Make to Innovate - Project Executive Summary

HABET

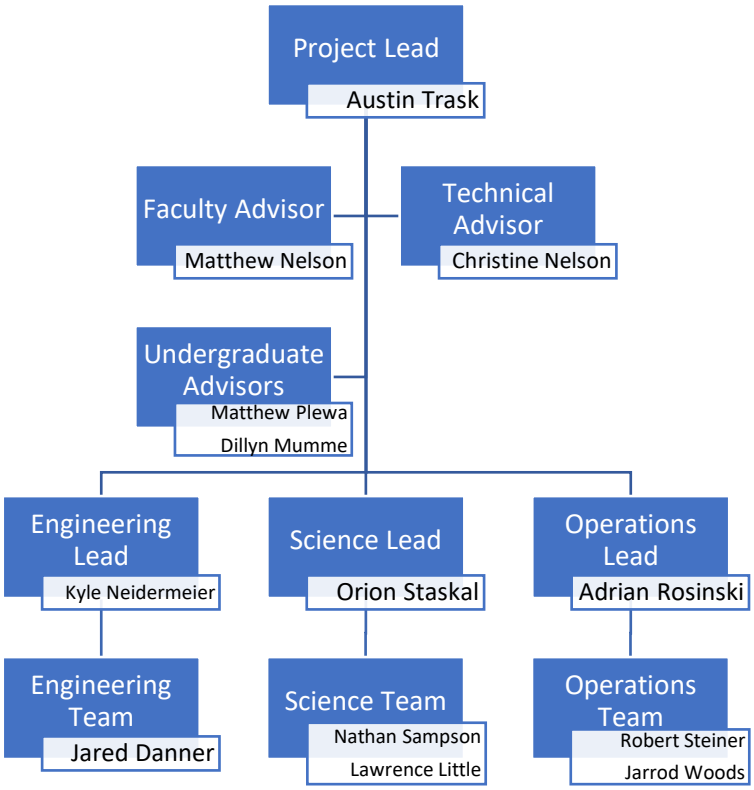
Project Lead- Austin Trask

Project Information

Project Name	HABET	**# semesters in service**	48
Project Classification	Service	**Budget Requested**	$7,860.00
Project Student Leader	Austin Trask	**Budget Approved**	$6,600.00
Project Member Size	9	**Budget Spent**	$1412.96

The project has 3 teams: Engineering, Science, and Operations. The team leads are: Kyle Neidermeier, Orion Staskal, and Adrian Rosinski, respectively. The stakeholders are: Make to Innovate, Iowa Space Grant Consortium, and the University of Iowa.

Organization Chart



Project Mission Statement

HABET's mission is to provide a platform for students, professors, and other interested third parties to perform experimentation and design work that would require a high-altitude balloon system.

Project Goals

HABET's overarching, major goal this semester is to return to full flight capabilities in order to operate by our mission statement. Specific goals are set for each team. Engineering team's goal is to fully test and implement the LoRa system for transmitting payload location data and implement our own tracking and prediction software. Science team's goal is to work alongside engineering team and learn about the hardware systems we use in order to begin work on a science mission by next semester. Operation team's goal is to update our documentation processes in order to support flight operations, as these are largely outdated, yet important to the longevity of HABET.

Project Deliverables

- Successful flight of a LoRa
- Implementation of prediction and tracking website
- New fill nozzle
- Proposal for a research mission
- Updated documentation
- Implementation of checklists into the website

What We Delivered

HABET has had a very successful semester compared to recent years. As of our most recent flight, LX-150-C, the LoRa system has been proven to work! We maintained tracking via the LoRa until balloon burst, when it dislodged from the PCB it was mounted in. A small improvement will give us tracking all the way to the ground.

In the final two of our three free flights, as well as in two tethered flights, we successfully flew a new fill nozzle that remains attached to the balloon during flight and fills using a quick connect hose. We tested that the nozzle would not interfere with the deployment of the parachute, and our third free flight does indicate that. We are moving on with building backups to this fill nozzle, as well as nozzles to fit balloons with wider necks.

Science team has a working proposal for a science mission to fly next semester. The mission involves the use of a camera modified with a filter that records images or video during ascent in the near infrared spectrum to analyze crop health. Flying this mission early next semester would allow for testing of the hardware being developed this summer by Matthew Plewa to support research missions.

Our documentation has seen significant upgrades throughout the course of this semester, and it will continue to be upgraded. As it stands, our documentation works well for basic flights in the style of the flights we performed this semester. With this foundation, we can build HABET's abilities to provide launch services for customers with specific mission parameters with documentation standards that allow for flexibility without sacrificing the benefits of structure.

