

Sponsorship Information

2021-2022



Pushing the bounds of collegiate rocketry.

PSP Liquids is Purdue's liquid bi-propellant rocket team participating in the FAR-DPF competition, awarding collegiate teams with a dollar for every foot traveled by their 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 two rockets, Boomie Zoomie (BZ) and Boomie Zoomie B (BZB). BZB launched twice in March 2022 in the FAR-MARS launch competition, reaching 10,000 and 6,600 feet in altitude. With the end of the BZB mission comes a new rocket project: CraterMaker Special (CMS). CMS will compete in the FAR DPF competition, and propel PSP-L to greater heights.

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 careers.

PSP-L members during launch in March 2022



STARTED IN

2017

200

CURRENT MEMBERS

1st & ONLY

COLLEGIATE TEAM TO
REFLY A LIQUID ROCKET
WITHIN TWO DAYS

12

MAJORS REPRESENTED

LAUNCH

BZB Mission Conclusion

In March 2022, the team made PSP-L history by launching for the first time ever. After traveling from Purdue to the FAR launch site in California, the team launched BZB twice. Crews worked around the clock to prepare the vehicle for this pivotal moment in PSP history.

Following launch, BZB flew to an apogee of 10,000 feet, where it deployed its main and drogue parachutes. BZB slowly coasted down, landing two miles away from the launch site. After recovery, the team analyzed BZB's components and systems and, after careful deliberation, decided that BZB could launch again.

The crew worked throughout the night and into the next morning to launch BZB again. On its second launch, BZB reached an apogee of 6,600 feet. The main and drogue chutes deployed at their expected altitudes, and BZB came back down with some damage to the mid-airframe.

Although BZB didn't reach its altitude goals, the mission was still a success. The data collected from launch will provide valuable information, enabling the next giant leap for the team. PSP-L will be back, to soar higher than ever before.





PAST 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 has already been launched and retired as members prepare for the next steps.

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.

