DESIGN *for* AMERICA

DF ★A YALE

WHAT IS DFA?

Design for America, founded in 2009, is a network of student-led studios creating local and social impact through interdisciplinary design. DFA student teams work on self-selected design projects throughout the academic year applying the skills and expertise gained through their for-credit academic courses. They look to their local community to assess pressing challenges and work in teams with organizational partners to understand user's needs, ideate, prototype and test potential solutions.

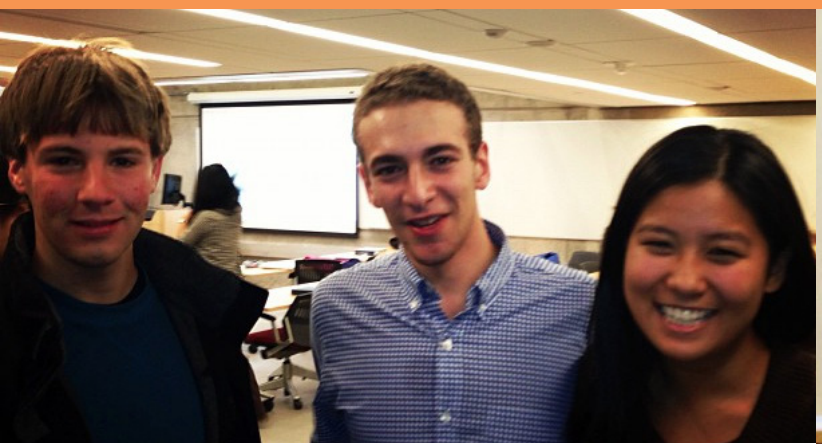
Through introducing and propagating the idea and process of design, DFA hopes to facilitate the creation of a world where people believe in their ability to design innovative solutions to today's challenges. Currently, DFA also acts as a pipeline of innovators, change makers, and social entrepreneurs. Our teams, members, and their projects have been featured in magazines such as Inc Magazine, Forbes, The Chicago Tribune, Harvard Business Review, and more. Some of the projects become start-up companies, such as SwipeSense and Jerry the Bear, which have raised more than $1.5 million in capital so far.

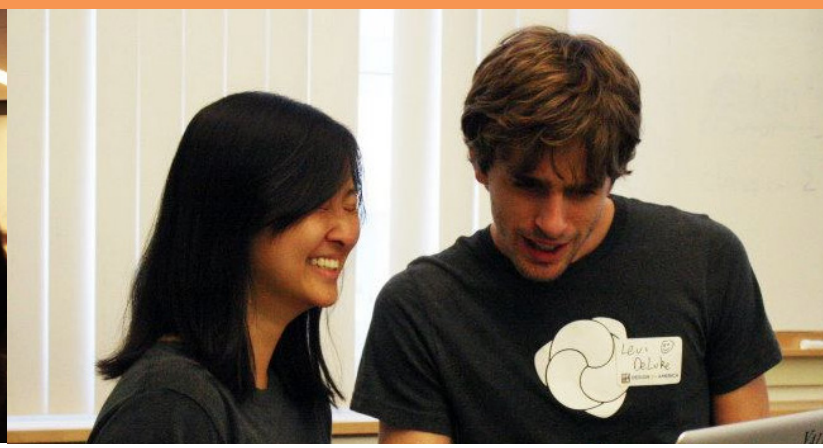
WHAT IS DFA YALE?

The DFA Yale chapter was founded during the spring semester of 2012. Composed of students of a wide variety of majors, DFA Yale seeks to bridge the gap between the different parts of Yale's student body by encouraging teams composed of undergraduate and graduate students with different skill sets. It aims to foster a culture of design by introducing students to the concept and process of human centered-design as a way of tackling societal problems and as a way of manifesting innovative change in the New Haven-Yale community.

