



STANFORD STUDENT SPACE INITIATIVE
DEVELOPING THE FUTURE OF SPACE

Vol. 6 | 2020-2021

Approaching SSI

A Handbook for
Prospective Members





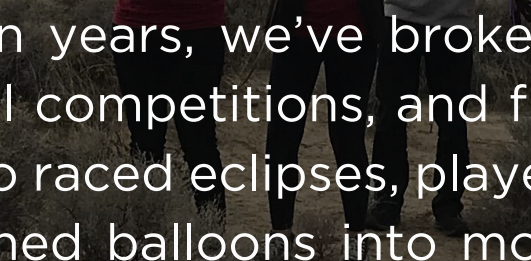
STANFORD STUDENT SPACE INITIATIVE
DEVELOPING THE FUTURE OF SPACE

Welcome to SSI



WELCOME TO SSI

SSI was founded on the premise that anyone should be able to act on their interest in space. If you're an experienced engineer looking for a challenge, SSI is a chance to do unparalleled work. But if you've never held a tool before, if you've never really thought of yourself as an engineer or a policymaker, if you are reading this right now and wondering if SSI can be a place you belong— the answer is yes.

A photograph of three people standing in a vast, arid desert landscape. The person on the left is a woman in a red t-shirt, the person in the middle is a woman in a black t-shirt and sunglasses, and the person on the right is a man in a grey hoodie and sunglasses. They are all smiling and holding large, colorful model rockets (blue, green, and orange) over their shoulders. The background shows a flat desert floor with sparse vegetation, distant mountains, and a cloudy sky.

In the past seven years, we've broken world records, won international competitions, and flown satellites to space. We've also raced eclipses, played baseball in the desert, and crashed balloons into mountains. We're a group of scrappy, excited people who are always ready for a challenge.

SSI is going to space. And we'd love for you to join us!

Community

SSI is a community. We believe that this can be a place for you to find support, friendship, and tips on how to pass CS106B that your TAs won't tell you.

This club is designed to be what you make of it. Want to stop by once a week, do a little code, and then head home? We love that. Want to make this your place? We have that too.

We in SSI stick together. Whether it's bonding over PSETs at study nights, going on adventures off campus, or meeting for team dinners every week, SSI is full of opportunities to meet interesting people and hang out with them.

After all, whether you're deep into a DNA-synthesis experiment or driving out to the New Mexico desert to launch a rocket, you're going to want to like the people you do it with.

SSI Teams

SSI has seven project teams. These teams include five technical teams – Balloons, Biology, Mars, Rockets, and Satellites, as well as the intellectually engaging Policy team, and the management-oriented Operations team.

This breadth makes SSI a student group for anyone interested in space. Got an idea for something cool that you don't see happening already? Bring it up!

We welcome you to try out projects from multiple teams. Be as involved as you want – but no need to overextend yourself! It's never too late to join or switch projects.

Every team works on a number of projects, ranging in size and scope. Team Leads are responsible for keeping multiple projects on track; Project Leads manage the ins and outs of team activities to meet specific objectives. If you're a committed member, you may soon find yourself leading a project or team.

ssi.stanford.edu/join



Balloons

The SSI Balloons Team develops and launches payloads to the edge of space and around the world aboard high altitude balloons. From launching into hurricanes collecting potentially life-saving data to deploying SSI's premier mission control software, we take pride in using our technology for real-world impact. In the past year, this team has broken world records, dropped drones from dizzying heights, and flown payloads as far as Africa. The sky ceases to be the limit - join us and send your design to near space!

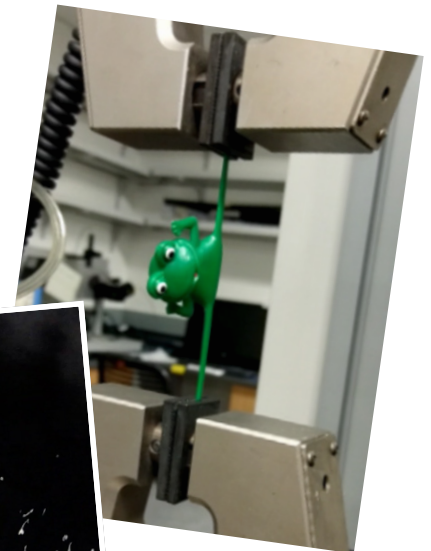


BALLOONS

Balloons is a team with a reputation for doing the unthinkable. SSI's Balloons team has broken the world record for the longest high altitude balloon flight THREE times by flying a latex balloon all the way to Morocco, launching at night over the Pacific Ocean, and sending a kiwi to space. In the next year, you will retrieve a payload with a drone, fly a balloon into a storm, help monitor climate change with geospatial imagery, and share new flight prediction software with the world. You will take beautiful pictures from the edge of space and fly your work across the United States. We guarantee, you'll have some incredible stories to tell at the end of it. If you're looking for an opportunity to have a real impact on the world, launch fast and frequently, and be your most adventurous and curious self, you might just be a Balloonatic.

Balloonarang

Retrieving payloads is just as important as launching them. Balloonarang tackles the challenge of payload recovery from a variety of different angles, simulating when aerodynamics, mechanical, and controls work become inseparable. Much like how a boomerang zips back to its thrower, a Balloonarang payload is launched to near-space and then returns to its starting coordinates, reducing time and cost of launch operations. If you're interested in Aerodynamics, CAD design, board fabrication, data visualization, optimizing flight paths, or anything electronics, Balloonarang has a place for you to shine. Join this tight knit team to experience a little bit of everything: flight control algorithms, complex mechanical design, and hands-on electrical engineering experience.





Cycloon

Balloons launched by SSI have flown over three continents and two oceans. What better way to leverage these high-precision, long-endurance flight capabilities than to fly into hurricanes, and collect data from Nature's most awe-inspiring and destructive storms?

