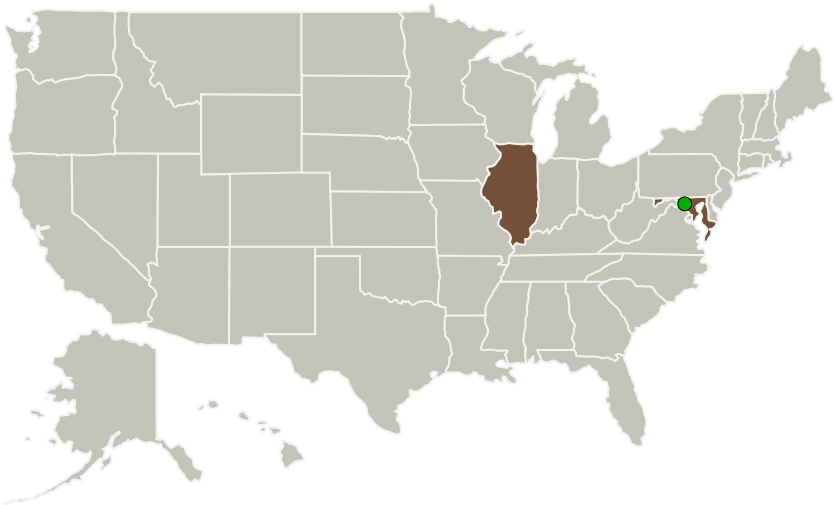
Parallel Nonlinear Optimization for Astrodynamic Navigation, Phase I

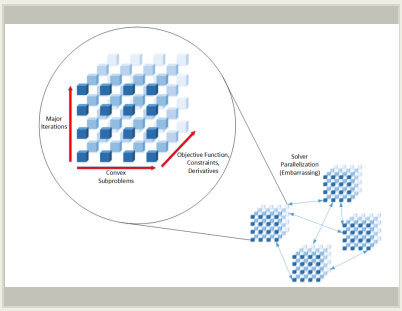
Completed Technology Project (2014 - 2014)

Project Introduction

CU Aerospace proposes the development of a new parallel nonlinear program (NLP) solver software package. NLPs allow the solution of complex optimization problems, and there exist today a number of capable NLP solvers typically used within the astrodynamics community. Unfortunately, none of them take into account the capabilities of a high performance computer with thousands of processors, nor use the recent advances in graphics processing unit (GPU) calculation. Many NASA optimal trajectory packages (OTIS, MALTO, EMTG) have already streamlined and optimized their own code to run as fast as possible, and it is now the serial-execution nature of the existing packages that represents the largest bottleneck. The new parallel NLP solver to be developed by CU Aerospace in partnership with the University of Illinois will represent a novel, ground-up redesign of this kind of solver. It will be built to be transparently usable by the existing optimal trajectory solvers used at NASA; however, it will also take advantage of high performance computing and/or GPU processing to reduce the run time by orders of magnitude. This has strong implications for NASA's mission design groups, as the time to solution for the trajectory teams will be significantly improved. Further, an improved optimization tool will have applications across all fields at NASA which user optimization, from engineering design to cost analysis. CU Aerospace is uniquely positioned to develop this new parallel NLP solver, with a team of experts, and the nearby proximity to the high performance computing resources at the National Center for Super Computing.

Primary U.S. Work Locations and Key Partners





Parallel Nonlinear Optimization for Astrodynamic Navigation Project Image

Table of Contents

Project Introduction	1
Primary U.S. Work Locations and Key Partners	1
Project Transitions	2
Images	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	2
Technology Areas	3
Target Destinations	3

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Organizations Performing Work	Role	Type	Location
CU Aerospace, LLC	Lead Organization	Industry	Champaign, Illinois
Goddard Space Flight Center(GSFC)	Supporting Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations	
Illinois	Maryland

Project Transitions

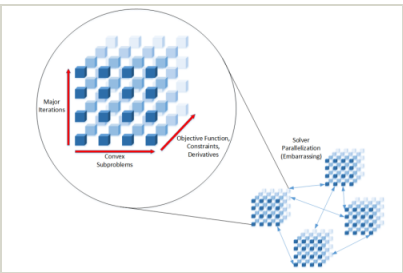
June 2014: Project Start

December 2014: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/137769)*

Images



Project Image
Parallel Nonlinear Optimization for Astrodynamic Navigation Project Image
(https://techport.nasa.gov/image/134201)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

CU Aerospace, LLC

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

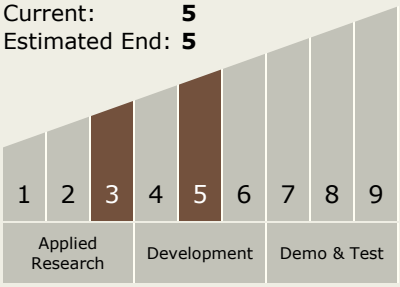
Carlos Torrez

Principal Investigator:

Alexander R Ghosh

Technology Maturity (TRL)

Start: **3**
Current: **5**
Estimated End: **5**



Technology Areas

Primary:

- TX11 Software, Modeling, Simulation, and Information Processing
  └ TX11.1 Software Development, Engineering, and Integrity
    └ TX11.1.8 Software Analysis and Design Tools

Target Destinations

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