

Boiler Bus Executive Summary

Problem Statement:

The space industry is currently experiencing unprecedented growth, with Morgan Stanley estimating that the global space industry could generate revenue of more than \$1 trillion in 2040, up from the current \$350 billion. This surge in the industry necessitates a continuous stream of passionate, experienced, and innovative workers. Also, to sustain this growth rate it is necessary to minimize costs and risks of space missions. This would allow the industry to seize market opportunities faster, enhance their competitiveness, and contribute significantly to the flourishing space industry. To address both these needs, the industry needs a low-cost and reliable satellite bus and ground support system capable of supporting payloads for various purposes.

Our Solution:

Boiler Bus, a series of student-friendly, low-cost, and reliable universal satellite buses, with ground services, capable of supporting generic payloads for commercial, academic and government partners. To begin, a Boiler Bus system will have a lower development speed and reliability; however, both speed and reliability will improve over time as a result of the repeated mission success of the satellite bus and associated development experience. Additionally, these initial disadvantages can be remedied more rapidly as a result of active participation from the space community, such as subject matter expert involvement in the design process. Furthermore, collegiate teams are fundamentally capable of achieving a lower satellite bus cost due to the lack of both profit motive and standard expenses that industry alternatives experience. Purdue Space Program's 3U Boiler Bus Platform is projected to cost <30% of alternative commercial solutions.

Competition:

1. Commercial Satellite Bus Manufacturers: What gives Boiler Bus a competitive edge is that a non-profit organization and a volunteer workforce should allow us to price Boiler Bus Platforms at near raw material cost.
2. University Satellite Developers: Boiler Bus standardizations should make our turnaround faster and more reliable than other university solutions.

Program Scalability & Sustainability:

Purdue Space Program is starting development with a 3U satellite bus platform. After the initial launch to test this 3U Boiler Bus Platform, the team will start working with partners to create missions. This will allow the satellite development subteam to iterate on the design to lower cost, raise reliability, and expand relations. Additionally, the team will work to replace as many COTS components as possible with in-house designed components. Once the 3U Platform has significantly reduced its cost and raised its reliability as well as confirmed the viability of the strategy, the team will be able to begin developing a new Boiler Bus Platform to align with a different market share than the previous platform(s).

Major Project Milestones/Program Timeline:

Mission Concept Review: April 2023

System Requirement Review: February 2024

System Design Review: Spring 2025

Preliminary Design Review: Spring 2026

Critical Design Review: Fall 2026

Manufacture Flight Unit: Fall 2026, Spring 2027

Handoff Flight Unit: Spring 2027

Team Demographics:

Purdue Space Program (PSP): Satellites is made up of 50+ passionate and innovative students, working in affiliation with Dr. Anthony Cofer of the Space Flight Projects Laboratory in the Aeronautical and Astronautical Engineering department and David Beering, Principal and Owner of Intelligent Designs LLC. Our team has over 10 majors represented and over 80% obtained internship and research experiences in the summer of 2024. We are a technical team inside of PSP, a 501(c)(3) non-profit through Purdue, which is a chapter of Students for Exploration and Development of Space (SEDS-USA).

At PSP Sats, our mission is to educate students by designing, manufacturing and launching satellites alongside commercial, academic and government partners. Members learn and use industry tools, hardware, and software like AGI STK, NASA F Prime Framework, Autodesk CAD, EAGLE PCB, Python, MATLAB, 3D printers, Slack, etc. Members also gain professional development by working in a highly collaborative environment and developing their network through cross-functional teamwork, communicating with partners, contacting suppliers, attending conferences, resume workshops, career planning, etc.