DFA Yale's first project focused on reducing heat-waste in student dorms. Most students did not understand how to use the unlabeled knob on their heaters to adjust heating, and instead would open windows when the temperature was too high. DFA Yale created a label that explained that the heaters worked by powering steam and a label that indicated how much steam was being powered based on where the knob was twisted to. Our project team also created a temperature probe that allowed users to set a certain temperature. This probe was connected to a gear, which would turn the knob to adjust the temperature as needed.

LEADERSHIP





Faculty Advisor: Joseph Zinter, Ph.D.

As our faculty advisor, Professor Zinter advises us with the design process and assists in contacting speakers and securing resources for our project teams.

Studio Leaders 2013: Amy [redacted] '16, Paul [redacted] '16, Benjamin [redacted] '16

2012: Levi [redacted] '14, Ellen [redacted] '13

Studio leaders serve as the liaisons between DFA Headquarters and DFA Yale. They communicate with team leaders to help with project planning and assign responsibilities to DFA Yale members to ensure that tasks are completed. Through working with the rest of the leadership board, studio leaders shape the long term goals of DFA Yale in order to promote the success of project teams.

Secretary: Jared [redacted] '16

The secretary is essential to the day to day running of DFA Yale. S/he takes notes at each meeting, creates task lists from the meetings, and makes sure that all the tasks that need to be accomplished have people working on them. As a new initiative, the secretary is also in charge of organizing and updating the DFA archive on Google Drive.

Treasurer: Cynthia [redacted] '14, Kevin [redacted] '16

The treasurers are responsible for fundraising and applying to Yale funding sources as well as for managing the DFA Yale bank account and reimbursements. One treasurer is responsible mostly for the former, while the other is responsible for the latter. Both work with the rest of the leadership board in order to determine what to purchase with DFA funds.

Community Coordinator: Aaron [redacted] '16

The community coordinator compiles and maintains the DFA Yale database of existing community partners, faculty connections, student groups, and mentors. S/he is also in charge of maintaining relationships with existing contacts and reaching out to make new connections in the community to help individual teams and DFA Yale overall.

Events Coordinator: Lucia [redacted] '16

The events planner is in charge of planning social events, speaker talks, workshops, and other special activities hosted by DFA Yale. S/he works with the studio leaders to determine the schedule of events for each semester and delegates tasks such as obtaining food, finding venues, and other logistics. Once events have been planned, the events planner is also responsible for publicizing them.

PROJECTS

DFA Yale is currently working on six projects with the possibility of adding an additional project.

Biking: **How can we make bikers safer in New Haven? How can we reduce bike thefts? How can we improve biker safety when crossing roads?**

Currently, the Biking team is working on designing a better bike rack that is both attractive and easier to use than existing racks. By doing so, they hope to encourage more people to use bicycles in their day-to-day life

Waste Reclamation: **How can we harness energy from waste materials? What can we use this energy for?**

The Waste Reclamation team is focusing on recycling used batteries. There are no well-known spaces at Yale where students can go to recycle their batteries. The Waste Reclamation team plans to design something similar to a recycling system for cans and bottles, except for batteries, that is easy and fun to use as well as widely available.

Community: **How can we build community pride in Yale and New Haven in general? How can we make New Haven a desirable place to live and stay?**

The Community team is currently designing a platform for people to share stories about landmarks and experiences in New Haven, in an effort to connect people to the places where they live and encourage community participation.

BluSense: **How can we decrease the carbon footprint of buildings here in New Haven/Yale? How can we reduce students' water usage? How can we reduce students' shower times?**

BluSense has applied for the Dell Social Innovation Challenge (http://www.dellchallenge.org/projects/blusense). The team has been collecting data by sending out a survey to Yale and DFA students nationwide, and will begin prototyping and user-testing several different products that aim to increase users' awareness of their shower time and what that time means in terms of energy.

Ergonomics: **How can we improve students' posture? How can we reduce carpal tunnel syndrome?**

The Ergonomics team will begin testing whether or not students actually use lap desks when they are provided. They have applied to the Yale College Council 10K Challenge to introduce lap desks to the Bass Library checkout system to encourage students to use lap desks.

