

# NASA FLIGHT CONTROLLERS – MEETING CULTURAL AND LEADERSHIP CHALLENGES ON THE CRITICAL PATH TO MISSION SUCCESS

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In preparing for missions to the Moon and Mars, NASA has identified high priority “critical path roadmap” (CPR) questions, two of which focus on the performance of mission control personnel. NASA flight controllers have always worked in an incredibly demanding setting, but the International Space Station (ISS) poses even more challenges than prior missions. We interviewed 14 senior and 12 junior ISS flight controllers about leadership and cultural challenges they face and strategies for addressing these challenges. Coding of qualitative data showed consensus on some issues, such as the importance of building a personal relationship with Russian colleagues. Viewpoints of junior and senior controllers differed in some areas, such as training. Findings provide some answers to both CPR questions.

## INTRODUCTION

As part of its preparation for missions to the Moon and Mars, NASA has identified high priority “critical path roadmap” (CPR) questions that must be answered in order to maximize the chances of mission safety and success ([bioastroroadmap.nasa.gov](http://bioastroroadmap.nasa.gov)). Two of these questions pertain to the performance of mission control personnel:

- *CPR-24b - What factors contribute to the breakdown of individual and team performance and team coordination with mission support with regard to scheduling, prioritization of work activities and control of timelines?*
- *CPR-24f - How can attitudes and behaviors of agency management, ground controllers, crewmembers and their families be modified to maintain and improve individual and group performance?*

Here we use data from a survey of a small group of ISS flight controllers to provide some answers to these questions.

NASA flight controllers have always worked in an incredibly demanding setting, but recently their task has become even more challenging, because supporting the International Space Station (ISS) requires them to work in globally dispersed international teams (Hinds & Bailey, 2003; Jarvenpaa & Leidner 1999, NASA JSC, 2005; Ritscher, 2005). NASA ISS flight controllers work in multi-cultural, multi-organizational, and geographically dispersed virtual teams in a high-stakes round-the-clock environment. Operating the International Space Station (ISS) involves an indefinite, continuous series of long-duration international missions, and this requires an unprecedented degree of cooperation across multiple sites, organizations, and nations.

ISS flight controllers have had to find ways to address the cultural and leadership challenges

inherent in such work, but have not had systematic training in how to do so. Typically their training is limited to technical skills. A recent survey of NASA flight controllers revealed a serious level of concern about communications problems with the International Partners (Parke & Orasanu 2004). The same study found that teams are seen as high performing, that controllers have a positive relationship with their work and take pride in their jobs, and that they have good relationships with supervisors, who are seen as accessible (Parke & Orasanu 2004). Data from another survey of flight controllers conducted by Kanas and colleagues found that NASA controllers' relationship with their management compared favorably to national norms (Clement et al, 2006). Thus, although flight controllers have been doing well, they have been having to learn some of their key job skills "the hard way" on their own. We sought to capture these pioneers' hard-won wisdom so that it could be shared with current and future controllers and incorporated into the body of evidence about the CPR questions.

The goals of this study were to identify and evaluate the major cultural and leadership challenges faced by ISS flight controllers and to highlight the approaches that they have found most effective to surmount these challenges. Because their perspectives may be different, we interviewed both junior and senior flight controllers. We pay particular attention to the approaches successfully employed by the senior personnel and the training needs identified by the junior personnel. We also evaluate the extent to which the identified approaches and needs are consistent across the two samples, and we frame the results in terms of the CPR questions.

## METHOD

Participants included a sample of 14 senior ISS flight controllers and a contrasting sample of 12 more junior controllers. All participants were mission operations specialists chosen on the basis of having worked extensively with international partners. Data were collected using a semi-structured qualitative interview and content analyzed using an iterative process with

multiple coders and consensus meetings to resolve discrepancies. Further details about the methodology of the study have been described in our earlier reports (Clement & Ritsher, 2005, 2006; Clement et al., 2006).

## RESULTS

The respondents identified numerous important leadership and cultural challenges and provided key strategies for dealing with them. In addition, they offered a wide range of specific tactics for implementing these strategies. The results are summarized in Table 1. Examples of each of these challenges and solutions have been presented in our earlier reports (Clement & Ritsher, 2005, 2006; Clement et al., 2006).

Table 1  
*Leadership and Cultural Challenges, and Successful Solutions to Them, According to ISS Flight Controllers (Summary of Qualitative Data).*

	% of Senior respondents	% of Junior respondents
<u>Leadership Challenges:</u>		
Team members dispersed across sites, organizations, time zones.	100%	92%
Historical differences between partner organizations.	100%	92%
More effort required to maintain morale and motivation of local team.	86%	42%
Constant change	64%	0%
<u>Cultural Challenges:</u>		
Cultural differences in relative importance of values.	100%	100%
Bilateral approaches /workarounds may not work for multilateral situations.	86%	41%
Language differences	50%	83%
<u>Successful Solutions:</u>		
Ensuring effective communication	100%	100%
Cultivating robust relationships	93%	92%
Fostering flexibility and open-mindedness	86%	75%
Expanding cultural awareness	57%	92%
Seeking and providing training	86%	92%

There was substantial consensus among participants on some issues, such as the importance of building a personal relationship with Russian colleagues. Responses from junior and senior controllers differed in some areas, such as training. The senior group was more aware of the extra effort needed in leading a dispersed team, the context of constant change,

and the upcoming difficulties with the multilateral situation. The senior group gave more examples of tried-and-true solutions to all the challenges. The junior group was more aware of the importance of cultural issues (not just national culture), the subtleties and impact of the language barrier. The junior group voiced a wide range of training needs. Our sample size was too low to conduct quantitative statistical analyses but the qualitative analysis clearly supported these contrasts in perspective.

