Promoting Crew Autonomy:
Current Advances and Novel Techniques

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Abstract: Since the dawn of the era of human space flight, mission control centers around the world have played an integral role in guiding space travelers toward mission success. In the International Space Station (ISS) program, astronauts and cosmonauts have the benefit of near constant access to the expertise and resources within mission control, as well as lifeboat capability to quickly return to Earth if something were to go wrong. As we move into an era of longer duration missions to more remote locations, rapid and ready access to mission control on earth will no longer be feasible. To prepare for such missions, long duration crews must be prepared to operate more autonomously, and the mission control paradigm that has been successfully employed for decades must be re-examined. The team at NASA's Payload Operations and Integration Center (POIC) in Huntsville, Alabama is playing an integral role in the development of concepts for a more autonomous long duration crew of the future via research on the ISS.

Many experiments onboard the ISS are actively exploring the future of long duration spaceflight, with several focusing specifically on crew autonomy. For example, the Communications Delay Assessment experiment introduced artificial communication delays into pre-determined periods of crew operations and assessed the impact of that delay on successful operations. The Autonomous Mission Operations investigation exercised software which allowed the crew to operate very complex science facilities on the ISS for the first time without any assistance from the ground. A third experiment called Crew Autonomous Scheduling Test (CAST) is exploring the benefits and implications of allowing crew members to plan some of their own schedules. Another fascinating technology demonstration project called Robonaut is focusing on the possible applications of robotic "crew members." Another tech demo project is using a 3-D printer to validate the concept of a "print as you go" supply chain. This presentation will focus on how these experiments and others are helping to prove crew autonomy on deep space missions is feasible.

While there is still a great deal of work to be done to clarify the role of long duration crews and Earth-based mission support, there appears to be widespread agreement that increased crew autonomy from mission control is a necessary and important component of long duration missions. Research being done on the ISS is an important first step toward understanding how to convert general theories about crew autonomy into reality, and propelling human space flight into the future.