



Team Culture Issues for Long-Duration Exploration Missions

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Executive Summary

Culture has been a factor for space exploration since the mid 1970's when the U. S. first partnered with Russia in the Apollo-Soyuz Test Project. Work has indicated that culturally-based differences in values, beliefs, and preferences for cognition and action can have an impact on interdependent action (Stahl, Maznevski, Voigt, & Jonsen, 2010b). The unique nature of spaceflight and long duration, distance exploration missions (LDDEM) drives the question as to whether cultural diversity within spaceflight crews has the same impact on team performance as that reported within the wider literature on cross-cultural teams/cross-cultural diversity. However, a recent review of the literature revealed that there has been limited research conducted on the effects of cultural diversity on teams within long duration spaceflight. This report documents the results the process and findings of an integrative review to catalog potential challenges brought about by cultural diversity in teams, what has been done to mitigate those challenges, and how this work might be leveraged in LDDEM.

In order to organize the results the report is divided into three sections. First, the critical issues surrounding culture and its effect on team functioning within LDDEM are explored. Section I details the methodology and findings from a review of the scientific literature with regard to how cultural diversity may impact team process, emergent states, and performance outcomes, with an emphasis on LDDEM. Accordingly, we found that cultural diversity influences not only team outcomes, but also team processes, emergent states. When examining team outcomes, satisfaction is the outcome whose relationship with cultural diversity within LDDEM contexts produced the most interesting contrast from the current general findings in the team literature. Even though the team literature shows a positive relationship between satisfaction and increasing diversity, this was not true for teams in isolated and confined spaces. For team processes, cultural diversity influenced a number of transition, action, interpersonal processes as well as more traditional ones, such as leadership. Cohesion, trust, mood, conflict, and mental models were identified as key emergent states that are influenced by cultural differences. Additionally, contextual moderators were specified. Some in which can inhibit the negative effects of cultural diversity (e.g., norms, climate) and others that may amplify the effects of cultural diversity (e.g., isolation, time) within the space flight context.

Second, this report delineates what methods are being used to train individuals and teams to work in culturally diverse settings. More specifically, Section II details the methodology and

findings with regard to mitigation strategies uncovered within the scientific literature and presents them within an overarching framework. The mitigation strategies that primarily focused on individuals were seen to use a wide variety of methods and were found most predominantly within the expatriate or cross-cultural literature. These mitigation strategies primarily focused on cognitive or behavioral change and the use of intellectual methods. Few of these strategies were tested in isolated, confined environments. Some examples of these individual-level mitigation strategies include attribution training, language training, cultural awareness, and cultural sensitization. Meta-analytic results and critical reviews would argue for overall effectiveness, but there is definitely room for improvement. Conversely, strategies focused on teams are few and far between. Some operational suggestions for this approach include socialization, superordinate identity, meaningful work, understanding partner space culture, and team debriefing. Other candidates for LDDEM include stress exposure training, event-based training, and understanding the cultural metaphors that partnering nations use for teams/teamwork.

Third, this effort incorporates a review of the scientific literature and an operational assessment from individuals with experience in LDDEM. Section III of this report details the methodology and results of the operational assessment. Challenges exist and manifest themselves in terms of frustration/irritation amongst crew members, but in current missions do not impact operational tasks. Evidence of cultural differences impacting: trust, mood, shared mental models, shared situation awareness, strategy formulation, team monitoring/backup, coordination, leadership, and satisfaction were found. One reason for cultural diversity not having an operational impact within current missions, is evidenced by the following quote -crews have “a much greater fear of never flying again and being considered a failure. That greatly overrides any interpersonal issues that might occur” (Flight Surgeon, personal communication, May 2014). However, the operational assessment also indicated that within longer, more isolated confined missions (e.g., Mars) issues that are now minor annoyances may become greater and have an operational impact.

Last but not least, Section IV identifies gaps as well as our conclusions and recommendations to advance science in this area. These recommendations are broken down into recommendations for research and practice. The former delineates ways science can advance (e.g., investigating underlying mechanisms), whereas the latter lays a foundation for how to deal with cultural differences in practice (e.g., pay close attention to faultlines and subgroup formation).

“The smooth functioning of the group contributes greatly to mission success and can be essential to survival under emergency conditions”

(Stuster, Bold Endeavors)

An American Institute of Medicine Report (2001) stated that, “behavioral adaptation and human interactions aboard a confined spacecraft, isolated both temporally and spatially from Earth may well be one of the most serious challenges to human exploratory missions” (p. 2-3). There are many factors within long duration distance exploration missions (LDDEM) which make human interaction and interdependent interaction challenging. For example, communication delays and other technical difficulties can often call for spaceflight crews to work in isolation without contact with ground crews even on shorter duration missions (e.g., ISS, MIR; NASA, 2008). Additionally, space exploration missions tend to be characterized by extremely long durations involving multiple distributed autonomous teams communicating asynchronously with significant time lags. These distributed autonomous teams are often comprised of individuals from a variety of cultural backgrounds with differing values, beliefs, and understandings of the world. The Institute of Medicine Report (Ball, 2001) noted differences in the cultural backgrounds of international crews as an important issue facing LDDEM. Diversity has been argued to lead to a reduction in team cohesion, complications in communications, increased conflict and misunderstandings, dissatisfaction, turnover, difficulty in learning to work with dissimilar others, increased ambiguity, and absenteeism (Adler, 2005; Brickson, 2000; Milliken & Martin, 1996; Watson, Johnson, & Merritt, 1998). Cultural diversity coupled with autonomous isolated conditions can lead to adverse behavioral conditions such as conflict, anxiety, frustration, and other negative outcomes that impede the ability of the flight crew to engage in the effective problem-solving necessary to succeed in their mission (Kanas, Sandal, Boyd, Gushin, Manzey, North, ... & Wang, 2009; Kealey, 2004; Sandal & Manzey, 2009; Tafforin, 2013).

A wide body of literature has shown multiple ways that national cultures differ in terms of their preferences and values regarding action and cognition (see Salas, Burke, Wilson-Donnelly, & Fowlkes, 2004, for a categorization, also Gelfand, Erez, & Aycan, 2007). Furthermore, work has indicated that culturally-based differences in values, beliefs, and preferences for cognition and action can have an impact on interdependent action (e.g., Earley & Gibson, 2002; Stahl, Maznevski, Voigt, & Jonsen, 2010b). For example, a meta-analytic investigation by Stahl et al.

(2010b) suggested that cultural diversity can lead to process loss within teams as it increases task conflict and decreases social integration/cohesion. Additionally, research has found that cultural distance influenced perceptions of group receptiveness (Thomas, 1999). However, there are some instances whereby cultural diversity can lead to gains in creativity and team satisfaction. The effects of cultural diversity depend on contextual influences (e.g., task complexity, team size, team tenure, team dispersion).

Due to the complexity involved in LDDEM, there is a need to understand: (1) the critical issues surrounding culture and its effect on team functioning within LDDEM and (2) what methods are being used to train individuals and teams to work in culturally diverse settings. The purpose of this paper is to report the results of an effort which examined that the state-of-the science with respect to the above issues. Given the unique nature of spaceflight and the fact that there has been limited research conducted on cultural diversity within long duration spaceflight, we also report on the results of an operational assessment. The operational assessment examines the relationship between cultural diversity and team performance in spaceflight and long duration exploration missions as seen by NASA personnel with experience in the area of spaceflight and/or long duration. In presenting our methodology and findings we have divided the report into four sections. Section I details the methodology and findings from the review of the scientific literature with regard to how cultural diversity may impact team process, emergent states, and performance outcomes, with an emphasis on LDDEM. Section II details the methodology and findings with regard to mitigation strategies uncovered within the scientific literature and presents them within an overarching framework. Section III details the methodology and results of the operational assessment. Finally, Section IV presents our conclusion and recommendations.

Section I:
The Effect of Culture and Cultural Diversity on Crew in LDDEM:
Insight from the Scientific Literature

Purpose

While there is a broad literature on cultural diversity, researchers have noted a scarcity of research on cultural diversity in teams (Jentsch, Hoelt, Fiore, & Bowers, 2004) and an even more limited sample and lack of understanding pertaining to cultural diversity and team performance in the context of spaceflight (Kraft, Lyons, & Binder, 2003). Therefore, we seek to identify the critical issues surrounding the presence of cultural diversity within LDDEM. In doing so, we review findings from cross- and –multi-cultural crews in spaceflight as well as relevant analogs like aviation, Antarctic research bases, and other complex environments to highlight how cultural diversity impacts team interactions, emergent states, and performance. Specifically, we focus on delineating the effect of differences in national culture within teams performing in isolated, confined settings with varying degrees of workload that are often couched within a larger multiteam system. Our specific focus is on what these differences may mean for teamwork as well as team outcomes (e.g., performance). Where possible, we leverage findings from NASA or analog environments, where not we draw from the larger literature base and extrapolate to these environments. With the potential benefits of a multicultural crew in mind, we aim to improve our understanding regarding the role of culture to team processes and outcomes in such contexts.

Methodology

A systematic review of the scientific literature was conducted to identify, select, and critically appraise relevant constructs associated with cultural diversity in teams in order to provide an integrative framework, current research findings, and to identify gaps in the literature. In conducting the review, we searched prominent databases to identify the initial set of articles. Databases that were searched include the following: EBSCO Host (e.g., PsychINFO, PsycARTICLES, Business Source Premier, Military and Government Collection, Academic Search Premier), Google Scholar, and NASA databases (e.g., NASA Technical Server). Variations of the following terms were used as keywords during the search: cultur* diversity, cultur*, multinational team*, transnation*, multicultural*, crosscultur*, cross-cultur*, multicultural*, culture* heterogeneity, training, team, collaboration, group, autonomous, long duration, long distance, and exploration mission. Nearly 300 articles, reports, and/or dissertations resulted from this search,

which were then carefully reviewed based on relevance. Relevance was determined by the extent to which the articles provided insight into the effect that differences in cultural orientation and/or cultural diversity may have on team process, emergent states, and team performance.

Two Industrial/Organizational Ph.D. students conducted the searches and did an initial review for relevance based on the criteria above and a scan of abstracts. Those articles that passed this first set of criteria were then further reviewed and information was coded independently by the students. In reviewing the articles the following pieces of information were the primary focus of what was extracted: variables related to cultural differences, context, and the type of culture being studied, focusing on those that conceptualized culture as nationality. Table 1 provides a sample of the coding schema and relevant articles within this search. Since research about multicultural teams in space is still in its nascent stage, we were often forced to draw from other literatures to extrapolate how cultural differences may influence team processes, emergent states and outcomes. We are following a similar approach that other researchers have taken when the topic is understudied. For instance, Kealey (2004) identified a number of relevance issues that multicultural crews face in space by juxtaposing with more studied areas, such as the research of intercultural effectiveness of sojourners. This reassures the relevance of expanding our searches to other areas in order to understand the phenomena associated with cultural differences.

Table 1
Sample of Articles Coded

Citation	Notes	Related variables	Context	Type of paper	Culture operationalization
Sandal & Manzey, 2009	<u>CONTEXT SPECIFIC</u> 1. Psychosocial issues (cultural differences) - leadership (P) 2. Psychosocial issues (cultural differences) - decision making (O) 3. Psychosocial issues (cultural differences) - values (ES) more nationalities --> more challenges	attitude (ES) leadership (P) decision making (O)	Space flights	Empirical	National
Sandal, 2007	<u>CONTEXT SPECIFIC</u> Calling to understand interactions and performance of space flight crew using psychological principles and considering the organizational context		Space flights	Theoretical	National
Sandal, 2004	<u>CONTEXT SPECIFIC</u> Cultural differences led to a number of issues, but these were likely exharcebated when psychological gap due to language difficulties	psychological gap (ES) morale (ES) productivity (O) conflicts (P) misunderstandings (ES)	Space simulation	Empirical	National and Gender
Sandal et al., 2011	<u>CONTEXT SPECIFIC</u> "Groupthink" phenomenon was not found in this context. More tension was attributed to difference in hedonism, benevolence, and tradition when the crew has greater autonomy.	salience of value differences (ES) intra-crew tension (ES) subgroup formation (O)	Space simulation	Empirical	National

Boyd et al. 2009	<u>CONTEXT SPECIFIC</u> 1. cultural differences - social climate (work pressure; perceptions of supervisor support) 2. cultural differences -mood 3. cultural differences - cohesion * mood and social climate: tension-anxiety, leader support, task orientation, anger/aggression, order and organization, leader control, innovation, and work pressure	climate (C) attitude (ES) cohesion (ES)	Space stations	Empirical	National, Occupational, and Organizational
Tafforin, 2013	<u>CONTEXT SPECIFIC</u> 1. cultural influences on their behavioral expressions (TP)	communication (P)	Space simulation	Empirical	National
Tafforin & Gerebtzoff, 2010	<u>CONTEXT SPECIFIC:</u> Did not find any difference in behavior across nationalities		Space flights	Empirical	National
Tafforin, 2009	<u>CONTEXT-SPECIFIC:</u> More frequently occupied place by gender and nationality was observed during critical phases of adaptation Attitudes towards multicultural teams are positive regardless of challenges	subgroup formation (O)	Space stations	Empirical	National and Gender
Tafforin, 2013	<u>CONTEXT-SPECIFIC:</u> We found evidence that the Mars-500 crew behavior was dependent on time, culture, and the individual.	time (C) adaptive states (O)	Space simulation	Empirical	National
Tafforin, 2013	<u>CONTEXT-SPECIFIC:</u> cultural and individual; differences influence verbal communication patterns during Mars mission simulation	communication (P)	Space simulation	Empirical	National

Arman & Adair, 2012	impact of temporal diversity on team processes and outcomes and effectiveness in multinational teams Specifically: time orientation, punctuality and pace of life are influenced by time-related differences among culture	time (C) transition, action, and interpersonal processes (P) performance (O) satisfaction (O) group cohesiveness (ES)	Multinational teams	Theoretical	
Ashleigh & Prichard, 2011	Book available online	trust (ES) norms (C)	General teams	Theoretical	National
Bond & Pyle, 1998	The organization's history and traditions shape the context on how diversity is handled [thus, doing NASA interviews to understand diversity dynamics] * Look at ecological lessons	organizational culture (C) multiple realities (ES)	Workplace Chemistry Steering team	Empirical	Race
Corley, 2011	<u>CONTEXT-SPECIFIC:</u> This is just an interview with the team members. I thought it was interesting to see their first-hand perspectives. We never had conflicts, but we had some moments where we didn't agree - sometimes due to our backgrounds and cultural differences	disagreement (ES)	Space simulation	Empirical	National
Cousins et al., (2007)	used face-to-face meetings to acknowledge both cultural diversity and shared identity within the teams	cognitive processing (ES) performance (O)	Hybrid teams	Empirical	North-South locations
Dameron & Joffre, 2007	cultural diversity on cooperative relationships	cooperation (P) contextual factors (C)	Integration team	Empirical	National and Organizational
Foldy, 2004	conceptual model of learning in culturally diverse groups	environment (C) learning (O)		Theoretical	

Griggs & Louw, 1995	Forming, storming, norming, and performing in multicultural teams	time (C)		Theoretical	
Groves & Feyerherm, 2011	leader CQ	performance (O) leadership (P)		Empirical	
Guo et al., 2008	cultural diversity as an antecedent of coalition formation in teams in negotiation	coalition formation (O)	Negotiation in MBA	Empirical	National
Gushin et al., 2001	<u>CONTEXT-SPECIFIC:</u> cultural differences can hinder the formation of a cohesive crew	cohesion (ES) perception of social environment, goals, and values (ES) subgroup formation (O)	Space stations	Empirical	National
Horowitz et al., 2006	1. virtual team- cross-cultural communication improvement (TP) 2. virtual team- leadership communication (TP) 3. virtual team- goal and role clarification, (C) 4. virtual team- relationship building (ES) 5. virtual team- virtual team performance (O) 6. virtual team- trust (moderator)	performance (O) communication (P) goal and role clarification (P) relationship building (P)	Virtual teams	Empirical	National
Humes & Reilly, 2007	cultural dimensions on the performance of intercultural, globally dispersed teams	miscommunication (P) conflict (P)	Multicultural teams	Empirical	Cultural dimensions
Kahane et al., 2013	diversity to broaden the skills and abilities beyond domestic workers	performance (O) communication (P)	National Hockey League	National	Canadians and Europeans

Kanas & Ritsher, 2005	<u>CONTEXT-SPECIFIC:</u> role of leadership	leadership (P)	Space stations	Empirical	National
Kanas et al., 2009	<u>CONTEXT-SPECIFIC:</u> there are certain issues specific to multicultural crews (language barriers and national culture) and how they cope with stress, DM styles, etc. Over time, organizational and professional cultures may develop in a heterogeneous manner that requires coping from crewmembers in addition to the national cultural differences	<p> coping with stress (ES) preferences and expectations (ES) cohesion (ES) isolation (C) norms (C) time (C) decision making (O) </p>	Space teams	Theoretical	National
Kankanhalli et al., 2006	conflict on team performance in global virtual teams	<p> task and relationship conflict (P) performance (O) </p>	Global virtual teams	Empirical	National
Kealey, 2004	<u>CONTEXT-SPECIFIC:</u> extrapolates findings from sojourners to space context * really calls for more research and intercultural training of astronauts	<p> time (C) isolation (C) miscommunication (P) conflict (P) performance (O) </p>	Space missions	Theoretical	
Watson et al., 1993	heterogeneous team underperform homogeneous team at first, then equalizes	time (C)	Multicultural teams	Empirical	Ethnic
Kokt, 2003	<p> team discussions and social interactions can diminish the alienation in diverse teams * diverse teams had communication/language issues * team leaders should receive training to deal with diverse team members </p>	<p> communication (P) leadership (P) </p>	Multicultural teams	Empirical	Ethnic

Kraft et al., (2003)	interpersonal issues can lead to detrimental effects to team performance * gap in research regarding multicultural crews in space	conflict (P) performance (O)	Space flights	Theoretical	National
Miller et al., 2000	* open style management to increase trust in multicultural teams * sense of humor to diffuse misunderstandings * sincere interest to increase morale	leadership (P) trust (ES) mistundestandings (ES) morale (ES) communication (P)	Multicultural teams	Theoretical	
Mitchell et al., 2011	cultural diversity on knowledge creating capability and collaboration	cognitive heterogeneity (ES) debate (P) knowledge creation (O)	Multicultural teams	Empirical	
Moon, 2013	CQ alleviates the adverse effect of cultural diversity on team performance	time (C)	Multicultural teams	Empirical	National
Nam et al., 2009	cultural diversity and team communication process	communication (P)	Multicultural teams	Empirical	Ethnic
Nouri et al., 2013	task-related theory of cultural diversity on team performance	team performance (O) conflict (P) cooperation (P) stong situation (C)	Multicultural teams	Empirical	National
Palinkas et al., 2004	<u>CONTEXT-SPECIFIC:</u> collectivist cultures were more likely to provide social support, higher mood, and better psychosocial adaptation in space crews	social support (P) mood (ES) psychosocial adaptation (O)	Space simulation	Empirical	Cultural dimension/Nationality

Puck et al., 2006	Did not find an effect of cultural diversity on team communication or knowledge transfer, but significant changes were found in team performance	performance (O)	Multicultural teams	Empirical	Cultural dimensions
Ramthun & Matkin, 2012	moderating role of intercultural competence on culturally diverse teams and shared leadership	shared leadership (P)	Multicultural teams	Theoretical	
Randel & Earley, 2009	org culture relates to similarity among individuals' salience of their team members' diversity characteristics	organizational culture (C) convergence of views (ES)	Multicultural teams	Empirical	
Shachaf, 2008	cultural diversity and information & communication technology on team effectiveness	decision making (O) communication (P)	Virtual teams	Empirical	National
Shapiro et al., 2002	transnational teams and performance	team identity (ES) reaching mutual socio-emotional understanding (ES) withholding performance-effort (P)	Multicultural teams	Theoretical	National
Stahl et al., 2010a	cross-cultural dynamics in teams and underlying processes * diversity as an asset	creativity (O) satisfaction (O) communication effectiveness (P)	Multicultural teams	Theoretical	

Stahl et al., 2010b	meta-analysis of surface- vs deep-level and cross- vs intra-national cultural diversity on team processes	team size (C) team tenure (C) team dispersion (C) task complexity (C) task conflict (P) communication effectiveness (P) social integration (ES) creativity (O) satisfaction (O)	Multicultural teams	Empirical - meta	National and Surface/Deep
Staples & Zhao, 2006	cultural diversity on team effectiveness in SHORT-TERM teams, virtual vs F2F *the reductive capabilities in collaborative technologies can reduce the salience of surface-level diversity	satisfaction (O) cohesion (ES) conflict (P)	Multicultural teams	Empirical	National
Suedfeld et al., 2013	good to understand the context	satisfaction (O) feelings about crewmates and home agencies (ES) personal values (ES) ways of coping with problems (ES) other psychosocial reactions of the mission participants (ES)	Space flights	Empirical	National
Thomas & Doak, 2000	negotiated values systems promote interaction and understanding amongst culturally diverse employees.	organizational culture (C) decision making (O)	Multicultural teams	Empirical	
Tjosvold & Wong, 2004)	conflict resolution in cultural groups to improve teamwork * apply theory of cooperation and competition	innovation (O) conflict management (P) common values,	Multicultural teams	Theoretical	

	through culturain cuning to help using disagreements to innovate	norms, and procedures (C)			
Tröster et al., 2014	theory development should focus on how structural and demographic factors interactively shape important team outcomes	team potency (ES) team performance (O) network centralization (O)	Multicultural teams	Empirical	National
Winkler & Bouncken, 2011		team performance (O) innovation (O) time (C)	Multicultural teams	Empirical	
Yeager & Nafukho, 2011	how diverse individuals become successful team members	performance (O)	Multicultural teams	Theoretical	

The Impact of Culture on Team Outcomes

Prior to presenting the results of the review, it is important to clearly define what we mean by *culture*. In the literature, this construct has been defined as “the collective programming of the mind which distinguishes the members of one category of people from those of another” (Hofstede, 1984, p. 389). With the notion that culture refers to shared experiences that differentiates people from others, nationality is then a common way to categorize individuals as ingroup or outgroup members (Bond & Pyle, 1998; Earley & Mosakowski, 2000; Sutton & Pierce, 2003). Along these lines, national differences can be associated with deeper level categories, such as cognition (Hofstede, 2001). Within the context of space flights, nationality is often an important characteristic that drives behaviors and differentiate crewmembers. Even with the attempt to use a common language, it is still common to find group formation based on nationality of crewmembers (Tafforin, 2013). When investigating cultural differences within and across crewmembers and mission control personnel, research found important national differences as one of the influencing factors (Boyd et al., 2009). Consequently, we will narrow our definition of cultural differences to refer to national boundaries.

Our framework (see Figure 1) is the result of the aforementioned review. Efforts have been made to understand mediators and moderators regarding the negative relationship between cultural diversity and performance (Nouri, Erez, Rockstuhl, Ang, Leshem-Calif, & Rafaeli, 2013), but not to a great extent in the space context. With that being said, this framework is tailored to shed some light regarding cultural diversity amongst crewmembers of LDDEM. The selection of variables was based on the theoretical and/or empirical evidence of the variable of interest, and its relevance to space context. We will now expand on each of these variables to understand how cultural differences can influence important team processes, emergent states, and outcomes.

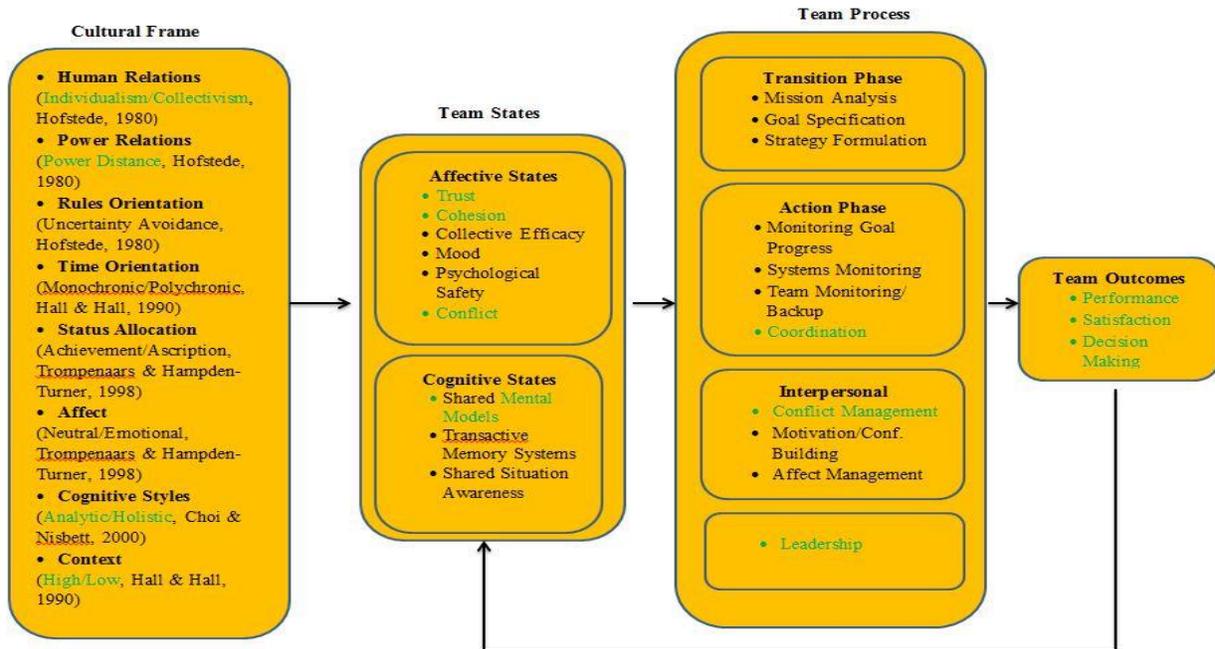


Figure 1. Model of cultural diversity in long distance and long duration space flights

Team Performance

Regarding team outcomes, team performance is one of the most – if not the most – important team-level outcome for organizations; this is not expected to be different for spaceflight. Team performance can be defined as what employees actually do when engaging in collaborative work towards their shared goal (Campbell et al., 1993). In other words, it is the output resulting from the compilation of action and transition processes as well as emergent states (i.e., team-level affect and cognition that influences and is influenced by team behaviors). Even though the perception exists that diversity in teams should be associated with better team performance (Robinson & Dechant, 1997), most research has found cultural diversity to have a negative impact on team performance (e.g., Arman & Adair, 2012; Humes & Reilly, 2007; Kraft, Lyons, Binder, 2003).

Different types of diversity have been shown to influence performance and productivity in a positive manner (e.g., educational and expertise diversity, Hambrick, Cho, & Chen, 1996; ability diversity, Hamilton, Nickerson, & Owan, 2003), but the same is not true for cultural diversity. There is a need to understand how cultural differences influence behaviors and performance in multicultural teams in space (Kealey, 2004). Corley (2011) reports that crewmembers reported

they did not have a lot of conflict during their spaceflight, but when disagreements emerged they were often due to cultural differences. A number of barriers to team performance exist in multicultural teams, such as lack of consensus, miscommunication, and poor management of goals and objectives (Humes & Reilly, 2007). Moreover, collectivism was found to moderate the relationship between collective efficacy and performance such that when collectivism was low collective efficacy was not related to performance (Gibson, 1999).

While research has predominantly shown that cultural diversity leads to lower levels of performance in the short term (Humes & Reilly, 2007; Kraft et al., 2003), it can lead to higher levels of team performance in the long term (Thomas, 1999; Watson, Kumar, & Michaelsen, 1993). Watson et al. found that while heterogeneous teams initially had lower levels of process and performance, later in group development their process was as effective as homogeneous teams. Correspondingly, team performance within heterogeneous teams was comparable to that of homogeneous teams at later points in the team's development, with problem solving performance being higher than homogeneous teams. Also examining the impact of culture on team performance over time is work by Cheng and colleagues. Cheng, Chua, Morris, and Lee (2012) conducted a longitudinal study of multicultural MBA study teams. Results indicated that in the early stages of team development teams with a low average level of uncertainty avoidance and moderate variance performed best. Later in team development the pattern changed with teams with a high average level of relationship orientation and moderate variance performing better than teams with a low average level of relationship orientation.

