

Fall 2021- Spring 2021 Project Descriptions

Overview

In this course, students will have the opportunity to be “NewSpace fellows.” Fellows will work for a partner space technology company throughout the course of the academic year, building technical skills and business acumen while working on projects that contribute to a company’s mission.

If you are applying to the course, please be sure to read the company project descriptions in this document carefully because on the online application, you will need to specify which company/companies you are interested in working with. For each company and project you are interested in, please keep in mind that you are expected to stick to that for the entire year - there will be no project switching after each semester.

Lastly, please know that even if you do not have the technical skills or background desired for a specific project, it is okay! As long as you are willing to put in the effort to learn, you will be fine and are encouraged to apply. If you have any questions about the project descriptions or the application, you can email us at info@newspaceatberkeley.org.

Application Tips Related to Project Descriptions

- You can name as many projects you are interested in. Your chances of being selected in the class do increase if you are interested in more projects so do keep that in mind.
- Please choose projects based on the work you are interested in rather than the company name.
- It is okay if you do not understand everything about the project you interested in (ie. if there are terms that you have not heard of that are in the project description). After students are enrolled in the course, they will be given more details on their respective projects.

The next few pages will have the different company projects. **The course may have another project from another company open within a week or two so we will keep all students who apply in mind for that as well**

Planet [Project 1]: Commercial Opportunity Identification In Sensor Market and Product Development

Company introduction

Planet is unique in its ability to image the entire Earth nearly every day, complemented by high-resolution taskable imagery. We have an unmatched data set that is important to businesses and governments worldwide: applications ranging from monitoring crop yields to detecting illegal deforestation in the Amazon to documenting natural disasters.

Project Prompt

Planet has the opportunity to identify a new end-to-end solution that no one in the space industry currently provides. During the first half of the year, you will identify opportunities in the current industry; in the second half of the year, you will design a project to address those gaps.

Fall Semester	Spring Semester
<p>You will...</p> <ul style="list-style-type: none"> ▸ Perform a competitive analysis to identify gaps in what the industry provides today -- what sensors are out there, what problems do they best address, what isn't present in the market today? ▸ Research the issues related to the problem you have identified to understand the sensors needed to best address this problem. ▸ Identify key industries or governments working in this area. Dig in to find out the current solution(s), and think about how Planet can simplify their pain. Reaching out to those entities is highly encouraged. <p>Deliverable: You will produce a proposed plan for the end-to-end solution as a "pitch" for funding at the end of the semester. The focus of the deliverable is to tell a story: what is problematic to many space entities, and how Planet can sweep the current solutions with a customized end-to-end approach.</p>	<p>You may...</p> <ul style="list-style-type: none"> ▸ Specify the sensor requirements to support solutions to the problem you identify during the first half of the year ▸ Develop the mission concept of operations (CONOPs) implied in the proposed solution (e.g. a single satellite or a constellation of satellites) ▸ Design and build out a prototype for data delivery ▸ Assess the compatibility with other existing data types to enhance the insights from the proposed solution <p>[Deliverables will be dependent on the student project proposal during the fall semester]</p> <p>Deliverable: Present the final work, a functional prototype if applicable, and documentation that fits the requirement listed above.</p>

Company Mentor(s)

Kenji Ozawa (Senior Systems Engineer) and Kelsey Brennan (Product Design Lead)

Who we're looking for

We'd love to get a mix. Building great products relies on cross-functional collaboration between multiple disciplines, and we'd love to expose people to how different functions work together (through both non-technical and technical phases).

Additional Readings

Any foundational text/blog/article relating to the prompt (could be something that provides the background information).

Below are examples of various types of satellite imagery that can be used to solve or gain insight into terrestrial problems:

- [Carbon Mapper Launches Satellite Program To Pinpoint Methane And CO2 Super Emitters](#)
- [How Amazon Conservation Is Cracking Down On Illegal Mining With Planet Data](#)
- [How Satellite Data Helps to Monitor Geopolitical Change](#)
- [Satellite \(MODIS\) Thermal Hotspots and Fire Activity](#)
- [How are Satellites Used to Observe the Ocean](#)

Planet [Project 2]: Novelty Change Detection in High Temporal Frequency Satellite Imagery

Company Introduction

Planet is unique in its ability to image the entire Earth nearly every day, complemented by high-resolution taskable imagery. We have an unmatched data set that is important to businesses and governments worldwide: applications ranging from monitoring crop yields to detecting illegal deforestation in the Amazon to documenting natural disasters.

Project Prompt

The surface of the Earth is constantly changing. Some of these are expected changes, like illumination variations throughout the days and seasons, changes in cloud cover, cars moving on roads, etc. However, not everything follows a set pattern: rapid construction, natural disasters, or anything unexpected that alters the environment dramatically. Your task is to create a novelty detection algorithm that can visualize “normal” vs. “abnormal” changes in a selected area of interest, with the deep temporal stack of data available from Planet.

Fall and Spring Semester

You will...

- Explore novelty and anomaly detection methods in machine learning (ML) to create a visualization of change over time in an area of interest. Potential suggested focus areas include the Amazon (deforestation), High Mountain Asia (landslides and glacial surges), Arctic regions (rapid changes from permafrost melt), urban areas (development, or destruction from events such as conflict or natural disasters), or areas of coastal erosion.
- Work with Planet’s Science Team to understand the causes and effects of the changes detected by the ML methodology, with the possibility of collaborating with other scientists who use Planet imagery for machine learning.

Deliverable:

The deliverables can be decided between the student team and the company. However, it should still be along the lines of a write-up describing the benefits of implementing novelty and anomaly detection methods, as well as the avenues for profiting that are company-specific, meaning that the proposed profit plan must fit the existing company profit model. In other words, students are trying to sell this technology (idea) to Planet. Other interactive aids, such as maps, web interfaces, animations, are encouraged but optional.