Food Waste: **How can we reduce food waste? What can we use wasted food for, other than compost?**

Over the course of the fall semester, the Food Waste team did a lot of research on how much food students waste. Now, team members will begin working on how to reduce this amount by making students aware of how much food they waste and improving the dining hall feedback system.

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IDEATION PROCESS

There are three major parts of the DFA design process: understand, create, and implement.

Understand: What is the challenge you are trying to solve?

The Understand phase involved identifying a challenge in your community you are passionate about solving, immersing yourself in the context where people confront the challenge, and reframing how you perceive your challenge to determine where design could make a difference. The more you understand your community, the better the solutions your team is likely to develop and improve the world around you.

Create: What are the possible solutions that fulfill the need?

The Create phase is where you make and test your ideas with community members, mentors, and professional experts. It involves ideating solutions, building prototypes, and testing these prototypes to see what works. You build and test different parts of the solution, tossing out the parts that don't work and keeping the parts that do. Through this iterative process, you can develop the best possible solution for your community?

Implement: How will you get your solution into the world?

The Implementation phase is about making sustainable impact with your solution. This stage involves pitching your solutions to secure needed resources, piloting your solution with the community, and creating an impact by getting your solution into the hands of people who will use your design.

EVENTS

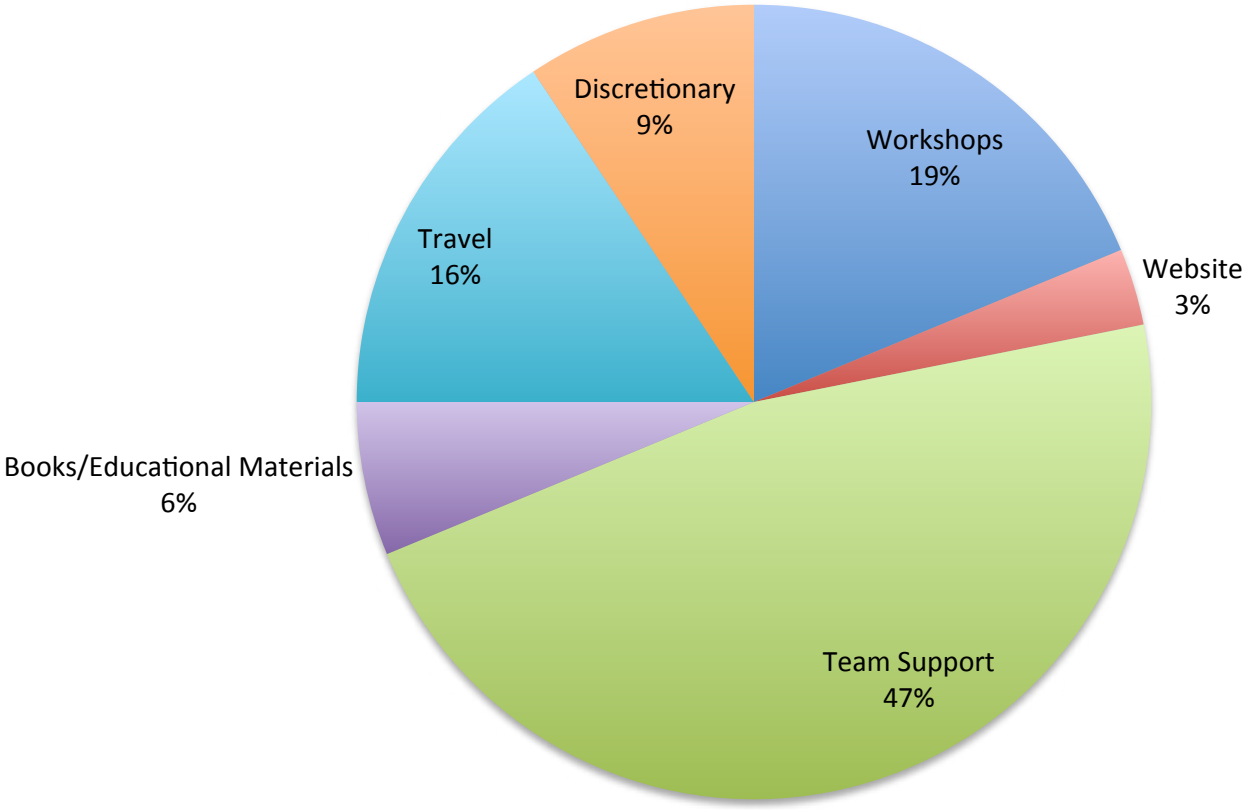
In addition to encouraging human centered-design projects and providing a forum for the development and review of those projects, DFA Yale will contribute to the Yale community through a series of design lectures and through design workshops.