That's exactly what Cycloon is up to. In just one quarter, our team successfully launched five missions that tested marine tethers, control algorithms, launch maneuvers, and trajectory optimizations to reach storms over the ocean.

In the coming year, we'll be developing radiosondes to drop into weather systems over the continental US, with our eyes set on the big prize: collecting data from a hurricane in fall 2020 and publishing our results!

Want to design lightweight, power-optimized embedded systems?

Have a ham radio license and ideas for data downlink?

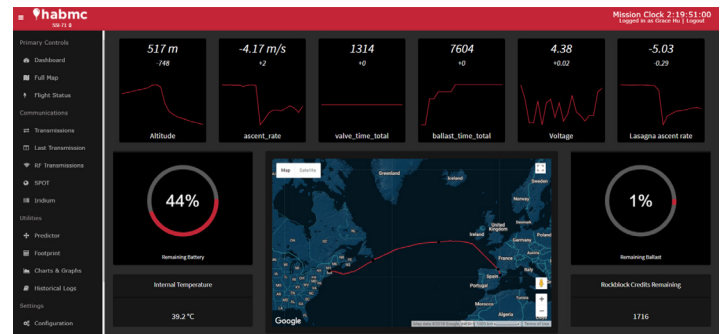
Interested in inventing new search and optimization algorithms?

Love meteorology and want to direct engineering efforts for a scientific objective?

Join Cycloon to develop cutting-edge technology, perform important scientific research, and have a meaningful impact on the world!



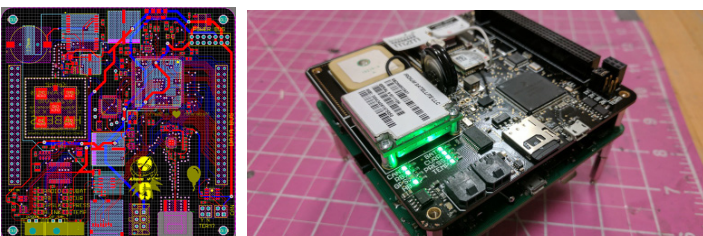
BALLOONS



HABMC

Our world-record breaking flights and many of our successful launches would not have been possible without HABMC, which stands for High Altitude Balloon Mission Control. HABMC provides real-time data visualization, a flight path predictor using live atmospheric data, and a navigation algorithm to avoid restricted airspaces or poor weather patterns. HABMC is written in Ruby on Rails and React with an Electron desktop app. There are limitless possibilities to advance HABMC, including front-end development, networking, and machine learning. Check it out at habmc.stanfordssi.org/code/ASSI.

Another integral piece of software to HAB payload development is HABSIM, a web-hosted prediction server for curating Global Forecast System (GFS) ensemble wind forecasts to make probabilistic predictions. This allows us to predict launch trajectories to facilitate launch and recovery, but also optimize over arbitrarily complex flight profiles for Cycloon and Spaceshot. Interested in writing fast numerical simulation code, maintaining a server processing 120 GB of data per day, contributing to a Python package on the real package index, or using those path finding algorithms you learn in 106A/B/X in a real project? Check out predict.stanfordssi.org to learn more!



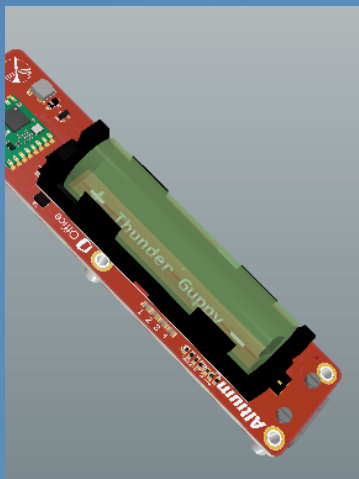


Spaceshot

There's a new space race brewing on college campuses around America - one that Stanford intends to win. The goal? Be the first college ever to the 100km Karman Line that formally defines the edge of space. Dozens of colleges are involved. Most notably: our arch-nemesis, Berkeley.

Stanford's secret weapon: unlike the other college rocket groups, we also have one of the world's best balloons teams. Hence our Rockets and Balloons teams are working together on a so called 'rockoon' system: a balloon platform will lift a rocket to 25 km and the rocket will boost to space from there.

This project is bracingly difficult and, if we're being honest with ourselves, mildly insane. There are incredible engineering challenges in our way. But at the same time, it's an opportunity to utilize all the technology SSI has developed so far to do something amazing.



Like electronics? Our electronics need to survive sixty gravities of acceleration and downlink video from 100+ km.

Like mechanical engineering? We need complicated mechatronics to stabilize our rocket in below freezing temperatures and make a carbon fiber airframe that can survive reentry from actual space.

Like computers? We need to code custom flight simulations (because the commercial ones are either military classified or don't even get close to modeling our performance), or compress live video into something the aforementioned electronics can handle.

Like physics? We need you to help the CS people understand how our system is going to behave when it goes from zero to twice the cruising speed of a fighter jet in three and a half seconds.

And if you're interested in learning about a topic that's not up there, don't worry, because we're probably doing that too.

Because we're a collaborative project between rockets and balloons, the best way to get involved is to go to rockets and balloons onboarding. And as with absolutely everything else in SSI, you don't need to know anything to work on this project - the whole point is for you to learn. We need all the people we can get if we're going to make our deadline. And if we don't - well, Berkeley is going to give it a shot too, with a rocket that's twenty times as expensive, five times as large, and doesn't travel a kilometer in the first second after the motor ignites.

And we can't have that, now can we?



Rockets

On Rockets Team, our shared passion for space travel is what fuels our dedication and what pushes us to go even further, higher, faster. While the long-term goal of Rockets Team is to make it all the way to space, our primary objective is to help our team members learn, grow, and have fun.

