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CROSSING BOUNDARIES IN SPACE EXPLORATION MULTITEAM SYSTEMS: INSIGHTS FROM SIRIUS-21 MISSION

Abstract

The success of the coming era of human spaceflight hinges on a new type of coordination characterized by shifting autonomy between space crews and mission support elements on Earth. Together, the crew and mission support teams, comprise what is known as a spaceflight multiteam system (SMTS). SMTSs require crews to work autonomously and, at the same time, coordinate closely with mission support as the mission unfolds. Members of SMTSs manage relationships within and across multiple types of boundaries, created by distance (i.e., space vs Earth) and goals (i.e., prevention vs promotion). In order to understand how boundaries shape SMTSs relations, we studied the formation of affective, behavioral, and cognitive ties among the 12-member space exploration SMTS who participated in a multiteam task.

Project RED included a series of complex problem-solving tasks requiring cooperation between the SIRIUS-21 crew and a remote Martian Analysis Group (MAG). The crew was located in Moscow, Russia; MAG was located in Evanston, USA. Together, the crew and MAG worked to design a water infrastructure for a future human colony on Mars. Interaction took place by text-based interface within the Project RED software. The software captured each members' actions and interactions, and launched periodic network surveys. Network surveys elicited affective, behavioral, and cognitive relations. Affective ties were assessed with the prompts, "who did you rely on for leadership?" and "who kept your taskforce motivated?" Behavioral ties were assessed by asking, "who do you work effectively with?" and "who worked hard for the taskforce?" Cognitive ties were assessed with the prompts, "who was a valuable source of information?" and "who was instrumental in helping the taskforce achieve its goals?" The task was completed a total of 17 times during the 8-month isolation mission.

We used the E-I index to examine the relative internal and external focus of SIRIUS-21 and MAG. Results show that location plays an important role in the relations that form within and between teams. All relations were strongly shaped by location-based differences, with a substantial inward focus: SMTS members formed a greater proportion of relationships with those who are proximal, than with those with whom they work remotely. Results also show that team goal foci prompted an outward focus on SMTS ties. SMTSs members were more likely to form external ties with those on teams with the opposite goal focus. Implications for tracking SMTSs relations and developing crew-mission support relation-based countermeasures are discussed.