DFA Yale plans to invite professionals and academics to give lectures on what design is, inspirational examples of design, why design is important, etc. These lectures will be open to the general public and will be advertised beforehand.

DFA Yale will also hold several design workshops that will be open to the entire Yale community. At these workshops, attendees will be split into teams and given a problem statement. They will spend time brainstorming in response to the problem statement before discussing the ideas and reactions that they had. From here, teams will further brainstorm before coming up with a possible design-oriented solution, which they will then present to all attendees.

Beyond simply introducing design to the Yale community, DFA Yale also hopes apply for the CEID Summer Fellowships in order to further foster design. Project teams will apply for this summer fellowship, and the winning team will stay on campus and be provided with a small stipend in order to continue with its work. This allows for the continuation of the design process beyond the academic year, which will emphasize how design can be incorporated into everyday life, and encourages more innovation and friendly competition.

BUDGET



TOTAL BUDGET: $[redacted]

BUDGET BREAKDOWN

Workshops- [redacted] per workshop x 3 workshops [redacted]

We plan on leading 2-3 workshops a year for our members to share research, brainstorm solutions, and receive feedback from their work. Workshops serve as a great way to recruit members and serve as an introduction to design. The events also help spark new ideas- many of our current projects have come out of previous workshops.

Website Support [redacted]

Maintaining a good website is an integral part of attracting sponsor and community partners. We currently own dfayale.com and would like to purchase a premium Wordpress account, to allow for more flexibility in designing our website.

Team Support- [redacted] per team x 6 teams

There are currently 6 teams in DFA Yale with needs as diverse at their topics. However, many of our teams are pursuing technical solutions to their problems, and are planning on using some of the same equipment. For those teams that are developing non-technical solutions, either educational or community based, they will need materials and supplies for implementing their ideas.

BUDGET

Implementing projects on a larger scale will require more resources and support than our budget allows for, so each team will be responsible for finding grants and community sponsors. We aim to supply each team with the supplies needed to do research, prototype their ideas, and test out their solutions for feedback.

Books/Educational Materials [redacted]

We plan to purchase a books that teach practical skills needed by our teams. We would like to build up the skill base of our members in areas not covered by their classes. Our more experienced members will help teach mini-classes that will be reinforced with our library. These books will be housed in the CEID so that they are available to the general Yale population as well as DFA Yale members.

Travel- [redacted]

We are required to pay for the travel expenses of DFA mentors who come from the national organization to help our studio. During the summer, the national organization of Design for America will also hold a leadership studio at Northwestern. It serves as a way to learn about DFA as an organization, meet other studios, gain insight into leading a studio, and shape the direction of DFA Yale when our new leaders return to campus.

Discretionary funding - [redacted]

Since DFA at Yale is a new organization, there will likely be unforeseen events and purchases throughout the semester.

