

# Sponsorship Information

2021-2022





## Pushing the bounds of collegiate rocketry.

PSP Liquids is Purdue's liquid bi-propellant rocket team participating in the FAR-MARS competition, challenging collegiate teams to reach 30,000 feet with a LOX/Methane rocket. With members from around the world, PSP-L is a multidisciplinary team of undergraduate and graduate students from 12 separate majors involved in nine different subteams.

PSP-L has manufactured and tested its first rocket, Boomie Zoomie (BZ), and is currently designing its second iteration, Boomie Zoomie B (BZB), in hopes to win the FAR-MARS competition in the near future.

PSP-L aims to give its members invaluable experience through practical work in the analysis, design, manufacturing, and testing of liquid rockets, something that only a few university teams are capable of. The team hopes to foster and provide its members with industry-relevant skills, encourage professional growth, and prepare students for the next giant leap in their career.

PSP-L members during hotfire operations in December 2021.



STARTED IN

# 2017

# 150

CURRENT MEMBERS

# ONLY

STUDENT-DESIGNED  
LIQUID ROCKET  
AT PURDUE

# 12

MAJORS REPRESENTED





## PAST PROJECT

# Boomie Zoomie

2017-2020

Boomie Zoomie (BZ) is PSP-L's first liquid methane and liquid oxygen rocket, with development beginning with the team's inception in 2017 and ending in late 2018. BZ has demonstrated high performance from multiple hotfire tests and provides a foundational design heritage to the team that excels in its lightweight airframe and high-efficiency engine.

Key design features of BZ include:

- An aluminum monocoque airframe and tanks result in a low inert mass.
- A lightweight silica phenolic ablative nozzle with a carbon fiber overwrap resulting in a total engine weight of 5 lbs.
- A high-efficiency, weight-optimized pintle injector that attains a c-star of 0.86.
- Externally-actuated propellant run valves that significantly reduce airframe weight and internal complexity of the vehicle.

**800lbf**

Nominal Thrust

**98lb**

Dry Mass

**800psi**

Tank Pressure

**13,000ft**

Pred. Altitude





## CURRENT PROJECT

# Boomie Zoomie B

Boomie Zoomie B (BZB) is PSP Liquid's second vehicle iteration, intended to improve on BZ and win the FAR-MARS Launch Contest. Using a simulation-driven, optimized design, BZB features significant performance increases on top of the strong vehicle architecture provided by BZ. Featuring a lightweight common bulkhead tank assembly, robust and redundant avionics design, and improved engine performance and cooling. Boomie Zoomie B is currently beginning its manufacturing and testing phase as system design is being finalized.

Key design improvements of BZB include:

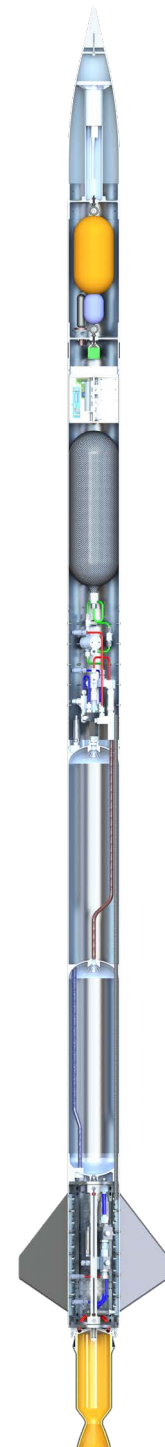
- 10% improved inert mass fraction compared to Boomie Zoomie, and half the dry mass of other collegiate liquid rockets in the same impulse class.
- Custom manifolding that allows compact fluid system packaging while reducing pressure drop.
- Improved pressurant modeling, ensuring constant tank pressures and propellant feed through flight.