Company Mentor(s)

Tanya Harrison (Director of Science Strategy)

Who We Are Looking For

Experience with Python and machine learning is necessary. In addition, experience with machine learning techniques applied to satellite imagery and/or satellite image interpretation is a strong bonus. Students will work remotely but participate in weekly syncs with Planet’s Science Team.

Skyloom: Inter-satellite laser communication router specification and market analysis

Company introduction

Headquartered in Oakland, Skyloom is revolutionizing how we move data in orbit. Their proprietary technology routes data efficiently in orbit to send signals bouncing across the satellite network to the customer on the ground. Each satellite uses RF gateways to send and receive signals and a router on the satellite determines where the signal should be sent next based on the signal it receives. The company went through Berkeley Skydeck in 2018 and has been growing since with 3.1 million USD in funding.

Project Prompt

Skyloom has to bounce signals from satellite to satellite and then to a receiver on the Earth. This receiver could be a moving aircraft or a stationary antenna. Optimising the path for this signal to travel across the satellite network to the customer is a huge area of interest currently in the space industry. The first semester of this project will involve developing a fundamental technical understanding of satellite constellations and Skyloom's network. The second semester of the course will entail a commercial project that extends the engineering project completed in the first semester.

Fall Semester	Spring Semester
<p>You will...</p> <ul style="list-style-type: none"> ▸ Learn about how satellite constellations work on a high level ▸ Become familiar with the challenges and limitations of satellite constellations ▸ Learn about path optimization and path diversity ▸ Identify how technical details correspond to profitability ▸ Learn about satellite based RF gateways and routers ▸ Research router design and examine existing router solutions <p>Deliverable: A specification for the routers on Skyloom satellites which redirect signals across the Skyloom constellation network and ultimately transmit signals to a receiver on Earth. The specification will be used by Skyloom as a starting point for designing their routers.</p>	<p>You may...</p> <ul style="list-style-type: none"> ▸ Do market research on the satellite constellation market ▸ Conduct competitive intelligence on the satellites communications market to define Skyloom's position in the market with the new router technology ▸ Define the total addressable market (TAM) for the router for the next 5, 10, and 20 years. ▸ Define the pricing model and constraints for the router technology ▸ Use data analytics and visualization tools to present macroeconomic trends in a clear and concise manner <p>Deliverable: Develop an industry analysis report that portrays where the satellite communications and satellite constellation industry will be in the near future. The goal of the report will be to highlight Skyloom's commercial opportunity with its new router.</p>

Company Mentor(s)

Marcos France (Director of Science Strategy)

Who We are Looking For

Any student with a technical or business background with a strong interest in networking, electronics, and satellite constellations in space is encouraged to apply. Mechanical Engineers and Electrical Engineers will have an easier time working on the technical project, but anyone with the dedication to learn by themselves and from Skyloom's CEO will be able to complete their project well.

Space Foundation: An Analysis of Orbital Debris in Lower Earth Orbit and the Policies Needed to Reach LEO Sustainability

Company Overview

Space Foundation is a nonprofit advocate organization founded in 1983, offering a gateway to information, education and collaboration for space exploration and space-inspired industries that define the global space ecosystem. Driven by a partnership model, Space Foundation operates three divisions that unite the entire spectrum of stakeholders — business, government, education and local communities — through corporate membership, sponsorship, fundraising and grants.

Project Prompt

Your project will focus on orbital debris, which is one of the most pressing topics currently being discussed in the space industry. With tens of thousands of untracked pieces of debris orbiting the globe right now, your work to inform policy makers on the issue will have meaningful ramifications for how the US approaches this issue.

Fall Semester	Spring Semester
<p>You will...</p> <ul style="list-style-type: none"> ▸ Understand the historical issue of space debris and the critical importance of addressing it for the sustainable development of the NewSpace Economy ▸ Research government initiatives and private sector developments to resolve space debris matters ▸ Dive deep into key metrics, researching and developing extrapolated data for projected space debris by 2030, risk assessment of collision with non-debris satellites, prospect of collision based on extrapolated data for 2030, etc. ▸ Compile all research into a paper that will be published <p><u>Deliverable #1:</u> 10-20 page draft report split into three areas: (1) History of Orbital Debris in LEO (2) Current Policy on Orbital Debris and response (3) Future of Orbital Debris including mitigation and on orbit services, to include suggested policy changes or implementation to regulate debris.</p>	<p>You will...</p> <ul style="list-style-type: none"> ▸ Review, revise, and finalize the draft report for publishing ▸ Prepare and conduct various briefings to a Capitol Hill and Administration level audience, to possibly include in person and virtual appearances. To include specific due outs as: <ul style="list-style-type: none"> ▸ Strategic discussion and outreach to Key Members and Staff for Orbital Debris policy implementation ▸ Prep meetings with Space Foundation Memorandums for each meeting ▸ Follow up action items from staff and members of meetings/briefings <p><u>Deliverable #2:</u> A report that will provide content for Space Foundation's quarterly TSR (The Space Report) -- to be published. Other deliverables will be related to briefings to appropriate Government officials.</p>

Company Mentor(s):

Megan Wenrich (Manager DC Operations)

Who We Are Looking For

We are interested in a diverse range of non-technical and technical candidates interested in space policy and its role in the development of the NewSpace Economy. Students working on this project should be able to break down the more technical elements of engineering elements for current and future mitigation techniques. They should also be comfortable presenting in a professional format, either in a one-on-one meeting, a virtual session, or a large briefing.