There have long been calls within research on teams for examining teams longitudinally and the initial findings from Watson et al. (1993) and Cheng et al. (2012) echo this need. Research needs to further examine the interaction and performance of multicultural teams over time as well as the mechanisms which allow them to capitalize on the potential synergy that is created by differences in perspectives.

Satisfaction

Another team outcome that cultural differences are likely to impact is member's satisfaction. Leveraging Judge, Hulin, and Dalal's (2012) definition of job satisfaction, we define team satisfaction as the multidimensional psychological response to the team. More specifically, team members will evaluate (i.e., cognitive component) and have feelings (i.e., affective

component) towards their teammates. This outcome is often linked to commitment, turnover, and organizational citizenship behaviors (Stahl et al., 2010b). A recent meta-analysis has indicated that despite the fact that cultural diversity in teams can lead to task conflict and a lack of social integration it can lead to increases in satisfaction. More recent research suggests that when dealing with multicultural teams operating in contexts of isolation and confinement, such as spaceflight, cultural diversity may have the opposite effect on satisfaction – leading to decrements in satisfaction (Suedfeld et al., 2013).

In the space context, it is common to have a host nation in which majority of members are from. A qualitative review showed that the minority-majority status is likely to influence the satisfaction of astronauts and cosmonauts (Suedfeld et al., 2013). Along these lines, those more culturally heterogeneous crews are likely to have more “guests” than “hosts”. The exposure to different cultures add the component of novelty, which can be beneficial for innovation, but not necessarily for the feelings of fulfilling needs – as defined by Hackman, 1987 –. Crewmembers have to navigate in terrains that are now not as predictable as when they are leading with more homogeneous teammates (Humes & Reilly, 2008). Consequently, cultural diversity has been mainly linked to detriments in satisfaction (Arman & Adair, 2012; Staples & Zhao, 2006).

Adaptation

Different than most team outcomes, adaptation is one that has come up more often than any other team outcome when researching cultural differences in the context of LDDEM. Team adaptation refers to team performance changes or modification in response to cues from the environment (Burke, Stagl, Salas, Pierce, & Kendall, 2006). Cultural differences have been related to causes of accidents on the job, and especially errors within context in which workload and stress are high (Strauch, 2010). Consequently, it is not surprising how important adaptation is for multicultural crewmembers to be ready to perform when unexpected events arise.

Team adaptation is not limited to response of cues that happen externally (e.g., task-related issues), but also interpersonally. It becomes crucial for crewmembers to adapt to different cultural values and perspectives from other individuals in the team. In the context of space flights, differences in values across crewmembers lead to subgroup formation (Sandal et al., 2011). Studies have shown that people can adapt their behavior, especially in regards to communication, to address cultural issues within the team (Anawati & Craig, 2006). However, this is likely to take

additional effort from the crew regarding the execution of their tasks in order to accept and utilize different perspectives. Research from space flights and simulations have found cultural differences to influence critical phases in adaptation over time (Sandal, 2005; Tafforin, 2013a). Tafforin (2013a, b) conducted an ethological study during the Mars-500 experiment (a 520-day experiment) to better understand the adaptation process in an isolated and confined environment over time. The Mars-500 study was designed to simulate a 250 day interplanetary mission from Earth to Mars with a six-person crew whose members were culturally diverse. Results indicated that crews varied their non-verbal behavior across nationalities. Verbal communication was also found to vary as a function of the individual and cultural diversity by the end of the mission. Specifically, the extent to which a crew member was communicating in English, Russian, or both languages varied. In examining how the crew adapted to the isolation and space constraints, Tafforin (2013a, b) identified time, culture, and individual differences as key predictors of adaptation. Furthermore, this culture-adaptation relationship can be better understood when other variables, such as amount of social support and mood levels, are considered. In particular, while national culture and individualist-collectivist orientation impacted adaptation, the effect was exacerbated when individuals felt confused, depressed, anxious, angry and their frequency of social interaction declined (Palinkas et al., 2004). Considering members' orientation is important because individualistic crew members seem to be more likely to adapt when the context is such an isolated and confined environment.

Results outside of the spaceflight context suggest that collectivistic cultures have difficulty adjusting to shifts in team membership (Harrison, McKinnon, Wu, & Chow, 2000). This may be due to the more group-orientated views of collectivistic cultures and focus on relationships. Harrison et al. (2000) also reported that high power distance cultures have difficulty adapting to changes in leadership. Consequently, having some crew members that are collectivistic and high power distance is likely to negatively impact the team adaptation. Knowing the cultural orientation of the members can help in projecting the negative reactions regarding changes in membership and/or leadership. Therefore, focusing on team adaptation drivers –considering the importance within this context– emerges as a main concern for multicultural crew functioning.

Decision Making

Team decision making is another important team outcome that can be impacted by the cultural diversity of the team in complex environments such as LDDEM. Within complex environments decision making must often be a team endeavor as no one individual has either the expertise nor available information to make the types of complex decisions often required. The process of team decision making is one that “involves gathering, processing, integrating, and communicating information in support of arriving at a task-relevant decision” (Cannon-Bowers & Salas, 1993, p. 222). For instance, the discussion of crucial problems and the search for an adequate solution can be executed more efficiently when two or more individuals are coming together to decide in a cohesive manner (Sims, Salas & Burke, 2005).

Research has shown that cultures vary in their preferences for particular cognitive styles (e.g., Choi & Nisbett, 2000; Erez & Earley, 1993; Klein, 2004). Given that decision making is heavily influenced by cognition it is not surprising that differences in cognitive styles can impact team decision making. Differences in cognitive style can impact what is attended to, how information is integrated, the manner in which information is collected, as well as issues related to the time horizon considered. For example, differences in activity orientation have been shown to impact what is attended to in decision making (Klein, 2004). Similarly, differences in power distance may impact the propensity to seek input from lower status members as well as the propensity for lower status individuals to speak up.

Cultures also vary in terms of preferences for analytic/holistic reasoning which impacts the cues sampled and the process by which they make decisions (e.g., how they integrate information). Choi and Nisbett (2000) argue that cultures guided by analytic reasoning sample different types of environmental cues than cultures with a preference for holistic reasoning (dispositional versus situational). Analytic cultures tend to use formal rules and logic in making decisions, whereas holistic cultures tend to rely on dialectical reasoning making little use of formal logic (Choi & Nisbett, 2000). This is similar to the notion of field dependence –field independence whereby members of field independent cultures differentiate between stimuli and follow an analytic approach to decision making (Erez & Earley, 1993). Conversely, field dependent cultures tend to have lower levels of differentiation. This, in turn, may lead to less ability to differentiate environmental cues and fewer cues eliciting attention.

Cultural differences in how time is conceptualized can also impact the time horizons considered in making decisions as well as the weighting of information. For example, cultures with a long-term orientation towards time tend to value perseverance and thrift, whereas cultures with a short-term orientation value a respect for tradition, fulfillment of social obligations, and ‘saving face’ (Hofstede, 2001). Cultures also differ in terms of whether they consider time as segmented into a series of passing events (i.e., sequential orientation), or synchronic with the past, present, and future all considered (Trompenaars & Hampden-Turner, 1998).

While the above highlights a few of the many differences in cognitive styles and cultural orientations that may impact decision making the discussion has been with respect to how differences in culture may impact an individual’s decision making – now let’s turn to how these differences might translate into challenges in team decision making. Hollenbeck and colleagues introduced a multi-level theory of team decision making which while not based on culturally diverse teams can highlight some of the challenges that may come about with regard to team decision making in such contexts (Hollenbeck, Ilgen, Segoe, Hedlund, Major, & Phillips, 1995). While this model is focused on decision making in hierarchical teams where the final decision authority resides within the leader it offers insight into factors which must be considered in integrating individual perspectives and information gathering activities in any team. Specifically, Hollenbeck et al. (1995) identify three core team-level constructs involved in team decision making: team informity, staff validity, and hierarchical sensitivity. For example, hierarchical sensitivity refers to the degree to which the team leader effectively weighs team member input in arriving at a decision (Hollenbeck et al., 1995). There are several cultural preferences which will impact this weighting, including but not limited to the following: power distance, long and short term orientation, the manner in which status is allocated and the types of attributions that are made. The cultural orientation of the leader will impact this process as it will play a role in the status assigned to particular information as well as impacting the weight assigned based on the status. Team informity or “the degree to which the team as a whole is apprised all the relevant cue values associated with the dimensions on which the decisions are based” (Hollenbeck et al., 1995, p. 296) can also be impacted by national culture. Cultural orientation will impact what cues are deemed relevant as well as the search strategy based on preferences for uncertainty avoidance, field dependent/independent thinking, and long/short term orientation. This list is not exhaustive as there are many other cultural orientations which may impact cue search and extraction.

Despite the challenges that cultural diversity presents, culture can shape how crewmembers make decisions and the processes which the team can leverage ideas and make better decisions (van Knippenberg & Schippers, 2007). Maznevski and Peterson (1997) found that multiple points of view can increase the quality of decision making. Similarly, cultural diversity (and the multiple perspectives) has been shown to have a positive effect on decision making (Shachaf, 2008), despite signs of miscommunication. However, more work is needed in this area that not only specifically examines cultural diversity and its impact on team decision making (as opposed to decision making), but is extended to mission-critical contexts such as LDDDEM.

The Impact of Culture on Team Process

Team process has been defined as, “members’ interdependent acts that convert inputs to outcomes through cognitive, verbal, and behavioral activities directed toward organizing taskwork to achieve collective goals” (Marks, Mathieu, & Zaccaro, 2001, p. 357). In an attempt to provide better organization to the dense literature on teams, Marks et al. (2001) produced a team process framework based on the idea that teams perform in “temporal cycles of goal-directed activity, called “episodes” (p. 359). Using this notion they argue that specific team processes are differentially important dependent on the phase of task accomplishment. More specifically, the framework emphasizes two temporal phases – action and transition. Action phases are those “periods of time when teams are engaged in acts that contribute directly to goal accomplishment (i.e., taskwork)” (p. 359). Conversely, transition phases are those “periods of time when teams focus primarily on evaluation and/or planning activities to guide their accomplishment of a team goal or objective” (p. 359). We use this framework as a guide in talking about cultural diversity and team process.

At a high level, diversity amongst team members has been found to significantly influence team process (Watson, BarNir, & Pavur, 2005). This influence on team process is, at least in part, due to differences in mental models regarding team structure and norms for interaction that often exist within culturally diverse teams (Gibson & Zellmer-Bruhn, 2001). Often these expectations (driven by cultural values) remain hidden under the surface until an environmental trigger or misstep causes them to explicitly surface. Below we briefly review how cultural orientations may drive differences in what is attended to within the environment, interpretation of events, and behavioral expectations.

Transition Phase Processes

Mission Analysis. Mission analysis is the “interpretation and evaluation of the team’s mission, including identification of its main tasks as well as the operative environmental conditions and team resources available for mission execution” (Marks, Mathieu, & Zaccaro, 2001, p. 363). While there has been little, if any work, conducted on how cultural diversity in teams might impact mission analysis we can leverage work on cultural orientation and combine it with the operational definition of mission analysis to specify impacts. For example, differences in power distance or the “extent to which a society accepts the fact that power in institutions is distributed unequally” (Hofstede, 1980, p. 45) might be expected to impact mission analysis within teams. First, in high power distance countries mission analysis would most likely be done by the team leader with little input from subordinates. Often those with the most expertise are those who have ‘boots on the ground’ which in many cases are not those individuals with the highest status. Attention to expertise no matter where it may lie is a foundational principle within high reliability organizations where missions are critical and mistakes are costly (Roberts & Bea, 2001). Second, within high power distance cultures members of lower status will not feel comfortable speaking up and offering input. Within multicultural teams, one of the benefits to mission analysis is the ability to take advantage of the multiple perspectives that exist; however, differences in power distance may cause those from high power distance cultures not to speak up. Alternatively if the team leader is from a high power distance culture subordinate input would not be elicited; potentially leading the team to missing key information. Moreover, a leader who goes against cultural expectations in this regard may be seen as having low credibility.

Cultures also differ in terms of analytic/holistic reasoning. Choi and Nisbett (2000) argue that these two reasoning styles differ in terms of the types of cues that are sampled as well as the actual decision making process. Team members who have an analytic orientation tend to use logic and sample dispositional cues. In contrast, holistic reasoning is characterized by little use of formal logic instead relying on dialectical reasoning. Moreover, leveraging the cultural diversity and team’s literature researchers have argued that one’s cultural orientation with respect to uncertainty avoidance, high-low context, and field dependence will also impact mission analysis (Salas, Burke, Wilson-Donnelly, & Burke, 2004). Specifically, Salas et al. (2004) argue that those less comfortable with uncertainty may not sample the same types of cues preferring not to step out of their ‘comfort zone’. Preference for high or low context comes into play as low-context cultures

seek data which emphasize individual as compared to group aspects (Ting-Toomey, 1985). Cultural preferences for past or future orientation (see Hall and Hall, 1990) may also impact mission analysis in weighting the information that is collected. Hence, there is a number of cultural differences that can shape how members approach the mission analysis phase.

Goal Specification. Goal specification can be defined as the, “identification and prioritization of goals and subgoals for mission accomplishment” (Marks et al., 2001, p. 363). As with many of the team processes covered there has not been explicit investigations of how cultural orientation may impact the goal specification process, but leveraging the cross-cultural and team literatures some linkages can be theorized. Differences in time orientation may impact the time horizon that goals are crafted around. While cultural differences with regards to ones orientation to nature (e.g., active-passive, Triandis, 2000; mastery-harmony, Schwartz, 1999) may impact the focus of the goals and the degree to goals are reflective of a learning or mastery orientation. The manner in which cultural orientation may impact the goal specification within teams is an area that needs research as little was found.

Strategy Formulation. Strategy formulation refers to “the development of alternative courses of action for mission accomplishment” (Marks et al., 2001, p.363). Tolerance for uncertainty is a cultural dimension that may impact strategy formulation in a team. Cultures with a low tolerance for uncertainty find uncertainty stressful and therefore try to avoid it. Therefore, team members seek stability by adhering strictly to rules and procedures and are not comfortable with making decisions with incomplete information (Hall & Hall, 1990). Similar to the notion of seeking stability, cultures with a low tolerance for uncertainty value consensus and are uncomfortable with conflict (Lane & DiStefano, 1992). Helmreich and Merritt (1998) argue that team members with a low tolerance for uncertainty feel unsettled until a final decision is reached and may also be less willing to change the decision once made. In terms of strategy formulation variations on this dimension may lead to conflict (Klein, 2004) or negative affect regarding the amount of detail that a plan must have, the willingness to adapt a plan once formulated, and the degree to which there are norms for challenging the status quo (i.e., playing devil’s advocate).

Culture may also impact the degree to which mental simulations are run and contingency plans made during the strategy formulation process. Differences in hypothetical and concrete reasoning might impact the degree to which ‘what if’ing’ is a normal part of strategy formulation (Klein, 2004). More specifically, cultures characterized by hypothetical thinking will be more

predisposed to engage in mental simulation than concrete reasoning. While this will impact the process of strategy formulation it will also likely impact the team's ability to be adaptive as the running of mental simulations allow members' mental models to gain more breadth.

While the cultural orientations mentioned above impact the strategy formulation process, preferences with regard to time horizon will impact the types of plans and goals that are made. For example, Klein (2004) argues that members with a cultural orientation towards a longer time horizon will make plans that consider longer term consequences and goals more than those with a present horizon. When team members vary on this dimension conflict can arise as members with a longer time horizon may see those with shorter time horizons as being short-sited and not seeing the 'big picture'.

Finally, cultural differences with regard to power distance may also impact strategy formulation. Similar to its impact on mission analysis, members whose orientation is low power distance are going to be more willing to offer input as well as accepting input from team members regardless of status during strategy formulation. Members from high power distance cultures will be governed by status differences during the strategy formulation process.

Action Phase Processes

Monitoring Progress Towards Goals. Monitoring progress towards goals has been argued to involve "tracking task and progress toward mission accomplishment, interpreting system information in terms of what needs to be accomplished for goal attainment, and transmitting progress to team members" (Marks et al., 2001, p. 363). Arman and Adair (2012) delineate the manner in which cross-cultural differences in the perception of time may impact interactions within multinational teams. For example, they argue that cultural orientations which view time as a scarce resource would engage in more monitoring progress towards goals. Other dimensions such as tolerance for uncertainty might impact the frequency with which goals are monitored. Cultures that have a low tolerance for uncertainty may be expected to monitor goal progress more frequently to maintain an accurate awareness of the situation and thereby avoid uncertainty to the extent the environment allows.

Systems Monitoring. Systems monitoring refers to, "tracking team resources and environmental conditions as they relate to mission accomplishment, which involves (1) internal systems monitoring (tracking team resources such as personnel, equipment, and other information

that is generated or contained within the team), and (2) environmental monitoring (tracking the environmental conditions relevant to the team” (Marks et al., 2001, p. 363). Similar to monitoring progress towards goals, tolerance for uncertainty and time orientation will impact the frequency within which the system is monitored. Collectivism/individualism as well as field dependence/independence may impact the types of system cues which elicit attention.

Klein (2004) argues that cultural orientation will also impact the speed with which problems are acknowledged. Specifically, a cultural orientation where members are comfortable with uncertainty and possess lower levels of power distance may be slower to acknowledge problems than their counterparts. While lower power distance cultures may be initially slower to react, they will be better able to adapt and recover when communication is lost due to the free flowing nature of such communication. This is especially important with regards to system monitoring as once a problem is identified time is of the utmost importance within mission critical environments.

Team Monitoring and Backup Behavior. Team monitoring and backup refer to those behaviors which involve “assisting team members to perform their tasks” (Marks et al., 2001, p. 363). Backup behavior can occur in several forms, including: providing verbal feedback or assistance, assisting a team member in accomplishing an action, and stepping in to complete a task for a team member (Marks et al., 2001). Unlike many of the other team processes, there has been some research that explicitly examines the impact of culture on those behaviors often included in team monitoring and backup behavior. For example, related to the evaluation component of team monitoring and backup, researchers have found that collectivists evaluate in-group members more positively than do individualists (Gomez, Kirkman, & Shapiro, 2000). Research examining culture and its impact on team monitoring and backup behavior has been focused outside the spaceflight context.

Other research while not explicitly focusing on teams does indicate several cultural dimensions that may impact team monitoring and backup. For example, the provision of verbal feedback or assistance is often included as an aspect of team backup behavior. Related to this, research has shown that differences in the manner in which cultures make attributions can impact feedback structure as well as the willingness to provide and accept feedback. Specifically, in making attributions cultures that adopt a root cause orientation tend to attribute responsibility to the person; whereas, in contrast, cultures with a systems orientation use attributions that are more

context-based (Schweder & Bourne, 1992). Additionally, Klein (2004) argues that team members with a root cause orientation expect and often seek out feedback as they view it as a normal part of the improvement process. In contrast, those with a systems orientation may see feedback as an attack on the individual and not an appraisal of a specific capacity. Klein (2004) argues that differences in these two ways to assign attribution can disturb teamwork in multinational teams.

Power distance is another cultural orientation that may have an impact on team backup behavior. By virtue of the definition of power distance, members with an orientation indicative of low levels of power distance are going to be more willing to accept and offer verbal input and assistance to team members regardless of their status (e.g., rank, age, etc). Conversely, members from high power distance cultures will not seek assistance from lower status members, nor will those lower status members be expected to provide backup behavior to team leaders as the leader is expected to have the answers. Klein, Klein, and Mumaw (2001) provide an example of how power distance can impact team monitoring and backup behavior (see below).

During a flight in China, it became clear that the Captain had a bad altitude director indicator. The First Officer had a good altitude director indicator. Nevertheless, the Captain persisted in using his indicator and crashed the airplane. It would have been unseemly for the Captain to have to depend on the First Officer (p. 12).

Another cultural orientation which has been implicitly argued to be related to aspects of team monitoring and backup behavior is differentiation/dialectical reasoning (see Klein, 2004). Cultures with a preference for dialectical reasoning value different perspectives, evaluate ideas by looking for connections, and tend to avoid conflict (Chu, Spire, & Sueyoshi, 1999). Thereby, team members with this orientation could be expected to avoid delivery of feedback that may be negative or cause conflict. This, in turn, would impact the effectiveness of team monitoring as after identifying an issue with performance they may be less willing to speak up concerning that issue. In contrast, those cultures preferring differentiation sharpen distinctions as they believe that each person has strong and weak areas of performance. Therefore, members of these cultures value frank analysis of performance. Multicultural teams where the cultural distance with respect to the dialectical and differentiation forms of reasoning is large may witness less cohesion due to negative affect caused by these differences.

Coordination. Coordination refers to “orchestrating the sequence and timing of interdependent actions” (Marks et al., 2001, p. 363). There has been limited work conducted on

the manner in which national culture or cultural diversity may impact coordination directly, although most of the differences discussed up to this point could be argued to ultimately impact the ability to coordinate. Within the larger literature on teams, shared mental models (with regard to the equipment, task, team, and team interaction) have been shown to facilitate coordination (Langan-Fox, Anglim, & Wilson, 2004; Rentsch & Woehr, 2004). Within multicultural teams this is not expected to be different. The challenge in multicultural teams is that the differences in values, attitudes, beliefs, and preferences that are reflected in one's cultural orientation often cause the underlying cognition (which forms mental models and shared mental models) to be different among team members. These deep-level differences are often hidden and team members implicit assumptions about how other team members view the team or team processes are often incorrect. These assumptions guide member's mental models regarding interaction and within multicultural teams often lead to lower levels of shared mental models (unless countermeasures are put in place), which in turn, impact coordination. See the later section on culture and shared mental models for a detailed explanation of how culture might impact shared mental models, and thereby coordination. The work of Gibson and Zellmer-Bruhn (2001, 2002) is especially relevant.

Cooperation. While cooperation does not appear as a dimension in the Marks et al. (2001) taxonomy of team processes work was uncovered in this area with respect to culture and teams which argued for its inclusion in the review. There have been several researchers who have argued that teams high in collectivism will behavior more cooperatively than teams high in individualism (e.g., Cox, Lobel, McLeod, 1991; Wade-Benzoni, Okumura, Brett, Moore, Tenbrunsel, & Bazerman, 2002; Eby & Dobbins, 1997). For example, Cox et al. (1991) examined cooperation in teams comprised of individualists (i.e., Anglo-Americans) and mixed teams where the Anglo-American was the minority member (i.e., teams higher in collectivism). He expected, and found, that teams with higher levels of collectivism were more cooperative than the teams comprised of all Anglo-Americans. Results also indicated that after receiving feedback which emphasized cooperative behavior cooperation in mixed teams compared to when no feedback was received. Additionally, after receiving the same feedback Anglo-American groups (i.e., individualistic) did not show an increase in cooperativeness.

Others have argued that cultural diversity will negatively impact cooperation in teams (Dameron & Joffre, 2007). The argument for cultural diversity negatively impacting cooperation can be seen in arguments that state that the degree of cooperation often depends on team members'

similarity in perspectives and values regarding task accomplishment (Argote & McGrath, 1993; Rico et al., 2008). Pulling from outside the cultural diversity literature, arguments have been made that the degree to which team members see other members as similar will impact the degree to which they identify with the team and have the positive affect that, in turn, drives coordination.

Communication. Again while communication processes are not explicitly one of the Marks et al. (2001) categories, perhaps as these processes are intertwined throughout many of the other teamwork processes, it is one of the more often researched aspects of cultural diversity in teams. Several researchers have pointed to the fact that cultural diversity often leads to miscommunication (Adler, 1997; Li, 1999; Humes & Reily, 2008; Kealey, 2004). Berger (1996) argued that some of the major problems in culturally diverse teams include language and norms regarding communication. In conducting research in a spaceflight context, Kealey (2004) states that miscommunication is likely to appear when dealing with communication between multicultural crews and mission controllers. David, Rubino, Keeton, Miller, and Patterson (2011) report the results of a series of investigations which investigated communication onboard the ISS. Results suggest instances where “high power distance and collectivist Russian crew members are apprehensive about participating in large group conversations” (David et al., 2011, p. 11). Differences in direct and indirect communication were also noted as were individual recognition preferences tied to the cultural dimensions of individualism and collectivism. Related to differences in communication style American were found to be much more “straightforward, direct, opinionated, and dominant” (David et al., 2011, p. 16) when interacting with the Russians, and Russians were found to be more agreeable and make eye contact.

In addition, cultural differences will impact communication via the process of information exchange. For example, information exchange has been argued to be slower in multicultural teams due to the increased effort that is needed to calibrate meaning in such contexts (Helmreich, 2000; Cherrie, 1998; Hayes, 1982 as cited in Adler, 1997). With regard to how specific cultural orientations may impact the process of information exchange, Conyne et al. (1999) found that collectivist team members were more likely than individualists to direct communication to the leader. In addition, collectivists were more hesitant to provide information, but when they did speak it was for longer periods of time (Coyne et al. 1999). Communication style has also been found to differ with collectivists preferring an indirect style and individualists having a preference for direct communication (Gudyknust, Matsumoto, Ting-Toomey, Nishida, Kim, & Heyman,

1996). These differences in information exchange related to collectivism could impact getting information to the right person as well as the sharing of relevant information.

Variation in power distance may also impact information exchange. In low power distance cultures norms regarding information exchange are such that anyone is free to contribute ideas and critique others regardless of status. In contrast, information exchange in high power distance cultures is very top-down. These differences in power distance are seen in the following quote obtained within the context of multinational military operations.

A U. S. officer reported, "They won't do anything unless I tell them exactly what to do and how to do it." A man under his command sees it differently, "He is my officer. He must make the decisions. I can't do that". (as cited in Klein, 2004, p., 273).

In high power distance cultures, subordinates may fail to provide information to higher status members unless specifically asked, especially if it is critiquing or questioning the performance of the higher status member. This dynamic can sometimes have detrimental consequences as has been seen in flight crews in aviation (Helmreich, 2000) and other contexts (Ilgen, LePine, & Hollenbeck, 1997).

Uncertainty avoidance may also impact information exchange. Team members from cultures with a low tolerance for uncertainty are uncomfortable with uncertainty. It may be expected that members with such an orientation will be less likely to report or perhaps notice situations that deviate from the plan as these cause anxiety and may be deemed to be threatening to those with a low tolerance for uncertainty (Ilgen et al., 1997). Thus, a culturally diverse team with low levels of cultural distance with respect to having a low tolerance for ambiguity may limit the recognition and/or reporting of cues that may signal a need to adapt (e.g., change behavior). Having a culturally diverse team on this dimension may facilitate the recognition and reporting of such information. Future research needs to be done in this area as differences on this dimension would seem especially important in mission critical environments, such as spaceflight.

Interpersonal Processes

The impact that cultural diversity has on interpersonal processes within teams has been one of the most often studied set of processes. This is especially true when looking at the context of spaceflight as the majority of work that has been done on the impact of national culture on crew performance has examined its impact on interpersonal processes. Utilizing the Marks et al. (2001)

framework as a guide interpersonal processes consist of the following behaviors – conflict management, motivation and confidence building, and affect management.

Conflict Management. Conflict management refers to “...establishing conditions to prevent, control, or guide team conflict before it occurs...[and] working through task and interpersonal disagreements among team members.” (Marks et al., 2001, p. 363). In order to diminish or avoid some of the negative consequences of cultural diversity, teams must engage in conflict management. Conflict management due to cultural differences was noted as an important area for astronaut training (Elias, 2007). Some argue for a preventive conflict management strategy (Smolek et al., 1999), but most conflict researchers focus on categorizing different ways to deal with conflict after disagreements are already in place. Competing, collaborating, avoiding, accommodating, and compromising are common ways to categorize conflict management strategies (Black & Mouton, 1964; Rahim, 1983, 1992). These vary in degree to which they require cooperativeness and assertiveness (see Figure 2 for details).