We further examined our data in light of the two CPR questions, which are shown again below:

*CPR-24b: What factors contribute to the breakdown of individual and team performance and team coordination with mission support with regard to scheduling, prioritization of work activities and control of timelines?*

Regarding CPR-24b, we found myriad disruptive impacts on constructing and implementing timelines. For example:

- Lack of face-to-face communication cues
- Incompatible time zones
- Different work styles between organizations/cultures
- Cumulative fatigue (missions are marathons)
- Constant change (turnover, technical, politics, agencies)

This situation is likely to become even more challenging in the future because although our subjects have found workarounds for the bilateral (Russian-American) situation, they are concerned that this may be prohibitively difficult for multilateral (Russian-American-European-Japanese) situations that are planned.

*CPR-24f: How can attitudes and behaviors of agency management, ground controllers, crewmembers and their families be modified to maintain and improve individual and group performance?*

Regarding CPR-24f, we found, for example, that cultural and language training can go a long way to improving interactions and performance on international teams, despite the fact that translators are heavily used. Training is and has been a significant mitigation strategy for

preparing ground and astronaut crews for the many challenges associated with the spaceflight environment. Specific strategies associated with each of the following could impact this CPR:

- Information and consideration on burnout prevention and stress management
- Training on how to communicate critical information to non-English-speaking team members through interpreters or translated documentation
- Use of “lessons learned” materials and training in how to work with individuals from cultural backgrounds different from one’s own
- Senior managers need to become more aware of the unique challenges presented to the junior members of the flight control team by participating in some of the cultural and leadership training themselves
- Agency managers could also benefit from training or sensitization to the impacts of policy changes and other impacts driven by changes in objectives or organizational goals.

## DISCUSSION

The ISS operations environment continues to be an excellent “learning laboratory” for ground controllers to experience challenges beyond the technical ones they were educated and trained for in engineering school and in mission simulations. Many of our respondents had to learn about these challenges “the hard way” after making initial gaffes and blunders. Aside from being inefficient, this way of operating further strains the already delicate relationship between NASA and its international partners.

Although specific to American ISS personnel, our results are consistent with recent management, cultural, and aerospace research on other populations (e.g., Kossler & Prestridge, 2003; Sandal, 2004; Hinds & Bailey, 2003, Jarvenpaa & Leidner, 1999). We aim to use our results to improve training for current and future mission control personnel working in international or multicultural mission operations

teams. Although confidentiality concerns and the need for brevity meant that it was beyond the scope of the present paper to give more complete details, we hope that the summary provided here will be useful to those compiling evidence about the CPR questions, and to others studying other populations in analogous situations.

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#### REFERENCES

- Clement, J. L., & Ritsher, J. B. (2005). Operating the ISS: Cultural and leadership challenges. *56<sup>th</sup> International Astronautical Congress*, Fukuoka, Japan, October 17-21, 2005. Paper #IAC-05-A1.5.05. International Astronautical Federation, Paris.
- Clement, J. L., & Ritsher, J. B. (2006). Cultural challenges faced by American mission control personnel working with international partners. *Committee on Space Research 36<sup>th</sup> Scientific Assembly*, July 16-23, 2006, Beijing, China.
- Clement, J. L., Ritsher, J. B., Saylor, S.A., Kanas, N. (2006). Leadership challenges in ISS operations: Lessons learned from junior and senior mission control personnel. *57<sup>th</sup> International Astronautical Congress*. Valencia, Spain. October 2-6, 2006. Paper #IAC-06-A1.1.06. International Astronautical Federation, Paris.
- Hinds, P. J., & Bailey, D. (2003) Out of sight, out of sync: Understanding conflict in distributed teams, *Organization Science*, 14(6), 615-632.
- Jarvenpaa, S. L., & Leidner, D. E. (1999). Communication and Trust in Global virtual Teams, *Organization Science*, 10(6), 791-815.
- Kossler, M. E., & Prestridge, S. (2003). Going the distance: The challenges of leading a dispersed team, *Leadership in Action* 23(5), 3-17.
- NASA JSC (2005). Memo DA-05-028. In: *Flight Controller Manifesto*, June 2, 2005. Author.
- Parke, B., & Orasanu, J. (2004). *Overview of ISS Flight Controller Ratings on Organizational Risk and Tool Development Survey*, Feb 2004, Ames Research Center.
- Ritsher, J. B. (2005). Cultural factors and the International Space Station, *Aviation, Space, and Environmental Medicine* 76, B135-B144.
- Ritsher, J. B., Kanas, N., Salnitskiy, V.P., Gushin, V. I., Saylor, S., Weiss, D. S., Marmar, C. (2006). Cultural and language backgrounds of international space station personnel. *57<sup>th</sup> International Astronautical Congress*. Valencia, Spain. October 2-6, 2006. Paper #IAC-06-A1.1.03. International Astronautical Federation, Paris.
- Sandal, G. M. (2004). Culture and tension during an International Space Station simulation: Results from SFINCSS'99, *Aviation, Space, and Environmental Medicine* 75, C44-C51.