Here you will build your own personal rocket (a pretty great dorm room decoration). Here you will find a community of passionate, kind friends that you'll feel lucky to call teammates. Here you will stay up late far too many nights but leave with a smile no matter the time of day. Here is where you'll say the word "hypersonic" in casual conversation. Here is where you will roadtrip thousands of miles with your closest friends to watch something you built soar into the sky. Here is where you will make history. From building a custom staging system, to programming complex mechatronic assemblies, to developing a powerful liquid rocket engine, Rockets is the place to be.

People of all interests and all skill levels are welcome. If you're excited about rockets (and what's not to be excited about?), then this is the team for you, regardless of what your background is.

Join us, and let's go to space!

The Rockets team is usually split up into several different projects each year. Each of these projects is split up into subteams that focus on different areas of rocket science. To build a rocket, we need people with all different kinds of skills. Whether you're interested in ME, Aero/Astro, CS, EE, MatSci, Physics, or literally anything else, we have meaningful work for you to do.

We're so excited for you to join us!

Check out [#rockets](#) on slack for all the newest information.

Project Nebula

Thanks to that pesky virus that's been going around, the Rockets team structure will look a little different this year. As a result of this, we are so excited to debut Project Nebula this year! A nebula is a chaotic, but beautiful interstellar cloud of dust, hydrogen, helium, and other gasses that clump together to eventually form planets and stars. True to its name, we expect Project Nebula to start off being exciting and chaotic but eventually come together to create something amazing

Project Nebula is intended to be an unusual rocket that pushes the envelope of college rocketry. We want

to create things that SSI hasn't done before and especially focus on things that can make our rocketry projects more relevant to the real world! In fall quarter, Nebula members will be split into small teams made up of people of all ages and skill sets. Each team will work together over the course of the fall to brainstorm ideas and ultimately create an exciting and unique de-





ROCKETS

sign for one subsystem of a rocket. These designs could be anything from a 3D printed rocket structure to a payload doing climate change research to an avionics system that will let us talk to aliens - anything you can imagine!

At the end of fall quarter, we'll have a design review/party and several of these designs will be chosen to create one ultimate franken-rocket. Then, ideally with the help of on-campus students in the winter and spring, we will design and build one awesome Nebula rocket composed of the exciting designs that were dreamt up in the fall. Right now, we hope to build this rocket during the school year and then launch it over summer. But, if conditions keep improving, we hope to be back out there launching rockets much sooner!

Project Nebula is an awesome opportunity to both form close connections through the small teams in the fall and be part of the larger Nebula team community throughout the whole year. You'll have the chance to do hands-on design work and to really flex your creative muscles. Worried that you don't know enough about rockets? Don't be! We'll teach you anything you need to know, and being new to the world of rocketry will make it even easier for you to think outside the box. This project is unlike anything Rockets has done before, and we are so so excited to see all of the amazing designs that your teams are going to dream up!



Personal Rockets

One of the best ways to start learning about rockets is to make your very own rocket. All members of the team are welcome to build their very own high-powered rocket! In just a few hours, you'll build a rocket capable of flying to over 3,000 ft and earning you a high-powered rocketry certification. They also make excellent dorm decor and conversation starters.



Can't wait to get started?
Join our Slack at ssi-teams.slack.com/signup, and hop onto [#rockets](#).

Project Phoenix

Phoenix is an exciting and ambitious team focused on pushing the boundaries of what SSI rocketry has done before. Phoenix competes in the FAR 1030 competition, a new rocketry competition with lots of opportunities for unusual and experimental designs. This past year, as a brand-new team, we made history by successfully developing and launching SSI's first-ever staged rocket! In addition to that, we also developed a custom rover to be our rocket's payload. Our rocket is full of custom-made components and provides limitless opportunities for hands-on design and engineering. After our success with staged rockets, Phoenix is looking forward to tackling new and exciting challenges in the years ahead!



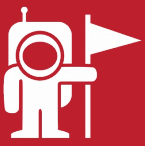
Project Olympus

Every year, SSI competes in the Intercollegiate Rocket Engineering Competition (IREC) - the world's largest university rocket engineering competition. With a goal of launching a rocket to the cruising altitude of an airplane, we strive to push the boundaries of what's possible in college rocketry. We develop our own avionics, structures, payload, recovery system, and more - emphasizing real-world engineering skills and high altitude excitement!

After competing and winning awards at the Spaceport America Cup in New Mexico, we've set our sights on a new challenge: building SSI's first custom propulsion system and competing in the high-altitude liquid propulsion category.

Olympus Propulsion team was one of the most productive SSI teams during quarantine, where we engaged in a lot of structural, thermal, and fluid analysis to different parts of the engine as well as complete full designs of our Mechanical Ground Support Equipment. In addition to that, team members organized weekly workshop series to teach other SSI members about rocket propulsion.





Mars

The SSI Mars team is the newest SSI core-team! Mars Team seeks to push the boundaries of crewed space missions and pave the way for permanent settlement of Mars and other celestial bodies. Our projects are centered on mission simulations and in-situ resource utilization (ISRU), which makes use of the resources on Mars for long-term missions and semi-permanent settlement. We take Martian air and soil and turn it into fuel and concrete, build landing pads on Mars, and simulate its environment.

Build Infrastructure on Mars, Stop Climate Change on Earth

In Situ Resource Utilization

We research ISRU methodologies and techniques which promise to produce everything necessary to sustain human life from desolate environments! You can help make places such as terrestrial tundras, lunar plains, and Martian deserts capable of sustaining life. The ability to make potable water, breathable air, and construction materials on site means that the major constraint on interplanetary missions, the need to bring massive amounts of cargo, can be sidestepped. This would reduce the cost of a Mars mission by orders of magnitude and even help expedite it. ISRU also provides the only way for Martian settlements to be truly self-sustaining, allowing humanity to become a multiplanetary species and kickstart a new era of history.