Conflict management is considered an important team interpersonal process (Marks, Mathieu, & Zaccaro, 2001), and has been positively related to team performance (Porter & Lily, 1996). Teams will develop a certain type of conflict management style over time according to their roles and climate (De Dreu & Beersma, 2005). However, this can become an issue when culture, which is internalized and persistent over time is the main driver of behavior manifestations (Rokeach, 1973). If team members resolve conflict in a different manner, this can often be misinterpreted and escalate the existing tension. Accordingly, Morris and colleagues (1998) showed how cultural differences greatly influence how individuals manage conflict. More specifically, the authors showed Chinese tendencies of relying on avoidance, whereas Americans were more likely to draw from competing conflict management styles. Even though these two types of conflict management strategies are similar in the level of cooperation, they are polar-opposites in regards to levels of assertiveness, which in turn can be a source of more disagreement when the crew is multicultural in nature. It would not be surprising if multicultural crews manifest a variation of conflict management styles, considering how Russians and Americans have a history of discrepancies in core values (e.g., individualism, power distance, paternalism, autonomy, etc.; see Suedfeld et al., 2013, for details). Consequently, it is important to be able to manage the different perspectives and disagreements that will emerge within a multicultural team.

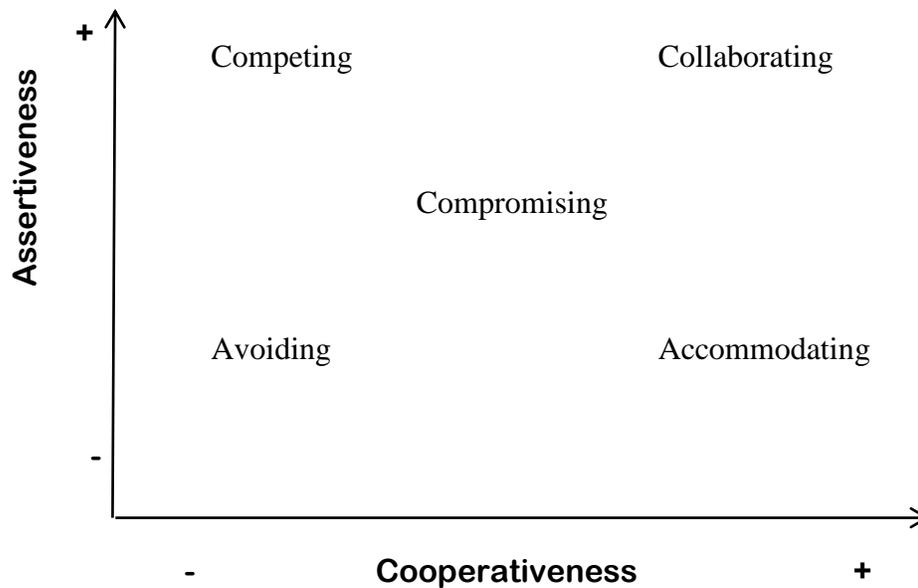


Figure 2. Degree of assertiveness and cooperativeness which characterizes various conflict management styles (adapted from Rahim, 1983)

Motivation and Confidence Building. This interpersonal process involves, “generating and preserving a sense of collective confidence, motivation, and task-based cohesion with regard to mission accomplishment” (Marks et al., 2001, p. 363). While explicit research has not been done with respect to the impact of national culture on motivation and confidence building there are some linkages which can be logically made. For example, cultures vary in the extent to which they possess an achievement or relationship orientation. Klein (2004) argues that these orientations impact the way people approach work and relationships. Leveraging this, it might be expected that those members with an achievement orientation would be motivated by accomplishments and work related activities. Conversely, members with a relationship orientation would be best motivated through a recognition of the importance of interpersonal dynamics and through a nurturing approach where relationships are key.

Within culturally diverse teams there may be a greater need for motivation and confidence building activities due to lower levels of trust and higher levels of reported frustration. Moreover, Arman and Adair (2012) make a theoretical argument that cultures also vary in terms of their

degree of comfort with silence. Cultures where silence is uncomfortable may use motivation and confidence building statements to avoid the silence.

In relation to confidence building with respect to being in teams and the corresponding needed teamwork skills, research has indicated that collectivists are better suited to working in teams than are members from highly individualistic cultures. This, in turn, may lead to members from individualistic cultures needing more motivational coaching to work through difficulties produced by the cultural diversity. It may also be expected that collectivists and individualists have different preferences with regard to the structure of motivational statements and the manner in which they are delivered. Collectivists would be concerned about ‘face’ and framing of the motivational statements would be couched within the context of doing it for the group, whereas individualists would most likely prefer a focus on the individual as compared to the group.

Affect Management. Affect management refers to ‘regulating member emotions during mission accomplishment, including (but not limited to) social cohesion, frustration, and excitement’ (p. 363, Marks et al., 2001). Cultures differ in the degree to which it is acceptable to express affect (neutral-emotional, Trompenaars & Hampden-Turner, 1998) as well as the degree to which instant gratification is acceptable (Erez & Earley, 1993). Therefore, some cultures have a belief system and norms for affect management while others experience much more variability in the expression of affect. When team members have high levels of cultural distance on dimensions related to the expression of affect it may make team members whose cultures have a tendency to suppress affect uncomfortable around those members who freely express affect as well as create tension. Cultures with a Buddhist value whereby self-control and temperance are valued may find affect management much easier than other cultural orientations. It is possible if affect is managed too much members with the opposite cultural orientation may perceive affect management as meaning that fellow team members do not care and have no connection to the team or mission.

Leadership. Team leadership has often been argued to be a primary driver of effective team performance. Moreover, the limited research that has examined team leadership in multicultural teams has reported it as being challenging (Oertig & Buergi, 2006). For example, Humes and Reilly (2008) argue that the dynamics in intercultural teams are often complex and time-consuming due to the potential for misunderstandings, miscommunication, and conflict. Kanas and Ritscher (2005) note the challenge and importance that leadership occupies in the

context of multicultural crews operating in LDDEM. These researchers have argued for more attention and research to be put towards the cultural composition of the team, preference of leadership styles, and distance between leader and other crewmembers' culture (Kanas & Ritsher, 2005). However, research in the context of LDDEM is limited and most work that has been done with respect to leadership and culture is almost exclusively focused on the leadership of individuals and focuses on cultural differences in terms of implicit leadership theories (i.e., each culture's prototype of what an "effective" leader would look like). We briefly report on research that has been conducted on leadership in team settings, followed by the work on implicit leadership theories across culture that is indicative of work conducted by the GLOBE researchers (House, Hanges, Javidan, Dorfman, & Gupta, 2004; Chhokar, Brodbeck, & House, 2007).

Meta-analytic findings reported by Burke, Stagl, Klein, Goodwin, Salas, & Halpin (2006) illustrated the importance of both task and social-related leadership to team effectiveness. However, most of the studies reported in the meta-analysis did not examine leadership in the context of culturally diverse teams. In examining leadership in the context of multicultural teams, researchers have reported that culturally heterogeneous teams emphasized interpersonal leadership to facilitate working through differences in perspectives (Watson, Johnson, & Zgourides, 2002). Conversely, culturally homogeneous teams displayed task related leadership as they were able to immediately begin task related work (Watson et al., 2002). Moreover, once the interpersonal issues were dealt with, culturally diverse teams were able to perform more effectively than the homogeneous teams on a problem solving task. In examining the types of roles that leaders engage in within a spaceflight context (i.e., onboard MIR), Kanas et al. (2007) reported different types of leader roles being important for cohesion depending on whether mission control or the crew was targeted. With respect to the crew it was the social-based leadership behaviors that were related to cohesion, while both task and social-related leadership behaviors were related to cohesion for mission control. The researchers posited that the reason for task-related leadership behaviors not being related to cohesion for the crew was due to the small crew size driving less of a need for task-related leadership.

Prior research has also shown that many cross-cultural differences related to team leadership may impact the performance of multicultural teams. For example, managing relationships and building networks with people have been shown to be key leadership behaviors and proficiency and comfort in doing these actions varies across cultures (House et al., 2004).

Additionally, cultures vary in their orientation towards being and doing (Kirkman & Shapiro, 2001). Kluckhohn and Strodtbeck (1961) argue that cultures with a doing orientation value action while those with a being orientation value reflection and understanding. These differences will drive the management of relationships as well as the mission analysis, planning, goal setting, and strategy formulation processes. Also related to the management of relationships are the results of a study whereby Chinese leaders were reported to value group success over individual member's feeling about participation (Conyne, Wilson, Tang, & Shi, 1999).

The predominant amount of remaining research which examines culture and leadership arises out of the GLOBE project and is grounded in implicit theories of leadership (House et al., 2004; Chhokar et al., 2007). Results suggest that (a) charismatic/value based and team-orientated leadership styles are universally endorsed, (b) humane and participative styles are nearly universally endorsed, and (c) autonomous and self-protective dimensions are culturally contingent. Results also suggest high within-culture agreement in terms of implicit leadership styles (see also Brodbeck et al., 2000).

GLOBE researchers also examined leader attributes and behaviors. In doing so they identified 21 that were universally endorsed as being indicative of effective leadership (e.g., trust, encouraging, motive arouser, communicative, coordinator, and team builder (see also Den Hartog, House, Hanges, & Ruiz-Quintanilla, 1999). Eight attributes were universally viewed as being negative and not contributing to leader effectiveness (e.g., loner, noncooperataive, nonexplicit, dictatorial) and 35 were culturally contingent attributes/behaviors (see House et al., 1999). This work is in line with others who have found evidence that cultures vary in their prototypes of effective leadership (Bass, 1990; Hofstede, 1993; Triandis, 1993; Bass, 1997). In addition, Pillai and Meindl (1998) found that charismatic group leadership was more prevalent in collectivistic cultures and transformational leadership was found to be correlated with member self-efficacy and group potency across cultures (Jung & Yammarino, 2001).

One implication of this work is that “what is expected of leaders, what leaders may or may not do, and the status and influence bestowed upon leaders vary considerably as a result of the cultural forces in the countries or regions in which leaders function” (House et al., 1999, p.178). However, an important point to note is that even if a leadership style is culturally endorsed, that does not imply that the ways the behaviors are enacted across cultures are the same.

Culture and Emergent Team States

The context of confinement for extended periods of time comes along with many unique stressors that are dealt with differently by each person and team (Vessey, 2014). The effects are further complicated by a multicultural crew composition with various perceptions of normalcy (Kanas et al., 2009). Cultural differences can lead to detrimental team outcomes, such as satisfaction and performance, as well as important emergent states throughout the team's life cycle (Sandal, 2005). Emergent states have been defined as “constructs that characterize properties of the team that are typically dynamic in nature and vary as a function of team context, inputs, processes, and outputs (Marks et al., 2001). Accordingly, psychosocial issues derived from cultural differences can influence not only critical phases in adaptation over time, but also the attitudes, values, and tension between crews and mission control (Sandal, 2005). Considering the context of LDDEM space flights, it is important to understand how key attitudes and cognitions may emerge in these circumstances. Specifically, cultural differences have been shown to influence group cohesiveness (Arman & Adair, 2012), trust (Brown, Adams, Famewo, & Karthaus, 2008), attitudes (Boyd et al., 2009), and moods (Kanas et al., 2009). Therefore, we will now further develop the likelihood of emergence of these constructs within multicultural space crews.

Cohesion. Historically, cohesion has been described as how well members of a group feel unified, respect one another, and stick together as a team (Shaw, 1976). Social cohesion helps regulate emotions and has been found to lead to positive team level outcomes (e.g., Beal, Cohen, Burke, & McLendon, 2003). As a long-recognized antecedent to performance, cohesion has been found to lead to increased communication (Shaw, Robbin, & Belser, 1981), reduced conflict (Tekleab, Quigley, & Tesluk, 2009), greater organizational citizenship (Kidwell, Mossholder, & Bennett, 1997), and increased team effectiveness (Carlson, Carlson, Hunter, Vaughn, & George, 2013). Gushin, Efimov, Smirnova et al. (1998) reported that crews became increasingly less cohesive over time with the emergence of subgroups and intra-group tension. Additionally, Kanas and colleagues conducted a series of studies aboard MIR. Kanas, Salnitskiy, Grund et al. (2001) found that American astronauts and mission control reported that interpersonal problems such as disagreements and a feeling of being unsupported by others were a critical area that impacted interaction.

In the multicultural context, Small (2012) found that certain leader behaviors can promote cohesion to increase team performance. In a qualitative ethnographic study of global and

multicultural teams, findings showed that 60% of team members believed their leader lacked 'cultural understanding', leading to cultural insensitivity. This, in turn, relates to resentment stemming from cultural discrimination and negatively effects team productivity and cohesion (Small, 2012).

However, Arman and Adair (2012) suggest that cultural differences in the use and perception of time (e.g., punctuality, pace of life) negatively impact team processes in multicultural teams, leading to decreased cohesiveness. While some research may not have found similar patterns of cohesion within multicultural teams (e.g., Boyd et al., 2009), most report substantial effects of cultural differences on cohesion. Kanas and colleagues (2009) extend this finding to spaceflight crews by noting a negative effect on cohesion due to cultural differences. It is not to say that multicultural crews are unable to become cohesive. After 60 days in a simulation study, multinational aeronautic crews showed a high degree of cohesion when selected based on an interpersonal compatibility test and participated in a team training program (Sandal, Vaernes, & Ursin, 1995). Regardless of the various cultural effects on team cohesion, results consistently suggest that cohesion relates to increased performance, and also highlight the potential effects of dispersion, such as the distribution of a flight crew and mission control. In observing this effect in virtually dispersed teams, Staples and Zhao (2006) found culturally heterogeneous teams to be less cohesive than homogeneous teams, but performed better than their face-to-face counterparts. Stahl and colleagues (2010b) also found evidence that cultural diversity is negatively associated with cohesion, but that dispersion results in less conflict and more cohesion than collocated teams.

Trust. Mayer, Davis, and Schoorman (1995) define trust as 'the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control the other party' (p. 712). Research has shown that trust is critical for team effectiveness in situations that require interdependence among team members (Costa, Roe, & Tailleau, 2001). However, diverse teams have often been found to report lower levels of trust (Suedfeld et al., 2011; Adler, 1997). Some researchers claim that trust depends, in part, on cultural cues (Olson & Olson, 2000). In a study of military personnel in a multicultural context, researchers found that participants initially trusted their teammates more when they were from a similar cultural background (Brown, Adams, Famewo, & Karthaus, 2008). In examining this effect in an ecommerce setting, Olson and Olson (2000) note that Americans and the Japanese are more forthcoming in trusting others than the

French and Chinese; signifying cultural differences in base trust that would likely be a factor in LDDEM missions with a multicultural crew composition.

Within the context of spaceflight, a lack of trust with respect to the ability of the member from the minority culture has been reported. Specifically, while “The comments of majority crewmembers are typically quite positive about their foreign colleagues’ personality and ability to get along with the rest of the crew, but the distrust in their competence within the “home team’s” spacecraft (and/or with the home team’s language) persisted nonetheless” (p. 151, Thagard, 1997 as cited in Suedfeld et al., 2013). This lack of trust has often resulted in the minority member doing menial jobs, not being assigned tasks, and generally being underutilized.

Mood. There have been several studies within the context of spaceflight that have indicated that cultural diversity within crews onboard the ISS, MIR, Shuttle, and corresponding simulations leads to negative affect (e.g., tension, frustration, Kanas, Weiss, & Marmar, 1996; Sandal, 2001; Sandal, 2005; Kanas, 2004). More specifically, reports from spaceflight debriefs and simulations have often reported instances of crew tension, leadership conflicts, and in some cases crew members being ostracized. Furthermore, the displacement of negative feelings to outside supervisors has also been reported as a common occurrence among both spaceflight crews and mission control (Kanas, 2004; Kanas et al., 2007). Kanas et al. (2007) reported that onboard the ISS tension-anxiety, anger-hostility, total mood disturbance, and work pressure was significantly greater for crew members than for mission control. Instances of intra-group tension and crew disintegration were also reported during a Mir space simulation in which crews were isolated for 135 days (see Gushin, Efimov, Smirnova et al., 1998; Gushin, Kholin, Ivanovsky, 1993).

Despite findings that indicate that the cultural diversity within spaceflight crews can lead to tension and negative moods, cultures vary in the degree to which emotional expressivity is acceptable (Kanas et al., 2009). The variation in emotional expressivity may make it even more complex for crew members to handle the stressors and cultural clashes which occur in LDDEM as member mood may not be readily apparent to fellow team members, but may lie festering underneath. Closely related to this are findings by Palinkas et al. (2004) who reported mood differences across cultural groups within spaceflight. Specifically, findings indicated that Americans were more likely to manifest anxiety and fatigue while Russians exhibited decreases in anxiety, depression, and confusion. These differences may, in part, be related to the fact that the Americans were the minority members on the crew and the Russians the majority. As research

has suggested that the ‘guest’ status, which often seen by the minority member on a crew where the majority is from the ‘host’ nation, often leads to considerable frustration and dissatisfaction (Suedfeld et al., 2013).

Conflict. Cultural diversity is often associated with conflict (Adler, 2005; Jehn, Northcraft, & Neale, 1999; Watson, Johnson, & Merritt, 1998). In general, conflict has a distinctively negative connotation and consistent negative relationships with performance (e.g., Peterson & Behfar, 2003; Hinds & Mortensen, 2005; Kankanhalli, Tan, & Wei, 2007). This construct is considered multidimensional, and often broken down into *task conflict* and *relationship conflict* (Jehn, 1995), and sometimes including *process conflict* (Jehn, 1997). *Task conflict* refers to those disagreements that entail peculiarities about the task that is being performed, whereas relationship conflict is solely in reference to interpersonal disagreements that do not pertain to the task. *Process conflict*, along the lines of task conflict, is defined as those disagreements regarding the task, but specifically to how it is being executed.

Unless linked to more creative outcomes (e.g., Farh, Lee, & Farh, 2010; De Dreu, 2006), all types of conflict seem to hinder performance within teams (Behfar, Mannix, Peterson, & Trochim, 2010; De Dreu & Weingart, 2003), especially in nonroutine tasks (Jehn, 1995). Thus, conflict has long been highlighted as a negative feature in teams (Gladstein, 1984; Salas et al., 1992), especially diverse ones (Brickson, 2000; Miliken & Martin, 1996; Pelled, Eisenhardt, & Xin, 1999). Oetzel (1998) reported that collectivist groups have fewer conflicts. Due to the emphasis on maintenance contributions and putting group needs above one’s own need as opposed to the high value that individualists place on task contribution conflict is less common in collectivist teams (Gomez et al., 2000). However, Elron (1997) reported that heterogeneity in top management teams with respect to uncertainty avoidance was positively related to issue-based conflict. More recently, the results of a meta-analytic effort which examined the effects of cultural diversity found that its effect on conflict was dependent on the type of conflict examined. Specifically, Stahl et al. (2010b) reported that cultural diversity had a negative relationship with task conflict, but was not significantly related to relationship conflict.

Within spaceflight cultural factors related to personal hygiene and housekeeping norms have been reported as being responsible for interpersonal conflict before, during, and after Space Shuttle missions. Specifically, debriefs with American astronauts who had flown with

international crew members reported misunderstandings, miscommunication, and interpersonal conflict (Santy, Holland, Looper, & Macondes-North, 1993).

Mental Models. Shared mental models have been consistently argued to be one of the underlying factors that allow teams to coordinate and adapt their actions within mission critical, complex environments (Langan-Fox, Anglim, & Wilson, 2004; Mathieu, Heffner, Goodwin, Salas, & Cannon-Bowers, 2000; Rentsch & Woehr, 2004). Work in this area has been done both within laboratory settings with student teams as well as within military settings. However, work has shown that mental models regarding teams vary by culture; thereby meaning that members come to the table with different expectations regarding team structure, norms, and boundaries. Specifically, Gibson and Zellmer-Bruhn (2001, 2002) report on the findings of an intercultural analysis of the concept of teamwork. These researchers conducted interviews about teamwork with matched samples from six pharmaceutical firms in four different geographic areas (Europe, Southeast Asia, Latin America, and the United States). These interviews were later thematically analyzed for teamwork metaphors (see Gibson & Zellmer-Bruhn, 2001 for description of the process). Results indicated that five teamwork metaphors emerged (family, sports, community, associates, and military). Within each of these metaphors were descriptions of what a team does, who is on the team, and why the team exists. For example, Gibson and Zellmer-Bruhn (2002) found that those who used a sports metaphor to talk about teamwork described teams as having a narrow scope and where activity was limited to physical and social interaction. Roles were expected to be clearly defined with low levels of hierarchy. Team objectives were specific and measurable with clear consequences. Conversely, those using a military metaphor tended to view teams as having a “fairly limited scope, with activity limited to professional, physical and educational activities” (p. 8, Gibson & Zellmer-Bruhn, 2002). Expectations include strong roles which are hierarchical in nature and clear, salient objectives.

Gibson and Zellmer-Bruhn (2002) did not only delineate teamwork metaphors, but investigated the degree to which national culture predicted the use of specific metaphors. For example, results indicated that individuals from individualistic cultures used metaphors that were more narrow in scope (e.g., sports, associate). Conversely, high levels of power distance were related to the use of metaphors with clear objectives (e.g., military). Family and community metaphors were used more predominantly by individuals within collectivistic settings where teams are expected to be broad in scope. Finally, the associate metaphor was used more by those with

an individualistic orientation such that teams were not expected to be broad in scope. This work provides a high level view of how cultural diversity may impact team process and performance as within culturally diverse team members may have different core expectations about what a team's scope, roles, and objectives.

While cultures vary in their cognitive schemas (and corresponding metaphors) for teams we argue that the team processes and emergent states which have been predominantly identified within the team literature generalize across cultures. However, the manner in which they are operationalized (the form they take) may vary across culture. This adds another layer of complexity onto an already complex picture as the manner in which a teamwork process (e.g., backup behavior) may be carried out by someone in the United States may look very different from the way it would occur in Japan or Russia.

The Importance of Context: Moderators

Context is one of the most important components to take into consideration when understanding the impact of culture on performance. Specifically, changing conditions of the context can enhance how teams perform (Guzzo & Dickson, 1996). This is especially relevant as a qualitative review noted that groups often fall short of their potential (Kerr & Tindale, 2004). For example, teams may lead to production blocking, evaluation apprehension, and social loafing during brainstorming sessions. Instead of looking at direct effects, researchers call for the importance in understanding the interactive effect between cultural diversity and contextual components and how they have a multiplicative effect on team outcomes (Joshi & Roh, 2009; Troster, Mehra, & van Knippenberg, 2014). Diversity can even enhance performance, but only under specific conditions (Jackson, Joshi, & Erhardt, 2003; Milliken & Martins, 1996; Stahl et al., 2010b). A meta-analysis showed the relationship between cultural diversity and processes loss or gain is highly dependent on the context, such as team size, team tenure, team dispersion, and task complexity (Stahl et al., 2010b). Therefore, we point out important moderators that are likely to change how cultural diversity relates to team outcomes. These moderators that will be further developed include: norms, isolation, time, and organizational climate.

Norms

The type of norm set is very important because it can ameliorate or hinder the performance of multicultural teams. For instance, an organizational culture that seemed to be positive — to respect others— ended up creating a barrier to team functioning in a culturally diverse context (Randel & Earley, 2009). Norms can be defined as shared assumptions that drive how employees perceive, think, and feel in relation to their organization (Schein, 1985). Since cultural and gender differences have been associated with difficulties in creating a cohesive crew, the formation of a common way to perceive the mission has the potential to hinder these negative effects (Gushkin, Pustynnikova, & Smirnova, 2001). Multicultural crews can hinder cohesion, depending on a common way of perceiving one's social environment (Gushin et al., 2001). Similarly, identifying with one's cultural background is likely to lead to negative team outcomes when diversity is high, but this can be mitigated with a strong sense of belonging to the team (Van der Zee, Atsma, & Brodbeck, 2004). It is common to bring up discussions that can serve as common ground to all crewmembers to facilitate communication (Tafforin, 2013). There is a certain dualism that can be highlighted by bringing to the forefront how teams are culturally diverse, but also homogeneous in regards to having a shared mission (Cousins, Robey, & Zigurs, 2007). Along these lines, the organization's history and traditions shape the context on how diversity is handled (Bond & Pyle, 1998).

Diversity can be beneficial, when the effort is put towards finding the proper cultural diversity composition (Kahane, Longley, & Simmons, 2013). It is known that the cultural composition of the team alone can create a welcoming or closed off environment (Foldy, 2004). Culturally diverse teams are emotionally charged and more conflictual (Brickson, 2000). Consequently, the adherence to organizational norms may not be as smooth as homogeneous teams. A weak situation in which context does not provide many cues on how to respond tends to magnify the cultural differences (Nouri, Erez, Rockstuhl, Ang, Leshem-Calif, & Rafaeli, 2013). When norms are different, it is common for multicultural teams to have hindered trust with each other (Ashleigh & Prichard, 2011). The detriments of cultural differences can be exacerbated when diverse crewmembers have to operate under one national organization (Sandal, 2004). Consequently, a stronger situation that allows for crewmembers to focus on team performance is more desirable for space flights with high cultural diversity.

Organizational Climate

Organizational climate is similar to norms in that by definition it requires a certain level of sharedness, but it differs in that climate is a consequence shaped by those shared assumptions are (Schneider, Ehrhart, & Macey, 2011). Climate concerns the meaning people derive from what they experience, but organizational culture (i.e., norms) is a function of values and beliefs that lead to the creation of what employees experience (Schein, 2000). Organizational climate can be defined as shared policies, practices, and procedures that employees perceive as important to the organization (Schneider et al., 2011). In a more holistic approach, Schoultz and colleagues (2009) suggest looking at climate in a more generic manner to allow for comparisons across organizations. If there is a strong agreement in regards to the perceptions of policies, practices, and procedures, then one can consider the climate to be strong.

The influence of diversity in interactions and performance of long duration, long distance space flight crews is vastly dependent on organizational climate (Sandal, 2007). Even informal practices can shape the organizational culture that signals the marginalization of minorities (Bond & Pyle, 1998). This, in turn, influences the shared perceptions about the organization's support of cultural diversity. Subtle signs, such as the working language, can provide crewmembers with a diminished sense of belonging and even be the source of cultural confrontations (Dameron & Joffre, 2007). Consequently, developing an organizational climate that is strong and positive can encourage individuals to work better together within a multicultural context. Drawing from a common framework can help intercultural interactions in organizations (Thomas & Doak, 2000).

Isolation

The space flights and corresponding analog simulations have a very specific context, in which crewmembers have to live in a confined and isolated space. Specifically, isolation in the context of LDDEM represents the stressor of restricted social contact, hypo-simulation, and low workload (Kanas et al., 2009). The extent to which isolation and lack of privacy can be a stressor can vary by culture (Raybeck, 1991). It is common for minority crewmember(s) to feel isolated and unwelcomed (Suedfeld et al., 2013). It is common to have a member who becomes distant from the rest of the crew, often associated with lower levels of commitment to the project (Kraft et al., 2003). In a multicultural context, where the likelihood of having faultlines is greater, the isolation issue becomes more salient. This type of environment then raises new challenges, and

requires adaptation of current knowledge about intercultural interactions and training (Kealey, 2004).

In order to maximize adaptation of crews in confined spaces, the adequate proportion of individuals that are more task-driven than socially-driven must exist (Helmreich, 1980). Furthermore, intergroup relations and psychological functioning can improve when diversity is experienced in a positive manner (Crisp & Turner, 2010). Different than multicultural teams on Earth, those in space do not have the option to remove the ineffective team member (Kealey, 2004). When dealing with cultural differences, this context does not allow for individuals to just geographically separate themselves from others because they are in a confined environment (Sandal, 2004). This is likely to present new challenges. As aforementioned, cultural diversity is often linked to negative processes, such as conflict, but this effect is likely to be intensified when the context is characterized by monotony and isolation (Kealey, 2004). Culture is likely to influence how crewmembers deal with time pressure, boredom, and workload (Kanas et al., 2009).

Time

Time refers to temporal dimensions of the mission (Tafforin, 2013); the duration (Moon, 2013), or the use and perception of time (Arman & Adair, 2012). Over time, organizational and professional cultures may develop in a heterogeneous manner that requires coping from crewmembers in addition to the national cultural differences (Kanas et al., 2009). It is known that cultural heterogeneity influences team performance over time, especially when members have low cultural intelligence (Moon, 2013), but the lack of longitudinal studies in this area does not allow for a deeper understanding of this phenomenon throughout a LDDEM. The importance of time, when investigating culturally diverse teams, is often underestimated by researchers (Griggs & Louw, 1995). Culturally diverse teams will have a number of challenges up front that more homogeneous teams will not have, such as the different perspectives and experiences that can cloud or hinder the development of shared cognition among crewmembers. Within the context of spaceflight simulations cultural differences and individual characteristics have been shown to have differential effects on performance, specifically adaptation, based on time (Tafforin, 2013).

