Client Overview:

Katalyst Space Technologies is a dynamic start-up operating out of Flagstaff, AZ with a mission to advance innovations with in-space servicing, assembly, and manufacturing while seeking to solve existing problems like congestion and traffic management in space. With an emphasis on leveraging modular technology to provide customers with responsiveness, mission flexibility, and sustainability, the company is developing a product to mitigate collisions. The probability for these kinds of impact events is growing as space becomes increasingly populated. With debris traveling at speeds of up to 17,500 mph, “even tiny paint flecks can damage a spacecraft” (Space Debris and Human Spacecraft | NASA). Space assets are expensive and have long timelines from conception to execution; one collision creates additional debris that compounds the probability of future impingements. The products Katalyst is developing have been recognized by the United States Space Force, as well as other organizations, including Northrop Grumman, the Defense Innovation Unit (DIU), and Defense Advanced Research Projects Agency (DARPA) for their potential impact on security and sustainability in space, bridging the gap between traditional mission architecture and the infrastructure needed for second generation space robotics. Katalyst will launch a demonstration mission with this technology in May 2024.

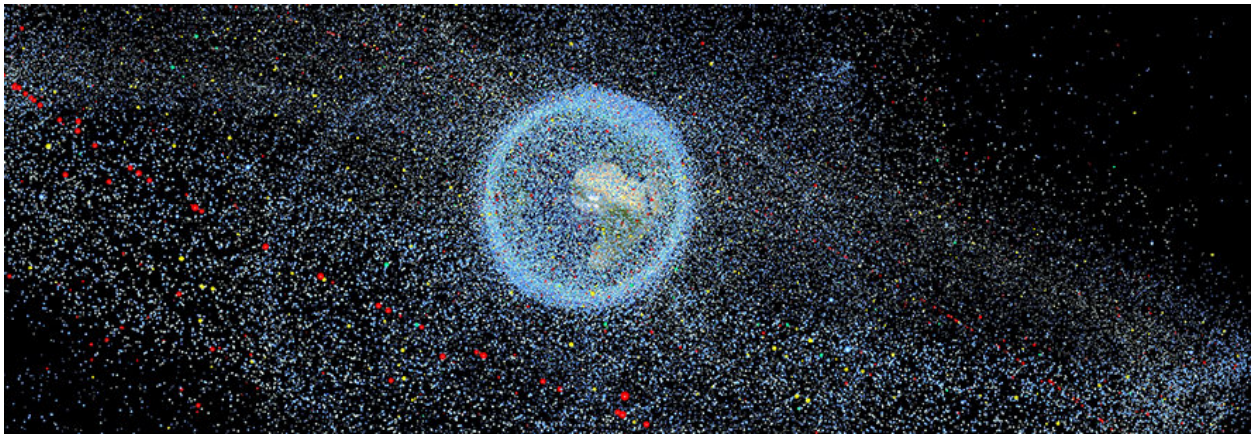

Figure 1 Map of cataloged space debris

Proposed Project:

Students will be working on a ground segment processing pipeline for Space Domain Awareness (SDA), which is the cataloging and characterization of Resident Space Objects (RSOs). This will include two fundamental tasks:

1) Students will take inertially fixed state observation vectors of an RSO with associated uncertainty (covariances) and compute an initial orbit determination of the observed RSO with downstream uncertainty. This should be initially demonstrated in a non-real time environment. Architecture and class diagrams will be created for the testing and implementation of code. Students will be required to demonstrated the logic behind their software designs, and the architecture will be translated to a complete software package with an easy interface.

2) Students will take inertially fixed state observation vectors of an RSO with associated uncertainty (covariances) and correlate it to an existing catalog of RSOs. Probability and confidence for the correlation will be determined and appropriately tagged.

Skillsets:

Required:

- Familiarity with Python or Matlab
- Strong written & communication skills
- Ability to research complex technical topics
- Ability to create maintainable & readable code that integrates into existing software
- GIT

Desired:

- Ability to specify software interfaces for complex software architectures
- Ability to perform trade studies
- Familiarity with space dynamics & orbital mechanics
- Experience in system definitions using UML or SysML
- Experience in satellite operations
- Physics-based modeling & simulation experience (development & analysis)
- Familiar with continuous integration framework

Preferred Team Size: 2-4

Student Benefits:

Students will get exposure to the space industry amid major architectural shifts from expensive single-use systems to second generation space robotics. Space has seen unprecedented growth in the last few years as developments in technology have allowed for a more accessible & sustainable future in space.

Internship Potential:

Katalyst Space has a robust internship program which has included students from Colorado School of Mines.

Work Location:

Remote. Connection via Microsoft Teams M, W-F. Tuesdays are independent workdays.

Intellectual Property:

Students will be required to sign an NDA and intellectual property assignment agreement

Contact Information:

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