19th IAA SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND DEVELOPMENT (D3)
Space Technology and System Management Practices and Tools (3)

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THREE NATIONS COLLABORATE TO BUILD MARS SPACECRAFT FLIGHT SOFTWARE

Abstract

A robust, reliable, state of the art spacecraft Flight Software (FSW) subsystem is an important component of space mission success; developing one in collaboration with engineers from other countries added new dimensions to the process. Designing and implementing the software was one challenge, however, managing the development to satisfy the project's schedule and requirements in terms of resources and build deliveries was more challenging. Engineers from 3 nations, the United Arab Emirates, the United States of America, and Canada, joined forces to create the Emirates Mars Mission (EMM) Spacecraft FSW. The combination of collective management, experienced engineers, an agile development methodology, common development and test tools, and open sourced products were crucial components of our success. These components equipped our team with the necessary resources to allow the flexibility needed to adapt to, and meet, the obstacles and limitations encountered on the journey. The processes we developed allowed our team to accomplish the task. Despite working in 3 different time zones, the FSW Team managed to deliver a feature-complete, fully-qualified product on-time that has since executed successfully in-flight. EMM is expected to reach Mars in early Feb 2021.

In 2015, Shiekh Mohammed Bin Rashid Almaktoum, the Vice President and Prime Minister of United Arab Emirates (UAE), and ruler of Dubai, announced the EMM Mission. This is the first Emirati planetary mission, and will bring UAE into the space exploration society. The UAE, with its counterparts, are sending a probe known as Al-Amal (Hope Probe). Launching in July 2020, it will reach Mars by 2021, to coincide with UAE's 50th anniversary. The aim of the EMM mission is to contribute to the Space Science Community. The Hope Probe observatory includes three instruments to study and observe the Martian atmosphere. The Emirates Mars Ultraviolet Spectrometer (EMUS) focuses on measuring

the global characteristics of hydrogen and oxygen coronae; the Emirates Mars InfraRed Spectrometer (EMIRS) measures the abundance of water ice and vapor and global thermal structure; and the Emirates eXploration Imager (EXI) uses a visible imager to measure the abundance of ozone and water ice and dust aerosols. The FSW supports the science instruments, all spacecraft subsystems, and provides for fault protection and autonomous operation. Such a complex observatory requires a highly coordinated FSW team. This paper describes the tools and methodology used to accomplish the goal.