Culturally homogeneous teams tend to outperform heterogeneous team at first, but this effect can be surpassed over time (Thomas, 1999; Watson et al., 1993). Along these lines, diversity effects diminished over time (Winkler & Bouncken, 2011). It is here where the differentiation

between surface- and deep-level diversity becomes imperative. Surface-level diversity refers to dissimilarities in individual characteristics that are easily observable, such as age, gender, and race. Those less task-relevant diversity categories have been related to affective constructs, such as group member satisfaction, intention to remain, and commitment (Jehn et al., 1999), but this same study showed that demographic diversity was not related to performance. On the other hand, deep-level diversity variables are less readily observable, such as cultural values and personality. Since this takes longer to be identified, research has suggested that they can become more important and often detrimental to team functioning over time (Harrison, Price, Gavin, & Florey, 2002).

Accordingly, research has found time to mediate the relationship between diversity and behaviors (Watson, BarNir, & Pavur, 2005). Over a 15-week period, Caucasians become more prone to being self-oriented, whereas non-Caucasians manifested more team-oriented behaviors. If deep-level values may emerge within couple months, the yearlong missions will definitely trigger the more ingrained values to emerge and potentially create conflict. Within the space flight context, crews perceived themselves as more different regarding values over time (Sandal, Bye, & van de Vijver, 2011). Multicultural crews are then more likely to need monitoring and support to deal with challenges that will emerge along the way (Kealey, 2004). Contrary to the expected in-group and out-group formation amongst crewmembers of different cultural backgrounds, Suedfeld et al. (2013) found trust and friendship within crews even across cultures, but this positive feeling decreased over time.

Conclusion

Throughout this paper, we have integrated key variables to develop an integrative framework to facilitate the understanding of cultural diversity in LDDEM. Previous research from space literature and other literatures (e.g., expatriate, medical, etc.) were reviewed to allow for the extraction of important emergent states, team processes, moderators, and team outcomes. It is important to highlight that many these links have not been studied within the space literature, thus providing a number of avenues for future research that goes beyond what is currently available. Moreover, much of what was found was extrapolating what the cross-cultural literature recognizes as key ways that cultures vary in terms of attitudes, beliefs, preferences, and values and integrating that with what is known about team processes and emergent states. There were very few empirical studies that systematically examined the interaction of the cultural orientation of individual team members and how this impacted teamwork and performance. Finally, cultural diversity while often seen as a challenge can be turned into an advantage. Understanding the impact on important team outcomes can be better understood when moderators are in place, and a better and more optimistic reality may emerge from looking at the phenomenon in a more holistic way. Table 2 highlights several points that should be taken away with respect to the impact of cultural diversity on team outcomes, team processes, emergent states and corresponding moderators that were identified as a result of the review discussed within this section of the report.

Table 2

Take Away Regarding the Effect of Culture and Cultural Diversity on Crew in LDDEM

Related to	How cultural diversity influences it
Team Outcomes	
<i>Performance</i>	<ul style="list-style-type: none"> • Cultural diversity negatively impacts performance through lack of consensus, miscommunication, and poor management of goals and objectives
<i>Satisfaction</i>	<ul style="list-style-type: none"> • Cultural diversity positively impacts satisfaction in most teams, but this has often been associated with detriments in satisfaction for teams in isolated and confined spaces
<i>Adaptation</i>	<ul style="list-style-type: none"> • Individuals from individualistic cultures will have an easier transition in LDDEM context along with shifts in team membership
<i>Decision making</i>	<ul style="list-style-type: none"> • Culture also impacts how crewmembers make decisions and the process which the team can leverage ideas and make better decisions
Team Processes	
<i>Transition</i>	<ul style="list-style-type: none"> • Mission analysis: Within, one of the benefits of multicultural teams is the ability to take advantage of the multiple perspectives that exist, but differences in cultural orientation (e.g., power distance) may cause those not to speak up or approach mission analysis phase differently • Goal specification: Some speculation about the importance of time orientation to this dimension, but little research exist in this area • Strategy formulation: Variations on this dimension may lead to conflict or negative affect regarding the amount of detail that a plan must have as well the willingness to adapt a plan once formulated, and the degree to which there are norms for challenging the status quo
<i>Action</i>	<ul style="list-style-type: none"> • Monitoring progress towards goals: Uncertainty avoidance individuals may exhibit more of this team process, and perceptions of time that differ can lead to conflict in this area • Systems monitoring: Cultural orientation will impact the speed with which problems are acknowledged • Team monitoring: Different than most dimensions, a lot of specific research on this (e.g., collectivists evaluate in-group members more positively than do individualists), including vivid examples within LDDEM context that shows the negative impact of high power distance

- Coordination: The deep-level differences (e.g., differences in mental models) are often hidden and team members implicit assumptions about how other team members view the team or team processes can often be incorrect
 - Cooperation: It occurs more often when teams have collectivistic individuals, but dissimilarities in general seem to be detrimental to this dimension
 - Communication: Several researchers have pointed to the fact that cultural diversity often leads to miscommunication, and this is true in LDDEM spaces due to differences in languages and societal norms
- Interpersonal*
- Conflict management: Cultural differences greatly influence how individuals manage conflict, so it is important to be able to manage the different perspectives and disagreements that will emerge within a multicultural LDDEM team
 - Motivation and confidence building: Within culturally diverse teams there may be a greater need for motivation and confidence building activities due to lower levels of trust and higher levels or reported frustration
 - Affect management: Some cultures have a belief system and norms for affect management while others experience much more variability in the expression of affect
 - Leadership: Culturally heterogeneous teams emphasized interpersonal leadership to facilitate working through differences in perspectives as well as managing relationships and building networks with people to improve key leadership behaviors and proficiency within the multicultural context

Team Emergent States

- Cohesion*
- Multinational crews can face challenges when building cohesion initially, but they can show a high degree of cohesion when selected based on an interpersonal compatibility test and participated in a team training program
- Trust*
- Cultural differences in base trust across nationalities show that would likely be a factor in LDDEM missions with a multicultural crew composition, especially depending on who is part of the “guest” crew
- Mood*
- Cultural diversity can lead to instances of crew tension, leadership conflicts, and in some cases crew members being ostracized
- Conflict*
- Cultural diversity’s effect on conflict is dependent on the type of conflict examined (e.g., spaceflight cultural factors related to personal hygiene and housekeeping norms can be responsible for interpersonal conflict before, during, and after Space Shuttle missions)

- Mental models*
- Culturally diverse team members have different core expectations about what a team's scope, roles, and objectives

Contextual Moderators

- Norms*
- The organization's history and traditions shape the context on how diversity is handled, and a stronger situation that allows for crewmembers to focus on team performance is more desirable for space flights with high cultural diversity

- Organizational climate*
- Subtle signs, such as the working language, can provide crewmembers with a diminished sense of belonging and even be the source of cultural confrontation, thus focus on developing an organizational climate that is strong and positive to encourage individuals to work better together within a multicultural context

- Isolation*
- The extent to which isolation and lack of privacy can be a stressor can vary by culture, but it is common for minority crewmember(s) to feel isolated and unwelcomed

- Time*
- Within the space flight context, crews perceived themselves as more different regarding values over time as well as a decrease in trust and friendship
-

Section II:
Strategies for Mitigating the Negative Effect of Cultural Diversity,
Moving Towards a Synergistic Perspective:
Insight from the Scientific Literature

Purpose

Given the difficulties that cultural diversity can create in teams, there is a need to understand how to facilitate the social and informational integration processes needed to maximize the performance of multicultural space flight crews. It has been argued that those in charge of training have consistently employed rigid and simplistic methods when preparing individuals to interact in multicultural environments (Mendenhall & Oddou, 1985). Although reviews have suggested that cross-cultural competence training is indeed effective (Black & Mendenhall, 1990; Morris & Robie, 2001), the components comprising cultural competence are not agreed upon. Berardo (2005), in a particularly cogent review, explains that while cultural competence at its broadest level simply refers to the patterns and degrees of knowledge, skills, and attitudes necessary for effective intercultural interactions, cultural competence at a practical level is highly context-specific and difficult to define. Calls for consistent theoretical models with respect to the components of cultural competency have existed for over fifteen years (cf., Gudykunst et al., 1996), and efforts are still being directed to this end (Abbe, Gulick, & Herman, 2008; Beach et al., 2005).

Therefore, the purpose of this section of the report is to begin to shed light on the following question, “What methods are used to address team cultural diversity in other industries with analogous populations and environments to long duration spaceflight missions?” To accomplish this task the scientific literature on cross- and multi-cultural training was examined along with the broader literature on cultural diversity in teams, collaborations, and groups as the broader literature often mentioned mitigation strategies that were non-training related (e.g., team composition, socialization). However, there is limited research with respect to mitigation strategies for cultural diversity and its effect on team interaction within spaceflight crews. Where possible we leverage from analogous environments, where this is not possible we report on those strategies that while currently not being used within the context of LDDEM show promise for application in such environments. Prior to presenting our findings, we first present our approach and define a few key terms pertaining to areas that were leveraged. Next we present findings with regard to cross-cultural training (primarily targeted for individuals) followed by other mitigation techniques which have been argued to facilitate interaction within culturally diverse environments at an individual or team level.

Methodology

A systematic review of the scientific literature was conducted to determine methods being used to address the impact of team cultural diversity. In conducting the review, we searched prominent databases to identify the initial set of articles. Databases that were searched include the following: EBSCO Host (e.g., PsychINFO, PsycARTICLES, Business Source Premier, Military and Government Collection, Academic Search Premier), Google Scholar, and NASA databases (e.g., NASA Technical Server). Variations of the following terms were used as keywords during the search: cultur* diversity, cultur*, multinational team*, transnation*, multicultural*, crosscultur*, cross-cultur*, multicultural*, culture* heterogeneity, training, team, collaboration, group, autonomous, long duration, long distance, and exploration mission. Nearly 300 articles, reports, and/or dissertations resulted from this search, which were then carefully reviewed based on relevance. Relevance was determined by the extent to which the articles provided insight into mitigation strategies used to prepare individuals to work in a culture different from their own as well as methods to prepare individuals to work in culturally diverse teams. In conducting the search we did not restrict the review to only training articles because it was felt that while training would be the primary mechanism by which individuals were prepared to work in culturally diverse environments and teams, other mechanisms might exist.

Two Industrial/Organizational Ph.D. students conducted the searches and did an initial review for relevance based on the criteria above and a scan of abstracts. Those articles that passed this first set of criteria were then further reviewed and information was coded independently by the students. In reviewing the articles the following pieces of information were the primary focus of what was extracted: training methods, mitigation strategies, targeted outcomes, and conceptualizations of the cultural training being studied. All of the above was conducted to identify those mitigation strategies that had either been used within a space context or analogous populations or would be expected to extend to LDDEM (e.g., analogous populations). Since research about multicultural teams in space is still in its nascent stage, we often have to draw from other literatures to extrapolate how different training methods could contribute towards mitigating the negative impact of cultural differences.

Cultural Training

Cultural training has traditionally been viewed as a subset of broader diversity training initiatives. While diversity training initiatives tend to address the implications of diversity (e.g., sex, age, gender, area of expertise, religion, etc.) for larger organizational needs and objectives (e.g., competition, customers, products, and marketplace, Ferdman & Brody, 1996), cultural training tends to be more narrowly focused on interacting with other cultures. Despite having a more focused content area than larger diversity initiatives, cultural training programs vary in length, content, format, and methods. Most of the cultural training programs identified do not explicitly focus on training team members for operating within culturally diverse teams, but instead are focused either on preparing individuals to: work with in another culture (e.g., expatriate literature, healthcare) or work with someone from another culture (e.g., general cultural training literature). Very few, if any, programs specifically target training members to work in culturally diverse teams with a focus on what cultural diversity means for interdependent, coordinated action and the development of the coherence (i.e., shared affect, behavior, cognition) which underlies such coordinated action. However, as a basis, much can be leveraged from science of team training and the literature on cross-cultural competence training in terms of training methods, tools, and strategies. Prior to reviewing our findings, we must first provide a brief definition of cultural competence to provide the context of what is being trained.

What is Cultural Competence?

Cultural competence has been defined in a variety of ways – and while these definitions are often highly contextual, there are some fundamental and philosophical distinctions that point toward an overarching definition (though not necessarily a theoretical framework) of cultural competence. Hammer, Bennett, and Wiseman (2003; p.422) consider cultural competence to be “the ability to think and act in interculturally appropriate ways.” Spitzberg (2001; p.375) defines cultural competence as appearing “appropriate and effective in a given context” to culturally different others. Abbe and colleagues (2008, p.2) define it as the basis for achieving “intercultural effectiveness regardless of the particular intersection of cultures.” The underlying message behind all of these definitions of cultural competence is that being culturally competent equates to being effective in different cultural situations. Much like McGrath (1962, p.5) elegantly and simply defined team leadership as getting done “whatever is not being adequately handled for group

needs,” cultural competence may be defined as doing or being whatever is necessary to achieve effectiveness (e.g., organizational, personal, or interpersonal) in a multicultural setting.

And while there is a general consensus that cultural competence refers to effectiveness across cultural boundaries, existing models and frameworks differ in both the manner in which cultural competence is operationalized (see Table 3), the outcomes targeted, and the methodological rigor with which they are examined (Cargile & Giles, 2012). A particularly relevant example for NASA is reflected in the work of Abbe et al. (2008) who developed a cross-cultural competence model grounded in the context of the military. Many military missions have characteristics similar to LDDEM including the isolation and inability to return home when desired. The model not only recognizes the importance of leadership, but it delineates the factors that comprise cross-cultural competence. Specifically, Abbe et al. (2008) argue that cross-cultural competence involves cultural awareness, cross-cultural schema, and cognitive complexity, as well as behaviors such as interpersonal skills, self-regulation, and flexibility. Abbe et al. (2008) also identify a set of affective components such as: empathy, need for closure, attitude, and initiative. Taken together, these components are broader than a trait-based approach and allows for training to increase one’s cultural competence. While the above model represents one view of the components comprising cultural-competence as manifested within the military, many other models exist. Moreover, each model typically maintains some element of divergence from other models, creating a wide of array knowledge, skills, attitudes, and other (KSAO) variables purported to contribute to cultural competence. In order to start reconciling the differences, Berardo (2005) notes that the ability to maintain one’s self-concept and identity is a common theme running across many models of cultural competence (cf., Chen, 1993; Gudykunst, 2004; Kealey & Protheroe, 1996). Note however, that in this definition there is little about interaction requirements for *culturally diverse teams*. Next, we highlight some of the more prevalent mitigation strategies that were found within the literature – most which involve cultural training.

Table 3
Sample Components of Cultural Training Models

Article	Components of the model
Bauce, K. (2014). Cultural competence model	<p>Cultural diversity - one's personal exposure and experience with individuals from different groups</p> <p>Cultural awareness - knowledge of areas that may be a source of differences between and within groups</p> <p>Cultural sensitivity - attitude about oneself and others and a willingness to learn about people from different cultures</p> <p>Cultural competence - a set of behaviors demonstrated in response to cultural diversity, awareness, and sensitivity</p>
Cross, T. L. (1988). Cultural competence continuum	<p>Cultural destructiveness - attitudes, policies, behaviors which are literally destructive to elements of other cultures</p> <p>Cultural incapacity - unintentional and minor "destructiveness," e.g., racism/paternalism, discrimination, fear</p> <p>Cultural blindness - ignoring cultural strengths and differences because "we're all the same"</p> <p>Cultural pre-competence - paying careful attention to the role of culture in the workplace and seeking to make cultural interactions as effective as possible</p> <p>Cultural proficiency - actively trying to get better and ever more effective (e.g., doing research, trying new things)</p>
Cross, T. L., et al. (1989). Towards a culturally competent system of care: A monograph on effective services for minority children who are severely emotionally disturbed.	<p>Value diversity - seeing and respecting its worth (attitudinal)</p> <p>Cultural self-assessment - awareness of personal culture</p> <p>Consciousness of the dynamics of cultural interaction</p> <p>Institutionalization of cultural knowledge - i.e., mandate cultural competence</p> <p>Development of adaptations to diversity</p>

Sue, Arredondo, & McDavis
(1992) Multicultural counseling
competencies and standards: A call
to the profession

Awareness of own culture/assumptions -

aware of their values, cultural strengths and weaknesses, comfortable with differences,
understand how cultural values impact their behaviors

Understanding others' cultural views - able to compare/contrast their views with views of
others, possess specific knowledge about relevant cultural groups, understand how values
impact others' behaviors

Developing appropriate intervention strats - actively adjust and implement culturally
sensitive interventions, show respect for cultural beliefs/values

Campinha-Bacote (2002) Process
of cultural competence

Cultural awareness - awareness of one's own assumptions and biases

Cultural knowledge - process of seeking and obtaining cognitive/declarative knowledge,
understanding others' worldviews, and integrating it with task relevant competencies

Cultural skill - ability to collect culturally and contextually (i.e., nursing) data, such as
cultural/national differences in health and health beliefs/values

Cultural encounters - exactly what it sounds like

Cultural desire - motivation to WANT to engage in cultural interactions, to become culturally
competent in all respects

Office of Minority Health (2001)
Culturally and linguistically
appropriate services in health care

STANDARD 1

Respectful care - "taking into consideration the values, preferences, and expressed needs of
the patient/consumer"

Understandable care - "communicating in the preferred language"

Effective care - "positive outcomes...including satisfaction...and improved health status"

STANDARD 2

Hire and retain a diverse staff

STANDARD 3

Consistently train for cultural competence

- practical effects of cultural differences
- skills training in intercultural communication
- conflict resolution strategies

Hammer, Bennet, & Wiseman
(2003) Measuring intercultural
sensitivity

Denial - self culture is only "real one... others are not seen as different or as vaguely different (e.g., "foreigner")

Defense/reversal - defense implies a sense of threat at cultural differences (us vs. them)... reversal implies a sense of one's own cultural inferiority and adopting other cultures (e.g., "going native")

Minimization - looking and seeing primarily similarities between cultures, looking for universal tendencies and ignoring legitimate cultural differences

Acceptance - understanding and admitting that the world is divided by values, and that holding different values doesn't make them less of people

Adaptation - ability to take the perspective and attributional styles of other cultures, and to use that attitude and understanding to adjust culturally relevant behaviors

Integration - not necessarily situationally better than adaptation, but describes when people lose the sense of monocultural identity and begin to integrate two or more cultural worldviews into their self identity

Cultural diversity - exposure to a wide array of cultures, ethnicities, etc.

Cultural awareness - knowing when and where similarities and differences tend to arise across cultures, as well as an understanding of individual differences vs. cultural overgeneralizations

Cultural sensitivity - attitudes and values regarding the fact that others are different than the self

Cultural competence behaviors - observable outcome of the meshing of the above three foundations of cultural competence into behaviors that are culturally adaptable, sensitive, and effective

Doorenbos et al. (2005)
Psychometric evaluation of the
cultural competence assessment
instrument

Borkan & Neher (1991) A developmental model of ethnosensitivity in family practice training

Fear - specific groups or differences in general

Denial - behaving as if differences do not exist or are unimportant

Superiority - admit to differences, but see one's own culture as generally better (reversal) is a related (but opposite) problem

Minimization - acknowledging differences, but overemphasizing similarities and operating only off of those

Relativism - conceptually acknowledging that cultural differences exist and are valuable, though specific knowledge may be lacking

Empathy - involves taking the perspective of individuals from other cultures and identifying with them... decision-making paralysis is a risk when individual cannot decide the importance of one cultural value over another in a situation, or the course of action to take

Integration - identifying and deeply understanding the values and implications of multiple cultural orientation

What Does the Literature on Cross-Cultural Training Look Like?

Training interventions from organizations often refrain from taking full advantage of sound scientifically-based pedagogical principles and methods and instead focus on fads and a narrow set of tools and methods. The literature on cross-cultural training often falls into this same trap as it has been argued that training has consistently employed rigid and simplistic methods when preparing individuals to interact in cross- or multicultural environments (Mendehall & Oddou, 1985). Unfortunately, there is not a “one size fits all” training intervention that will accommodate both cultural differences and team needs for all people under all conditions (van de Vijver & Breugelmans, 2008).

In order to promote learning, training should come in different forms (Landis & Brislin, 1983). Littrell and colleagues (2006) suggest that an assessment should take place prior to training so that the individual needs of the trainee can be factored into the training. Unfortunately, a meta-analysis showed that only 6% of studies reported any needs assessment prior to training implementation (Arthur, Bennett, Edens, & Bell, 2003). Ultimately, the training should address the needs of the individual while also preparing crew members with the necessary skills to adapt within LDDEM. With that in mind, we highlight training methods and elements used within cultural training programs that have been shown to be important across literatures, and may be applicable in the context of isolated and confined multicultural crews. Table 4 summarizes the different training types, methods, elements, and outcomes.

Table 4
Cultural Training Components

Training types	Methods		Elements				Outcomes		
	Intellectual	Experiential	Information	Demonstration	Practice	Feedback	Affective	Cognitive	Behavioral
• Language training	x		x	x	x	x	x	x	x
• Cultural awareness	x		x	x				x	
• Attribution training	x		x	x			x	x	x
• Interaction training	x	S	x	x	S	x	x	x	S
• Relational ideology	x		x					x	
• Cognitive behavior modification	x		x	x	x			x	x
• Cultural brokering	x	x	x	x	x			x	x
• Culture contrast		x	x	x	x	x		x	
• Cultural sensitizer		x	x		x		x	x	x
• Storytelling*	x		x					x	
• Behavioral modeling*		x	x	x	x	x			x
• Blended learning*	x	x	x	x	x	x	x		x
• Immersive simulation*		x	x	x	x	x	x	x	x

Note. * Strategies not currently being predominantly used, but leveraged from other domains; S= Sometimes.

Training methods

The cultural competence literature does not provide a clear breakdown of training elements that should be included in order to achieve successful outcomes. This is consistent with the lack of agreed upon definition and overarching framework to illustrate what culture competence truly comprises (Bhui, Warfa, Edonya, McKenzie, & Bhugra, 2007). This gap in the literature reflects an area of further research and becomes even more crucial due to research that has shown the impact of training characteristics (e.g., medium, content, interactivity) and emphases (e.g., reactions, learning, transfer, and results) on training effectiveness (Baldwin & Ford, 1984). Hence, there is a need to better understand the mechanisms that can maximize training effectiveness (Black & Mendenhall, 1990; Desphande & Viswesvaran, 1992). It is common to categorize training methods based upon their degree of richness and degree of active learning involved. Within the cross-cultural literature training methods are most often broadly categorized as either intellectual or experiential (Bennett, 1986).

Intellectual methods. While programs do vary along a number of lines, the most common of the training methods is intellectual or didactic training, also known as information training (Celaya & Swift, 2006; Littrell & Salas, 2005). Used by over two thirds of multinational corporations, intellectual training provides trainees with factual information regarding a culture or foreign location (Brewter, 1995; Kealey & Protheroe, 1996). This method provides information, or rote knowledge, as opposed to practice or skill-building, through applications such as lectures, slide presentations, or computer-based instructions. It is a passive method of conveying information about cultural dimensions, tendencies, language, and country specific information, with its ultimate goal being to impart knowledge. Johnson, Lenartowicz, and Apud (2006), for example, suggest that knowledge is more easily transmitted through traditional training techniques than are behaviors and attitudes. Specifically, the authors argue that factual and conceptual knowledge about other cultures can most easily be conveyed through methods such as lectures and readings. Similarly, in their discussion of intercultural learning, Fowler and Blohm (2007) suggest that traditional training (e.g., reading, lecture, video, etc.) is sufficient for the acquisition of knowledge.

While intellectual training content may cover a broad range of topics, key discussion areas typically involve issues related to a culture's working conditions, living conditions, and/or the differences between cultures (Bennett, 1986). Among the most likely techniques for presenting

such information include: information briefings (e.g., casual conversations with those experienced in the culture), formal activities (e.g., classroom-based lectures), and cultural assimilators (Brewster, 1995). Area studies are also utilized in this approach to provide trainees with knowledge about a country's political, economic, or cultural conditions (Kealey & Protheroe, 1996; Morris & Robie, 2001). In this vein, Mendenhall and colleagues (2004) reported that 54% of cultural training programs that were empirically tested were intellectual (i.e., didactic) in nature and focused on a specific cultural region or area. The premise behind intellectual-based programs is that the cognitive knowledge gained through training will serve as a frame of reference to aide in the interpretation of novel cultural situations. Recent research has noted, however, that while intellectual approaches to training are the most commonly used, they are less effective than behavioral oriented approaches in supporting cultural understanding (Calaya & Swift, 2006). In light of this rationale, intellectual training methods training techniques will be most conducive to the development of the cognitive component of cultural competence. In particular, we propose that:

Guideline 1: Use intellectual methods to impart baseline information about cultural differences and expectations.

Experiential methods. Experiential methods (i.e., practice-based) emphasize the “learn by doing” philosophy (Littrell & Salas, 2005). Thus, this training provides individuals with opportunities to practice culture related interactions, similar to those they are likely to face on-the-job when interacting with individuals from a different culture. Within the experiential training methods there often tends to be a particular focus on the development of cross-cultural communication skills (Kealey & Protheroe, 1996; Morris & Robie, 2001). For example, a trainee may role-play various workplace interactions to practice responding in a manner which is culturally acceptable. In addition to role-playing, other common techniques used for experiential learning are intercultural workshops, simulations, and look-see visits (Grove & Torbiörn, 1985; Kealey & Protheroe, 1996; Morris & Robie, 2001). Some of the first training programs to utilize experiential methods include the intercultural sensitizer (Fiedler, Mitchell, & Triandis, 1971) and BaFa BaFa simulation (Shirts, 1977, 1995), but the experiential approach continues to be less frequently used than intellectual methods.

For the behavioral aspect of cultural competence, the literature generally suggests that experiential training methods are most effective. Because behaviors involve actual interactions

with other cultures, it is important for trainees to gain experience engaging in such behaviors within the security of the training environment. Experiential methods allow for key behaviors to be practiced and refined through instructor guidance and feedback. In support of this notion, Harrison and Hopkins (1967) suggest that experiential training is better than traditional methods for training cultural behaviors. Other authors have made similar claims (e.g., Bhawuk & Brislin, 2000). Fowler and Blohm (2007), for example, mention that cross-cultural relationship building behaviors are best trained through experiential techniques. Some have proposed a cultural assimilator in order to increase cultural awareness and sensitivity (Draguns & Harrison, 2011). Thus, on the basis of the extant literature, we expect that experiential training methods will be most effective for developing the behavioral component of cultural competence. In particular, we propose that:

Guideline 2: Use experiential methods to move beyond cultural knowledge to actual behavioral or skill development.

Summary

There is not one method that will work across contexts. In deciding on a method(s) to incorporate into cultural training those responsible for the design of training should keep in mind both the targeted outcome and the cultural orientation of the trainee. For example, crew members from Russia are more likely to be trained by an intellectual method, whereas Americans utilize more hands-on or experiential methods (Ritsher, 2005). Therefore, crew members often have different expectations and corresponding comfort levels with different training methods. When using a method that might not be compatible with their expectations, additional work may be required to illustrate why such a method is being used. Furthermore, it is important to highlight that the decision about training methods should be driven by the outcomes one is aiming to achieve, such that more intellectual methods can be best for cognitive outcomes, whereas experiential methods are best to facilitate behavioral outcomes. Research suggests that different training methods may have different effects on cultural training components. Most integrated training programs should contain intellectual and experiential components, culture-specific and generic content, as well as activities that target attitudinal, behavioral, and cognitive learning (Paige, 1993). A review by Mendenhall and colleagues (2004) indicated that very few programs used a combination of intellectual and experiential methods. Mendenhall et al. (2004) reported lectures, presentations, class discussions, and culture assimilators were the formats most often used for

cultural training within the identified studies. Effective training should use both components (Bennet, 1986; Brislin & Yoshida, 1994; Paige, 1986) and be ready to adapt to the audience when targeting affective, cognitive, and behavioral outcomes (Fowler & Blohm, 2007). Based on these arguments, we urge training to incorporate both intellectual- and experiential-based methods in order to facilitate the learning of cultural competence in a holistic manner.

