

A Ground Testbed To Advance US Capability In Autonomous Rendezvous And Docking Project

Center Innovation Fund: JSC CIF (Also Includes JSC IRAD) Program
Human Exploration And Operations Mission Directorate (HEOMD)

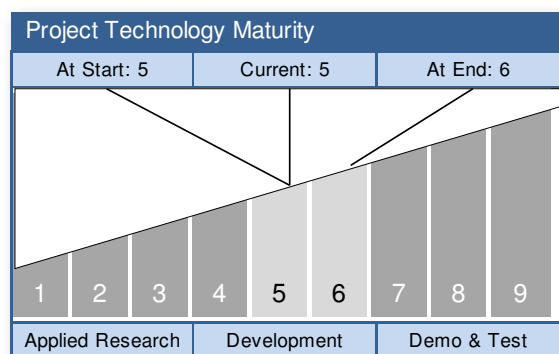
National Aeronautics and
Space Administration



ABSTRACT

This project will advance the Autonomous Rendezvous and Docking (AR&D) GNC system by testing it on hardware, particularly in a flight processor, with a goal of testing it in IPAS with the Waypoint L2 AR&D scenario.

The entire Agency supports development of a Commodity for Autonomous Rendezvous and Docking (CARD) as outlined in the Agency-wide Community of Practice whitepaper entitled: "A Strategy for the U.S. to Develop and Maintain a Mainstream Capability ...**Read more on the last page.**



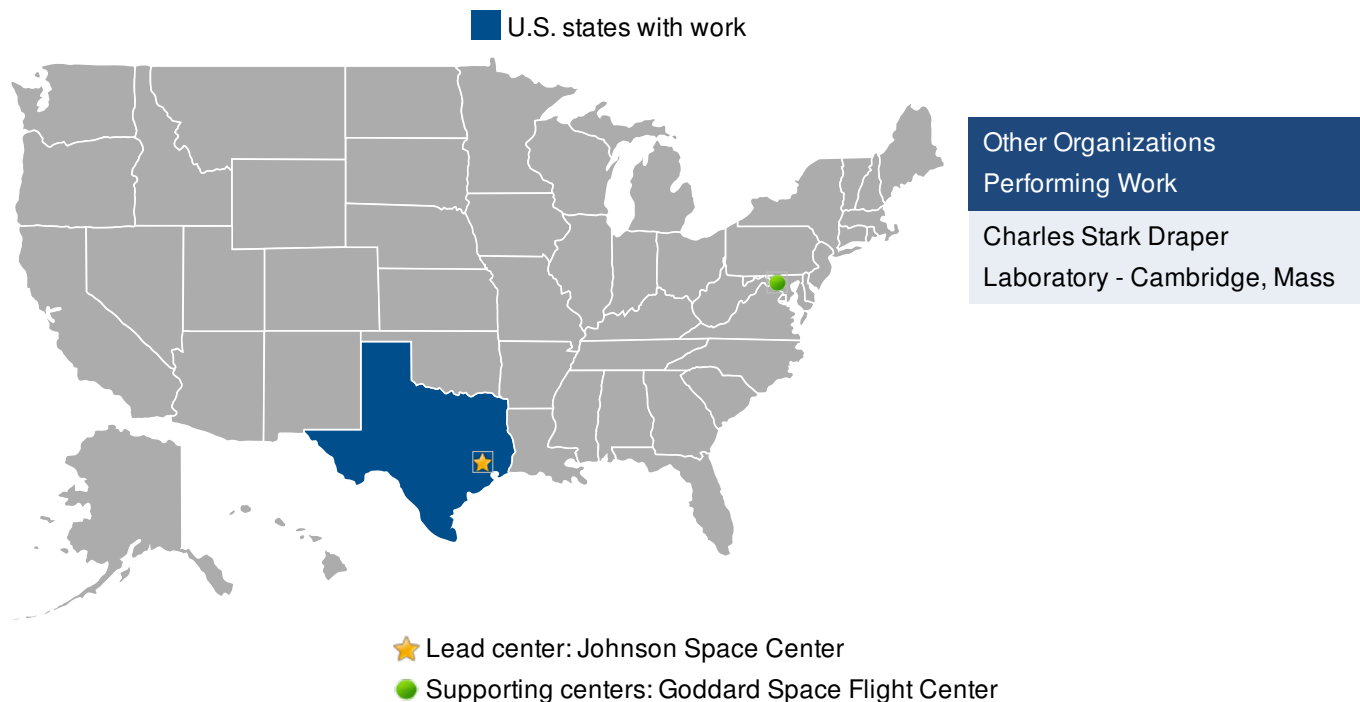
Technology Area: Robotics, Tele-Robotics & Autonomous Systems
TA04 (Primary)

ANTICIPATED BENEFITS

To NASA funded missions:

1) the US is in a continual state of AR&D point-designs and therefore there is no US "off-the-shelf" AR&D capability in existence today, 2) the US has fallen behind our foreign counterparts particularly in the autonomy of AR&D systems, 3) development of an AR&D commodity is a national need that would benefit NASA, our commercial partners, and DoD, and 4) an initial estimate indicates that the development of a standardized AR&D capability could save the US approximately \$60M for each AR&D project and cut each project's AR&D flight ...

Read more on the last page.