**900lbf**  
Nominal Thrust

**92lb**  
Dry Mass

**500psi**  
Tank Pressure

**40,000ft**  
Pred. Altitude



## CURRENT PROJECT

# BLACK CAT LAUNCH SYSTEM

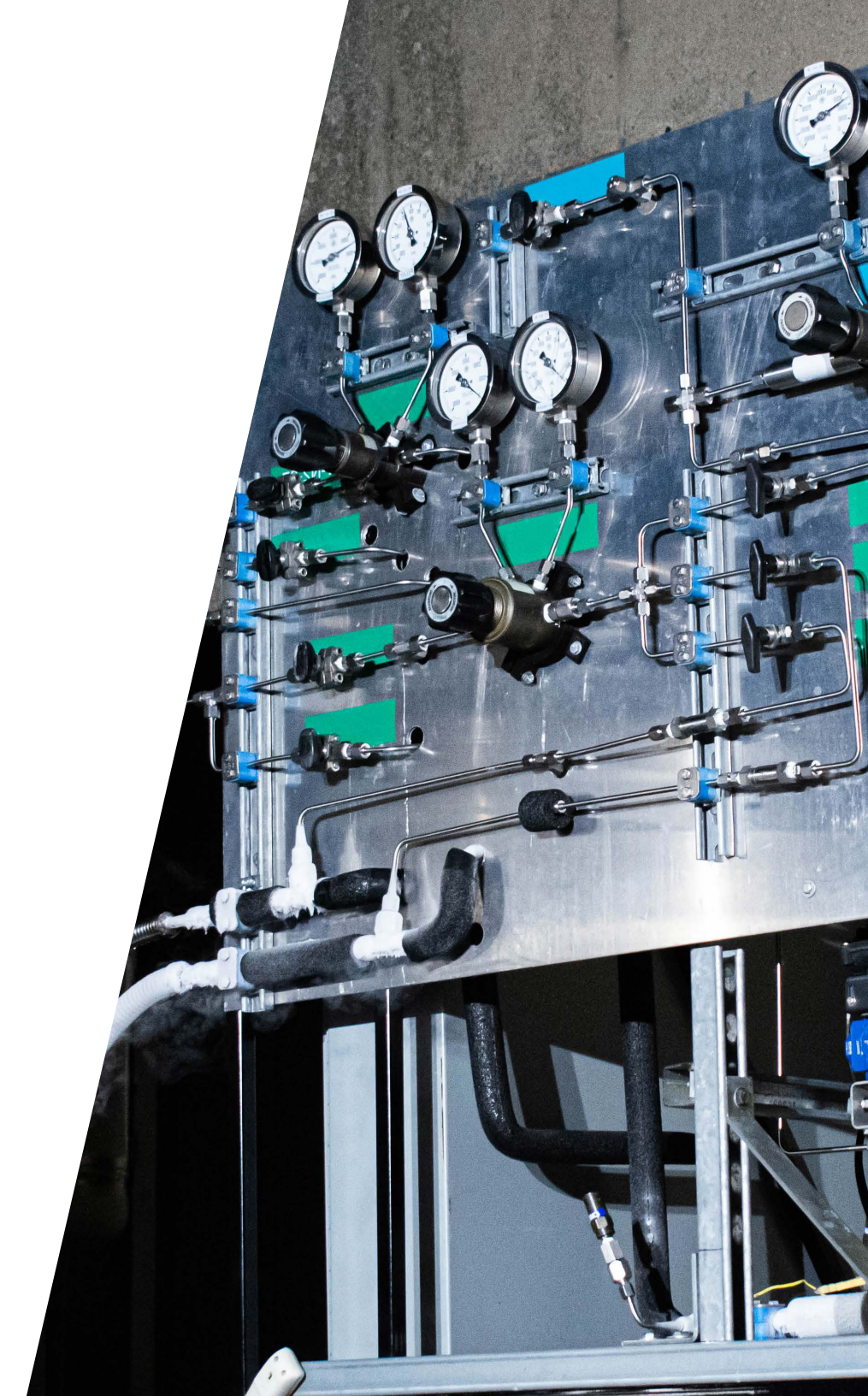
Black Cat Launch System (BCLS) is the launch operations system designed for rockets built by PSP-L. With a more compact design compared to the original launch trailer, BCLS can be easily transported to long-distance locations with lower risk of damaging fragile components. BCLS currently supports BZB in testing and launch operations.

Key design features of BCLS include:

- Pneumatic valves and self-separating quick disconnects that enable remote propellant loading to prioritize team and vehicle safety.
- A modular data acquisition system that provides a 1 kHz sampling rate, auto-sequencing, and complete power control of onboard systems.
- Compatibility with various liquid propellants and testing operations.
- Fully integrated nitrogen leak-checking system for rapid testing.