Training elements

In reviewing the literature on cultural training we not only examined the training methods that were utilized, but also examined the elements included in training and compared these against best practices in training. Information, demonstration, practice, and feedback (IDPF) are the basic four elements of any training program (Salas, Tannenbaum, Kraiger, & Smith-Jentsch, 2012), and we can extrapolate this logic to cultural training in LDDEM. Based on the science of learning, it has been argued that in designing effective training environments care should be taken to ensure that the instructional strategies contained within a program incorporate elements by which: (a) the information or concepts to be learned are presented (i.e., didactic, information-based methods), (b) the KSAs to be learned are presented (i.e., demonstration-based methods), (c) opportunities for guided practice are created (i.e., experiential methods), and (d) constructive criticism during practice is provided to adjust trainees' learning (i.e., feedback). In most circumstance, a number of strategies are appropriate and may be used with all four elements (i.e., information, demonstration, practice-based, and feedback). Often, training strategies combine the information, demonstration, and practice-based elements discussed. In addition, practice needs to offer an opportunity for feedback and suggested remediation.

While the cultural training literature abides by some of the above principles, some appear almost non-existent. As Table 4 shows, less than half of common training types include all four training elements. Important steps of training interventions are often overlooked or at the very least underreported within journal articles (Arthur et al., 2003; Ptak, Cooper, & Brislin, 1995). Even though researchers recognize the growing relevance of cultural training, the use and development of this type of training often lacks strong theoretical grounding (Black & Mendenhall, 1990; Deardorff, 2012; Mesmer-Magnus & Viswesvaran, 2007). Often programs are based primarily on anecdotal examples or information without ensuring that the anecdotes (and corresponding explanation) can be tied back to the theoretical literature. While anecdotes can form a basis for

scenario development as they provide instances of critical events within the domain, trainers should be cognizant of relying on them exclusively without verifying their tie back to the larger scientific literature. In other words, training should take care to focus on real cultural differences (Ptak et al., 1995). Consequently, leveraging the science of training and what is known regarding the variety of training elements available to those charged with training, can maximize the effectiveness of current cultural training. For training complex skills such as the type of skills needed to interact effectively in culturally diverse teams a variety of training elements will need to be included. We next describe each training element in more detail.

Information. The first element, information, provides trainees with essential knowledge. This type of didactic training will promote understanding of the host culture and allow the trainee to develop a framework to evaluate new situations (Littrell & Salas, 2005). Within the space context, David and colleague (2010) point out the importance of ensuring trainees have the appropriate understanding and baseline knowledge regarding optimal teamwork. In addition to teamwork knowledge, it is important to be cognizant of cultural differences. For example, personal hygiene and housekeeping practices are common habits that can vary across cultures (Santy, Holland, Looper, & Marcondes-North, 1993). Another area that cultures vary in with respect to expected norms was noted in the following quote: *“Another [in addition to language barrier] big culture difference is the way you do things. It always totally surprised me [...] I noticed that we are very much on procedures and written down. We [Americans] follow the written procedures, and the Russians were not that way. They did so much verbally.”* (Astronaut, personal communication, June 2014) This is just one example of how being aware of cultural differences ahead of time can mitigate cultural shock and allow time to strategize about how to deal with these situations or ambiguities. Providing information that is culture-specific via meetings with international staff, on-the-job training, lectures, reading assignments, and audio/visual presentations – is positively related to cultural understanding (Celaya & Swift, 2006). While didactic or information-based learning is currently the most used and easiest to implement, it is only a first step and serves to build a foundation for deeper learning. Therefore:

Guideline3: Use information-based elements to build a baseline cultural knowledge where the focus is on cognitive outcomes (e.g., increased knowledge of other partnering cultures).

Demonstration. The second element, demonstration, should aim to model correct behaviors and cognitive processes relevant to cultural competence (Kraut, 1976; Taylor, Russ-Eft, & Chan, 2005). Demonstration training elements aid in learning as they require the use of experiential learning, which is not only more rigorous, but helps the acquisition of cognitive skills needed to make correct attributions (Littrell & Salas, 2005). When trainees successfully create their own attributions, they have an internal cognitive structure that allows them to interpret events and respond in the multicultural context correctly (Morris & Robie, 2001; Littrell et al., 2006), which can aid in learning. Examples of the demonstration element are training initiatives that model communication strategies that are more appropriate within LDDEM (Fischer & Orasanu, 1999). A NASA psychologist provides even more details about using the element of demonstration within NASA training interventions:

We use these [Ship crossing Artic-Manson as a great example of how to do a mission versus Shackleton who went to the South Pole and had to rescue his people] as examples of what a good crew does opposed to a bad one. But you find out that they are very independent.”
(personal communication, April 2014)

In addition to matching the demonstration to situations that the trainees will actually face, this quote shows the importance of illustrating positive and negative examples to allow for the understanding of both desirable and suboptimal behaviors. Based on these arguments, we propose:

Guideline 4: Use demonstration elements to move beyond declarative knowledge to a more complex understanding of cultural differences (cognitive outcome).

Guideline 5: Use demonstration elements to model behavioral skills which facilitate operating in culturally diverse contexts and teams.

Practice. Practice (i.e., “behavioral rehearsal” or “skill practice”), the third element, is important for the transfer of learned content and can go hand-in-hand with the previous element of demonstration (Taylor et al., 2005). According to the power law of practice, repeated execution of a new skill facilitates greater learning (Newell & Rosenbloom, 1981). International trainers consider the practice of cultural skills to be a primary method of preparation (Grahm & Swenson, 2000). The benefit of these approaches is that they directly involve the application of behavior as compared to a mental simulation of that behavior and its application.. Fortunately, with the increasingly widespread use of technology, the customization of training is advancing and trainees can have the opportunity to practice learned skills at their own pace for a reduced cost.

The few studies that have explored cultural differences within space have pointed out communication issues due to value differences (e.g., David, Rubino, Keeton, Miller, & Patterson, 2010). Such pitfalls can be avoided by encouraging everyone to participate, even when certain members may be apprehensive. Insights from a NASA flight controller:

I hope we do a lot of cross-training on the way out. For instance, Russians learning about American systems and vice-versa. If we are smart, we will develop scenarios that force them to work as a team, to change roles such as a Russian being forced to play American commander, etc. Maybe that will help with filling time and a better appreciation of the technical side, as well as better ability to work as a team. (Flight Director, personal communication, April 2014)

Practicing can then allow trainees to immerse in others' culture and have a better understanding about differences, which can yield in attitudinal, cognitive, and behavioral changes. Hence, we propose the following:

***Guideline 6:** Use practice to reinforce lower level cognitive outcomes (e.g., knowledge) and facilitate cognitive, behavioral and attitudinal skill-based outcomes.*

Feedback. Practice is most influential when combined with constructive and task-focused feedback (Cannon & Witherspoon, 2005; Kluger & DeNisi, 1996). Feedback serves to identify needed areas of improvement in a timely manner. Within any method or instructional strategy employed, providing feedback to trainees in a constructive and timely manner is important. Trainers should systematically present feedback to trainees by evaluating performance results, learning measures, reaction measures, and including a behavioral assessment (Luthans & Farner, 2002). Accordingly, feedback is important because it ensures the individual is learning and understanding their role along with the novelties of the context, which in turn, has a positive impact on cognitive and behavioral adjustment outcomes (Caligiuri, Phillips, Lazarova, Tarique, & Bürgi, 2001; Kupka, Everett, & Cathro, 2008). Furthermore, feedback can help trainees target the important skills they should learn (Noe, Sears, & Fullenkamp, 1990).

However, the accuracy, timing, and delivery methods are crucial components to keep in mind (Smith-Jentsch et al., 1998); especially when dealing with members from different cultural backgrounds. Feedback is not equally effective across all cultures (Shipper, Hoffman, & Rotondo, 2007). In regards to the accuracy, Salas, Burke, and Cannon-Bowers (2002) emphasize the need for feedback to be clear, concise, and constructive in order for it to be beneficial. In regards to

timing, pausing videos of the performance episode at the specific times when critical behaviors are (or should have been) performed is a good example of appropriate use of training elements. This allows participants to receive feedback and evaluation ‘in the moment’ (Cant & Cooper, 2011). Fortunately, training occurring within space analogs seems to be following the right steps. More specifically, discussions are happening on a daily basis and the content is more process-driven than outcome-driven. For instance, a station training lead mentioned: “*They [crew members] are discussing this [any issue that emerges] every day, which does not allow these issues to explode because they are tackled as soon as they happen*” (European Space Agency Researcher, personal communication, June 2014). This preemptive element allows crew members to identify with each other as well as providing timely feedback regarding recent team process and performance. In regards to the delivery method, when facilitators take the direct role of sharing observations with the team, they must also be aware of how to deliver feedback in a meaningful and effective way. The way the feedback is given can promote a desirable and safe learning environment (Mort & Donahue, 2004). This in turn can shape how emotions, understanding and skill development are dealt within the training context. Consequently, we the propose that:

Guideline 7: Clear, concise, and constructive feedback should be utilized to ensure proper cognitive structures are developed and facilitate the acquisition of behavioral, attitudinal, and cognitive skill.

Guideline 8: Design feedback with the trainee’s cultural orientation in mind. Cultural orientation will impact the directness, source, and form in which feedback is expected.

Targeted outcomes

The last component that we examined within the literature on cultural training was the outcome(s) that were most commonly targeted. In terms of the targets of cultural training, Mendenhall et al. (2004) reported training outcomes were predominantly characterized as being either knowledge development, changes in behavior or attitudes, adjustment, performance, and trainee satisfaction. Cross-cultural adjustment thus requires the trainee to learn behaviors that are better suited to the new environment. Learning can be defined as a “relatively permanent change in knowledge or skill produced by experience” (Weiss, 1990, p. 172). Using a multidimensional approach, Kraiger, Ford, and Salas (1993) examined learning taxonomies from education and cognitive sciences (e.g., Bloom, 1956; Gagné, 1985) to develop a classification scheme of three

major learning outcomes: cognitive (e.g., verbal knowledge), skill-based (e.g., compilation), and affective (e.g., self-efficacy). Learning illustrates what the trainee can do and should include the three aforementioned components: cognitive, skill-based, and affective (Ford, Kraiger, & Merritt, 2010). Therefore, we highlight the importance of all three dimensions when considering the targeted outcomes of cultural training. However, little is known regarding how cultural training is related to these different outcomes (Budworth & DeGama, 2012). Table 5 summarizes the main targeted outcomes highlighted by Mendenhall and colleagues (2004) as well as the underlying mechanisms that training should focus on to maximize these outcomes. We will now expand on each of these, but with the caveat that cognitive and attitudinal training are often paired with other targets to facilitate desired behavioral change. Desired outcomes include knowledge about different cultures, skills to allow for appropriate interactions, and positive attitudes towards dissimilar others.

Table 5
Sample of Underlying Mechanisms and Targeted Outcomes of Cultural Training

Outcomes	Underlying mechanisms	Examples	Effectiveness (based on Mendenhall et al., 2004)
<u>Cognitive</u>	Shared mental model	<ul style="list-style-type: none"> • Ability to make isomorphic attributions • Awareness of cultural differences between host and home culture 	Mostly effective
<u>Behavioral</u>	Adaptation	<ul style="list-style-type: none"> • Problem solving ability of trainees in intercultural situations • The ability to deal with cross-cultural misunderstandings • Display of cultural sensitivity • Cultural competence 	Occasionally effective
<u>Attitudinal</u>	Trust	<ul style="list-style-type: none"> • Cultural interest • Positive attitude toward members of other cultures • Trainee ethnocentrism • Stereotyping 	Mixed record

Cognitive outcomes. For programs whose goal was to promote cultural knowledge, many focused on increasing accurate analysis about cross-cultural behavior and awareness of cultural differences between home and host culture. Most of those programs (60%) showed significant positive change in knowledge development (Mendenhall et al., 2004). Cognitive outcomes are rarely the only desired outcome of cultural training, but time constraints often make organizations target this over any other outcomes. In other words, change in cognition even if significantly improved does not necessarily lead to attitudinal and behavioral changes alone. When targeting cognitive outcomes, the primary focus is on the way people perceive and think about themselves and others. This includes a focus on how individuals process information about their own group (ingroup) and other groups (outgroups). Consequently, it is common for cultural training to target trainees' ability to make isomorphic attributions and their awareness of cultural differences. However, people differ in the way they perceive behaviors and make attributions (Pekerti, 2005). For example, Asians prefer low abstraction, whereas Americans and northern Europeans prefer moderate to high abstract ways of thinking (Fowler & Blohm, 2004). Therefore, the cultural background of trainees should also be taken into account when targeting cognitive outcomes.

When members of a space flight crew hail from different countries, differences in culture can inhibit the likelihood that members view teamwork and taskwork the same (Gibson & Zellmer-Bruhn, 2001), which can threaten mission performance. Autonomous teams, in which supervision is often low or absent, involve more responsibility and need for collaboration amongst team members. These teams also have prominent cognitive processes that impact their performance. Specifically, shared mental models are an important cognitive construct that have been argued to facilitate implicit coordination within mission critical environments and impact a team process and performance (Langan-Fox, Anglim, & Wilson, 2004; Rentsch & Woehr, 2004). Shared mental models are defined as cognitive representations of a team's task, roles, and resources (Cannon-Bowers, Salas, & Converse, 1993). Shared mental models can enhance coordination and anticipation within teams. Thus, it is important to have accurate shared mental models in autonomous teams. However, the achievement of a shared understanding becomes more complex and difficult when team members' cultures differ. Particularly, heterogeneity in cultural characteristics can influence outcomes by decreasing sharedness (van Knippenberg & Schippers, 2007), lessening levels of cooperation (Chatman & Flynn, 2001), as well as increasing conflict (Jehn, Northcraft, & Neale, 1999; Pelled, Eisenhardt, & Xin, 1999), and creating a rising sense of

isolation (Reynold & Pope, 1991). An extensive review on team mental models has identified team members' characteristics, team interventions, and contextual factors as their antecedents (Mohammed, Ferzandi, & Hamilton, 2010). Knowing that flight crews often have culturally diverse team members, it is important to advance our understanding on potential interventions that could improve their shared cultural understanding.

Guideline 9: Focus on improving the shared mental models in addition to the more traditional cognitive outcomes of cultural competence (e.g., cultural awareness) to maximize the competence of trainees.

Behavioral outcomes. While focusing on behavioral change, Mendenhall et al. (2004) reported that the studies reviewed concentrated on problem solving ability, ability to deal with misunderstandings, display of cultural sensitivity, and cultural competence within cross-cultural settings as examples of behavioral outcomes. A majority of the programs within this category failed to show significant changes in behavior (57%). While Mendenhall and colleagues (2004) suggest that this may be partially due to difficulty in changing behavior through training, we argue that an examination of the methods used to promote behavioral change within the reviewed studies is needed. Given the nature of cultural training literature, primarily intellectual, it may be that the studies reviewed relied more heavily on intellectual methods as opposed to other means. We argue this would be an inappropriate match between method and the target objective of behavioral change. Learning how to actually behave in a new culture and become adjusted to a new set of norms require more than just information. For instance, the trainee should have the motivation to not only learn the material, but also transfer what is learned to the operational context (Noe, 1986). To promote behavioral changes we argue that a combination of intellectual and experiential methods is needed, which will provide trainees with the toolset to practice and get feedback regarding appropriate behaviors.

Based on the assumption that cross-cultural problems arise because those new to cross-cultural situations will have difficulties in managing everyday social encounters, targeting behavioral components seem crucial. As such, adaptation is argued to come in the form of learning the culture specific skills that are needed to make sense of the behavioral actions of others. Team adaptation refers to team performance changes or modification in response to cues from the environment (Burke, Stagl, Salas, Pierce, & Kendall, 2006). Cultural differences have been related to causes of accidents on the job, and especially errors within context in which workload and stress

are high (Strauch, 2010). Consequently, it is not surprising how important adaptation is for multicultural crewmembers to be ready to perform when unexpected events arise. It becomes crucial for crewmembers to adapt to different cultural values and perspectives from other individuals in the team. In the context of spaceflights, differences in values across crewmembers lead to subgroup formation (Sandal, Bye, & van de Vijver, (2011). Studies have shown that people can adapt their behavior, especially in regards to communication, to address cultural issues within the team (Anawati & Craig, 2006). However, this is likely to take additional effort from the crew regarding the execution of their tasks in order to accept and utilize different perspectives. The way people experience cultural diversity has to challenge previously formed stereotypes in order to possibly yield in any positive outcome (Crisp & Turner, 2011), including behavioral outcomes.

Guideline 10: Focus on improving adaptation in addition to the more traditional behavioral outcomes of cultural competence (e.g., cultural sensitivity) to maximize the competence of trainees.

Attitudinal outcomes. Within programs where attitude change was the primary dependent variable, the focus was predominantly on reducing trainee ethnocentrism, stereotyping, and promoting a positive attitude towards members of other cultures (see Mendenhall et al., 2004). Results were again mixed with approximately 45% of programs yielding a significant change in attitudes, while 45% did not reveal a change in attitudes. It seems that the attitudinal outcomes that included some component of cognition (e.g., stereotyping, ethnocentrism) were more likely to be successful than training programs that targeted solely attitudinal outcomes (e.g., cultural sensitivity, attitudes toward host country members, etc.).

The stress and coping approach highlights the affective components of training (cf. Stahl & Caligiuri, 2005). Within this approach, cross-cultural transition is seen as a series of stress provoking life changes that draw on ones' resources and requires coping responses. Differences in cultural background can lead to a variety of manifestations of distress (Boyd, Kanas, Gushin, & Saylor, 2007). Research and training conducted within this approach often focuses on situational and contextual characteristics that may impact cultural adjustment. The attitudinal component of cultural competence can include empathy, charisma, and ability to manage anxiety when there is uncertainty within the context (Gudykunst, 1998). In order to develop empathy, some programs have monolingual participants and new-language learners learning a Piglish language (Hartley &

Lapinsky, 1999). This allows for everyone to understand what learning another language is like and progress through similar obstacles together.

Teams are usually encouraged to engage in open information sharing and participative decision-making by their leaders and through norms and policies that encourage a sense of psychological safety among team members and a culture of open communication. Research has shown that teams that share high levels of unique information are more effective problem-solvers than those who exchange only shared (i.e., common to all members) information (Mesmer-Magnus & DeChurch, 2009). Research has also suggested that emotionally-related concepts such as trust and conflict influence the problem-solving effectiveness of teams (e.g., DeDreu & Weingart, 2003; Zand, 1972). Entire books (cf Ashleigh & Prichard, 2011) have been dedicated to improve trust through training. Fortunately, researchers found trust and friendship within crews even across cultures, but this positive feeling decreased over time (Suedfeld et al., 2011). Even with an overall positive experience, distrust between those from the host or guest country persisted. It is important to draw from literatures that focus on enhancing trust across different others (e.g., virtual teams literature, Jarvenpaa, Knoll, & Leidner, 1998). Additionally, how trust is developed can vary across cultures. For example, “*The Russians don’t tend to put a lot of stock in your position within an organization. What they care about is knowing you personally, and knowing if they can trust what you say because of your personal history with them.*” (Flight Director, personal communication, May 2014). Considering the negative consequences of distrust, the attitudinal outcomes may not be so easily attained when cultural diversity is not addressed properly. Therefore, effort to increase or at least maintain trust across multicultural crew members is extremely important.

Guideline 11: Focus on improving trust amongst team members in addition to traditional attitudinal outcomes of cultural competence (e.g., empathy) to maximize the competence of trainees.

Moving Towards an Integrated Mitigation Framework

While cross-cultural/cultural competence training was perhaps the most often identified intervention, other mitigation techniques were uncovered within the literature. Specifically, the following are some of the mitigation strategies uncovered: interaction training/socialization, application of teamwork metaphors, creation of a superordinate identity, immersive simulation, team debriefing, team composition, and meaningful work. Some of these strategies have been argued to directly mitigate challenges associated with cultural diversity in teams, while others represent overarching models that have shown promise within the team literature and should be able to be extended for use in turning cultural diversity into a synergistic force for the crew. Few of these techniques have been specifically reported in the scientific literature as being used within populations analogous to LDDEM crews.

We next present these techniques within the context of the overarching framework of stress exposure training. Stress exposure training is not a specific, prescriptive, training technique per se, but a model for training coping strategies. In this case the stressor would be the cultural diversity and its' impact on team functioning. In a meta-analysis examining the efficacy of stress exposure training, it was determined that individuals who received such training demonstrated: improved task performance during stressful situations, reductions in anxiety-related behaviors, improved self-efficacy, and often hold high expectations for success (Saunders, Driskell, Johnston, & Salas, 1996). Through gradual approximation of the environment which is found to be stressful, stress exposure training (i.e., SET) seeks to provide familiarity with the stressful environment, build the skills needed to handle the stressors, and build self-efficacy by providing practice opportunities in a scaffolded manner within the stressful situation (Driskell & Johnston, 1998). We next expand on the three stages of this model and how it applies to this context. In addition to SET stages, we highlight how each of these tap into the key training elements (i.e., information, demonstration, practice) as well as techniques that can be used throughout the mission (i.e., feedback and other techniques). Figure 3 illustrates the broader framework and maps the training elements in a temporal manner. When designing cultural training, these are the elements that should be in it in order to produce an integrative training program according to learning theory and maximize the effectiveness of training.

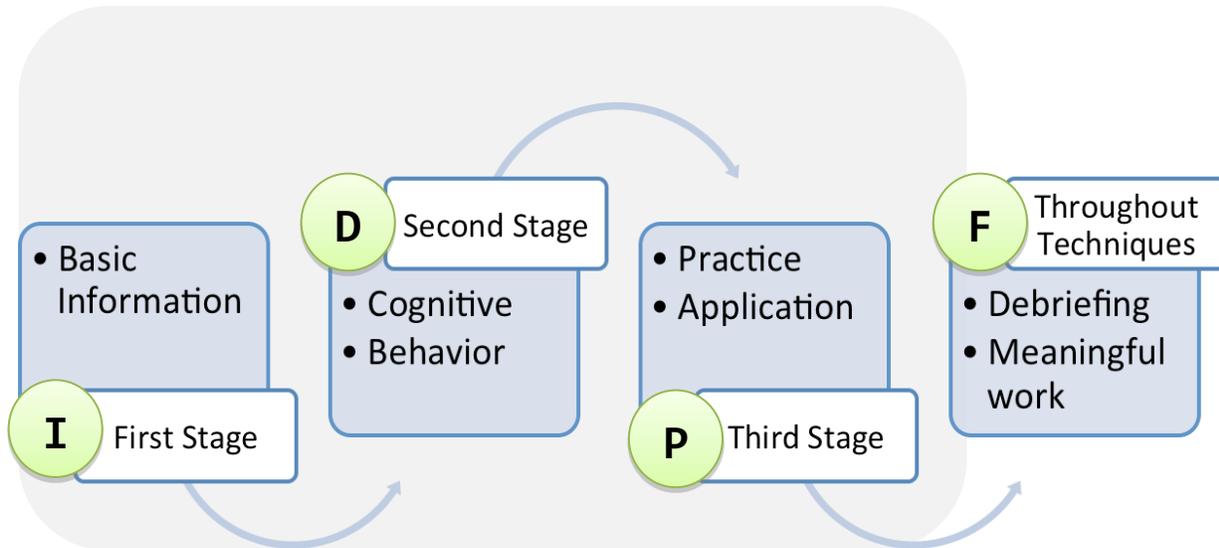


Figure 3. Overarching Cultural Framework to Mitigate Cultural Issues
 Note. I= Information; D=Demonstration; P= Practice; F=Feedback

Laying the groundwork: Information provision

The first stage of stress exposure training is information provision. The primary goal of this stage is to convey declarative knowledge of the stress environment to the trainees. Within the first phase information is provided regarding stress, stress symptoms, and likely stress effects in the performance context (e.g., LDDEM comprised of culturally diverse crews). Information and knowledge gained during this phase serve as preparatory information for trainees prior to being immersed in the actual performance environment and they serve to create an advanced organizer for information learned in later stages. Given the focus on creating an awareness of stressors and their likely impact within the performance environment common techniques involve the use of didactic methods with a primary focus on the informational elements of training. Next, we highlight some of the mitigation strategies that were identified within the literature that could be placed within this first stage.

Informational elements of cultural training programs. Earlier in the manuscript we presented several training techniques that have been used to train cultural competence (see Table 4). Some of the elements of many of these training programs could be fit within this first stage. For example, cultural awareness training focuses on highlighting one’s own cultural orientation such that trainees become aware of their own cultural biases. Cultural awareness training is

primarily didactic and is based on the idea that if one has a greater understanding of their own culture they will be more successful in interacting with other cultures (Bennett, 1986). Similar in its focus, on didactic methods and informational elements used are the initial stages of attribution training. The initial stages of such training are often designed to provide trainees with the knowledge [and skills] to help them understand the behaviors of another culture. The knowledge focus within cultural attribution training closely maps onto the information provision stage within stress exposure training. In essence, the knowledge portions of both cultural awareness training and cultural attribution training serve to provide information on how cultures vary in their attitudes, values, and beliefs – thereby, highlighting the nature of the stressor (cultural diversity) and the manner in which differences may be manifested.

Interaction training and socialization. A second strategy that may be utilized as a mechanism to impart some of the basic knowledge regarding potential stressors and the impact that these stressors have (e.g., cultural diversity, LDDEM contextual characteristics) is interaction training. Most commonly used in training expatriates, this type of cultural training argues that adjustment to a new culture will be most successful when an individual is orientated to the culture by someone who has already been through the experience (Befus, 1988). Correspondingly, the knowledge transmitted in interaction training is most often done through the use of overlap assignments where an incoming expatriate is trained on-the job by an incumbent expatriate prior to departure. In the context of LDDEM missions this might take the form of briefings or informational presentations whereby the experienced individual (crew member who has experienced cultural diversity in the targeted environment) shares knowledge about his experiences and helps the new crew member to orient to the work environment as well as the impact of cultural diversity within the crew. This concept is similar to the right seat rides that are used within military settings.

The goal of this type of training is to quickly promote cultural understanding through the passing of first-hand knowledge and workarounds combined with instances of behavioral modeling via the incumbent. In doing so, it begins to facilitate awareness of existing norms, expectations, and meaning systems (Moreland & Levine, 1982), which can set the precedence for dealing with cultural diversity in space. Portions of this technique fall within the information provision stage of SET in that it provides some baseline information concerning expected stressors and their effects as experienced by the crew member who has already been on a culturally diverse

LDDEM. However, when examined in its entirety, interaction training goes beyond information provision moving towards skill acquisition. Behavioral modeling combined with learning-by-doing facilitates crew members moving into the skill acquisition phase of SET. In essence, behavioral modeling can not only illustrate the impact of cultural diversity, but also what some of the mitigating mechanisms are. This falls in line with Ritscher's (2005) recommendation that crew members have knowledge of cultural differences and their consequences prior to mission deployment.

With that in mind, the socialization period prior to the actual long duration mission can be a good opportunity to engage in interaction training. Additionally, some have suggested analogs, such as NEEMO and NOLS, may be used to allow crew members to get to know each other prior to their main LDDEM (Noe, Dachner, Saxton, & Keeton, 2011). The exposure during socialization can diminish negative outcomes associated with the culture shock that is often initially experienced in culturally diverse crews (Smith, Bond, & Kağıtçıbaşı, 2006). There are a number of socialization tactics that one can engage in, including feedback seeking, relationship building, and behavioral self-management (Griffin et al., 2000). Therefore, we also highlight the importance of socializations as a mitigating technique that should influence and shape future interactions across cultures.

***Guideline 12:** Socialization strategies and interaction training can be used to provide basic knowledge about cultural differences and declarative knowledge pertaining how to minimize the effect of those differences.*

Metaphors. Gibson and Zellmer-Bruhn (2002) point out the importance of understanding that cultures differ in their views of teams and, as such, use different metaphors in talking about teams. The metaphors that are used provide insight into expectations regarding role structure, leadership structure, and team scope/boundaries. Consequently, having a discussion regarding the specific manner in which cultures differ in terms of the metaphors used when speaking of teams and teamwork is another way that knowledge of cultural differences can be provided to team members during the information provision stage of stress exposure training. The process of understanding the metaphors is similar to frame of reference training, which attempts to familiarize individuals with given constructs (Borman, 1991). However, the metaphors can be tailored to highlight the differences in conceptualizations due to cultural differences prior to achieving the goals of having everyone on the same page. The sharing of metaphors across crew members is

likely to increase the common understanding within the team (i.e., shared mental models). The theory behind shared mental models suggests that when team members hold highly similar mental representations of their task and task-related issues, they are better able to anticipate the needs of the group, respond quickly to changes in the environment, and more efficiently develop solutions to problems (Smith-Jentsch et al., 2008). Research has supported the notion that having compatible mental models between team members contributes to effective team processes and overall team performance (e.g., Mathieu et al., 2000; 2005; Marks et al., 2002). Consequently, the reliance on metaphors can help bridge the gap that many multicultural teams are likely to have at first. These gaps in understanding are often based on confusion and misunderstandings concerning those deep level cultural differences which often remain hidden under the surface.