Exciting Possibilities

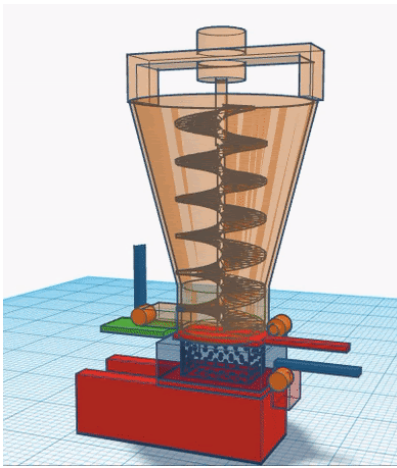
As many of the other SSI teams, a lot of our projects involve CS, EE, Aero/Astro. Additionally, they also involve chemistry and chemical engineering (for understanding material production methods), materials science (for predicting and testing material properties), civil engineering (for developing applications), economics. Many projects, centered on Mars, can also be adopted for use on the Moon. We can't wait for you to join us to help build the next settlement on another celestial body!

Mars team has access to the Blume Earthquake Engineering Center thanks to one of the team's faculty advisors, Professor Michael Lepech. In addition, he helps us develop ISRU projects, including our starting projects with sul-

phur concrete and basalt reinforcing bars. He, his students, and Dr. David Loftus, a researcher at NASA Ames, have worked on similar ISRU projects, so we have an excellent pool of expertise to guide us and there is a lot to learn!

Bricks

The bricks subteam experiments with methods of turning Martian and lunar soil into building materials for habitats and other structures. The team works with biopolymer-bound soil composite (BSC), which is made of soil, protein binder, and water. BSC has similar compressive strength as Portland cement concrete, the world's most common construction material! While concrete production accounts for about 8% of global CO₂ emissions, BSC provides a possible carbon-neutral al-



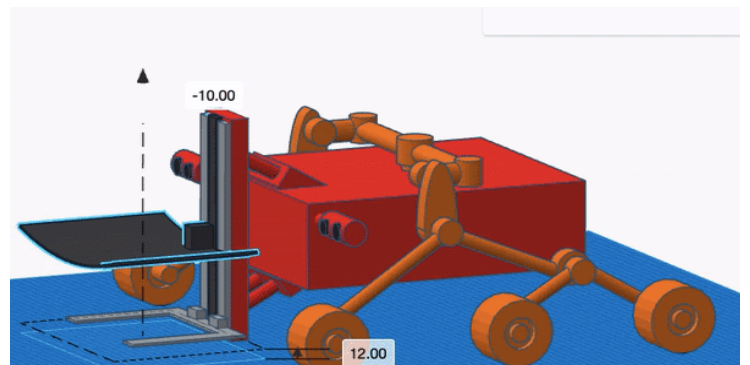
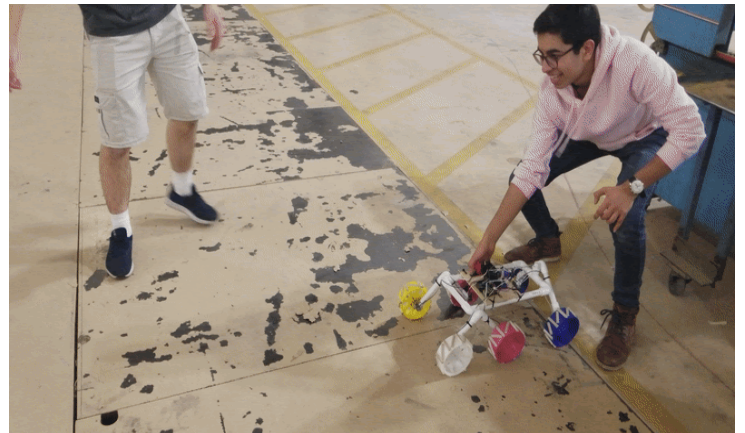
Tractor

The tractor subteam is designing and constructing an autonomous roving vehicle that goes hand in hand with the Bricks Team machine. The vehicle, dubbed Mars Tractor, can gather soil, deposit said soil into the Bricks machine, and manipulate produced bricks to construct simple structures like walls and roads!

ternative and is also easy to produce from Martian resources. The team is currently designing a prototype device to autonomously produce BSC bricks.

This subteam works on proposal writing for NASA design competitions. Earlier this year, we wrote a proposal for NASA's Big Idea Challenge. There are other proposals such as that for SPOCS (Student Payload Opportunity with Citizen Science), a NASA design competition. Where we will be proposing a payload that will test how BSC dries in microgravity aboard the International Space Station! This experiment will be very important to our team as it will provide valuable data to compare with ground experiments, hopefully shedding light on the material's usage on the Moon and Mars!

Earlier this year, a basic prototype, Alpha, was completed using pipes, 3D-printed wheels, off-the-shelf motors, and a Raspberry Pi as a controller, and threw it off a flight of stairs to test it. COVID-19 has interrupted assembly of the Alpha hardware, but computer vision work and CAD design continued remotely!



Project Marsim

This year, we are proud to announce the launch of a new, all remote team: Mars Simulation!