DETAILED DESCRIPTION

The entire Agency supports development of a Commodity for Autonomous Rendezvous and Docking (CARD) as outlined in the Agency-wide Community of Practice whitepaper entitled: "A Strategy for the U.S. to Develop and Maintain a Mainstream Capability for Automated/Autonomous Rendezvous and Docking in Low Earth Orbit and Beyond". The whitepaper establishes that 1) the US is in a continual state of AR&D point-designs and therefore there is no US "off-the-shelf" AR&D capability in existence today, 2) the US has fallen behind our foreign counterparts particularly in the autonomy of AR&D systems, 3) development of an AR&D commodity is a national need that would benefit NASA, our commercial partners, and DoD, and 4) an initial estimate indicates that the development of a standardized AR&D capability could save the US approximately \$60M for each AR&D project and cut each project's AR&D flight system implementation time in half.

As designed, each element of the AR&D commodity is to be evolvable so that as sensor, computer technology, and algorithm advances occur, the commodity will harness these advances and allow the new hardware and software to be integrated with a minimum of difficulty because the interfaces have been well-defined. Since ...

MANAGEMENT

Program Manager:
Ronald Clayton

Project Manager:
Chris D'souza

Principal Investigator:
Chris D'souza

DETAILED DESCRIPTION (CONT'D)

the majority of the effort in any AR&D mission involves solving systems integration challenges, having an 80% solution will go a long way toward reducing time and cost – and risk -- of future missions.

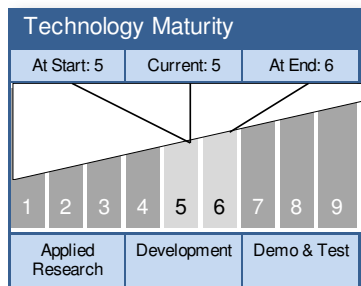
This project's objective is to develop a CARD software and hardware package (which goes well beyond this IR&D proposal and is a long-term endeavor) that will provide a cross-cutting starting point that will provide 80% of the functionality necessary to carry out any conceivable AR&D mission. The remaining 20% will need to be tailored to a particular mission. One of the key elements of this commodity is a set of well-defined, standardized interfaces.

To date, all of the work performed for AR&D has focused on either Low Earth Orbit (LEO) or Low Lunar Orbit (LLO). We seek to advance AR&D technology by focusing this IRaD on rendezvous in a weak gravity environment –either at L2 or around an asteroid. We choose to focus our IRaD effort on the AR&D algorithms and software for the Waypoint Mission, thus broadening our scope, maintaining our cutting-edge capability, and advancing US manned space exploration. Our goal is to be flexible enough to meet the needs of the NASA vision as it applies to any AR&D mission the Agency chooses to embark upon.



TECHNOLOGY DETAILS

Autonomous Rendezvous and Docking



TECHNOLOGY DESCRIPTION

This project's objective is to develop a Autonomous Rendezvous and Docking (AR&D) package (which goes well beyond this IR&D proposal and is a long-term endeavor) that will provide a cross-cutting starting point that will provide 80% of the functionality necessary to carry out any conceivable AR&D mission.

This technology is categorized as a software macro for manned spaceflight

- Technology Area

- TA04 Robotics, Tele-Robotics & Autonomous Systems (Primary)

CAPABILITIES PROVIDED

This project will advance the capability to perform AR&D independent of the ground

This can be applied to any vehicle needing to perform rendezvous away from LEO

Performance Metrics		
Metric	Unit	Quantity
Maturity (TRL)	TRL	6

ABSTRACT (CONTINUED FROM PAGE 1)

for Automated/Autonomous Rendezvous and Docking in Low Earth Orbit and Beyond". The whitepaper establishes that 1) the US is in a continual state of AR&D point-designs and therefore there is no US "off-the-shelf" AR&D capability in existence today, 2) the US has fallen behind our foreign counterparts particularly in the autonomy of AR&D systems, 3) development of an AR&D commodity is a national need that would benefit NASA, our commercial partners, and DoD, and 4) an initial estimate indicates that the development of a standardized AR&D capability could save the US approximately \$60M for each AR&D project and cut each project's AR&D flight system implementation time in half.



ANTICIPATED BENEFITS

To NASA funded missions: (CONT'D)

system implementation time in half.

To NASA unfunded & planned missions:

The Waypoint mission is the direct focus of the AR&D proposal; in particular, we intend to test the algorithms and software developed here in the IPAS environment with the Waypoint L2 AR&D scenario.

To other government agencies:

DARPA and other AFRL have projects which could benefit from this technology

To the commercial space industry:

Development of an AR&D commodity is a national need that would benefit NASA, our commercial partners, and DoD

To the nation:

The entire Agency supports development of a Commodity for Autonomous Rendezvous and Docking (CARD) as outlined in the Agency-wide Community of Practice whitepaper entitled: "A Strategy for the U.S. to Develop and Maintain a Mainstream Capability for Automated/Autonomous Rendezvous and Docking in Low Earth Orbit and Beyond". The whitepaper establishes that 1) the US is in a continual state of AR&D point-designs and therefore there is no US "off-the-shelf" AR&D capability in existence today, 2) the US has fallen behind our foreign counterparts particularly in the autonomy of AR&D systems, 3) development of an AR&D commodity is a national need that would benefit NASA, our commercial partners, and DoD, and 4) an initial estimate indicates that the development of a standardized AR&D capability could save the US approximately \$60M for each AR&D project and cut each project's AR&D flight system implementation time in half.