Yale School of Engineering

Drop Team Project Grant Proposal

Yale Drop Team

Curvature Effects of Spacecraft Propellant Management Screens
March 2013

[redacted]

SPACEX
Space Exploration Technologies

NASA

LOCKHEED MARTIN

Abstract:

For the past two years, members of the Yale Drop Team have been working closely with Lockheed Martin engineer, Christine Edwards, to design and build an experiment to test the bubble point of different curvatures of propellant management screens. The advancement of propellant management technology would allow for reduction of propellant slosh and better gas-free propellant delivery to rocket engines. This fall we were accepted by NASA into the Systems Engineering Educational Discovery (SEED), a part of the Reduced Gravity Education Flight Opportunities Program, to test our apparatus on a zero gravity parabolic flight aircraft next July. Christine Edwards and the Yale students are organizing for our team to attend two or three conferences in the fall of 2013 in order to present and publish our findings.

All spacecraft, whether they are in orbit around Earth or visiting distant locations, have the requirement to understand and mitigate propellant slosh as well as deliver gas free propellant to the systems engines – the JUNO and Multi Purpose Crew Vehicle are no exception. The engineering solution to both of these problems is the application of a surface tension based propellant management device (PMD). Propellant management devices range in complexity and are unique to every propulsion system. However, a large subset of PMDs use surface tension screens to directly control the location of gas and indirectly control the location of the liquid. An example PMD is shown in Figure 1:

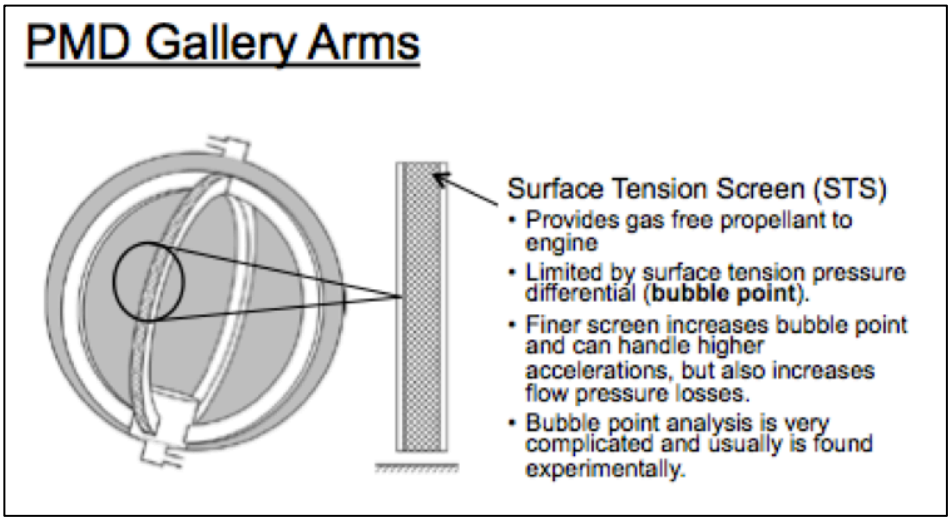


Figure 1: Propellant Management Device design. The spherical chamber holds the propellant for spacecraft and the gallery arms extract the propellant – that sticks to the walls naturally – for pumping into the engine. The surface tension screens along the gallery arms help prevent gas from entering the engine and help reduce propellant slosh.

The limiting capability of any surface tension screen is defined by its “bubble point.” Inside Propellant Management Devices, wet surface tension screens allow liquid to pass through but stop gas from passing through. The ‘Bubble Point’ is the pressure difference between the two sides of the wet screen that causes the gas pressure to be high enough to break the surface tension and bubble through. It is known by the propellant management community that curving a surface tension screen alters its bubble point in the direction of degradation for a concave screen and goodness for a convex screen. However, the effect of curvature is not easily quantified and the problem is typically overcome by overdesigning the system to ensure its proper function. This overdesign can cost the system in terms of weight, money, and general uncertainty.

In this project we will attempt to quantify the effects of curvature on the bubble point of several typical types of surface tension screens. Since the surfaces will be curved, a zero gravity environment is required to ensure that the pressure across the screens is uniform. The presence of gravity makes it very challenging to get an accurate quantification of this small effect. We have designed test cells that are capable of testing various screen types for various radii of curvature in a zero gravity environment. Prototypes of these cells can be seen below in Figure 2.