Our engineering team has begun work on a system that allows for balloons to be released remotely by mission control with the push of a button once the system has been armed by both launch and recovery teams toggling an arming switch. These devices will use the LoRa system for wireless control, and the launch being triggered by mission control aligns with our structure of command on launch day.

Obstacles Encountered

HABET did experience several setbacks, as is to be expected for a Make to Innovate project with many objectives. The primary issue that plagued HABET this semester was the LoRa system. Our first flight, LX-150-A, intended to test the range of the LoRa board we were flying for the first time. We lost communication with the LoRa very shortly after liftoff. With the belief that a thermal failure was at play, LX-150-B was flown with the largest change to the system being a better insulated payload box. This suffered a similar failure. It took replacement of all the coaxial cables between the penthouse and the roof, as well as equipping a new directional antenna to the dish pointer, to secure a solid connection to the payload throughout the flight. This issue, and the time spent on it by Matthew Plewa and Jared Danner, is responsible for the website and automatic launch system being incomplete.

The only other significant obstacle would be the weather we experienced. Several launch windows had to be scrubbed due to weather, and delayed launches delay our ability to find and fix issues. Limits in launch windows limit opportunities to learn and troubleshoot.

Presentation Summary

The objective of HABET is to provide effective and reliable launch services to those who wish to perform experiments, tests, or research and extremely high altitudes. Having previously lost flight capabilities, this semester has been focused heavily on restoring those capabilities for long-term success. It is safe to say that the progress made this semester has been vital in restoring HABET to full flight operations. Three flights were conducted with complete success in locating and recovering payloads.

HABET achieved a great deal of success related to our primary goal of this semester. Our members now have three successful flights of experience under their belts. The LoRa was proven

to work as intended on flight LX-150-C, despite the setbacks experienced during the first two launches of the semester. Engineering and science teams have built, tested, and proven the ability of our new nozzle design to fly successfully on a mission as well as provide extra convenience to the launch team in filling balloons for liftoff. Engineering team has also begun work on the hardware that will support remote launching of balloons. Science team has written a proposal for a mission to fly next semester that will test the abilities of HABET's science mission hardware that is to be developed this summer. Operations team has worked to update documentation as we gain the experience of more flights. They have also worked with Dillyn Mumme to update existing trainings and run simulations that will help train incoming members as well as keep our skills sharp.

HABET members' tasks have been focused on the goals at hand in order to restore HABET to operational status.

The final design of the HABET payload this semester includes two radios that broadcast GPS data in the form of APRS packets that we can track using online resources. It also includes the LoRa radio, which communicates directly with Howe Hall and our recovery vehicle. As we learned shortly before LX-150-C, one of the radios interferes with the LoRa, and only one of those should be used at a time. We will explore how changing our radio setup affects possible mission profiles.

We may experience design risks in the future beyond those that we did run into this semester. The CyStack system will need to be tested early next semester before we can begin flights with the University of Iowa later in the fall.

		Total Project Budget		**$7,860.00**	**$6,600.00**	**$0.00**	**$6,600.00**
☐		**Equipment**		**$5,050.00**	**$5,050.00**	**$0.00**	**$5,050.00**
☑		Thunderstorm Payload Electronics	modules required for the thunderstorm payload single and two node configurations	$250.00	$250.00		$250.00
☑		Trak Stak Components	any additional components needed for trak stak upgrades	$400.00	$400.00		$400.00
☑		Tower		$800.00	$800.00		$800.00
☑		HABET Electrical System V3	New PCBs and compatability with Cubesat	$2,500.00	$2,500.00		$2,500.00
☑		Ground Station Upgrades	New wiring and power supplies	$300.00	$300.00		$300.00
☑		Garmin VIRB Camera	New camera for videos	$800.00	$800.00		$800.00
☐					$0.00		$0.00
☐					$0.00		$0.00
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☐					$0.00		$0.00
☐					$0.00		$0.00
☐					$0.00		$0.00
☐					$0.00		$0.00
☐					$0.00		$0.00
☐		**Travel**		**$750**	**$750**	**$0.00**	**$750.00**
☑		Chase Vehicle Rental	5 flights	$750	$750.00		$750.00
☐					$0.00		$0.00
☐					$0.00		$0.00
☐							$0.00
☐		**Raw Supplies**		**$2,060.00**	**$800**	**$0.00**	**$800.00**
☑		Helium	8 canisters @ $100 each	$800	$800.00		$800.00
☑		3000 g balloon	2 @ $350	$700			
☑		1500 g balloon	1	$200			
☑		600 g balloon	6	$360			

This is the budget sheet. Of $7,860.00 requested in the fall, we were approved for $6,600. We have spent $3970.15 this semester.

The progress HABET has made this semester will carry on into the fall as we prepare to fly real missions for outside customers.