Discussing team metaphors during the information provision stage (i.e., knowledge of the stressor) can be combined with information that alerts the team to signs of triggers that can later cause interpersonal friction (i.e., stress symptoms). Considering the likelihood of culturally diverse members to have divergent metaphors regarding how to do the task and operate as a team (Gibson & Zellmer-Bruhn, 2001), accurate and similar shared mental models is bound to become an initial challenge to LDDEM with multicultural crew members. Hence, we highlight the use of metaphors early in training as one mechanism to promote compatibility in thinking and understanding of team tasks, team processes, and cultural differences.

Guideline 13: Understanding how cultures vary in their use of team metaphors can assist in providing a baseline understanding of expectations regarding team functioning.

Gaining the skills to mitigate stressors: Skill acquisition.

The second stage of training, skill acquisition, focuses on teaching trainees the behavioral and cognitive skills needed to combat the impact of the stressor(s) and providing them with the opportunity for guided practice. The training techniques used within this stage of training will vary depending on the stressor and specific requirements of the task setting. For example, highly interdependent teams might learn the basics skills for fostering implicit cooperation, and teams requiring a high volume of information exchange would learn the fundamentals of closed-loop communication. This stage is aligned with the demonstration training element for targeting the cognitive and behavioral learning. Within multicultural environments members might learn how differences in cultural preferences impact coordinative behavior and the corresponding skills

which can assist in mitigating the challenges. Driskell and Johnston (1998) argue that the types of skills taught in this stage are usually one of two broad categories: (1) those intended to make the trainee more resistant to the stress effects, or (2) others which accept that stress will cause decrements and trainees are provided skills that allow them to compensate for losses in synergy. Below we briefly describe some of the mitigation techniques that were identified within the literature that might best fit within this stage of training. Specifically, we highlight the creation of a superordinate identity, hybrid culture, and cultural perspective taking as potential mitigation techniques that could fall within this phase of training.

Superordinate identity. A common problem that appears in multicultural teams is the formation of subgroups or hypothetical divides (i.e., faultlines; Lau & Murnighan, 1998, 2005). Contrary to this scenario, research has supported the notion that having highly similar mental models between team members contributes to effective team processes and overall team performance (e.g., Mathieu et al., 2000; 2005; Marks et al., 2002). When teams are diverse, many unique perspectives may get in the way of forming a cohesive team identity. The issue of divergent thinking can not only hinder team identity, but also mitigate the possibility of team members holding similar mental representations of their task and task-related issues. Identities become salient when there are obvious differences amongst people (Lewer, 2008). Considering how social identities are multifaceted and people negotiate them in their social relations (Markus & Wurf, 1987; Swann, 1983), it has been shown that subcultures are likely to form because astronauts from different nationalities often have different values, goals, backgrounds, and class membership (Bishop, 2010). It is important, thus, that training focuses on creating a team identity to avoid identification with subgroups across multicultural crew members (Dion, 2004).

Accordingly, when people who represent distinct cultural groups have a sense of identification to an overarching collective or superordinate group (e.g., NASA) favoritism has been shown to extend beyond one's own group to also be inclusive of others (Gaertner & Dovidio, 2000). Distinct in- and outgroups can result in reduced interpersonal liking and social bias towards outgroup members (Gaertner, Mann, Murrell, & Dovidio, 1989), but the sense of a common identity can reverse this, and lead to better team information processing such as knowledge sharing (Kane, Argote, Levine, 2005; Kane, 2012). Along these lines, a station training lead mentioned:

At the beginning of the mission they have a joint mission goal, which is all technical tasks, but they have to [as a multicultural team] do a complete exploration of the cave with a map, photographic report, and design tasks; all this while discussing team processes to

obtain most effective and safe objective. They have to keep this mission goal in mind throughout the mission because everything is centered around it. The technical objective is what they have to achieve while improving their team processes along the way (Researcher European Space Agency, personal communication, June 2014).

In the context of LDDEM, making the differences less salient through the use of commonality (e.g., space culture) can facilitate the interaction across multicultural crew members (Sadal & Manzey, 2009).

Fortunately, there seems to be evidence that diverse teams in isolation may be more likely to foster a third culture than subgroups (David et al., 2010). This emergent culture can help equalize the differences and provide a new set of rules and expectations to follow instead of the national culture that would otherwise crash (see more on this in next section). Another dimension of this issue is minority versus majority status, often referred to the proportion of nationalities within the crew or the relation to the national origin of the station. More specifically, conflict can occur between majority and minority members as well as home and host cultures (Suedfeld et al., 2011). Authors suggest the latter is more of a problem than even cultural differences. Compatibility of values across nations can minimize process loss (Sandal & Manzey, 2009), but it is not always possible. Therefore, focusing on the superordinate identity to bring individuals together is a feasible and desirable approach within LDDEM.

Guideline 14: Teaching leaders how to create a superordinate identify can help to mitigate fault lines caused by cultural diversity.

Hybrid team culture. The creation of a hybrid team culture that reflects a negotiated reality that is reflective of not any one cultural perspective has been argued to be an effective mitigation strategy for cultural differences in teams. Early and Mosakowski (2000) define a hybrid team culture as consisting “of an emergent and simplified set of rules and actions, work capability expectations, and member perceptions that individuals within a team develop, share, and enact after mutual interactions” (p. 27). The notion of a hybrid culture has been argued to be similar to notions of team mental models. While the notion of team mental models have been heavily investigated within the team literature (and shown to be a key contributor to team coordination and performance – Marks et al., 2002; Mathieu et al., 2000; 2005; Mohammed et al., 2010), they have been much less heavily investigated as a mitigation strategy for process decrements seen in culturally diverse teams.

The work of Earley and Mosakowski (2000) is seminal in this regard. Not only do they argue for the importance of a hybrid team culture within culturally diverse teams, but argue that team composition will impact the ease with which a hybrid team culture is formed. Earley and Mosakowski (2000) argue that a hybrid culture will be the most difficult to form in teams of moderate diversity as compared to those in highly diverse teams. In contrast to teams with moderate diversity, in highly diverse teams there are few commonalities thereby fewer bases on which subgroups, social identities, or self-categorization can develop. As a consequence, members will attempt to create a new shared understanding of team norms, requirements, role expectations and coordination requirements. However, the development of such shared norms often does not occur immediately, but takes time (Lau & Murnighan, 1998). The awareness of team metaphors and how they differ by culture may be an initial step towards negotiating such a hybrid culture. While research has not specifically made the link between team metaphors and hybrid team cultures, the awareness of those differences should provide an initial basis for shared mental models to develop within the team. Through team interaction, a hybrid culture and associated norms and expectations regarding teamwork may be achieved. Work by Shokey and Erez (2006) also provides support for the importance of interaction in the formation of hybrid team cultures. Specifically, Shokey and Erez (2006) argue that socialization can assist in the creation of shared meaning in teams. In turn, shared meaning forms the basis for the formation of hybrid cultures. While there has not been much explicit research on how to create such hybrid team cultures, their argued link to shared mental models in teams suggests one avenue through which such hybrid cultures may be negotiated.

Guideline 15: Teaching strategies to facilitate the formation of a hybrid team culture can mitigate fault lines and ease coordination in culturally diverse teams.

Perspective taking/Frameswitching. Building off some of the tenets involved in cultural attribution training is training that focuses on perspective taking. Perspective taking has been defined as “the cognitive process of understanding how another person thinks and feels about the situation and why they are behaving as they are” (Sessa, 1996, p. 105). While the training of perspective taking skills is most commonly seen in the literature on adolescents or negotiation research, there has also been some initial work done on perspective taking skills within the military. In this vein, Rentsch, Gunderson, Goodwin, and Abbe (2007) argue that multicultural perspective taking includes the ability to extract, interpret, and understand cultural information.

Perspective taking has been argued to facilitate intercultural coordination (Mor, Morris, & Joh, 2013), reduce stereotyping, encourage helping behavior and social coordination as well as facilitating the determination of triggers for disagreement (e.g., anticipation of disagreement points, Galinsky, Wang, & Ku, 2008, Sessa, 1996). Furthermore, Sessa (1996) argues that perspective taking will facilitate an understanding of the other person or team member in conflict situations.

Rentsch et al. (2007) developed a framework for multicultural perspective taking within the military. The framework argues for a set of three skills that are fundamental and form the foundation for perspective taking: self-awareness, interpersonal skills, and regional expertise. Each of these three competencies are further broken down into their subcomponents. Specifically, self-awareness consists of knowledge of one's own culture and associated biases as well as the ability to regulate emotion. Interpersonal skills such as critical thinking, communication, and relationship building are also fundamental. Finally, regional expertise (knowledge of religion and language, knowledge of similarities and differences between regional and own cultures) is needed to facilitate understanding. While Rentsch et al. (2007) identify the fundamental skills that must exist for perspective taking, they go further to identify a set of advanced skills. The set of advanced skills that are identified are not advanced in the sense that they must be taught after the fundamental skills, but Rentsch and colleagues (2007) argue that this advanced set of competencies allow the real time extraction, evaluation, and interpretation of cultural information. This set of competencies include: extraction skills (ability to: suspend judgment, elicit and detect cultural information, identify patterns and triangulate information), interpretation skills (ability to integrate and assign meaning, ability to visualize, ability to cognitively reconstruct), and the development of a cultural schema (understanding of cultural impact, cultural identifiers, cultural barriers). The framework delineated by Rentsch and colleagues (2007) provides an initial basis to examine the types of competencies that might be needed in order for crew members to engage in perspective taking in LDDEM given the mission critical environments of both the military and long duration spaceflight. The exact manner in which the components of perspective taking are trained will be dependent on the particular competency and subcomponent one is focusing on; however we would expect training to incorporate experiential methods with elements of information, demonstration, practice, and feedback due to the complex nature of this skill.

Guideline 16: Use perspective taking to facilitate intercultural coordination and reduce stereotyping.

Gradual approximation of stress environment: Application and practice.

During the final stage of training, the skills learned in first and second stages are then applied and practiced. Once a behavior or thought is modeled, the trainee should practice the skills to ensure that the information is easily recognized and instilled (Halpern, 1998). Trainees use what they have learned in conditions that gradually take on qualities of the stressful task environment. This strategy maximizes the use of training methods and elements to provide trainees with the tools to deal with stress. Often, individuals that go abroad do not fully adapt or understand other cultures until they are immersed within that culture. Therefore, we highlight immersion strategies to allow for practice of learned skills and team debriefing to ensure timely learning.

Immersive simulation. Immersive simulation can be used as a means to acquire and apply knowledge, skills, and affect in a relevant setting. Simulation is increasingly being used within training contexts. When designed correctly, simulation allows educators and trainers to expose trainees to situations that may be critical, but infrequently occurring in the natural world or that may be too dangerous to practice in the actual environment. For instance, healthcare is drawing more from simulations to mimic real-life patient scenarios without putting someone's life at risk (Rosen et al., 2008). Within the realm of cultural training, it allows trainees to practice skills related to cultural flexibility without the often political and social repercussions that might happen from an ineffective display of these behaviors and attitudes within the actual environment. NASA has already started to draw from such techniques, and benefits identified include: (1) the highlight of themes and features about the given culture(s), (2) the amount of scenarios that can be maximized to counteract the novel scenarios that may appear in reality, (3) the flexibility and potential to customize scenarios allows for an easier adaptation to the space context, and (4) it can draw from both cultural specific and general scenarios (Draguns & Harrison, 2011). These are all good practical ways to improve attitude, cognition, and behaviors towards culturally dissimilar others.

While research has begun to suggest that simulation can be a useful training tool (Tannenbaum & Yukl, 1992), it is only a tool and only effective to the degree to which it is designed and used appropriately. Salas and Burke (2002) have identified several features that must be included to make simulation effective for training. The following is a list of some of these features that must be embedded: instructional features, carefully crafted scenarios, opportunities for assessing and

diagnosing performance, guided learning experiences and levels of fidelity which match training requirements. In addition, the development of such simulations for cultural training must reflect a partnership between subject matter and learning specialists. This is in line with our call to integrate culture, teamwork, and space literature to improve the adaptive performance of multicultural crew members.

Guideline 17: Immersive simulation can be used to provide systematic opportunities to practice skills related to cultural competence at the individual and team-level.

The event-based approach to training (EBAT) is an overarching methodology that has been used in designing immersive simulation within military and aviation contexts which relies on the features argued for by Salas and Burke (2002). This approach to training is one where learning objectives are identified a priori and then trigger events are systematically inserted within training exercises (see Salas, Fowlkes, Stout, Milanovich, & Prince, 1999; Smith-Jentsch, Zeisig, Acton, McPherson, 1998; Jentsch, Abbott, & Bowers, 1999). These trigger events provide known opportunities to observe behaviors that have been targeted for training while maintaining the illusion of a free flowing, non-scripted scenario. The strength of this approach lies in the systematic link between training objectives, exercise design, performance assessment, and the use of historical performance data, to focus training on the objectives and produce standardized training opportunities. EBAT represents a generic methodology that can be applied to train many types of skills. While this approach is not widely seen in relation to cross-cultural training, its use has been argued for within that training domain by those studying teams (see Salas, Burke, Wilson-Donnelly, & Fowlkes, 2004). For those in charge of its development, it is important to note that scenario development is labor intensive and requires the cooperation of subject matter experts. However, it provides a systematic methodology for designing training that reduces the burden on the person responsible for skill evaluation as they do not have to watch all of team interaction, but focus solely on ‘trigger points’ within the scenario.

Guideline 18: Event-based training methods can be used to systematically devise training and measurement instruments to prepare members to operate in culturally diverse teams.

Team debriefing. A number of practitioners and scientists have invested in understanding techniques, such as debriefing, to improve teamwork through the enhancement of team mental models and other crucial team processes and outcomes (Smith-Jentsch, Cannon-Bowers, Tannenbaum, & Salas, 2008). More specifically, debriefing can be defined as the discussion

regarding an experience with the purpose to learn from it (Lederman, 1992). Objectives of debriefing include clarifying questions, reinforcing learning outcomes, and releasing any tension from exercise (Fritzsche, Leonard, Boscia, & Anderson, 2004). It generally ranges from five to seven phases, but mostly include some variation of an introduction, explaining objectives, sharing individual's reactions regarding an event or the process, examining the reasons things played out a certain way, and discussing the lessons learned about what should have happened (Adler, Castro, McGurk, 2009).

Even though this technique started in the military context with performance critiques (Miller, 2004; Rall, Manser, & Howard, 2009), and later called after action review (Gardner, 2013), adaptations have allowed the debriefing technique to go from military to healthcare and other contexts (e.g., Sawyer & Derring, 2013). Accordingly, a meta-analysis on debriefing called for more research targeted at specific populations (Mitchell, Sakraida, & Kameg, 2003). It is then applicable and meaningful to bring this technique to the context of LDDEM to address cultural and teamwork issues. Providing accurate feedback can improve performance by over 20% (Tannenbaum & Cerasoli, 2012); however, providing debriefing and feedback alone is not enough to ensure effective performance if these are not well thought-out (Gardner, 2013).

Some have pointed to debriefing as the most important component of training, and the consequences of inefficient debriefing can be detrimental to individual and team outcomes (Rall, Manser, & Howard, 2009). This highlights the importance of properly developing a debriefing session. Focusing on solving problems as they emerge is the most recommended approach (Mitchell et al., 2003). This technique is known to bring people together by bringing similar events to the forefront even when they belong to heterogeneous groups (Miller, 2004). Diverse individuals that may feel dissimilar from others can now have a greater sense of belonging with crew members due to shared experiences. Along these lines, Watson, Kumar, and Michaelsen (1993) found that diverse teams improved over time, but this could be maximized when topics are discussed on a daily-based. In our operational analysis, a station training lead from the European Space Agency mentioned the importance of the daily interactive debriefings instead of letting frictions and other potential for conflict build.

While this technique is currently housed within the application and practice component of SET, team debriefing can (and should) also occur outside the training environment (Hackman & Wageman, 2005). Specifically, research has recommended that team debriefing should happen during the transition phases of team performance. In examining team debriefs with respect to

mitigating the impact of cultural diversity on team process, states, and performance, we must mention guided team self-correction (Smith-Jentsch et al., 2008). This strategy takes advantage of a team's natural desire to review its own performance (e.g., the talk around the bar after the game). As used within the military this technique has been used to facilitate debriefing about key team processes. Prior to the mission the key dimensions are described to the team, then after the mission (or during a transition phase) a facilitator guides the team in a debrief wherein the team is actively involved and does most of the talking. Within the debrief, the facilitator first recaps key events in the mission to trigger member recall. Next, the facilitator goes through each teamwork dimension that members were told about prior to the mission and asks for concrete examples of effective and ineffective from the team (based on the performance segment just completed). The facilitator also facilitates a discussion regarding how to improve on those areas in which the team is weak. This strategy has been shown to be effective within military environments and is beginning to be used within spaceflight environments. The key is a specific close tie to teamwork dimensions, which are important in the domain. Additionally, the facilitator should not monopolize the discussion – the discussion should be primarily team lead. While this strategy has not specifically been used to mitigate decrements in team interaction caused by cultural diversity its applicability is clear. In the current context, the focus would be on those teamwork behaviors most important to LDDEM. Team self-correction would provide one way to begin to work through decrements caused by cultural diversity by allowing members to confront challenges and discuss how to improve before problems become impact operations.

Guideline 19: Team debriefing strategies (e.g., team self-correction) should be used in conjunction with training opportunities where practice is involved (e.g., immersive simulation) as well as within the mission itself.

Moving Beyond Training: Leveraging Design Opportunities

In thinking about training techniques, there is often a focus on what can be done pre-mission, during mission, and post mission – cultural training is no different. The predominant number of techniques that have been highlighted above deal with setting the stage and training that can be done pre-mission. However, in examining the scientific literature for mitigation strategies to combat the potential loss of synergy often created by cultural diversity there were a few other identified techniques/strategies that are applicable across a larger spectrum than pre-mission. We highlight two such techniques next –the presence of meaningful work and team composition. We note that the

presence of meaningful work was not explicitly identified as a way to reduce the process loss which sometimes occurs within culturally diverse teams. However, its importance in LDDEM and the consistency with which it was mentioned in operational interviews caused us to go back and examine theoretical links to it as a possible mitigation strategy.

Meaningful work. Crew members must feel they are doing meaningful work to avoid boredom and unnecessary conflict. Hardship seems to bring people together, whereas monotony is likely to do the opposite for multicultural crews in LDDEM (Kealey, 2004). Considering the vast down time that crew members will have on journey to and from Mars, it is important to design engaging tasks to avoid lessening of commitment. This lessening of commitment can further be manifested in decreased effort to work through conflict caused by cultural diversity and negative affect manifesting more easily. Even though astronauts may already have a certain level of meaningfulness in what they do (i.e., intrinsic caring about work tasks, Chen et al., 2007), higher levels of meaning of work is related to resilience when facing challenges as well as better quality of life. Most of research on meaningful work is associated with autonomy, which astronauts on their way to Mars will have plenty. However, the differences in the nature of the work and level of autonomy within long duration exploration missions may require higher levels of adaptability and a desire to extend greater effort in modifying behavior due to the variation from work conducted while on the ground. . A station training lead mentioned:

First thing that occurs to me is procrastination (no sense of urgency). You go from 110% in multiple years to a loading level that is productive at a 20%. Even if you know you have to land this vehicle, that you should brush up in your geology, there is no way you did not get a lot of training on this already. Why go through another 40 run today when I can do this next month? (personal communication, May 2014).

Such statement calls for more attention towards what astronauts will be doing during their mission and how to avoid boredom.

One way in which time can be filled is with ongoing cultural training. Focusing on general principals instead of going through every single scenario possible is crucial (Noe et al., 2011). As a NASA flight director pointed out “*For long duration missions, our ability to anticipate and write a procedure for every possible scenario is going to be limited.*” (personal communication, May 2014). Consequently, the selection of key scenarios that serve as foundation for cultural competence in a multicultural team are more desirable and practical than trying to lay out every possible scenario that

one may encounter. In addition to scenario, preventative conflict management strategies can be designed. It can be defined as the reduction or control of the nature of conflict before it occurs (Lingard et al., 2004). For example, creating a standard operating procedure which has shown to reduce negative teamwork behaviors can one mechanism through which conflict is reduced (Smolek et al., 1999). Furthermore, effective conflict management behaviors are positively related to team performance (Porter & Lilly, 1996). It is important to consider social motivation, the structure of the group (e.g., majority-minority), and the negotiation process being used (Velden, Beersma, & De Dreu, 2007). Better decisions can be made when members are prosocially motivated. Therefore, we urge training designers to thoroughly investigate intrinsic motives and the meaning of work during LDDDEM to maximize outcomes.

Guideline 20: Design tasks to ensure the meaningfulness of the work to diminish the negative impact of cultural diversity on team outcomes.

Team composition. Perhaps one of the first questions that is often asked with regards to cultural diversity in teams is whether there is a ‘right mix’. While there is not yet a definitive answer to that question, recent work within the cultural diversity literature has begun to highlight this issue. Work by Harrison and Klein (2007) argue for three primary ways in which teams can be diverse (i.e., separation, variety, and disparity). Knowledge of the type of diversity is important because it has a differential impact on team outcomes as well as the form that team composition would take to minimize or maximize diversity (Harrison & Klein, 2007). Of most relevance to the investigation of team composition issues related to cultural diversity is diversity as viewed as separation. Harrison and Klein (2007) define separation as the “composition of differences in (lateral) position or opinion among unit members, primarily of value, belief, or attitude; disagreement or opposition” (p. 1203). Moreover, Harrison and Klein (2007) argue that this type of diversity is maximized with a bimodal distribution whereby half of the team members are at the high endpoints and the remaining half at the low endpoints. The result is reduced cohesiveness, less trust, and more interpersonal conflict. To minimize the effect of such diversity, Harrison and Klein (2007) would argue for a team composition whereby “all members of a unit occupy the same position at any location along the continuum” (p. 1203). See Figure 4 for a graphic representation of how teams can be comprised based on separation to create minimal, moderate, and high levels of diversity perceptions.

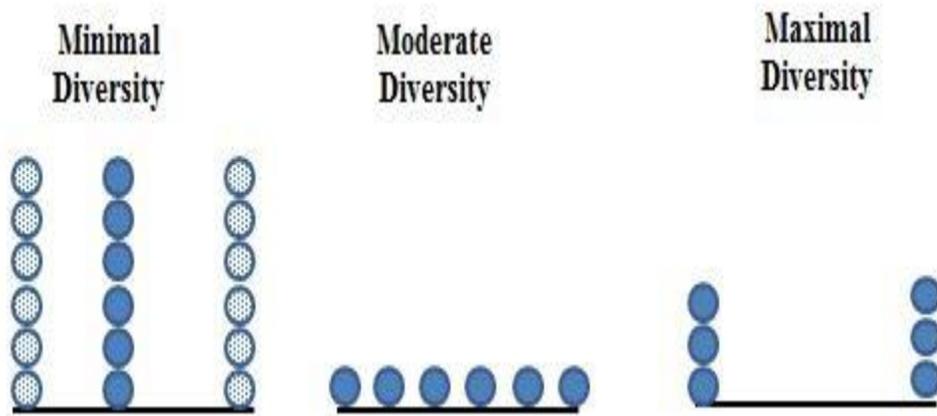


Figure 4. Separation Viewed as Amount of Diversity (Harrison & Klein, 2007)

While Harrison and Klein (2007) focus on the type of diversity category that is being discussed, research by Cheng and colleagues (2012) focuses on composition as it relates to specific cultural dimensions. Results of a longitudinal study of self-managing multicultural teams indicated that in the initial stages of team development teams having a low average level of uncertainty avoidance (with moderate variance) performed best. However, four months into team development teams that had a high average level of relationship orientation (moderate variance) performed best. This initial research suggests that there may not be a single right answer when it comes to team composition with respect to cultural diversity.

Conclusion

Cultural diversity has been a hallmark of spaceflight missions since the early 70s. While there has been limited work within the spaceflight context that focuses on the impact of cultural diversity, especially from a team perspective, there is a wide body of work outside of spaceflight to leverage. Included in this wider literature are a myriad of techniques that have been used to prepare individuals to work within cultures other than their own. In this vein, a search of the scientific literature revealed a number of programs targeted at training different components of cultural competence. An analysis of the methods, elements, and outcomes focused upon within identified programs revealed that training programs primarily focus on changing cognitive outcomes such as increased knowledge of one's own cultural bias' and knowledge of differences amongst cultures. This is closely followed by programs that target behavioral outcomes. Specifically, programs that seek to provide trainees with the skills to help them to understand the behaviors of another culture and make attributions similar to members of the other culture (e.g., attribution training, training perspective taking skills, interaction training). Finally, a smaller number of programs were identified that focused on affective outcomes.

While the literature would suggest that cultural diversity training is, in general, effective room for improvement and extension exists. Specifically, the predominant amount of training does not focus on preparing individuals or teams to work in culturally diverse teams nor does it fully capitalize on the science of training. Additionally, little was specifically identified with regards to cultural training for isolated, confined environments. Beyond training other mitigation techniques were also found that should be further investigated with regards to their use within LDDEM. These techniques include such things as: the creation of superordinate identity, hybrid team cultures, socialization, use and understanding of team metaphors, composing the team to minimize faultlines, debriefs, stress-exposure training, and event-based training.

Section III:
An Operational Perspective on Cultural Diversity in
LDDEM Crews

Purpose

The unique nature of spaceflight and corresponding long duration exploration missions (e.g., isolation, confinement, danger, elite position and spotlight, workload variation, etc.) drives the question as to whether cultural diversity within spaceflight crews has the same impact on team performance as what has been reported within the wider literature on cross-cultural teams and cross-cultural diversity. However, there has been limited research conducted on cultural diversity within long duration spaceflight. Therefore, the purpose of this section of the report is to detail the process and results of an operational assessment which examined the relationship between cultural diversity and team performance in spaceflight and long duration exploration missions by conducting a series of interviews with NASA personnel. Additionally, we sought to gather information on potential mitigation strategies for any negative impact of cultural diversity within spaceflight crews. The information extracted from our subject matter expert (SME) interviews will be used to develop a better understanding of the challenges that are expected to exist with respect to culture on long duration missions as well as potential mitigation strategies. Although long-duration missions such as a possible mission to Mars are not clearly defined at this point, we speculate based on what is known to date regarding task characteristics that are likely to differ.

Methodology

Sample

The sample consisted of ten subject matter experts from the National Aeronautics Space Administration (NASA) who had experience with long duration missions of at least 3 months. There was a mixture of male and female interviewees. The sample was both ethnically and culturally diverse.

The rank, tenure, and type of spaceflight experience of the participants varied. Participant expertise ranged from that of astronaut, flight director, CAPCOM, flight surgeon, flight psychologist, and members of the flight analog project team. Additionally, we were fortunate enough to obtain two perspectives from those outside of NASA – one from the European Space Agency and one from a psychologist within the Institute for Biomedical Problems in Russia.

Interviewees were selected based on their long duration spaceflight experience, their potential to provide a diverse perspective, and their availability. All participants were informed of

the purpose of the study, notified of any risks and benefits associated with their participation, and were asked to provide informed consent. Further, all participants were treated in accordance with the guidelines set forth by the University of Central Florida's Institutional Review Board for the Protection of Human Subjects and with those set forth by NASA's Committee for the Protection of Human Subjects.