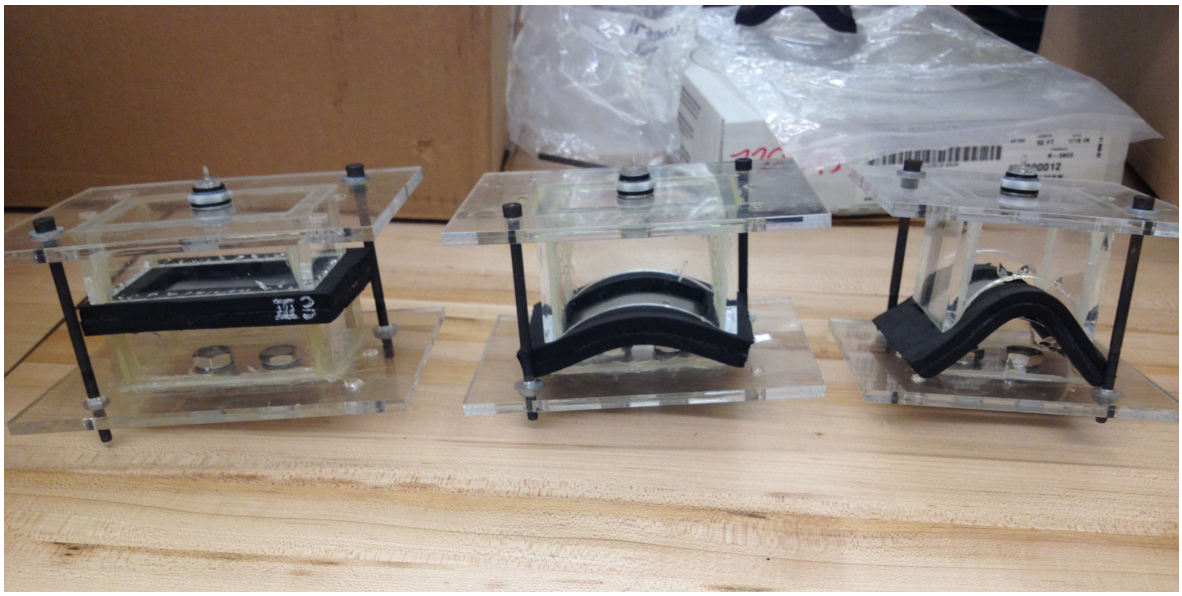


Figure 2: Prototype Cells. Surface tension screens in middle, from left to right: flat, two-inch radii, one-inch radii. The top chamber will be filled with isopropyl as propellant simulant and the bottom chamber will be pressurized with air to simulate pressurents used in PMDs.

The results will show how sensitive the bubble point is to screen curvature and if screen type also plays a role. The team will get to witness fluid behavior in zero gravity and will also be faced with unique challenges. Students will be working closely with the project principal investigator as well as industry experts from Lockheed Martin on the topic. Ultimately the results of this project will help to close the gap in understanding about this important on-orbit effect.

Last year, the Yale Drop Team group working on this project, led by recent alumnus, Joe O'Rourke, designed a fully functional prototype of the experiment but did not fly it. This year, we have the opportunity to dramatically improve the package and we are taking the approach of building a second version from the ground up to make the upgrades seamless. Our first significant improvement is to fully automate the experiment including the pumping system. Our second significant change is to redesign the testing chamber so that the radii of curvature of the screens can change in-flight as opposed to only between flights. This will allow for much more data than the prototype could have collected, giving weight to our findings.

The Team:

Yale Student Team

Our student team leader, Emma [redacted], is a senior double majoring in Physics and Computer Science. Other team member majors include: Mechanical Engineering, Electrical Engineering, Biomedical Engineering, Physics and Molecular Cellular and Developmental Biology. Allison [redacted], Emma [redacted], and Phillip [redacted] have flown on the NASA parabolic flights with the Drop Team in past years – shown below in figure 3 - and the other team members will be first-time flyers.

