

HERMES: CACTUS-1 QUALITY ASSURANCE TESTING



From the Classroom to Orbit

3 YEARS AGO, THERE WAS NO THOUGHT CONCEIVED OF PROJECT HERMES. THE ASSEMBLED TEAM HAD NEVER COMMUNICATED WITH ONE ANOTHER EVER BEFORE.

PRESENTED AS A FINAL PROJECT FOR AN INTRODUCTION TO SPACE CLASS, THE OBJECTIVE HAD YET TO BE ACCOMPLISHED, LET ALONE EXECUTED. OF THE ORIGINAL CLASS, ONLY TWO STUDENTS DECIDED TO ADVANCE THE PROJECT INTO SPACEFLIGHT.

THE IDEA WAS TESTED SUCCESSFUL IN VARIOUS FORMS VIA HABS A SOUNDING ROCKET FLIGHT. PROJECT HERMES SUCCESSFULLY DEMONSTRATED THAT YOU CAN RECEIVE TELEMETRY DIRECTLY ON YOUR SMARTPHONES AND COMMAND USING THEM. WE FLEW ON A SOUNDING ROCKET OF WALLOPS ISLAND ON 12TH OF AUGUST 2015 AND ACHIEVED THE FOLLOWING:

- ESTABLISHED A WI-FI NETWORK IN SPACE FOR SYSTEM BUS USE
- PAIRED AN ANDROID SMARTPHONE IN SPACE TO AN IRIIDIUM-BASED WI-FI HOTSPOT DEVICE
- USED & PROGRAMMED APPLICATIONS (SUCH AS IRIIDIUM AND VARIOUS ANDROID AUTOMATION APPS) AVAILABLE IN THE GOOGLE PLAY STORE TO FUNCTION AS OUR FLIGHT SOFTWARE (FSW).
- USED TCP / IP DEVICES (SMARTPHONE & SMARTWATCH) ON THE GROUND AS OUR T&C SYSTEM
- *THE WORK WAS PRESENTED AT A CONFERENCE CALLED GSAW 2016

WITH PROVEN SUCCESS IN PREVIOUS MISSIONS, THE VETERAN TEAM IS NOW MENTORING A NEWLY ASSEMBLED TEAM TO TAKE THE PROJECT INTO ORBIT. THIS NEW TEAM WAS SOUGHT OUT FOR THEIR CHARACTERISTIC OF DEDICATION, ADVANCED SKILLS, AND PASSION FOR SPACE.

IDENTIFYING LIMITS, WEAKNESSES, AND POTENTIAL FAILURES IS ESSENTIAL TO A SUCCESSFUL MISSION FOR HERMES. ASSURING QUALITY IS A CRUCIAL PRACTICE FOR ANY MISSION THAT IS GOING TO ORBIT THE EARTH. TESTING IS PERFORMED AS IF THE SPACECRAFT IS GOING THROUGH A DAY-IN-THE-LIFE CYCLE, WHICH CAN CONFIDENTLY ASSURE THAT THE EXPERIMENT RUNS AS IT SHOULD.



PHOTO CREDIT TO UMD BALLOON PAYLOAD PROGRAM

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Testing Performed

THE PAYLOAD IS TO BE TESTED UNTIL ITS PERFORMANCE OVER A PERIOD OF TIME IS PREDICTABLE. SOFTWARE IS TESTED UNTIL THE CODE IS PROPERLY DEBUGGED AND FREE OF ERRORS. TO ENSURE QUALITY OF THE PRODUCT, THE PAYLOAD MUST RUN THROUGH A DAY-IN-ITS-LIFE CYCLE. ALL OF THE COMPONENTS TO THE SPACECRAFT WILL GO THROUGH SUCH TESTING TO VALIDATE THAT EACH SUBSYSTEM OPERATES AS SMOOTHLY AS POSSIBLE. RUNNING THIS PROCEDURE IDENTIFIES THE LIMITS OF THE PAYLOAD AND ALL OF ITS SUBSYSTEMS. **TEST, TEST ALL YOU CAN.** TESTING IS AN ESSENTIAL PART TO A SUCCESSFUL MISSION. IF THERE IS ANY PART OF THE SYSTEM THAT MAY FAIL, IT IS WORTH TESTING. BY TESTING THE LIMITS OF COMPONENTS, IT IS POSSIBLE TO ASSURE THE QUALITY OF THE COMPONENTS FOR THE MISSION. IN ORDER TO PROVIDE CONFIDENCE WITH THE DESIGN, RIGOROUS TESTING MUST BE APPLIED. ONCE THE LIMITS AND FAULTS OF THE SYSTEM ARE IDENTIFIED, A DESIGN CHANGE IS POSSIBLY NEEDED. THE BEST WAY TO AVOID LAST MINUTE CHANGES IS TO PREPARE FOR TESTING AS EARLY AS POSSIBLE.

Testing Results

AFTER TESTING EACH COMPONENT AND THOROUGHLY UNDERSTANDING THE WEAKNESSES OF THE PAYLOAD, THE FLIGHT MODEL WILL THEN BE ASSEMBLED. THROUGHOUT THE TESTING PROCEDURE, REPLACEMENT COMPONENTS WILL REMAIN ON STANDBY IN CASE OF FAILURE WITHIN THE SUBSYSTEMS. ONCE THE FLIGHT MODEL IS BUILT WITH READY COMPONENTS, NO MORE ALTERATIONS SHOULD BE MADE. **DON'T EXPECT SUCCESS IF YOU DON'T TEST.** IN ANY CASE, MEMBERS SHOULD NEVER EXPECT SUCCESS WITHIN A COMPONENT THAT HAS BEEN POWERED ON ONCE AND ASSUME THAT IT WILL POWER ON IN THE FUTURE. MOST LIKELY, THERE ARE COMPONENTS THAT WILL NOT PERFORM OPTIMALLY OVER TIME. IT IS IMPORTANT TO TEST ALL AREAS OF THE SYSTEM. ONCE MULTIPLE PARTS OF THE SYSTEM ARE TESTED FOR LIMITS AND FAULTS, THE PAYLOAD OVERALL QUALITY IS ASSURED.



Integration to CACTUS-1

HERMES WILL BE INTEGRATING ONTO A 3U CUBESAT AS A 1U SECTION OF THE SPACECRAFT. AS INTERGRATION IS BEING PERFORMED. THE 1U CUBESAT IS EASILY ABLE TO INTERGRATE TO THE REST OF THE SPACECRAFT. SIMILAR TO THE HIGH ALTITUDE BALLOON LAUNCHES AND SOUNDING ROCKETS, THE TESTS PERFORMED CAN VERIFY QUALITY ASSURANCE FOR THE HERMES MISSION.