

IAF SPACE SYSTEMS SYMPOSIUM (D1)

Lessons Learned in Space Systems: Achievements, Challenges, Best Practices, Standards. (5)

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LESSONS LEARNED IN SYSTEMS ENGINEERING AVAILABILITY AND RECOMMENDATIONS
FOR MISSION TECHNICAL LEADERS**Abstract**

In spaceflight missions at Goddard Space Flight Center (GSFC), the Mission System Engineer (MSE) is the technical leader of the overall engineering team and also is the Independent Engineering Technical Authority. The responsibility of this role includes the definition of the Mission design architecture, concept of operations, and mission requirements, management of risk throughout the development, and verification and validation of the final system amongst other duties. This responsibility inherently requires time management, enabling focus on a balanced development with appropriate risk. Time is the most valuable resource of the MSE.

The system engineer's availability to interact with the development team (often product or component design leads and technicians, often in different worksites) to discover and mitigate mission risks during development is key to mission success. This paper presents examples from Lunar Reconnaissance Orbiter, Solar Dynamic Observatory, and Neutron star Interior Composition Explorer (NICER) in-house Goddard Space Flight Center Hardware builds demonstrating how interactions between the Mission Systems Engineer and team engineers and technicians resulted in discovery of critical risks, resulting in early mitigation with significant cost and performance savings. These three missions would have suffered test failures or on-orbit failures had their MSEs not set aside time to visit engineers and technicians that were working on key pieces of space flight hardware.

Availability is more than just time; it is openness to listen to concerns and questions. It begins by building a level of trust in the team that it is safe to ask questions or share concerns without the fear of blame or additional workload. It also requires enabling informal conversations (over lunch, coffee, in the clean room, or at the team members desk, etc.) where key information can be exchanged, and team members may even provide an easy-to-implement mitigation idea for another subsystem.

Availability is a highly valuable commodity and completely non-obvious to protect and optimize. The natural tendency of engineers is to keep themselves busy with solving problems that they know about. This paper is encouraging MSEs to resist this tendency to try and solve all the complex problems themselves and actively devote daily time to learning and solving problems that are found with informal communications with other team members.