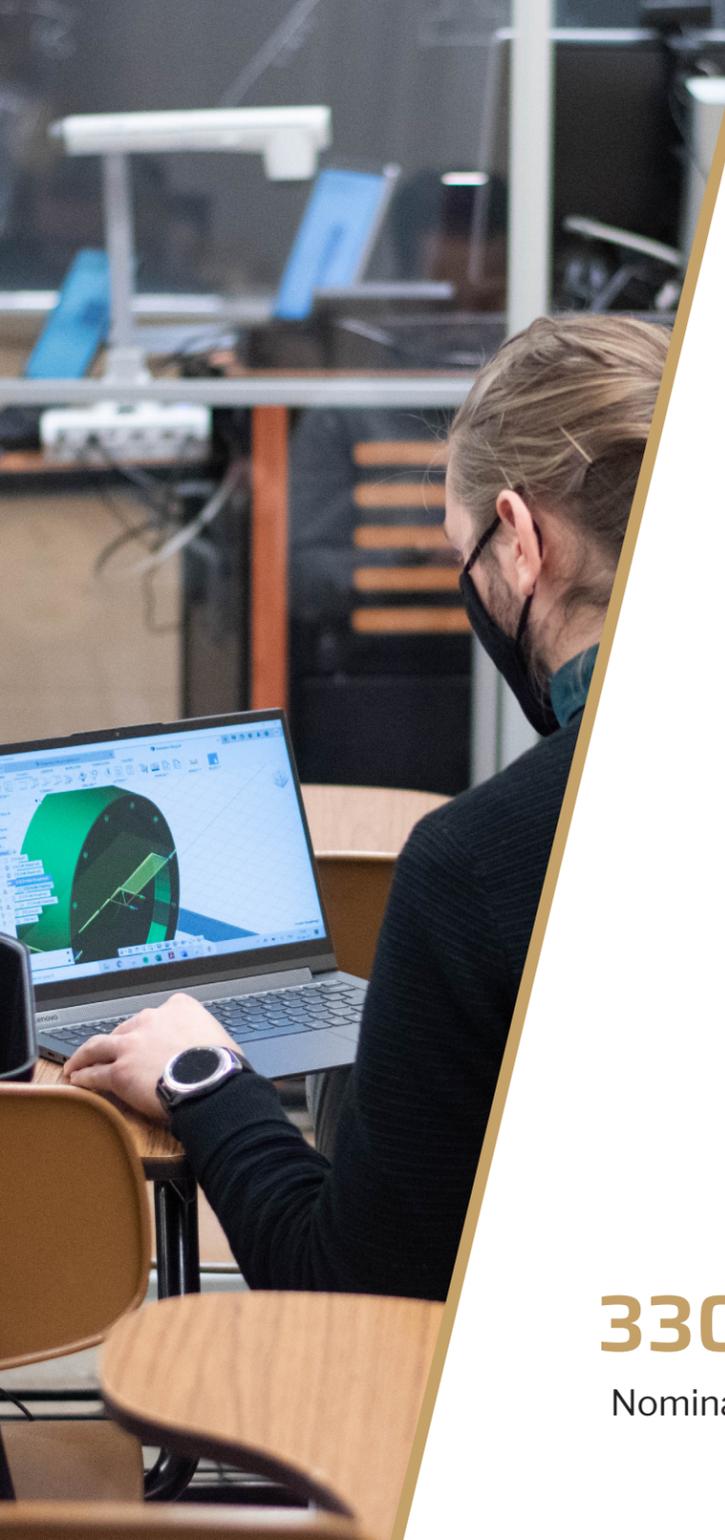
4ft x 4ft

Footprint

50+

Valves & Sensors





CURRENT PROJECT

CraterMaker **Special**

CraterMaker Special (CMS) is a third generation launch vehicle designed to compete in the FAR Dollar Per Foot challenge. Building on four years of experience, CMS is PSP-L's most ambitious rocket yet, reaching heights never achieved by student liquid rocketry teams. CMS employs a comprehensive avionics system, a composite airframe structure, and a crater-making engine. Sizing for CMS is driven by a complex, extensive simulation developed to maximize altitude. CMS has just begun its design phase with a preliminary design review in the coming weeks.

Key features on CMS include:

- 32 sensors for avionics, increased from three, to record a more comprehensive profile of flight data.
- Bang-bang fluid regulator technology to maintain constant tank pressure to ensure constant mass flow.
- A custom, overwrapped, carbon fiber airframe to decrease overall vehicle mass.

3300lbf

Nominal Thrust

300lb

Dry Mass

385psi

Tank Pressure

65,000ft

Pred. Altitude

CURRENT PROJECT

Engine Test Stand

The engine test stand is an R&D project started to provide new team members with essential fluids systems experience they will need to elevate their design skills. Once completed, the test stand will allow PSP-L to conduct rapid testing on engines to innovate on chamber geometry, propellant injectors, and cooling solutions. The test stand is currently in its preliminary design phase.

Key design features of the test stand include:

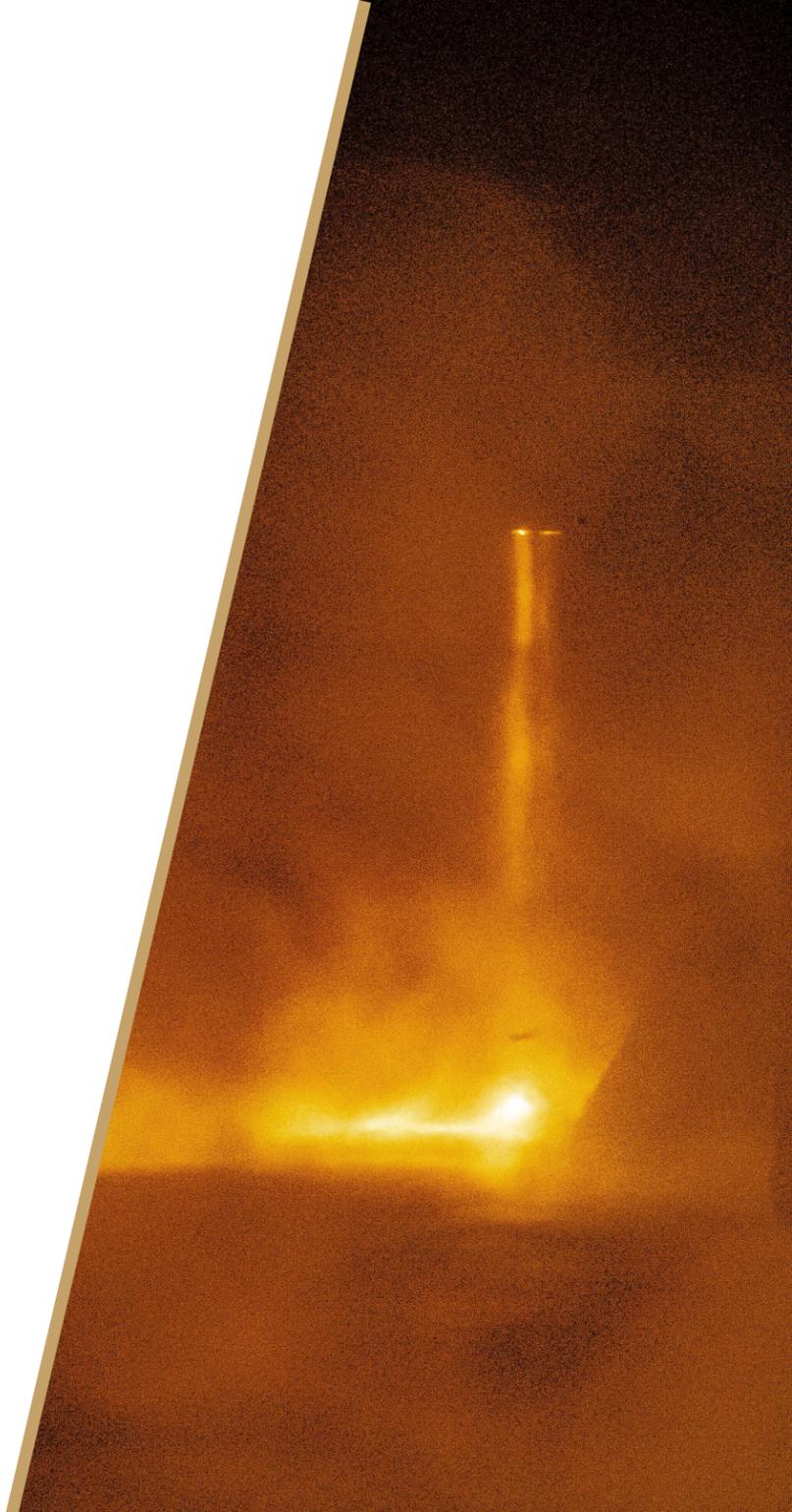
- Designed to interface with BCLS to ensure compatibility with flight hardware.
- Capable of supporting regeneratively cooled rocket engines with a maximum propellant mass flow rate of 15.8 lbf/s for 30 second burns.
- Custom, in-house designed and manufactured venturi valves to allow for measurement of fluid mass flow.

5000lbf

Thrust Stand Capacity

1375psi

Maximum Expected Operating Pressure





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.

“As the Liquids team, we strive to create an exciting and welcoming environment for all students to cultivate their engineering skills outside of the classroom. I am very proud to be a part of a team that provides invaluable technical experience to all of its passionate members.”



Jonah Fouts
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.

Regeneratively Cooled Engine Design

Cultivating emerging propulsion engineers specialized in industry standard cooling solutions for next-generation PSP-L vehicles.

Coaxial Swirl Propellant Injector

Exploring the cutting-edge of injector technology to maximize propellant atomization for higher efficiency combustion.

Composite Airframe

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

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	APOGEE \$10,000 and up
Name on PSP website	•	•	•	•
Exposure on social media	•	•	•	•
Logo in workspace	•	•	•	•
Access to résumé book		•	•	•
Logo on launch day shirts & ground support		•	•	•
PSP merchandise			•	•
Logo displayed on rocket			•	•
Exclusive networking event with team			•	•
Preferred logo placement				•
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



School of Aeronautics and Astronautics



Bechtel Innovation Design Center





PURDUE SPACE PROGRAM

A SEDS Chapter

purdueseds.space/liquids

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