**4ft x 4ft**  
Footprint

**50+**  
Valves & Sensors







# Team Culture

## Growth and Development

### Training and Mentorship

PSP-L prioritizes training, teaching, and mentoring members. We have technical mentor roles filled by senior members who dedicate time to answering technical and professional questions. Specific workshops and software training sessions are in place during onboarding of new team members.

### Team Professionalism

The team partakes in industry practices such as:

- Implementing a standardized part naming convention and labeling manufactured parts.
- Following an outlined branding guideline for a consistent team identity.
- Holding frequent design reviews to obtain feedback and improve upon designs and processes.

### SEDS Affiliation

As part of the largest SEDS chapter in the world, students are provided with access to networking opportunities, guest speakers, and a large community of space enthusiasts that extends beyond the team itself.

## Inclusion and Well-Being

### Open Recruitment

PSP-L remains open to everyone. There is no application process and no prerequisites or criteria to join the team. This policy is rooted in PSP's core values—anyone should be able to join this team and develop fundamental skills to prepare them for the aerospace industry.

### Diversity, Equity, and Inclusion Town Halls

PSP-L hosted a chapter wide DE&I town hall where the four PSP rocket teams evaluated team practices and inclusivity. These town halls will continue to occur every semester to ensure we are continuously improving and holding teams accountable.

### Prioritizing Well-Being

With the difficulties and challenges team members face academically and in navigating the COVID-19 environment, PSP-L has prioritized the well-being of its members. The team has invited and held workshops with Purdue's Counseling and Psychological Services (CAPS) to emphasize what resources are available for students.

“I believe the core mission of the Liquids team is to be a place where anyone can join, feel welcome and excited, cultivate their engineering skills, and meaningfully contribute to a rocket project. This team has provided myself and so many others invaluable technical experience and I am so proud to be a part of it.”



**Brynne Hunt**  
Project Manager





## Research and Development

For the 2021-2022 academic year, PSP-L began several research and development projects to prepare for next generation members. These R&D projects meaningfully benefit the team while develop critical technical and team skills that will help newer members grow to become strong leaders in the future.

New members are at the forefront of development while second-year members lead these projects, and veteran members take advisory roles to ensure that newer members have the best support possible.

### Current R&D Projects

#### **Bang-Bang Regulator Test Stand**

Aiming to develop controlled pressure regulation using a bang-bang solenoid valve for implementation on future vehicles.

#### **Test Campaign Ground Support Upgrade**

Focusing on designing necessary upgrades to existing ground support infrastructure for a functional engine test stand, enabling the team to hotfire without reliance on a manufactured vehicle.

#### **Engine Design**

Intending to develop emerging propulsion engineers and get a head start with designing the propulsion system for next-generation PSP-L vehicles.

