

Understanding the International Space Station Crew Perspective following Long-Duration Missions through Data Analytics & Visualization of Crew Feedback

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The International Space Station (ISS) first became a home and research laboratory for NASA and International Partner crewmembers over 16 years ago. Each ISS mission lasts approximately 6 months and consists of three to six crewmembers. After returning to Earth, most crewmembers participate in an extensive series of 30+ debriefs intended to further understand life onboard ISS and allow crews to reflect on their experiences. Examples of debrief data collected include ISS crew feedback about sleep, dining, payload science, scheduling and time planning, health & safety, and maintenance. The Flight Crew Integration (FCI) Operational Habitability (OpsHab) team, based at Johnson Space Center (JSC), is a small group of Human Factors engineers and one stenographer that has worked collaboratively with the NASA Astronaut office and ISS Program to collect, maintain, disseminate and analyze this data. The database provides an exceptional and unique resource for understanding the “crew perspective” on long duration space missions. Data is formatted and categorized to allow for ease of search, reporting, and ultimately trending, in order to understand lessons learned, recurring issues and efficiencies gained over time.

Recently, the FCI OpsHab team began collaborating with the NASA JSC Knowledge Management team to provide analytical analysis and visualization of these over 75,000 crew comments in order to better ascertain the crew’s perspective on long duration spaceflight and gain insight on changes over time. In this initial phase of study, a text mining framework was used to cluster similar comments and develop measures of similarity useful for identifying relevant topics affecting crew health or performance, locating similar comments when a particular issue or item of operational interest is identified, and providing search capabilities to identify information pertinent to future spaceflight systems and processes for things like procedure development and training. In addition, the comments were scored for sentiment using a polarity scoring algorithm to identify both positive and negative comments for particular groups and clusters, allowing the team to make analytically informed decisions regarding future hardware and operating procedures. The use of polarity scoring with time series analysis was used to provide insight into how crew health and habitability is changing throughout various spaceflight increments or the station lifecycle as a whole. Finally, a visualization framework was developed to address the needs of the end users to search for and analyze comments by user, category or mission.

This paper will discuss how the use of an analytical framework in conjunction with the current human interface, improved the understanding of crew perspective and shortened the time for analysis allowing for more informed decisions and rapid development of improvements. These methods are significantly optimizing the way that this valuable data can be assessed and applied to current and future spaceflight design and development. This collaboration allows the FCI OpsHab team to effectively analyze and share data in a more automated and timely fashion. Trends are no longer derived manually and can be illustrated effectively and accurately with these evolving techniques to an ever growing group of human spaceflight end users.