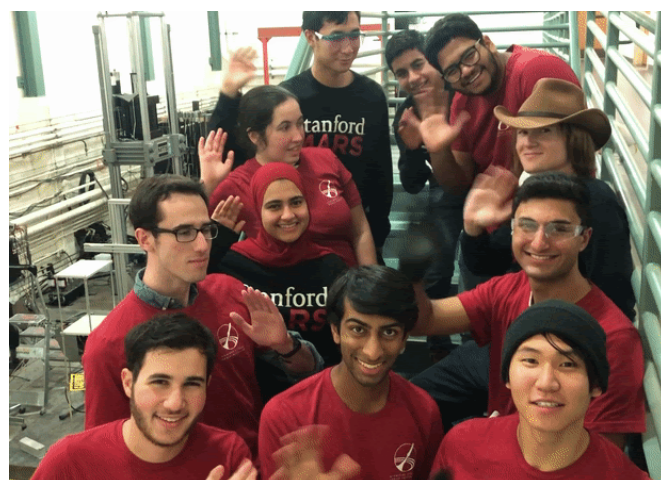
Do you want to be part of the software NASA or SpaceX will use to plan their mission to Mars? Are you passionate about humans being an interplanetary species? Do you like thinking about scenarios and ways things could happen, and even apply that to space? Have no CS experience at all but want to help us build the simulation? We have a place just for you at the Simulations Team! We will be offering basic Python programming courses as well as sessions with Adam Raudonis, an AI engineer at Tesla, and a former SSI member, to talk to us about Python in simulations and help us understand what has gone in the project so far!

Want to contribute in non-CS ways? We need people like you to help us brainstorm scenarios, document procedures, write papers, and perform research experiments to help us gather more data that will make our simulation better! In Marsim sub-team, there is a place for everyone whatever they want to do!



Come join the most out-of-this world team (quite literally) on SSI!

Absolutely no experience necessary! This team would be perfect for existing or aspiring chemical engineers, material scientists, programmers, physicists, economists, environmentalists, roboticists, or anyone who wants a Mars stamp in their passport! Come join the Martian family!

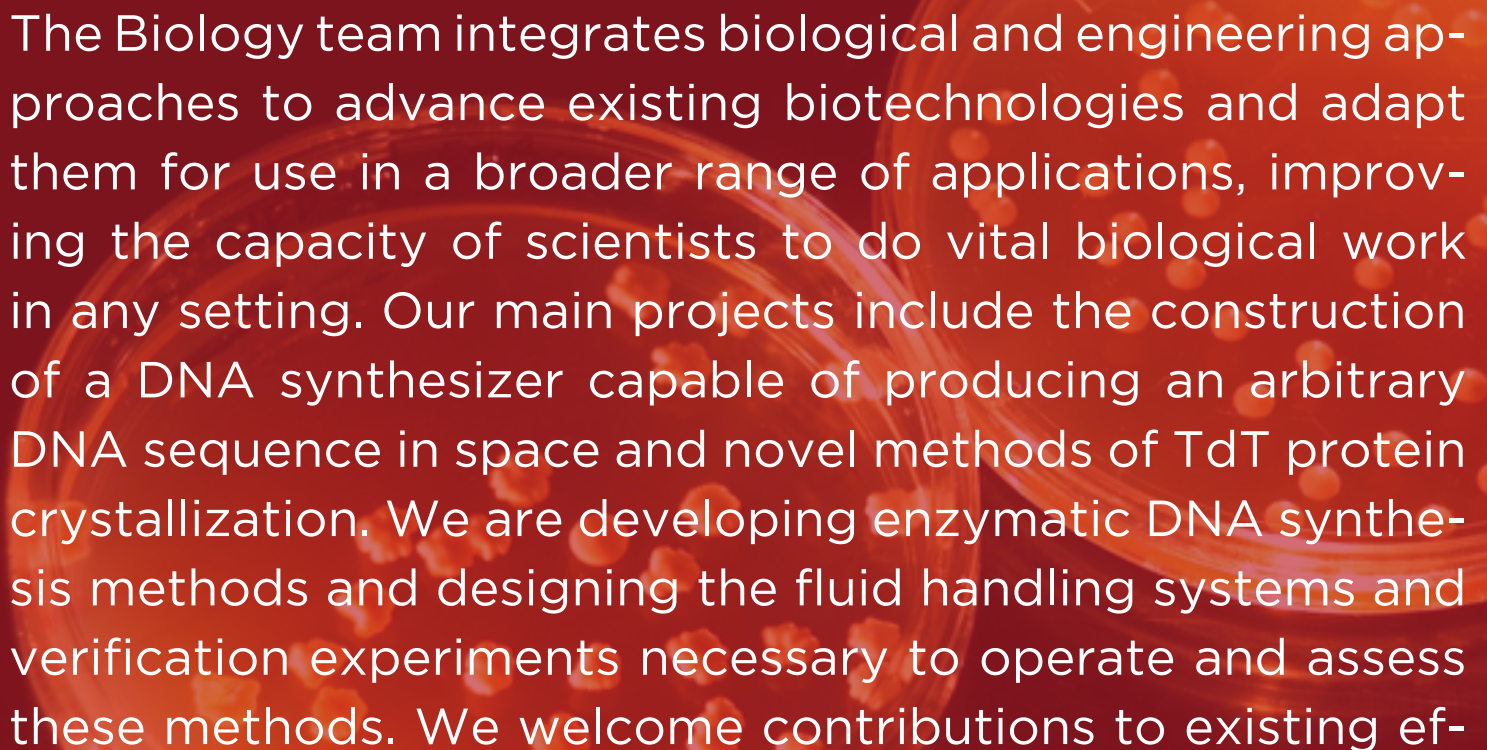


Can't wait to get started?
Join our Slack at ssi-teams.slack.com/signup, and hop onto [#mars](#)



Biology

The SSI Biology team spans the intersection of life sciences, engineering, and space with a focus on enabling technologies for biological experimentation in extraterrestrial habitats. SSI Bio is currently pioneering enzymatic DNA synthesis methods for use in a portable, autonomous DNA synthesizer operable in space. The team's work towards safe, accessible, distributed DNA synthesis holds potential not only for science and medicine on Earth, but also for on-site genetic engineering and experimentation

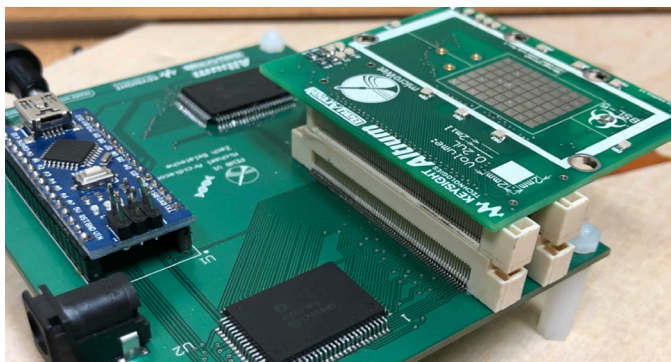
The background of the top half of the page is a dark red color. Overlaid on this is a semi-transparent image of several petri dishes containing bacterial colonies. The colonies appear as small, white, circular spots on a dark surface. The lighting is soft, creating a slight glow around the colonies.

