Paper ID: 48446
oral
student

46th STUDENT CONFERENCE (E2)
Student Team Competition (3-GTS.4)

Author: Mr. Hunter Hall
NASA Jet Propulsion Laboratory, United States

Mr. Benjamin Donitz
University of Michigan, United States

PROJECT ZEPHYRUS: AN AUTONOMOUS AND ECONOMICAL HIGH ALTITUDE TESTING SYSTEM

Abstract

As evidenced by internal JPL interest, reusable, inexpensive, and rapid testing of payloads at near-space conditions is an unfilled niche that could speed development of flight-ready projects. High altitude ballooning (HAB) has become an increasingly accessible hobbyist activity in recent years, with availability of commercial off-the-shelf (COTS) hardware and open source software making HAB a viable option for rapid prototyping of instruments, experiments, and ideas in near-space conditions. A product of the collaborative Innovation to Flight (i2F) program, the Zephyrus system is a proposed HAB solution for JPL high-altitude testing and atmospheric observation, a cheaper and easy-to-use alternative to traditional HAB systems. Currently, no infrastructure is in place at JPL for small research teams and individuals to collect data from the upper atmosphere without prohibitive operational costs or developing an independent HAB system altogether. While many HAB systems already exist at JPL, most are for larger and more expensive missions that usually require months of preparation for flight readiness. The scope of these systems overshoots smaller research teams and individuals, who may be operating on thin budgets and perhaps with no prior HAB experience. The Zephyrus HAB system is unique in the fact that it is reusable, reliable, and incredibly economical, paving the way for researchers at JPL to test small- to mid-sized instruments (¡30,000 cm3 encapsulated volume, ¡5.44 kg) in the upper atmosphere (35,000 m maximum altitude) using a common architecture that may be reused for many testing goals. Over the summer of 2017, the i2F team demonstrated all of these key features of the Zephyrus platform via four test flights. From concept to first flight of Zephyrus I in just five weeks, followed by three-, two-, and one-week turnarounds for subsequent flights, the team demonstrated a new, rapid test-platform. This year, the i2F team is implementing an autonomous launching system that will be able to provide researchers the ability to launch and track their payloads remotely with a push of a button. The autolauncher is equipped with an advanced and custom sensor suite to ensure reliable and safe launching from balloon to balloon. The i2F team will be implementing the successes from the Zephyrus missions into the launcher as well as exploring new concepts such as autonomous return-to-home capabilities during the descent of the payload. The ultimate goal by August 2018 is the have an almost fully autonomous launch, flight, and recovery system for high altitude balloon research.