An Intelligent Autonomous Executive for cFS Distributed Spacecraft Missions, Phase I Project

SBIR/STTR Programs | Space Technology Mission Directorate (STMD)

ABSTRACT

Distributed Spacecraft Missions (DSM) have become increasingly important in the effort to extend the capabilities of instruments to gather critical Earth and Space science data. DSMs, which include constellations, formations and clusters, have already been employed and have been proposed for several future space science missions. The Magnetospheric Multiscale (MMS) mission is a current Solar-terrestrial Probe mission comprising four identically instrumented spacecraft flying in a relatively close formation to study the Earth?s magnetosphere. Although they open up new science frontiers and new possibilities for satellite design, constellations will be limited if their operations costs scale with the number of satellites. A key enabling technology for future DSMs will be their ability to operate with a level of autonomy to leverage the capabilities of a standard-sized team of satellite operators to safely operate a fleet of satellites. Our innovation is the development of a cFS App suite, called the Distributed Automation Suite for Heuristic Execution and Response (DASHER), which extends the current state of the art in onboard automation for spacecraft flight software. The main component of DASHER is a mission manager that can execute science observation and engineering plans intelligently. DASHER uses a common planning language to intelligently execute plans.

ANTICIPATED BENEFITS

To NASA funded missions:

Potential NASA Commercial Applications: There are a number of distributed spacecraft missions identified in the NASA Decadal Survey and they will be very expensive to operate without a higher level of automation than the current spacecraft state of the art. The software developed under this proposal will is reusable and will enable multiple missions as part of the cFS library.

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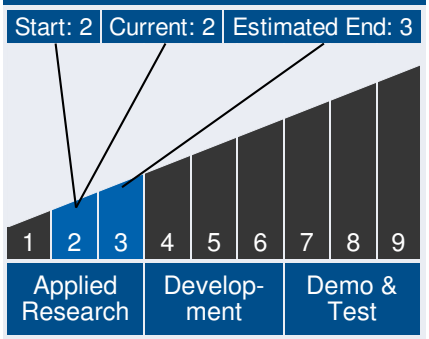
Technology Maturity



Management Team

Program Executives:

- Joseph Grant
- Laguduva Kubendran

Program Manager:

- Carlos Torrez

Continued on following page.

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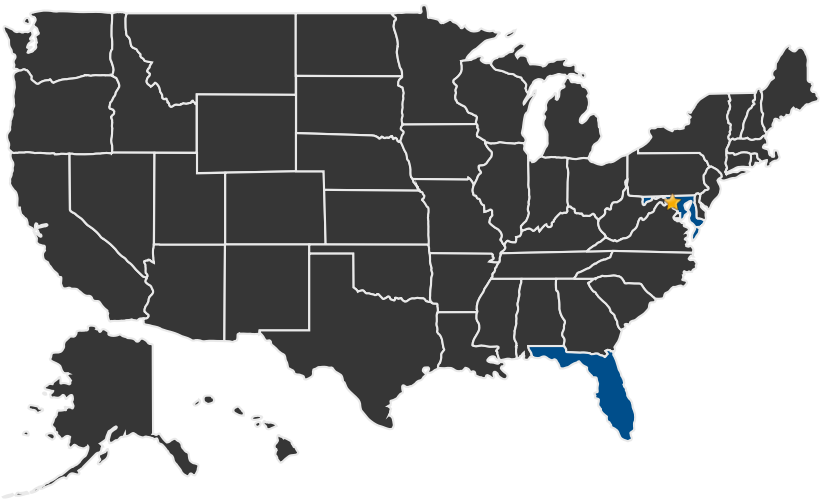
To the commercial space industry:

Potential Non-NASA Commercial Applications: Agencies outside of NASA, like the DoD have begun to take an interest in the cFS reusable flight software platform. The software developed under this proposal will be equally applicable to non-NASA missions that have multiple spacecraft and require automation. Outside of the spacecraft market, autonomous systems need reliable autonomy and a standardized planning language. The software developed under this project will useful in other autonomy markets.

U.S. WORK LOCATIONS AND KEY PARTNERS



U.S. States With Work

Lead Center:
Goddard Space Flight Center

Other Organizations Performing Work:

- Emergent Space Technologies, Inc. (Greenbelt, MD)
- University of Florida

Management Team *(cont.)*

Principal Investigator:

- Brendan O'Connor

Technology Areas

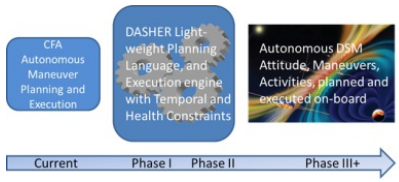
Primary Technology Area:
Modeling, Simulation, Information Technology and Processing (TA 11)
└ Information Processing (TA 11.4)
  └ Intelligent Data Understanding (TA 11.4.2)

PROJECT LIBRARY

Presentations

- Briefing Chart
  - (http://techport.nasa.gov:80/file/23428)

IMAGE GALLERY



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DETAILS FOR TECHNOLOGY 1

Technology Title

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Potential Applications

There are a number of distributed spacecraft missions identified in the NASA Decadal Survey and they will be very expensive to operate without a higher level of automation than the current spacecraft state of the art. The software developed under this proposal will is reusable and will enable multiple missions as part of the cFS library.