Student	Major	Position
Emma [redacted]	Computer Science & Physics	Flyer – Project Leader
Phillip [redacted]	Engineering Sciences: Mechanical & Physics	Flyer – Drop Team President
Nafeesa [redacted]	Biomedical Engineering	Flyer – Treasurer
Michael [redacted]	MCDB	Flyer – Safety Officer
Allison [redacted]	Mechanical Engineering	Ground Crew & Backup Flyer
Sarah [redacted]	Electrical Engineering	Ground Crew
Noah [redacted]	Evo Bio	Support
Brianna [redacted]	Biomedical Engineering	Support
Manjari [redacted]	Physics	Support

Figure 3: Drop Team members with Professor Irons before a parabolic flight. This was from a separate project last year unaffiliated with this year's project, but with some of the same Drop Team members and advisor.

Yale Advisors

The student team receives advice on an "as-needed" basis. Dr. Irons is our main faculty advisor and will travel with us to Houston in July. Last year we worked in Dr. Irons' lab space, and this year we are being additionally advised by Dr. Szymkowiak and are working in his lab space when not in the CEID. Dave Johnson, director of the chemistry department machine shop, provides crucial machining advising as well as materials expertise and design advise.

Faculty Member	**Position**
Dr. Stephen Irons	Flyer - Faculty Advisor
Dr. Andrew Szymkowiak	Faculty Advisor
Dave Johnson	Machinist Advisor

Lockheed Martin Advisors

The Lockheed Martin advisors came up with the goal of the experiment, leaving the design, analysis, testing and fabrication to the Yale student team. The Yale student team and Lockheed Martin advisors meet weekly for the students to update the Lockheed engineers on our progress and discuss any challenges or new ideas. Christine Edwards is the Principle Investigator. She is an Aerospace Systems Engineer who works primarily on the Mars Reconnaissance Orbiter. Jonathan Braun is our Subject Matter Expert. He is an aeronautical and astronautical engineer who works on propulsion systems analysis and design. Lockheed Martin provides certain materials for the experiment such as the surface tension screens, which they ship to the student team at Yale for assembly.

Lockheed Martin Engineer	**Position**
Christine Edwards	Flyer - Principle Investigator
Jonathan Braun	Subject Matter Expert

Itemized Budget:

We are requesting [redacted] from the Yale School of Engineering. Engineering funding would go both towards the experiment budget costs and travel costs.

Item	Cost ($)
Experimental Budget	
Isopropyl Alcohol - Rocket Propellant Simulant	[redacted]
Chemically Resistant Plexiglas	[redacted]
Polycarbonate Sheeting	[redacted]
Resistive Thermal Devices	[redacted]
Pressure Transducers	[redacted]
Peristaltic Pump	[redacted]
Medical tubing, connectors, and vessels	[redacted]
80/20 Modular Aluminum Extrusions	[redacted]
Epoxy, rubber cement, acrylic bonder	[redacted]
Power amplifiers, Arduino, circuit components	[redacted]
Zip ties and foam tubing	[redacted]
UPS Ground 2-way shipping	[redacted]
Subtotal	[redacted]
Flight Week Travel Costs	
Airline Tickets	[redacted]
Baggage Fees	[redacted]
Hotel	[redacted]
Car Rental	[redacted]
Gas for Rental Car	[redacted]
Meals and Misc.	[redacted]
Subtotal	[redacted]
Total	[redacted]

Received and Pending Funding Sources	Amount	Status
Yale Science & Engineering Association	[redacted]	Received
Yale Dean's Office	[redacted]	Received
Residential College Travel Grants	[redacted]	Received
CT Space Grant	[redacted]	Pending
Subtotal	[redacted]	
Yale Physics Department		Received
Yale School of Engineering		
Subtotal	[redacted]	
Total	[redacted]	