The Biology team integrates biological and engineering approaches to advance existing biotechnologies and adapt them for use in a broader range of applications, improving the capacity of scientists to do vital biological work in any setting. Our main projects include the construction of a DNA synthesizer capable of producing an arbitrary DNA sequence in space and novel methods of TdT protein crystallization. We are developing enzymatic DNA synthesis methods and designing the fluid handling systems and verification experiments necessary to operate and assess these methods. We welcome contributions to existing ef-

DNA Synthesis

In the biomedical fields, cutting-edge research requires frequent access to short single-stranded DNA fragments called oligonucleotides. Currently, the standard methods for synthesizing these fragments uses flammable chemical solvents resulting in toxic byproducts, constraining work to centralized facilities. For researchers seeking to make advances in remote environments like space, the inability to synthesize DNA on-site efficiently and safely poses a major challenge.

To overcome these limitations, SSI Bio is developing a DNA synthesizer using specialized enzymes. Together, these enzymes add one nucleotide at a time to a single strand of DNA without a pre-existing template, enabling de novo synthesis in a controllable manner. The water-based enzymatic chemistry allows for safe, affordable DNA synthesis at any place on Earth-- and beyond.



Microfluidic Device Design

Constructing a DNA synthesizer requires programmable manipulation of incredibly small amounts of fluid, a challenging task from both engineering and computer science perspectives. In order to accomplish this goal, we are prototyping a droplet-based fluid handling platform capable of moving nanoliter-scale droplets using a large voltage differential. Merging and splitting droplets containing our DNA synthesis reagents on a printed circuit board enables precise control over each reaction step, maximizing space efficiency and flexibility and minimizing reagent waste. Developing, programming, testing, and integrating an electrowetting system with our method for DNA synthesis would constitute major progress towards a functional DNA synthesizer ready for launch.



New Projects

While our exciting research out of Shriram has been put on pause for fall quarter, the cutting-edge innovation and community of the Bio Team continues to thrive! This quarter, we are pivoting to computer science-based projects surrounding bioinformatics and biomedical computation. Our fall project will be focused on dynamic molecular modeling and protein evolution software. We also plan to create educational resources and host virtual bioethics events, and are always open to your project ideas too. In a setting like this, the importance of bioengineering research and supportive community are made even more evident--the SSI Bio team has both!





Your Place In Bio

SSI Bio is looking for aspiring engineers, biologists, chemists and computer scientists to help us achieve our goals. With us, you will find yourself engineering not metal components or support structures, but rather the very materials that make up life itself. You will be part of a team striving to revolutionize the way DNA synthesis is conducted, accelerating biomedical advances across the globe and helping bring terraforming one step closer to reality. No matter your present skill

set, our team will bring you up to speed and help you contribute to potentially industry-shaking projects. While doing groundbreaking work, you will also become part of the community that is SSI Bio, a community that involves beach



Can't wait to get started?
Join our Slack at ssi-teams.slack.com/signup, and hop onto [#biology](#).



Operations



Operations enacts SSI's mission statement: giving the future leaders of the space industry the hands-on experience and broader insight they need to realize the next era of space development. We elevate more of our members into executive leadership positions than any other group in SSI. We obsess over the big picture while diligently laying the groundwork to make that picture possible. We work closely with the co-presidents to execute their vision for the organization and support the SSI community – one of the most vibrant and brilliant at Stanford.

You can find our members doing all sorts of things, from inviting industry leaders to our speaker series, to running networking events for our members; managing our website, to designing our popular club merchandise. Our workspace team manages several active lab spaces, and our finance team budgets over \$100,000 each year. Featuring the most service-oriented arm of SSI, we strongly support SSI's core values such as Diversity and Inclusion. So what are you waiting for? Come join Operations today and start making an impact on the high-flying student group on campus. This year, with your help, Operations is the place to be.

Making SSI Tick

SSI will face many unique challenges this year due to the impacts of Coronavirus, and our Operations Team will play a bigger role than ever to ensure that SSI continues to function. Come channel any of your frustration about the barriers 2020 has brought you into productive work to help a vibrant, 300-member organization still accomplish great feats and provide incredible outside-the-classroom experience. We're looking forward to hearing your ideas!





OPERATIONS

Events

The entire Operations team started with events, and we're only getting better. Throughout the year we host speakers, giving SSI members valuable insight into the workings of the aerospace industry. This practice has become even more accessible over Zoom, and we've had some amazing partnerships with industry. Events also organizes field trips! Last year we toured Bay Area Circuits so that members could learn about how circuit boards are made - from raw materials to final product. We also visited Nuro, a self-driving car company. Come support the work Events is doing and enable some of the coolest perks of being in SSI.

Marketing

Intrigued by the graphic design of this booklet? Curious about SSI's branding? Want to design cool art for our shirts and other swag? Addicted to social media? Join marketing and help SSI look as cool as we actually are. Whether you're interested in art, digital design, or running one (or all!) of SSI's social media accounts, there's a place for you on marketing.

