Abstract

NASA JSC EV2 Intern Spring 2016– Jennie Chung

Exploration Mission 2 (EM-2) is a mission to resume the manned exploration of the Solar System. This mission is the first crewed mission of NASA's Orion on the Space Launch System. The target for EM-2 is to perform a flyby of a captured asteroid in lunar orbit, which NASA plans to launch in 2023. As an intern working with EV-2 – Avionics Systems Division in Johnson Space Center, we are developing flight instrumentation systems for EM-2 (MISL & RFID). The Modular Integrated Stackable Layer (MISL) is a compact space-related computer system that is modular, scalable and reconfigurable. The RFID (radio frequency identification) sensors are used to take lower frequency (TC) type measurements and be able to stream data real-time to an RF (radio frequency) interrogator upon demand. Our job, in EV-2, is to certify, test, manufacture/assemble and deliver flight EM-2 DFI System (MISL & RFID). Our goal is to propose a development effort to design low-mass wire and wireless data acquisition and sensor solutions for EM-2 DFI (Development Flight Instrumentation). The team is tasked to provide the most effective use of 75 lbs. to acquire DFI data and to collect sensor data for 100-200 high priority DFI channels (mass driven).

EV is building and evaluating a new hybrid wired and wireless DFI system designed for the Orion EM-2 vehicle but based off of proven technology. The wired design concept constitutes small, lightweight, modular flex-boards that can easily support a variety of configurations and sensors. The wireless DFI, based on radio frequency identification (RFID) technology, will be capable of harvesting all the energy needed for communication, extending its battery life significantly. The designers are also exploring and extending this architecture by harvesting energy for data acquisition as well, which may allow for a purely passive operating

indefinitely on harvested power alone.

While supporting the Orion EM-2 DFI, I have been given the opportunity to work with a data acquisition unit called DTS Slice Micro, which is the world's smallest complete DAS solution. This data acquisition unit includes twice the memory, longer battery life, lower power, higher throughput and up to ten times faster sampling. I developed a schematic to connect the coaxial cables to a triaxial isotron accelerometer that will connect to the DTS Slice Micro. After creating the schematic, I worked closely with the lab technician to solder the wires together to connect the coaxial cables that will eventually be hooked up to the DTS Slice Micro.

Another project I worked on while working with EV2 is creating a project plan for vacuum testing on the MISL processor stack and RFID interrogators. I was tasked to develop a vacuum bell jar project plan for the MISL processor board stack and RFID interrogators that will be used on the Orion EM-2 DFI. The MISL and RFID will be running in a near vacuum environment at an ambient temperature at max capacity and the temperature will be monitored with 2 thermocouples attached to the chip while it is in near vacuum and characterize the temperature response until we reach steady state. We will reach steady state once we are at a tight band temperature range for 1 hour or more. A vacuum in the lab is created by sucking out the gasses/matter, but in space, the same vacuum is supposedly created and maintained by the paradoxical expansion of the universe. The principal environmental characteristic of outer space is the vacuum or nearly total absence of gas molecules.

Another opportunity I was given was to work closely with the BEAM (Bigelow Expandable Activity Module) Instrumentation Lead to support preparation of the BEAM operations and training. By doing this, I supported BEAM meetings as required, and training of the instrumentation systems for on-orbit operations. BEAM was launched on the Space X Falcon

9 with a Dragon cargo spacecraft on April 8, 2016. This mission included taking the BEAM to ISS (International Space Station). On April 10, 2016, ISS successfully grappled the Space X Dragon with the ISS SRMS (Shuttle Remote Manipulator System) and installed it onto Node 2 (Harmony module). The compressed BEAM module was removed out of the Dragon trunk using the SRMS where it will be installed onto Node 3 Aft. BEAM will eventually be deployed/expanded in late May/early June timeframe. Once BEAM is expanded, they are planning to keep in installed on ISS for a minimum of 2 years.

With the projects that I helped assist during my internship, there were several things I have learned and was challenged with. In the Marine Corps, I worked as a helicopter technician on Hueys and Cobras, where I followed a manual for the inspection of the flight control systems and inspect, test, maintained and repaired the aircraft components. The schematics were given to us and the manuals gave us step by step instructions for troubleshooting the components. As a NASA intern, I worked with EV2, where they were tasked to certify, test, manufacture/assemble and deliver flight to projects like EM-2 DFI. I developed a schematic on my own and got a better understanding of where the wires are connected and how the schematics work. I was given an opportunity to solder the wires together. In the Marine Corps, if a wire was broken or unusable, we would send the wires to another department and get it replaced. Here, I had the opportunity to work with a lab technician, where he introduced how to solder the wires together and read the schematic I developed.

Through this internship experience, I am able to grasp the concept of an electrical schematic and apply this for my future career goals. NASA has taught me the development phase of project plans that I have never seen. From developing the architecture of development flight instrumentation to reviewing project plans to roll out an experiment. I've enjoyed my time at

NASA JSC immensely. I think this is a wonderful program that has stretched my mind and introduced me to many like-minded, curious, driven individuals. This experience during these past sixteen weeks challenged me out of my comfort zone and gave me the opportunity to develop research and receive answers from knowledgeable individuals. This wonderful social and educational environment is beyond the regular classroom experience. Overall, my experience through this internship program with NASA JSC was unforgettable.