Procedure

Interviews were conducted over the phone with researchers at the University of Central Florida and Michigan State University. Total interview time for each interviewee was 1 hour with 30 minutes devoted to the topic of culture (Burke, PI) and 30 minutes to the topic of motivation (Morgeson, PI). The ordering of topics (culture first, motivation first) was counterbalanced across participants. Semi-structured interviews were conducted from April 2014 – August 2014. During the interviews, the primary interviewer for that topic asked a series of open-ended questions designed to elicit information regarding the participants' experiences during long-duration spaceflight missions (or long duration analogs), namely the expected impact of national culture on the ability of spaceflight crews to work together effectively within long duration missions and how (and if) this might change as NASA moves towards longer duration missions (i.e., Mars).

Transcription and Coding

Audio from the interviews were not recorded, but instead a graduate student at UCF sat in on each interview and transcribed in real time capturing as much detail as possible. Transcriptions were later content analyzed for themes pertaining to the following: (1) the impact that culture had on crew interaction, (2) mitigation strategies to overcome cultural differences, (3) how the impact and potential mitigation strategies might change as NASA moves towards longer duration missions such as those to Mars. In thematically analyzing the interview content we primarily used a bottom-up approach whereby we let the data guide the themes that emerged. However, once we had an initial set of themes, we then went back and examined them in the context of prior work on cultural dimensions to assist in providing explanations of the cultural dimensions involved. In doing so we leveraged a review of the cross-cultural literature conducted by Salas, Burke, Wilson-Donnelly, and Fowlkes (2004). Salas et al. (2004) produced an integrative framework which grouped cultural dimensions into nine higher order categories

according to whether they reflected values, attitudes, or behaviors concerning human relations, power distribution, rule of behavior, orientation to time, rules for status ascription, expression of affect, orientation to nature, cognitive style, and norms for communication.

What Was Uncovered with Respect to Cultural Differences?

While the results of our operational assessment revealed that "... cultural differences can be very, very big" (Astronaut Interview, June 2014), they also revealed that "at the person to person level, astronaut to astronaut, we get along really well" (Flight Director Interview, May 2014). So this begs the question as to what those cultural differences are and how at the person to person level they are overcome. From an operational perspective our interviews highlighted several cultural differences that are often apparent in spaceflight crews, which, in turn, could impact crew interaction. Cultural differences highlighted include: views regarding gender and status, communication preferences, expectations regarding leadership, management structure and degree of autonomy afforded to crews, variability in the openness about personal matters (especially health related), status allocation, and ways of earning trust and respect. We next briefly discuss some of the cultural differences that were mentioned and tie them to crew interaction (see Table 6 for several take away points based on the operational assessment).

Allocation of Status

One of the themes that came out of the interviews was that the cultures that operate in space exploration missions with the United States have different beliefs regarding how status is gained and maintained. Tying this back to the larger literature on cross-cultural dimensions, crew members differ in the degree to which they believe status is dictated by ascription or achievement (e.g., see Parsons & Shils, 1951; Trompenaars & Hampden-Turner, 1998). Specifically, the cross-cultural literature argues that ascriptive cultures judge individuals and therefore assign status by personal characteristics and attributes, whereas achievement cultures judge individuals by their actions and performance (Parsons & Shils, 1951). Within the spaceflight context, this difference was mentioned in the context of the degree to which women struggled with being judged as equals. The following are some quotes illustrative of this difference.

One instance where this different view of gender and the status it ascribes was seen was an incident where a very accomplished female astronaut from the United States went to Star City in preparation for MIR 18. Upon arriving at Star City, she was definitely viewed as inferior to all the other cosmonauts because she was a woman and one of the cosmonauts made it very clear that he didn't want to fly with women, they shouldn't be flying, that they can't do the same thing. (Former Deputy Director of Operations in Russia, personal communication, 2014)

Some female astronauts have reported being offended by the attitude and lack of respect provided by the Russians and it's almost always due to the Russian culture. (Flight Surgeon, personal communication, May 2014)

While it was noted that the view of females being of unequal status as compared to males, at least initially, is beginning to change with the younger cosmonauts where the view remains it may cause challenges for interaction. From a socioemotional perspective it could cause decrements in cohesion, negative affect, and at the most extreme the potential of Russian cosmonauts not being as willing to follow (when need be) or put stock in the expertise brought forth by crew members of the opposite gender.

Another difference related to the allocation of status deals with attributions regarding the amount of time that someone has been in a position. Data extracted from the operational interviews highlighted that within the United States if someone stays in a position for more than two years the implication is that you are stagnated. However, *"Russians get in a position and do it for their entire life. Their goal is to become the nationally renowned expert in that"* (Flight Director Interview, personal communication, May 2014). The implication of this cultural difference for the team manifested itself in trust development. *"...what they care about is knowing you personally, and knowing if they can trust what you say because of your personal history with them"* (Flight Director Interview, personal communication, May 2014). Given the cultural expectations regarding 'job tenure', this translated to:

...when they [Russians] finally figure out that you were okay and trustworthy and knew what you were talking about, then they could do business with you. Then you got promoted out of

your job and a new person has to start all over with them. (Flight Director, personal communication, May 2014)

The cultural difference noted above regarding job tenure was highlighted in discussing interaction between ground control centers. This may be less of an issue with the astronaut core given the amount of time they spend together in training prior to the actual mission. This affords them the opportunity to build ‘personal knowledge’ prior to interacting in spaceflight. This is not necessarily the case with respect to the various ground control operations.

Management Structure

Closely related to the allocation of status were cultural differences noted with respect to management structure and how much autonomy was afforded to the crew. Within the United States it was reported that “*people at lower levels are the ones who have information to feed to management and management gives them the authority to implement*” (Former Deputy Director of Operations in Russia, personal communication, May 2014). This is in stark contrast to the degree of autonomy that is afforded to Russian cosmonauts. In Russia it is “*top down*” (Former Deputy Director of Operations in Russia, personal communication, May 2014). Another interviewee recalled a visit to Star City where there was a poster on the wall in the chief flight director’s office

...it had a picture of two hands with strings attached like puppets going down to a spacecraft below, indicating that they were the control center. And one of the American astronauts took great offense to that and told me about it later that he thought it was terrible because the way that Russians view that the ground is in charge and the crews are subordinate and our astronauts don’t really view it that way. So that was one big cultural difference. (Flight Director, personal communication, May 2014)

This difference in management structure can be tied to cultural differences with regard to power distance and potentially to a lesser extent differences with respect to uncertainty avoidance. Power distance refers to the “extent to which a society accepts the fact that power in institutions is distributed unequally” (Hofstede, 1980, p. 45) and social exchanges are based upon this unequal distribution. So in high power distance cultures there is little questioning of higher status members

and lower status members look to those individuals for guidance, whereas in low power distance cultures lower status members feel comfortable questioning those of higher status and offering suggestions. This also has some similarity to the cultural dimensions universalism-particularism and vertical-horizontal (see Triandis, 2000). These differences may lead to conflict as crew members expect different degrees of autonomy and input into decisions. At the most extreme case, consider a situation whereby there is a significant communication lag between the crew and ground control. While some members of the crew are waiting on approval from ground to try an unplanned strategy to correct something on the mission, other members may feel they have the latitude to implement the new strategy without an explicit 'go ahead' from ground. Despite the differences in the management structure and the degree of autonomy provided, our interviews also revealed that when necessary individuals adapted and did what needed to be done. However, of interest is the following comment:

...when we talked to the ground the Russians always gave the ground what the ground expected, I mean not reality. For instance, I was always surprised, the lights would go off if something was malfunctioning and you know [Russian crew members] would just fix it. And it surprised me because they never ever mentioned it to the ground when they came in contact with them. (Astronaut, personal communication, June 2014)

This points to another very real implication of this cultural difference amongst crew members - the possibility that ground control has a very different (and in some cases, faulty) mental model regarding what is happening on board due to a lack of 'true communication' between them and the crew. Or alternatively depending on the location of the crew and which ground control center they are speaking with (and who is doing the talking on the crew) different pictures might get created.

Leadership

There were two themes that revolved around differences in cultural expectations regarding leadership. The leadership themes that emerged primarily came out of interviews regarding crew interaction within the CAVES analog. The first notable theme that emerged were that members had different expectations regarding whether leadership was going to be more autocratic versus participative. This was one of the three big areas where cultural differences were noted.

Specifically, crew members varied in the degree they expected leadership to be more directive (autocratic) where subordinates are discouraged from participating in decision making versus an expectation that leaders would reach out to members to gather their perspective on problems and potential solutions (participative).

A second difference that was noted by the researcher at the European Space Agency was the way that crew members see themselves in the team and their role in supporting the leader. Within the CAVES environment researchers try to create “*what happens on the space station with the commander being commander of the space station, but second on a particular mission*” (Researcher European Space Agency, personal communication, June 2014). This provides the crew with experience in switching between being in a leadership versus a follower role. This is particularly important in mission critical environments where, “*offering the best help you can to whomever is the leader at the moment is important to the team*” (European Space Agency, personal communication, June 2014). In essence, within this environment leadership was pushed to whoever had the technical expertise at the moment. However, “*this continuous change of leader to follower, some people switch easily and some people don’t accept it as easily*” (Researcher European Space Agency, personal communication, June 2014).

The ease of switching between leader and follower role may be in part due to cultural differences in power distance and uncertainty avoidance. Cultures with higher levels of power distance expect a clearly defined leader and would most likely not be comfortable with leadership changing based on immediate needs as it might switch to someone with a technically ‘lower status’ at times based on the particular expertise needed. Additionally, cultures that are not comfortable with uncertainty might also have a harder time with this type of team design in that there is a fair amount of uncertainty in switching between leader and follower roles as well as the recognition that leadership will change amongst the team. This, however, points to the literature on shared or collective leadership. Researchers have noted (and empirically shown) that in complex environments leadership being shared or distributed within the team may predict team performance over and above hierarchical leadership (Pearce & Conger, 2002). When members are able to switch between leadership and followership it serves to build the leadership capacity within the team (Day, Gronn, & Salas, 2004). Otherwise the complexity within mission critical environments often makes it difficult for a single leader to bear the sole responsibility for leadership due to the varied expertise needed in such environments.

Expression of Affect

Cross-cultural researchers note that cultures differ with respect to the degree to which it is acceptable to express affect (e.g., Parsons & Shils, 1951; Triandis, 2000). The crews within spaceflight were argued to vary in the degree to which affect was seen and expressed during conversation. An interviewee noted the stark contrast in Russian as compared to American conversations. *“The Russians are much more direct and aggressive and you quickly learn, and you can be taken aback as an American where everyone in meetings is very polite, whereas in Russia everyone is shouting at each other”* (Astronaut Interview, August 2014).

While the difference above was mentioned in the context of Russian-American crew members, given the cross-cultural literature we would expect the difference between Russian-Japanese members to be even more pronounced due to the collectivistic nature of Japan and concerns about saving face and not standing out. If crew members do not recognize this cultural difference, it could impact crew interaction by facilitating misperceptions of negative affect which could, in turn, reduce information sharing and degrade cohesion. If crew members recognize the difference in cultural communication styles and the corresponding degree of affect expected to be shown, but cannot adapt then there is also the possibility of them not being ‘heard’ or the aggressiveness of the communication style adding an additional stressor to an already stressful environment. Closely tied to the expression of affect are themes that emerged with regards to the degree of comfort ‘opening up’ to fellow crew members. This will be discussed next.

Degree of Comfort Sharing Personal Information

Another theme in the interviews involves differences in showing affect, but might be better couched within cultural differences regarding the boundaries of personal space (Hall & Hall, 1990). Specifically, it was noted that there were cultural differences in the degree to which crew members were willing to open up to the flight surgeons. This difference is witnessed in the following quote,

...I think Americans generally are pretty open and the flight surgeons have worked hard and they’re your friends. There was an instance on MIR when one of the crew really should have been talking to a flight surgeon; I mean absolutely...but they [Russian astronaut] would not bring

anything like that up to the flight surgeon whatsoever. (Astronaut, personal communication, June 2014)

There was a fear that they might not fly again and *“I don’t know you just didn’t say anything like medical issues with anybody”* (Astronaut, personal communication, June 2014). The implication for crew interaction here is not so much in the cohesion, but in the sense of crew members potentially not getting the proper help when needed which may then translate into performance degradations –either physical or mental. When this occurs and interdependent tasks are involved it impacts the entire crew unless someone recognizes the problem and is able to step in and provide backup to that team member.

Differences were also seen with regard to the ease with which crew members of different nationalities were willing to openly provide face to face feedback concerning their fellow team members, especially surrounding non-technical issues. In talking about mitigation strategies with regards to cultural differences one of our interviewees pointed to the use of a version of guided team self-correction. However, in noting this technique one potential concern that was voiced by a researcher at the European Space Agency was the following:

I’m worried because we started working with the Chinese and one of the key issues is to expose them to discussing mistakes and positively criticizing them and opening up to leadership. It’s not part of their culture to criticize or try to change, but rather to go around and they have a greater acceptance for things as they are. (personal communication, June 2014)

In mission-critical environments such as those of long duration space exploration, these differences need to be recognized and crews need to work to create a third culture whereby an environment is created that acknowledges the differences and works to create a climate where openness is valued. One approach to working through such differences is noted below:

So what I’m trying to do is have some exercises that are very technical and have people discuss technical issues so they’ll open up because there is a clear effect on the technical outcome, and then I can point out where the behavioral elements came out and how that influenced the

outcome. If they see a tangible outcome that is technical, they'll be more accepting. (Researcher at European Space Agency, personal communication, June 2014)

Communication Preferences

Another difference that was highlighted during the interviews was differences in terms of how task based procedures are presented. Specifically noted were differences between preferences within the United States for things to be written down in concrete terms, while Russian crew members were most comfortable vocalizing procedural steps as compared to requesting them to be written down. For example, *“then I noticed that we are very much on procedures and written down and you follow the procedures and the Russians weren't that way. They did so much verbally”* (Astronaut, personal communication, June 2014).

[Russian crew members] were getting ready to do a spacewalk and [Russian crew member] was telling me what to do and I said ‘what?’ and then he said ‘no’ and he was getting a little louder because he wanted to make sure I knew what to do and finally I said look, can we just write it down? And he said, we don't need to write it down, I'm telling you! And finally I'm just like ‘I'm an old American woman. I need to have things written down. Can you just write it down?’ ...and he just sort of rolled his eyes and said okay. This was a very obvious culture difference in the way we worked. (Astronaut, personal communication, June 2014)

Differences in communication styles were also noted with respect to the level of detail that crew members from the United States expected to be contained in procedural documentation as compared to the level of detail expected by Japanese crew members.

While crews want latitude, they also don't want to be allowed to be in a situation where they may make a mistake. The Japanese were appalled at our standard for the level of detail that we put into procedures because it was insulting to them. They had two standards, they had the procedures for the smart Japanese and one for the dumb American astronaut. It was just a cultural thing that they were very surprised that we went to that level to dumb-down the procedure so that any idiot could do it. It was sort of a learned behavior on our part. (Flight Director, personal communication, May 2014)

Taking a slightly different vantage point were interviews with a researcher within the European Space Agency that worked with CAVES analog. Differences were seen with respect to how the various cultures expected communication to occur. Communication style, directive or participative, is most often talked about in the context of communication with the leader. In this case cultures that had expectations regarding a more directive style of communication would look for (and prefer) communication that provides explicit guidance. In contrast, more participative communication would be witnessed by sharing problem solving with the rest of the crew and consulting followers prior to making a decision (Bass & Bass, 2008). This difference in expectations among crew members is expected to co-vary with levels of power distance such that high power distance cultures witness more directive communication and low power distance cultures more participative. When crew members vary on this expectation and this isn't taken into account in the context of communication it could lead to the person providing the communication being seen as weak or being a non-expert when directive communication is expected, but participative offered. Conversely, when participative communication is the expectation and directive is given, it may lead to feelings that opinions are not valued and be demotivating.

Incongruent Mental Models

Another difference that emerged in some of the interviews was the potential impact that culturally-based task and equipment mental models, especially in terms of system design, may have on crew interaction. While crews are trained on the various systems that will be housed in the spacecraft we still heard quotes like, “... *I was just shocked. There was this teensy little switch, there were two of them and both of them were of vital importance and both did different functions and they had the same Russian acronym on them and I thought, ‘my goodness’, this is crazy!*” (Astronaut, personal communication, June 2014). Another example was given with respect to the coloring of fire extinguishers on MIR – everything was green including the fire extinguishers – they just blended in (Astronaut Interview, personal communication, May 2014). This is in direct contrast to the coloring of fire extinguishers within the United States.

While the examples that were specifically mentioned in the interviews revolved most predominantly around mental models pertaining to equipment design, in some of the earlier examples one can also see hints of cultural differences in terms of mental models regarding

communication, leadership, and status. Research has shown that within teams the possession of compatible/shared mental models is a key predictor of team coordination (Mathieu, Heffner, Goodwin, Salas, & Cannon-Bowers, 2000; Mohammed, Ferzandi, & Hamilton, 2010). Therefore, these differences within the crew need to be highlighted so faulty team mental models do not develop (e.g., equipment, task, or team interaction models) or the mental models held are not shared.

Language

A final difference that will be noted is perhaps the most obvious one – language. Despite a primary focus on those aspects of culture that may not be readily apparent (i.e., deep level variables) differences in language did emerge as a factor which could cause interaction challenges. Differences in language makes it hard for crew members to understand one another. One interviewee said, “...*you have cases where the leader can’t communicate with some of the followers*” (Researcher European Space Agency, personal communication, June 2014). This can become especially challenging in emergency situations, whereby it “*is necessary in an emergency to have a common language and sometimes that doesn’t happen*” (Researcher European Space Agency, personal communication, June 2014). While this factor emerged as a potential aspect of culture which could have a detrimental impact on team interaction, interviewees also noted that U. S. astronauts are required to learn Russian. And while Russian cosmonauts are not the only foreign culture that United States astronauts must work with on long duration missions, it is not clear to what extent this is an isolated issue or a larger, more general issue across spaceflight.

Table 6

Take Away Regarding the Operational Perspective on Cultural Diversity in LDDEM Crews

Themes	Take Away	Operational support
Allocation of status	<ul style="list-style-type: none"> • The degree to which women struggled with being judged as equals • Being in a position for a while can have different ascriptions across cultures (e.g., Americans may think they are stagnated, whereas Russians may think they can now trust that person) • Importance of having the opportunity to build ‘personal knowledge’ prior to interacting in spaceflight 	<p><i>Some female astronauts have reported being offended by the attitude and lack of respect provided by the Russians and it’s almost always due to the Russian culture.</i> (Flight Surgeon, personal communication, May 2014)</p> <p><i>Russians get in a position and do it for their entire life. Their goal is to become the nationally renowned expert in that</i> (Flight Director Interview, personal communication, May 2014)</p>
Management structure	<ul style="list-style-type: none"> • While some members of the crew are waiting on approval from ground to try an unplanned strategy to correct something on the mission, other members may feel they have the latitude to implement the new strategy without an explicit ‘go ahead’ from ground 	<p><i>...when we talked to the ground the Russians always gave the ground what the ground expected, I mean not reality. For instance, I was always surprised, the lights would go off if something was malfunctioning and you know [Russian crew members] would just fix it. And it surprised me because they never ever mentioned it to the ground when they came in contact with them.</i> (Astronaut, personal communication, June 2014)</p>

Leadership

- Crew members varied in the degree they expected leadership to be more directive (autocratic) where subordinates are discouraged from participating in decision making versus an expectation that leaders would reach out to members to gather their perspective on problems and potential solutions (participative)

This continuous change of leader to follower, some people switch easily and some people don't accept it as easily (Researcher European Space Agency, personal communication, June 2014)

Expression of affect

- If crew members recognize the difference in cultural communication styles and the corresponding degree of affect expected to be shown, but cannot adapt then there is also the possibility of them not being 'heard' or the aggressiveness of the communication style adding an additional stressor to an already stressful environment

The Russians are much more direct and aggressive and you quickly learn, and you can be taken aback as an American where everyone in meetings is very polite, whereas in Russia everyone is shouting at each other (Astronaut Interview, August 2014)

Degree of comfort sharing personal information

- When members fear voicing their concerns and interdependent tasks are involved, it impacts the entire crew unless someone recognizes the problem and is able to step in and provide backup to that team member

...I think Americans generally are pretty open and the flight surgeons have worked hard and they're your friends. There was an instance on MIR when one of the crew really should have been talking to a flight surgeon; I mean absolutely...but they [Russian astronaut] would not bring anything like that up to the flight surgeon whatsoever. (Astronaut, personal communication, June 2014)

Communication preferences

- Communication style (e.g., directive or participative) as well as levels of detail required can vastly change what crew members expect from their procedural documentation and application

Then I noticed that we are very much on procedures and written down and you follow the procedures and the Russians weren't that way. They did so much verbally (Astronaut, personal communication, June 2014).

Incongruent mental models

- These differences within the crew need to be highlighted so faulty team mental models do not develop (e.g., equipment, task, or team interaction models) or the mental models held are not shared.

... I was just shocked. There was this teensy little switch, there were two of them and both of them were of vital importance and both did different functions and they had the same Russian acronym on them and I thought, 'my goodness', this is crazy! (Astronaut, personal communication, June 2014)

Language

- Despite a primary focus on those aspects of culture that may not be readily apparent (i.e., deep level variables), differences in language did emerge as a factor which could cause interaction challenges

Is necessary in an emergency to have a common language and sometimes that doesn't happen (Researcher European Space Agency, personal communication, June 2014)

Looking Forward

While the operational interviews highlighted a number of cultural differences that may have an impact on interdependent interaction within long duration exploration missions, it was also noted that *"the vast majority of time on ISS... teamwork/cohesion are generally defined as optimal. Our work is similar to working with elite athletes"* (Flight Surgeon, personal communication, May 2014). The sentiment expressed across several interviews was that in most cases on past missions cultural differences had not translated into operational issues, but may result in reports of crew members being angry, frustrated, or irritated with one another. Yet they have *"a much greater fear of never flying again and being considered a failure. That greatly overrides any interpersonal issues that might occur"* (Flight Surgeon, personal communication, May 2014).

However, in moving from current missions to longer duration missions (e.g., Mars) there was also a general sentiment that some of the cultural differences that were 'small bothers' or 'mere annoyances' now might manifest into larger issues given the longer confinement, lack of personal space to 'get away', and isolation of the longer duration missions. For example, in extrapolating to longer duration missions the following are examples of some of the quotes obtained:

If some of the problems we see as being minor irritants or personal friction can be overlooked on a six month mission on a Mars mission, they may become more relevant and impact task execution. (Flight Surgeon, personal communication, May 2014)

Some of the small things that are small and can be ignored or worked through on a short duration mission may become larger challenges on Mars mission, but would deal with them in the same way as do on Earth. (Astronaut, personal communication, August 2014)

When we go the international expedition to Mars, we will have to work a lot harder at coming to a common agreement of what the norms and standards are as currently on the ISS there is still sort of dividing line and we play by whoever's rules it is. (Flight Director, personal communication, May 2014)

My general concern is if there is a crew of six that interpersonal differences would cause one member of the crew to be the outlier or red headed step child or scapegoat, or perhaps if there are factions that develop for decision making, etc. (Flight Surgeon, personal communication, May 2014).

The last quote brings up the fact that one perhaps one of the largest detriments to interdependent interaction is the potential for faultline development within culturally diverse teams. Faultlines have been defined as, “hypothetical dividing lines that split a team into relatively homogeneous subgroups based on the team members’ demographic alignment along multiple attributes” (Thatcher & Patel, 2011, p. 1119). Research has shown that faultlines within a team can lead to a decrement in many key team processes. For example, a recent meta-analysis on demographic faultlines found that demographic faultline strength increased task and relationship conflict, decreased team cohesion, as well as team satisfaction and performance (Thatcher & Patel, 2011). So cultural differences have the potential to impact crew interaction, affect, and cognition, especially as mission duration, isolation, and confinement increase, so how can these things be mitigated as there is also the realization that for a number of reasons “...we’re not going to have the perfect crew, so how do we take what we’re given and maximize it” (Astronaut, personal communication, June 2014). This leads to our next section concerning operational perspectives on mitigation strategies.

Mitigation Strategies

Throughout the operational interviews several potential mitigation strategies were extracted that dealt with mechanisms that might mitigate the impact that cultural differences may have on interdependent interaction within long duration exploration missions. Mitigation strategies that will be touched upon within this section include: meaningful work, knowledge of space culture, socialization, common identities/superordinate goals, team composition, conflict management strategies, fostering an outside connection, and making cultural differences salient combined with reflection/correction techniques.

However, it is also important to note that most of the mitigation strategies noted below were pulled out in reference to projection to longer duration missions. With regard to current missions there was a general sentiment that the fear of not flying again or being considered a failure overrode cultural differences and that crews made it work. Below is a response that summarizes this perspective:

It's simply due to the task at hand and the professionalism of those involved. It's a pretty unique skill set. There is a much greater fear of being considered technically inept than being conciliatory. So I've been told there are some space shuttle crews where before the crew was put together there was animosity for some reason, but once they were put on the space shuttle and worked together for a year, there was no indication of problems. They had a much greater fear of never flying again and being considered a failure. (Flight Surgeon, personal communication, May 2014)

This fear of not flying again is something that is fairly unique and not seen in most industries outside NASA; however, on longer duration missions this may again become less of a driving force due to greater hazards as crews move further away from Earth. Therefore, next we discuss some of the mitigation strategies that were mentioned – some of which are currently being used.

Meaningful Work

Almost every person interviewed commented on the importance of having meaningful work during transit during the longer duration missions. Meaningful work was argued to provide purpose and reduce boredom. There were a number of ways that were mentioned with regard to the provision of meaningful work (e.g., learning a new skill, engaging in a hobby, learning a new language, painting, reading, writing a manuscript). The exact nature of what would be deemed ‘meaningful’ would at least, in part, be driven by the particular individuals involved, their preferences, and aptitudes. We will not go into great detail here as it is our expectation that this mitigation strategy will be thoroughly covered in the operational review on motivational issues (see Morgeson, unpublished manuscript). However, it is pertinent here as the provision of a sense of purpose was also seen as being able to mitigate cultural clashes primarily by providing the motivation to work through clashes and facilitating a positive mental state and corresponding affect. This view was most succinctly expressed in an interview with a CAPCOM who stated, *“Purposeful, meaningful work can help mitigate cultural clashes that occur as well as conditions such as depression”* (personal communication, May 2014).

Knowledge of Space Culture

Despite the primary focus on national culture, the topic of space culture repeatedly came up. More specifically that space cultures of the nations which often partner with the United States evolved differently. The starkest difference is between the United States space culture and Russian space culture.

We crash in engineer level and operational level (early on) because we have strong opinions how to approach and design systems. Piece-by-piece, we could find that we had very different approaches and values on how things should be done. I have seen this across the board, especially with Russians. (CAPCOM, personal communication, May 2014)

While there are also differences in the space cultures amongst the remaining nations (e.g., Europeans, Japanese, Canadians) they are more similar to the United States space culture due to the heavy influence of a more established NASA space culture. Whereas, Russian space culture and NASA space culture were already firmly cemented at the time of initial interaction between

these countries in space. Having a knowledge of the cultural differences and how that has driven the development of the partnering nation's space culture was mentioned as a potential mitigation strategy. For example, when speaking on this topic a CAPCOM noted, "*Learn about cultural perspectives not only culture, but how national culture drives decisions in the different agencies space culture*" (CAPCOM, personal communication, May 2014). Additionally, he noted the following: "*How the Russian space culture grew up? We should learn how Russians would make decisions, their perspective on things. We never learn about that*" (CAPCOM, personal communication, May 2014).

The possession of such knowledge, provides a more complete, integrated mental model of the organizational environment within which crew members are embedded in and facilitates an understanding of preferred mechanisms as well as providing a mechanism through which sense can be made of crew member action. This cultural knowledge, which has been translated into an operational setting, is best paired with shared problem and team models (Orasanu, 1990; Rouse & Morris, 1986) to allow for more accurate prediction of action, identification of potential trigger points for interaction to break, as well as to suggest insights into ways to create a third culture within the crew.

Beyond Cultural Awareness to Socialization

Repeatedly within the interviews individuals argued for the importance of not only understanding cultural differences in terms of cultural awareness training and task-based training, but moving beyond that to truly interacting with crew members from other cultures. Socializing with them in areas outside of the immediate work environment such that crew members knew one another as individuals and not just cultural differences in a broad sense. When asking for an operational perspective on how to go about finding a middle ground or a 3rd hybrid culture (see Adair, Tinsley, & Taylor, 2006; Early & Mosakowski, 2000) the following was noted in one of the astronaut interviews "*It's actually living in the community together-you get to know each other personally, working together, and going out together and spending time together outside of work*" (personal communication, August 2014).