Business

Represent SSI at networking events and tell venture capitalists and CEOs about what we do. The business team handles existing connections as well as building new ones. Thanks to Business we have excellent funding from industry, supplies, and mentorship on our projects!



Community

Run quarterly SSI-wide dinners, trivia night, and even our spring retreat. Community is what makes SSI, in the words of one of our members, "the family I always wish I had." While SSI members form meaningful bonds within the teams they work on, Community is an opportunity to give structure and cross-team interactions throughout the 300-person friend group that is SSI!

Website

Our website is also entirely student designed and run - come apply your passion for CS to helping SSI maintain an online presence. Run the internal website with all its details. Help the public know more about SSI's work and details.

Outreach

SSI also does outreach with local schools, encouraging the next generation of space-enthusiasts! We volunteer annually at a local Maker Faire, inspiring a passion for learning and STEM.



Diversity and Inclusion

From supporting healthy team dynamics, to a yearly census to track our demographics and where sources of discomfort or discrimination may arise, we are pushing back against the historically white-male dominated demographics of the space industry. SSI isn't perfect, but we work tremendously hard to consistently seek to improve our diversity and inclusion, and we would love for you to become an active member of realizing this goal. At SSI we consider big-picture DNI issues - we understand the importance of our impact on our members' future careers (many hadn't even considered engineering before joining), and also our role to counteract the biases we all have accumulated before coming to Stanford. We also tackle the day-to-day; our DNI co-leads also recently received a grant to get boba (or whatever beverage you prefer!) with SSI members to open up even more active conversations about diversity and inclusion in SSI and understand our members' personal experiences. If you're wondering how you can get involved in DNI efforts, this could be a great way to start!



We also work to make the Slack more accessible, host weekly meetings to address specific DNI issues SSI faces, and ensure onboarding is as inclusive and accessible as possible!

Safety & Workspace

By getting involved with workspace, you can run a real machine shop, paint murals across our 60-foot tall underground bunker, and give SSI a physical home. Our work in SSI is often hands-on, real industry experience, and we rely on a dedicated group of individuals to ensure our members and workspace stay safe so we can continue to operate sustainably.

You + Operations

Even with so many parts to Operations, we make sure it's as easy as possible to get involved. As well as being open to your ideas, each category has its own established structure. The tasks start out bite-sized and quickly prepare you to run our group. No matter what your background or skillset, there's a place for you. Come to our weekly meetings to learn about all of our subteams and how you can be a part of our mission. Reach out to [Phoebe Wall](#) with any questions or just to learn more!



Policy

Outer space is one of the few places in the universe that is shared among nations. It serves as a hub of innovation, creative thinking, and invaluable discoveries. Space projects have historically been some of the most challenging yet rewarding endeavors ever attempted. Why do we do it? What should Space be used for? Who decides?

SSI's Policy Team investigates the politics of Space. Whether you are an engineer, lawyer, economist, philosopher, or just a deep thinker, Policy is a place for you. Come join us as we explore the space industry, past and present, and change the future of Space.

Why do we travel to Space? Who is allowed to go? What are they allowed to do? Who regulates Space travel? How will the privatization of Space transform the industry? How do we explore sustainably? What happens if Space is used for war? How do we minimize Space debris? Questions like these and many more are at the core of the SSI Policy Team.

The Final Frontier

Throughout the year, Policy team will tackle the most pressing questions of modern Space exploration through research, discussion, debate, podcasts, campaigns, and immersive trips to Washington, DC and Vienna.

Engage Worldwide

Ever dreamt of presenting to the United Nations in Vienna, meeting with senators in DC, or having your thoughts on Space heard worldwide? SSI's Policy team provides meaningful opportunities like these to enrich your understanding of the Space industry and engage in the communities within it.

For the past two years, members of the Policy team have teamed with For All Moonkind to formulate and present proposals to the UN. With the help of this nonprofit, SSI has been able to advocate for Space heritage in front of delegates from around the globe. Students

involved in this project will be sponsored by SSI to fly to the United Nations Office for Outer Space Affairs (UNOOSA) to share the team proposal in front of the council and defend it to delegates. Though the trip was unable to occur this past Spring, For All Moonkind is looking forward to teaming up again this year.

Additionally, SSI Policy sends members to the International Astronautical Congress (IAC) every year. While there, students will see presentations from Space experts and have the opportunity to network with others in the industry. This year, the conference will be held virtually, so all members of SSI Policy will be able to attend!





Be Engaged

For readers and sci-fi lovers, we have a newly founded book club. Over the past year, members have read Space and future themed books, engaged in meaningful conversations, and invited authors to come speak. Book club now meets over Zoom, making it easy to contribute no matter where you are.

Additionally, the Policy team has weekly meetings. Each time, we discuss a new topic surrounding Space exploration. From terraforming Mars to Astronaut selection processes, the team enjoys candid conversation about these topics and more. Though we are unable to provide snacks during remote learning, everything else about these weekly team meetings will be the same this year.

Above all else, SSI Policy fosters a community of curious Space enthusiasts. Whether you are an avid rocket engineer or have never studied Space before, there is a place on this team for you.



Be Heard

Policy team has a podcast! Every week, we discuss the newest and most pressing questions in our program This Week in Space. Listeners from around the globe tune in to hear us dive into Space news, interview professionals, and engage in conversations. The podcast team has adapted to virtual recording sessions so you can be involved all year from anywhere! Episodes are available on all major podcast outlets, allowing your voice to be heard worldwide.