#### **Composite Airframe**

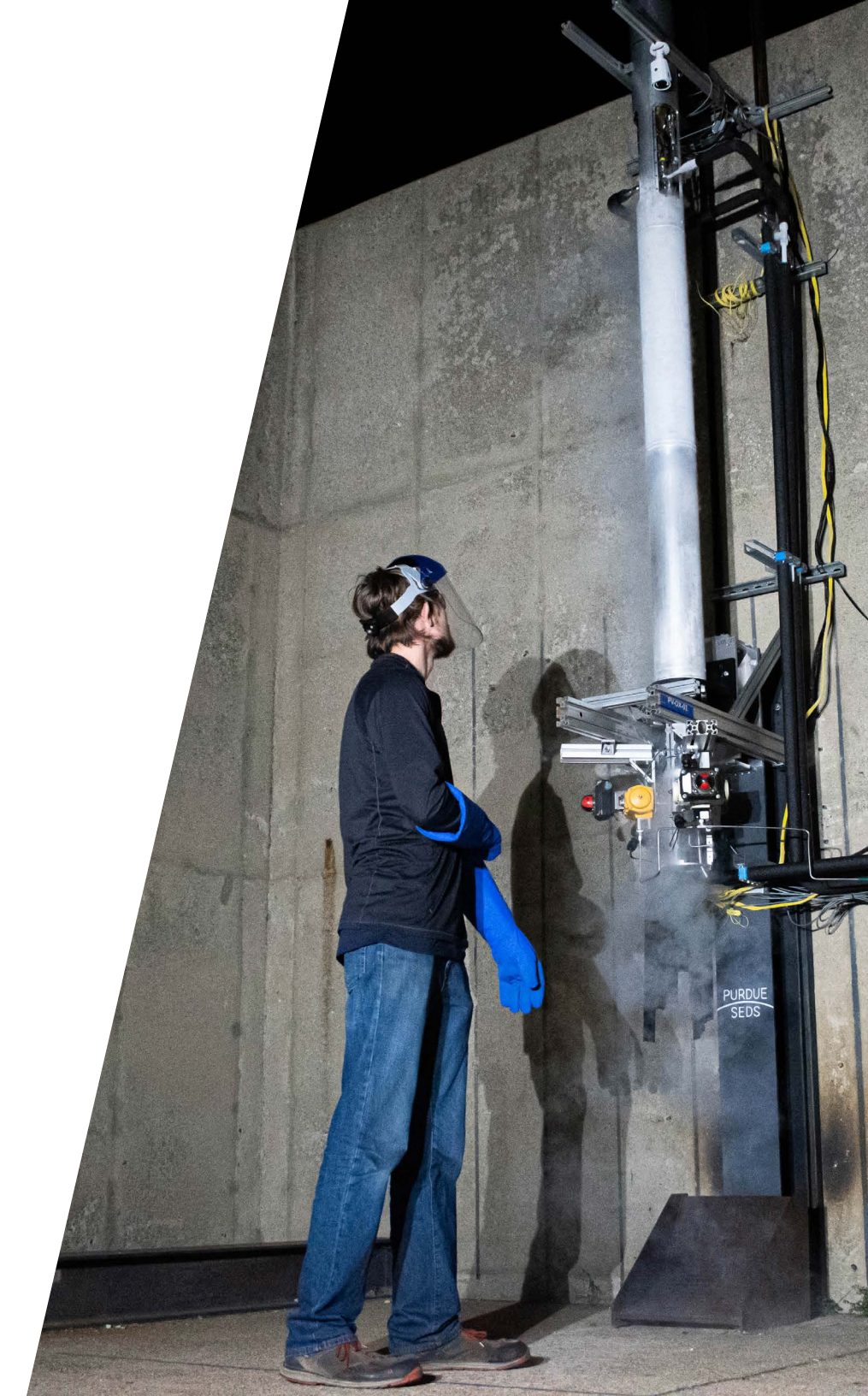
Focusing on experimenting with composite airframes for future rocket projects, allowing for more advanced and lightweight future vehicles.

#### **Filament Winder Design**

Designing and building a filament winder to increase manufacturing capabilities with composites.

#### **Live Telemetry Downlink**

Advancing vehicle data collection through live data downlink and live footage capabilities during flight.







# How You Can Help

There are several ways through which you can help PSP Liquids achieve its mission:

- **Monetary donations** are incredibly important to the team’s success. They will be used to purchase materials, tooling, and components for the manufacturing, assembly, and testing of our projects.
- **Material donations** advance the team’s progress and alleviate significant costs in the team’s budget. Materials include but are not limited to stock materials, valves, fittings, tooling, and machining services.
- **Mentorship and guidance** are highly valued by the team as a way to provide critical design or operational feedback and create meaningful connections between team members and industry professionals.

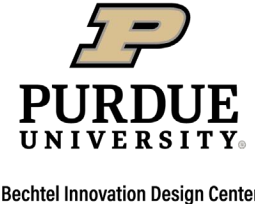
Whatever way you choose to give to PSP-L, you gain benefits such as promotion, recognition, and exclusive opportunities with the team.

	T MINUS 10 Less than \$1,000	IGNITION \$1,000 and up	LIFTOFF \$5,000 and up	MAX Q \$10,000 and up
Name on PSP website	•	•	•	•
Exposure on social media	•	•	•	•
Access to résumé book		•	•	•
Logo on ground support		•	•	•
Logo on launch day shirts		•	•	•
Logo in workspace			•	•
PSP merchandise			•	•
Exclusive networking event with team			•	•
Logo displayed on rocket				•
Personal design presentation				•
Machined rocket model				•

Any material or service donation will be considered equal to its monetary value.  
Any sponsorship involving a software license for the team’s use is considered an Ignition tier donation.



# Current Supporters





## PURDUE SPACE PROGRAM

A SEDS Chapter

[purdueseds.space/liquids](http://purdueseds.space/liquids)

[puseds@purdue.edu](mailto:puseds@purdue.edu)

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