Draper Space Systems Research Interests

University Programs Point of Contact

Dr. Brenan McCarragher, CTO
617.692.0932
education@draper.com

Technical Point of Contact

Dr. Kevin R. Duda
617.258.4385
kduda@draper.com

Introduction

Draper has an extensive and proud heritage in space beginning with the selection by NASA as the first prime contractor on the Apollo program. Throughout the ensuing 60+ years, Draper has continued to make significant contributions in civil and commercial space, including NASA's Artemis and Commercial Crew Programs, NASA science missions, and commercial robotic/autonomous exploration missions.

> **About Draper Laboratory (www.draper.com)**
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> *Draper is an independent, not-for-profit corporation, chartered to work on problems in the national interest. Draper is **seeking collaborative research partners from universities** to further the state of the art in key technologies of mutual interest. Research Whitepapers describing Draper's technology interests and Technical Points of Contact can be found on the Draper Scholars webpage (Draper Scholar Program | Draper). The Draper Scholars Program funds thesis-bearing MS and PhD students at partner universities as one of the effective ways to progress the technology. Other means of collaborative research (e.g. joint proposals, sabbaticals, etc.) are also encouraged. Please contact education@draper.com if you have further questions.*

Research Interests

1. ### Mission-Enabling Autonomy

   Draper is investing in advancing our mission-planning technology – which has heritage in low-earth orbit (LEO) technology demonstrations, terrestrial undersea applications, and terrestrial unmanned aerial vehicles. We are interested in innovations that advance the state-of-the-art in mission-enabling autonomy to support human and robotic space missions beyond LEO, such as cislunar operations (including the lunar surface), include AI/ML technologies when appropriate, and are certifiable to relevant NASA software standards. Draper may share specifics of particular interests once the collaborative research topic has been agreed upon.

2. ### Navigation Sensors

   The ability to navigate a spacecraft is critical to all space missions. Draper is interested in architectures and technologies (both hardware and software) to support autonomous precision navigation in cis-lunar space (including on the lunar surface). Approaches that enable new missions, or fill gaps in current mission concepts, minimize size, weight, and power (SWaP), and can operate autonomously for extended durations in deep space are of particular interest. Again, Draper may share specifics of particular interests once the collaborative research topic has been agreed upon.

3. ### Space Situational Awareness

   The ability to be situationally aware in space (SSA) requires unique space-based sensors with innovative sensing modalities, mixed sensor suites, and algorithms for detection, identification, and tracking of objects in both near and far proximity to a space asset (e.g. cubesat). Draper is

interested in novel sensors, algorithms, and system approaches to SSA for LEO through to cis-lunar domains. Draper may share specifics of particular interests (e.g. field of view; field of regard; accuracy; etc.) once the collaborative research topic has been agreed upon.

4. *Fault-Tolerant Computing*

Fault tolerant computer architectures satisfy NASA safety requirements by providing the reliability and redundancy necessary for human-rated NASA systems, enabled by highly-reliable computing elements, are also required for commercial and science missions that must have mission availability. Draper is investing in technologies such as our software-based redundancy management (which was developed for NASA' Space Launch System) and highly reliable electronics to satisfy the growing need for edge-computing and/ high reliability / fault tolerance in space. We are interested in advances in technologies, algorithms, and approaches to fault-tolerant computing and architectures to support these needs, including radiation hardening and high-temperature electronics. As with the prior research areas, Draper may share specifics of particular interests once the collaborative research topic has been agreed upon.

We would be targeting PhD students for the development of novel approaches; and MS students for the application of existing approaches to specific problems of interest to Draper.