Satellites

Welcome to the Sats team, where your projects go to space! On the team you'll find a fun community full of members with all different passions about satellites, kombucha, fishing, DJing, and quantum machine learning. We write code to deploy our solar panels, walk the dish to test our radios, print specialized structures to brace for a rocket's intense vibrations, and send memes over Snapchat. If you're passionate about space, engineering, policy, or even how to fund and manage a mission that goes to space, we hope you'll give us a visit. Working at SpaceX requires expe-



SATELLITES

The Sats team is broken up into a few different sub-teams: avionics (electrical engineering in space), structures (the material that hold everything up), software (the code that bosses everything around), GNC (Guidance, Navigation, and Control: making sure the satellite doesn't start spinning), and Systems (making sure we don't do illegal stuff). Each sub-team meets once a week and then every saturday we hold Satsurday—an informal work session to meet up with everyone on the team. Right now we are fully online, but that hasn't stopped us from making progress on our Sequoia satellite and having a bit of fun. To be introduced to the team, learn about each sub-team, and make new friends stop by the first (or any) Satsurday.

2021 Onboarding Projects

Learn machine learning!

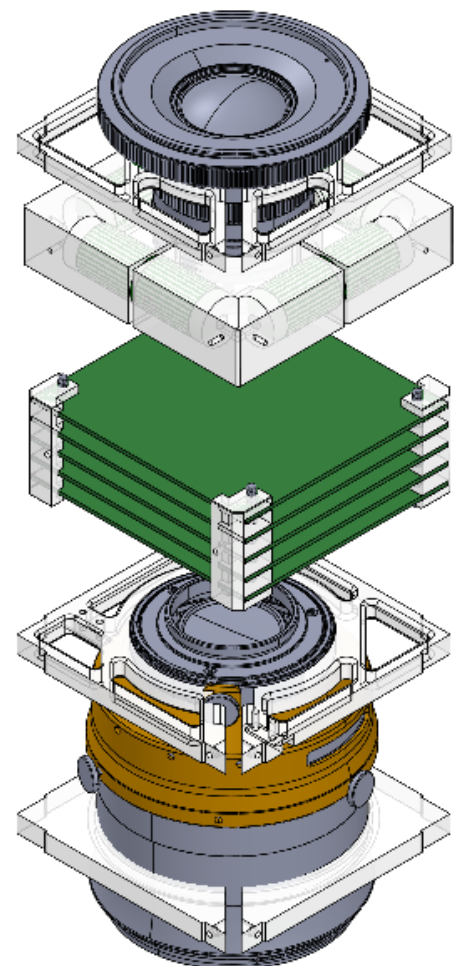
We will teach you what machine learning is, and you will train your own model on a fancy remote server!

Design (with CAD) and 3D print remotely!

We will teach you computer aided design, and then you will design and print parts remotely!

Learn electrical engineering!

We will ship you a kit to tinker around with and make some buzz!





Our Missions:

A Self-Driving Satellite?

The “Self-Driving Sat” is a technical proposal to autonomously navigate a cubesat in deep space using a catalog of known asteroids.

Currently, finding your spacecraft’s pointing direction is largely done with startrackers. These devices compare images of stars against a catalog of constellations to determine what part of the sky it’s looking at.

The situation is different for finding out where you actually are in space. By keeping a log of the trajectory of their spacecraft, Earth-based computers can estimate the spacecraft’s position. Keyword: estimate. The transmission delay makes the estimation too rough to navigate near an asteroid.

What if we applied the startracker catalog technology on asteroids? This could, in theory, allow positional navigation to take place on the spacecraft itself, eliminating the dependence on Earth groundstations, the transmission delay, and the resulting margins of error. Such a technology might make precise, autonomous deep space navigation possible. That’s exactly the technology we’re looking to develop this coming year.

How to Join Sats!

Join Slack [here](#), the lifeblood of SSI. Then, join the [#satellites](#) channel, and any channel prefixed with [#satellites-](#) that you find interesting!

Come to [Satsaturday, 12-2pm PDT every Saturday!](#)

Zoom details are in the description of the [#satellites](#) channel, but feel free to ask for help in the channel! We have tons of cool CS, EE, ME, and of course AA projects for folks to work on! DM [@flynn](#) or [@Grant Regen](#) with any questions!





Get Involved

So, what's next?

Now that you've read through *Approaching SSI*, we hope you have a better understanding of who we are, what we do, and most importantly, how excited we are for you to join us!

We strive to make SSI a welcoming community for new members joining at any point in the year. All Stanford students – especially prospective members – are welcome to stop by any SSI general meeting to hear the latest updates from our teams. You can also reach out to anyone on the SSI Leadership Team – we'll be more than happy to answer

ssi.stanford.edu/join



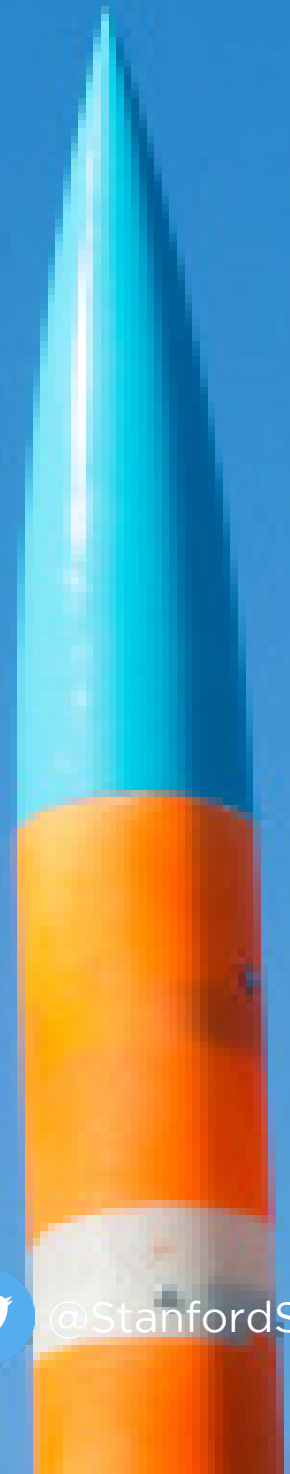
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