

2018 - 2019 SPACE PHYSICS SEMINAR SERIES

Dellingr: NASA Goddard Space Flight Center's first 6U CubeSat

Dellingr, NASA Goddard Space Flight Center's (GSFC) first 6U CubeSat, was deployed from the International Space Station (ISS) on November 20, 2017. The Dellingr team was intentionally given limited resources and a tight schedule to accomplish the mission. The goal was to "stress the system" and apply and appropriately tailor GSFC knowledge and capability to design and build a CubeSat that increases resiliency and capability, while keeping costs down. The Dellingr spacecraft is a mixture of COTS and in-house components, and includes two science instruments – an advanced gated time-of-flight ion-neutral mass spectrometer (INMS) and a boom mounted fluxgate. Dellingr also includes several technology demonstrations, including a new fine sun sensor, release mechanism, and a thermal louvre experiment. While a traditional GSFC spacecraft approach includes detailed analysis, design, testing, and extensive reviews, the Dellingr team adopted a "build, test, fix" approach to identify and correct potential mission ending issues. Yet, despite extensive testing, Dellingr immediately experienced unexpected major anomalies once on orbit. The first anomaly occurred when the boom and antenna deployed prematurely inside the NanoRacks deployer, likely while still inside the ISS. Anomalies continued to arise throughout the mission and increased in severity through early February, 2018, and included issues with the GPS, IMU, fine sun sensor, and errors on the I2C bus that threatened to cripple the mission. Just when we had thought the mission was over, we managed to initiate a backdoor reset of the system, recover the spacecraft, and turn on the INMS instrument. From the "learning from flying" perspective, Dellingr is a major success. The extensive set of lessons-learned is driving changes to our systems architecture, flight software, and testing approaches, and has provided valuable insight into what is required to produce a NASA SmallSat science mission with a moderate assurance of mission success, while containing resource requirements. It also provides valuable ground-truth for future Decadal Survey missions that may involve SmallSat architectures, especially the upcoming GDC mission.

**Thursday, October 4th**

4:00 - 5:00 p.m.

725 Commonwealth Avenue | Room 502

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