A few other quotes that point to the importance of getting to know crew members prior to launch through socialization processes that are both task and social include the following:

But with ISS, you've been working together and training together for the better part of 3.5 years so you've had a chance to learn about each other and the other cultures so you can avoid those problems. (Astronaut, personal communication, August 2014)

No matter what decisions are made, what politics decide, we have to live with each other. Everyone else can plot, but at the end of the day we have to rise above this and live with each other. Russians and American really went through this and tried to see as a unified crew [talking about the early days of Russian-American partnership]. Built a bar where crew members lived, extra effort to socialize and relax. (CAPCOM, personal communication, May 2014)

Key is to learn about each other before the composition of the crew. For shuttle you can compose and then learn about each other, but for longer mission you want to learn about each other first. (Astronaut, personal communication, August 2014)

Building a Common Identity/Creation Superordinate Goals

Earlier the occurrence of faultlines within the crew was identified as one of the potential effects of cultural diversity. The scientific literature on faultlines would suggest that one way to mitigate faultlines is the building of a common identity often through the creation of a collective, superordinate goal that the entire crew can rally behind. The importance of having a common collective goal was also noted within the context of the CAVES analog which represents one of the more interdependent contexts which the operational personnel we interviewed spoke about.

Yes – at the beginning of the mission they have a joint mission goal, which is all technical tasks, but they have to (as a multicultural team) do a complete exploration of the cave with a map, photographic report, and design tasks, all the while discussing team processes to obtain most effective and safe objective. They have to keep this mission goal in mind throughout the mission because everything is centered around it. (European Space Agency Researcher, personal communication, June 2014)

While the term identity was not specifically used by those that were interviewed we did hear several comments which point to the building of such an identity among crew members.

Also indicative of faultiness were comments related to it not being cultural differences within the crew that caused the most challenges to interdependent interaction, but cultural differences between the crew and ground control. There was often a faultline created between these two elements. This divide was often primarily driven by perceptions that ground control couldn't relate to what was happening or that the expertise of those with 'boots on the ground' was not valued. Regarding the building of a common identity, we heard that the notion of a common enemy (e.g., superordinate goal) could pull the crew together. For example, one astronaut noted that *"conflict between ground and crew often pulls crew tighter together; feeling of I'm here why not listen to me, ground trying to be considerate and not interrupt"* (personal communication, August, 2014). We are not suggesting that creation of a common enemy is necessarily a viable strategy within the context of long duration exploration missions, but the notion of having that superordinate goal which serves to unite the crew and form a common identity does make sense. Successfully navigating difficult situations or challenging situations is also something that can pull crews together and build a common identity. There is a large literature on how to mitigate faultlines, the building of common identity, and superordinate goals some of which is discussed in Section I of this report. Specific mitigation strategies other than those noted in the quotes were not extracted from the operational interviews.

Team Composition

There was an overriding sentiment among the subject matter experts that while cultural differences were present and could pose challenges, often other things were able to trump those differences. Individual differences and compatibility amongst the crew in terms of those individuals differences was repeatedly mentioned, some crews 'gel' better than others. Other characteristics that our interviewees felt might be important within long duration missions are the following: (1) "in terms of leadership need someone who can operate as both a facilitator and adapt to a more hands-on approach in emergencies" (Astronaut Interview, personal communication, June, 2014); (2) flexibility, (3) ability to see the 'big picture' for *"...even if I force this guy to do it my way, I haven't won because he's unhappy and there could be a potential future conflict"* (Astronaut, personal communication, August, 2014); and (4) cultural openness.

Of those that are mentioned above, the most direct relation to culture is to select individuals who are culturally open or who lack ethnocentric views that their culture is the single best and only way to do things. One astronaut said:

We found there are two types of people: 1) I want to fly ISS and have to learn Russian, but I will hate it and they didn't do well, and 2) guys who want to fly ISS and learn new cultures and the language and saw it as a new adventure (personal communication, August, 2014).

While some of the other characteristics that were mentioned deal more with individual differences such as personality characteristics a few have loose ties to culture (however these cultural ties were not explicitly mentioned in the operational interviews). For example, it might be expected that cultures that are comfortable with uncertainty and are more flexible in terms of rule orientations (see tight-loose and universalism-particularism dimensions – Triandis, 2000; Parsons & Shils, 1951) may be more likely to be adaptive. The rationale for this that acknowledging the need for adaptation represents an acknowledgement of a level of uncertainty within the environment for if everything could be planned out adaptation and flexibility would be less of a requirement. With respect to the cultural dimension of tight-loose cultures (Triandis, 2000; Gelfand, Erez, & Aycan, 2007), tight cultures have “many rules, norms, and ideas about what is correct behavior in each situation and conformity is high” and cultures with a belief in particularism actions “are guided by the unique aspects of the situation and its relevance to specific aspect of the actor” (Salas, Burke, Wilson-Donnelly, & Fowlkes, 2004, p. 302).

It might also be expected that the cultural dimensions of past-future and monochronic-polychronic orientations (Hall & Hall, 1990) which relate to perspectives on time might have a relation to the ability to see the big picture. For example, cultures with a polychronic orientation are involved in many things at once and therefore might be better able to see the interconnections among various pieces versus the more segmented approach witnessed in monochronic cultures. Variations in cognitive styles (e.g., analytic-holistic, field dependence-independence, see Choi & Nisbett, 2000; Erez & Earley, 1993) might also impact the ease with which a person is able to see ‘the big picture’. Cognitive styles across cultures vary in what is attended to within the field, the degree of information seeking behavior, and the type of reasoning that is used to make connections amongst the disparate parts that come together to create the whole (Salas et al., 2004).

Conflict Management Strategies

While only mentioned by a few of our interviewees, knowledge of how to diffuse situations was identified as another way that cultural challenges are dealt with. Along with the desire for the infusion of more conflict management strategies was an acknowledgement of the tightness of the training schedule. This is witnessed in the comments offered by one of the astronauts during our interviews:

So I think it has to do with selection, getting to know each other through training, and the tactics for how to diffuse situation. I think you use the same techniques as on the ground – e.g., finding a win-win – but I’m sure that yea, there could be issues. Infusing more conflict management strategies would help, and the issue is training time for the crews (personal communication, August 2014).

While there was no one conflict management strategy that was mentioned a comment offered by one of the astronauts interviewed provides insight into recognizing that the same strategy may not work in all situations (see below). Therefore, the bottom line might be to ensure that crew members have a toolkit of conflict management strategies that can be used depending on the cultural and personality characteristics of the target.

I’m sure there are some generalities, but my perspective is that you have different types of people and you just have to figure out what type of person you’re dealing with. My impression is that it’s more the individual and thus need to get to know each other before flying together. Individual differences override the culture (Astronaut, personal communication, August 2014).

Once again there is a wide body of literature that talks about cross-cultural differences in conflict management and negotiation strategies and preferences (e.g., Kaushal & Kwantes, 2006; Gelfand & Brett, 2004; Tinsley, 2001; Morris et al., 1998). As well as some work that talks about general strategies for resolving conflict and ‘getting to yes’ (see Fisher, Ury, & Patton, 2011). As specific strategies were not mentioned in the operational interviews here we highlight that knowledge of conflict management strategies was recognized as important; however, cross-cultural differences in conflict management will not be covered in this section of the report. For

more information on specific strategies see the section on cultural diversity and mitigation techniques (i.e., Section II).

Fostering Outside Connection

Within many of the interviews individuals spoke about the importance of having some type of contact with loved ones back home as a way to remain connected and that as crews move further from Earth this may become even more important. The inclusion of maintaining a connection as a potential mitigation strategy for cultural differences lies not in providing an outlet for crew frustration, but in its ability to enhance positive affect and mental state. Both of which may, in turn, facilitate the motivation and effort put forth to handle any conflict that may occur versus withdrawal from the team or ‘shutting down’. Interviews suggested that the maintenance of an outside connection did not facilitate ‘venting’ per se as crew members normally would not ‘vent’ to those outside the crew due to a feeling of others outside not being able to relate; therefore, most venting would be expected to happen within the crew itself not with outside family members.

While maintaining a connection may be important the timing of mechanisms to facilitate such a connection needs to be further researched. For those mechanisms that foster connections which are not prerecorded, but represent a ‘live’ connection with someone outside the crew or exploration, team researchers at the European Space Agency have seen timing is everything within one of the analogs (i.e., CAVES). Interviews suggested that having too much of a virtual social life in the beginning of crew development can actually hurt team bonding as crew members spend too much time conversing virtually with those outside whom they know. This is easier than taking a chance and putting themselves out there with crew members early on. So, timing is a key consideration in creating the potential for outside connections.

In an interview with one of the researchers working with the CAVES analog we heard that while it can provide a mechanism for crews to ‘vent’ early in the crew’s development when they might not yet feel comfortable with the crew we also heard:

I have seen three sides. The third side is that communication with outside is that something that is vented out comes back. So the team suffers because the venting out comes back through some other channel. It influences the team in a very nasty way. That pretty much breaks the team down. ... The problem is that venting out and having external support is very important, but the

continued aspect is what creates the problem because then you don't go back. If you have it continuous then my teammate might not be available now, and when he is available now I might be on the internet. (European Space Agency Researcher, personal communication, June 2014)

Awareness and Reflection

A final mitigation strategy that will be briefly discussed is one that came up in interviews with a researcher who is part of the CAVES analog team. One of the primary purposes of this analog is to provide an international crew of astronauts practice in working together in a team environment where science and exploration is a hallmark. In discussing lessons learned within this analog with respect to cultural differences and mitigation strategies one approach that is used is to make different expectations regarding teamwork and leadership salient early in the team's interaction and create a norm of discussing these differences and how they can be overcome so a climate of openness is created. Therefore, problems are not allowed to fester under the surface, but should be brought up early on such that they can be worked through before becoming a larger issue. For example, a researcher from the European Space Agency described the following procedure within the CAVE analog –

Upon first arriving, crew members are asked to first reflect by themselves regarding what they want/ expect from leadership, their expectations regarding being a part of the team and how their background influences how they will behave. Once members have reflected on this individually they are paired up with another team member and they each interview each other along the lines described above. The answers from each partner are written down and then presented to the larger group. (personal communication, June 2014)

In the end, differences were discussed not in terms of their culture but how they interact and communicate, take decisions, perceive leadership or their teamwork role. So that's how I usually try to focus them because in the following days, what I'm asking them is how their teamwork processes worked during concrete activities, and how they would change it for the next day to be more effective. So far I find that this focus has worked in allowing them to work the practical issues and the tools without focusing on individual differences in terms of I am a different

person, or I have a different attitude. (European Space Agency Researcher, personal communication, June 2014)

Then the following day they help one another to keep in mind the preferences and then revisit them in the evening in the debrief after technical discussions. *“For instance, today I force you to keep going but then I realized some people were very tired, so should we change things tomorrow”* (European Space Agency Researcher, personal communication, June 2014). This continual discussion focused around cultural preferences, but translated into the operational environment and the mission crew members are engaged in not only combats issues building up and exploding, but also provides context to differences.

This strategy is similar to the strategy of team-self correction that has been utilized within military environments with great success (see Smith-Jentsch, Cannon-Bowers, Tannenbau, & Salas, 2008; Smith-Jentsch, Zeisig, Acton, McPherson, 1998). Key to this strategy is that reflection/self-correction is guided by an overarching framework, crew members are actively involved in the process, action plans are made for correcting faulty team process. This produces buy in from crew members and provides them with a way forward that is operationally relevant. However, given the focus on openly discussing missteps and mistakes and potential correction strategies, this strategy may not be comfortable for those from more collectivistic cultures where open criticism and standing out are not preferred modes of operation. This concern was also expressed by the researcher within the CAVES environment, but see below for how that analog is beginning to handle this aspect.

I’m worried because we started working with the Chinese and one of the key issues is to expose them to discussing mistakes and positively criticizing them and opening up to leadership. ... It’s not that one is better than the other, but the dominant culture is to try to improve and discuss openly. ...So what I’m trying to do is have some exercises that are very technical and have people discuss technical issues so they’ll open up because there is a clear effect on the technical outcome, and then I can point out where the behavioral elements came out and how that influenced the outcome. If they see a tangible outcome that is technical, they’ll be more accepting. CAVES is where they’re doing real science and have real outcomes, so they are worried about the result. (personal communication, June 2014)

Conclusion

While several cultural differences were noted that could at times cause frustration, anger, and irritation among crew members involved in space exploration. With respect to current missions the overarching sentiment was that within normal day-to-day situations (non-emergency) that the cultural differences did not impact operational tasks. Furthermore, there is a large percentage of tasks within the current mission set that are either independent in nature or require low levels of coordination. On missions such as prior shuttle missions and current ISS missions it was reported that the design of the environment is such that when crew members do get frustrated due to cross-cultural differences they can ‘escape’ for a short period of time by going into another area of the ISS until the frustration subsides. Moreover, the unique skill set, professional demeanor, and public scrutiny that crews are under once they are deployed on a mission has been said to contribute to crews being more afraid to be seen as technically inept and never flying again than being conciliatory (Flight Surgeon, personal communication, May 2014). Furthermore, in many exploration missions that were multicultural in nature members of the U.S. crew were guests and therefore more adaptation on their part was to be expected.

With this being said, there were several who thought that the ability to ignore the ‘small irritations’ on a longer duration mission (e.g., Mars) along with the isolation, confinement, and smaller living/working space could lead to cultural diversity becoming more of a challenge and impact operational tasks. Furthermore, the strategy of ‘going to one’s own corner’ is less likely to work as there may not be the space to do so. Astronauts going on longer duration missions, such as Mars, will also most likely have different concerns than those flying on ISS or prior shuttle missions. For example, in extrapolating about Mars mission one of the Flight Surgeons interviewed said:

I imagine that for an eventual Mars mission, everyone flying it will acknowledge that it will be their last. It could possibly change the dynamics, but initially (at least for the first Mars mission), the crew members will be aware that everything they do will be under an international microscope and they will have a sense that everything has to be done technically right in order for them to return to Earth. And they want to return to be heroes and receive their accolades and return to humanity. (personal communication, May 2014)

At least in the long term, this points to potentially different dynamics and that some of the aspects that may now push crews to ignore the ‘small stuff’ won’t be present or will be present to a lesser degree. Therefore, the cultural differences that were mentioned during the interviews (e.g., status allocation, views towards gender, expectations regarding communication, leadership, autonomy, etc.) will likely be more of a factor. These differences have the potential to create faultlines within the crew which, in turn, has been shown to decrease team process, cohesion, team performance and often information sharing. Therefore, it becomes imperative to think about mitigation strategies that facilitate a team’s ability to recognize the signs and triggers of impending faultlines and corresponding strategies for reducing the perceived differences which cause faultlines to form in the first place. Research should be conducted to not only investigate the feasibility of some of the strategies mentioned in the operational assessment, but to think about the full range of countermeasures – ones that can be delivered pre-mission as crews are beginning to get to know one another and going through training as well as those that can be delivered in real time to assist crews more autonomously.

Section IV:
Gaps and Recommendations

Even though we pushed forward towards an integrative model of cultural diversity in the space context, there is still an array of research areas that require further exploration. We will now elaborate on recommendations we were able to extract from the current literature and operational findings, but we will also highlight the lack of studies within the literature that explicitly examine cultural diversity and teams in the context of LDDEM, the importance of underlying mechanisms, and a special focus on the role of identity as part of the future research agenda. In doing so, recommendations for practice as well as research are put forth.

Recommendations for Practice

Considering the potential for negative consequences to teamwork and outcomes when culture diversity is high, mitigation strategies should be further explored. While research is accumulating to support the effectiveness of cultural diversity training, existing training often does not take advantage of lessons from within the science of training. For example, current cultural training programs often do not systematically ensure that there is a theoretical tie between targeted outcomes, training elements, and methods. Moreover, programs focused on behavioral change do not always take advantage of guided practice, systematic design of training scenarios, or provide systematic, timely feedback. Finally, for the purposes of LDDEM, most programs do not have a primary focus on preparing members to work in *culturally diverse teams*, but focus more on preparing expatriates for work abroad. Current programs fail to take into account the unique requirements of working in a team where interdependent, coordinated action is a requirement and very little has been published with regards to mitigation within spaceflight context.

While the predominant focus within the literature on cultural diversity has been on training as a mitigation mechanism to try to capitalize on the potential synergy present when different cultural perspectives are brought to bear on a problem, other types of mitigation strategies were found. Mitigation strategies such as the creation of superordinate identity, hybrid team cultures, socialization, use and understanding of team metaphors, and team composition have been argued to directly mitigate some of the decrements that the literature would argue exist when individuals have to work within culturally diverse environments or culturally diverse teams. Other mitigation strategies were identified outside the initial literature on cultural diversity, but based on identified challenges to team interaction in culturally diverse teams. Examples of these include team

debriefing/team self-correction as well as two overarching frameworks for training design (i.e., stress exposure training, event-based training).

Based on our findings, a few takeaways can be offered. First, experiential or exposure training is not always the sole answer when it comes to training methods. We highlight intellectual and experiential methods, but with the call for an integrated approach. Second, there is not a “one size fits all” training agenda, but the evaluation of current training types can provide a more concise list to serve as a resource (see Table 4). Third, cultural outcomes (i.e., affective, cognitive, and behavioral) can be more easily achieved when the training design adopts elements from science of training literature (i.e., information, demonstration, practice, and feedback). Fourth, the field of cultural training is a diverse one –making it difficult to say which training approach is “best”. However, our literature review allows us to extrapolate training elements that are likely to mitigate the negative outcomes derived from cultural differences in isolated and confined spaces. Finally, there are techniques that should be developed even prior to the departure to mitigate cultural issues in this context.

In line with these thoughts, our findings have been placed within an overarching framework that can be used to guide an integrated approach to cultural training – stress exposure training. Specifically, we suggested how some of the identified mitigation strategies would fit within this larger framework. Along the way we have offered guidelines where possible (for a summary see Table 7). However, the guidelines offered are primarily based on what is known with regards to the larger literature on mitigation strategies with respect to cultural diversity and interaction. While we have no reason to suspect that the guidance put forth would not extend to training for cultural diversity within LDDEM, in reality most of this work has not been tested in that context. This area is ripe for research both in terms of the degree to which current strategies truly generalize to the spaceflight context as well as the investigation of training focused on the specific type of content that needs to be developed to create cultural synergy within a team environment. However, there seems to be great potential to successfully link culture, teams, and space literatures to maximize the benefits of cultural diversity in this context. Below, we compile a list of guidelines that should be taken into consideration when thinking about implementing mitigating strategies.

Table 7
Recommendations for Operations: Mitigation Guidelines

Cultural Training

Guideline 1: Use intellectual methods to impart baseline information about cultural differences and expectations.

Guideline 2: Use experiential methods to move beyond cultural knowledge to actual behavioral or skill development.

Guideline 3: Use information-based elements to build a baseline cultural knowledge where the focus is on cognitive outcomes (e.g., increased knowledge of other partnering cultures).

Guideline 4: Use demonstration elements to move beyond declarative knowledge to a more complex understanding of cultural differences (cognitive outcome).

Guideline 5: Use demonstration elements to model behavioral skills which facilitate operating in culturally diverse contexts and teams.

Guideline 6: Use practice to reinforce lower level cognitive outcomes (e.g., knowledge) and facilitate cognitive, behavioral and attitudinal skill-based outcomes.

Guideline 7: Clear, concise, and constructive feedback should be utilized to ensure proper cognitive structures are developed and facilitate the acquisition of behavioral, attitudinal, and cognitive skill.

Guideline 8: Design feedback with the trainee's cultural orientation in mind. Cultural orientation will impact the directness, source, and form in which feedback is expected.

Guideline 9: Focus on improving the shared mental models in addition to the more traditional cognitive outcomes of cultural competence (e.g., cultural awareness) to maximize the competence of trainees.

Guideline 10: Focus on improving adaptation in addition to the more traditional behavioral outcomes of cultural competence (e.g., cultural sensitivity) to maximize the competence of trainees.

Guideline 11: Focus on improving trust amongst team members in addition to traditional attitudinal outcomes of cultural competence (e.g., empathy) to maximize the competence of trainees.

Other Mitigation Strategies Beyond Training

Guideline 12: Socialization strategies and interaction training can be used to provide basic knowledge about cultural differences and declarative knowledge pertaining how to minimize the effect of those differences.

Guideline 13: Understanding how cultures vary in their use of team metaphors can assist in providing a baseline understanding of expectations regarding team functioning.

Guideline 14: Teaching leaders how to create a superordinate identify can help to mitigate faultlines caused by cultural diversity.

Guideline 15: Teaching strategies to facilitate the formation of a hybrid team culture can mitigate faultlines and ease coordination in culturally diverse teams.

Guideline 16: Use perspective taking to facilitate intercultural coordination and reduce stereotyping.

Guideline 17: Immersive simulation can be used to provide systematic opportunities to practice skills related to cultural competence at the individual and team-level.

Guideline 18: Event-based training methods can be used to systematically devise training and measurement instruments to prepare members to operate in culturally diverse teams.

Guideline 19: Team debriefing strategies (e.g., team self- correction) should be used in conjunction with training opportunities where practice is involved (e.g., immersive simulation) as well as within the mission itself.

Guideline 20: Design tasks to ensure the meaningfulness of the work to diminish the negative impact of cultural diversity on team outcomes.

Recommendations for Research

First, compared to the literature on teams and the cross-cultural literature, the literature on cultural diversity in teams is small. In general theoretical as well as empirical work would suggest that cultural diversity can create challenges for teams in terms of leadership, communication, the development of shared mental models, and affect (e.g., trust, conflict). There is also a fair amount which can be extrapolated from the cross-cultural literature to inform researchers and practitioners as to how specific cultural orientations might impact a variety of team level constructs. However, what is lacking from the literature is work that pays particular attention to team composition with regard to cultural diversity and how different patterns of cultural diversity may differentially impact team process, states, and performance. Prior work has shown us that not all teams are alike and we suspect that there are certain compositional patterns which may facilitate teamwork, while others may create more challenges. The interaction amongst the cultural orientation of crew members and its impact on team constructs is an area ripe for research.

Second, investigation of the underlying mechanism that influence the relationship between cultural diversity and team outcomes should provide a more relevant and informative picture of the phenomena. In a meta-analysis, Stahl and colleagues (2010b) identified moderators that could not be included in our integrative model due to lack of evidence for the space context, such as team size and task complexity. However, this exclusion is by no means a statement that these variables are not important, but highlight a need for future research to devote attention to them. More specifically, team size has been both positively (e.g., Yetton & Bottget, 1983) and negatively (e.g., Blau, 1977) related to important variables, illustrating the importance to parse out when and whether team size exacerbates the negative impact of cultural diversity. Along these lines, a better understanding of how the contextual variables involved in LDDEM may impact the relationships reported in the wider literature outside of the context of LDDEM is needed. Most of the studies that examined cultural diversity within the context of spaceflight focus on more affective dimensions to the near exclusion of behaviors. Therefore, a large gap exists in terms of how cultural diversity (and what forms) impact the development and maintenance of shared coherence within LDDEM teams.

Third, the importance of identification is brought to the forefront when the space crew is multicultural. The overlap and difference in the multiple identities that exist throughout multicultural teams can yield in complex compositions. Some have started to look at the dark side

of a strong identity. For instance, strongly identifying with the team may increase the intergroup conflict across teams within the organization, which in turn will have detrimental effect to the overall organizational identity (Van der Zee, Atsma, & Brodbeck, 2004). This can be extrapolated to those in space because they can identify with others according to their nationality (e.g., Russian vs. Americans), roles (e.g., astronauts vs. ground control), gender (e.g., females vs. males), etc. The possibilities are limitless, but leveraging from those who are more flexible and can facilitate the interaction across cultures is crucial. When a third party was involved that could understand the different points of view from a new perspective, it tended to neutralize the arguments and improve the interactions of diverse crews (Sandal, 2004). With that being said, we highlight the role of identity and identification amongst multicultural crewmembers as key processes to understand the impact of cultural diversity.

Gaps also exist from a methodological standpoint. Studies should have more sophisticated methodologies to allow for a better understanding of cultural diversity. For instance, Tafforin and Gerebtzoff (2010) presented a software-based system that can study physical ability, psychological capabilities and performance. Even though this tool did not capture any difference in behavior across nationalities, it shows advancements and a new way to investigate behavior within spaceflight. There is still a long way before we achieve a computerized way to get at psychological constructs, but the search for non-obtrusive measures should be on the forefront of research. While we recognize the complexity of implementing longitudinal studies with teams, they still represent a key to understanding how cultural diversity unfolds to impact team process, states, and performance as well as what effects are short-term and what are triggers for escalation.. The argument for understanding cultural diversity over time is not novel (e.g., Milliken et al., 2003), but the overreliance on cross-sectional and simpler designs still exists.

References

- Abbe, A., Gulick, L. M. V., & Herman, J. L. (2008). *Cross-cultural competence in Army leaders: A conceptual and empirical foundation*. Arlington, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.
- Adair, W. L., Tinsley, C. H., & Taylor, M. (2006). Managing the Intercultural Interface: Third Cultures, Antecedents, and Consequences. In Ya-Ru Chen (Ed.) *National Culture and Groups (Research on Managing Groups and Teams, Volume 9)*(pp. 205-232). Emerald Group Publishing Limited.
- Adler, N. J. (1997). *International dimensions of organizational behavior* (3rd ed.). Cincinnati, OH: International Thomson Publishing.
- Adler, N. J. (2005). *Cultural synergy: Managing the impact of cultural diversity*. London: Sage Publications.
- Adler, A. B., Castro, C. A., & McGurk, D. (2009). Time-driven battlemind psychological debriefing: A group-level early intervention in combat. *Military Medicine*, 174(1), 21-28.
- Anawati, D., & Craig, A. (2006). Behavioral Adaptation Within Cross-Cultural Virtual Teams. *IEEE Transactions On Professional Communication*, 49(1), 44-56. doi:10.1109/TPC.2006.870459
- Argote, L., & McGrath, J. E. (1993). Group processes in organizations: Continuity and change. In: C. Cooper & I. T. Robertson (Eds), *International Review of Industrial and Organizational Psychology* (Vol. 8, pp. 333-389). New York: Wiley.
- Arman, G. & Adair, C.K. (2012). Cross-cultural differences in perception of time: Implications for multinational teams. *European Journal of Work and Organizational Psychology*, 21(5), 657-680. doi:10.1080/1359432X.2012.662488
- Arthur Jr, W., Bennett Jr, W., Edens, P. S., & Bell, S. T. (2003). Effectiveness of training in organizations: A meta-analysis of design and evaluation features. *Journal of Applied psychology*, 88(2), 234.
- Ashleigh, M. J. & Prichard, J. S. (2011). Enhancing trust through training. In D. Skinner & R. Searle (Eds.) *Trust & Human Resource Management* (pp. 125-138). UK: Edward Elgar Publishing.

- Ayman, R., & Chemers, M. M. (1983). Relationship of supervisory behavior ratings to work group effectiveness and subordinate satisfaction among Iranian managers. *Journal of Applied Psychology, 68*(2), 338-341.
- Baldwin, T. T., & Ford, J. K. (1988). Transfer of training: A review and directions for future research. *Personnel Psychology, 41*(1), 63-105.
- Ball, J. R., & Evans, E. H., Jr. (2001). *Safe passage: Astronaut care for exploration missions*. Washington, DC: National Academy Press.
- Barinaga, E. (2007). 'Cultural diversity' at work: 'National culture' as a discourse organizing an international project group. *Human Relations, 60*(2), 315-340.
- Bass, B. M. (1990). Bass and Stogdill's handbook of leadership. *Theory, Research & Managerial Applications*. New York, NY: Free Press.
- Bass, B. M. (1997). Does the transactional–transformational leadership paradigm transcend organizational and national boundaries? *American Psychologist, 52*(2), 130.
- Bass, B. & Bass, R. (2008). *The Bass handbook of leadership: Theory, research, and managerial applications*. New York, NY: Free Press.
- Bauce, K. (2014). Cultural competence model. In J. J. Fitzpatrick & G. McCarthy (Eds.), *Theories guiding nursing research and practice: Making nursing knowledge development explicit* (pp. 159-171). New York, NY: Springer Publishing Company.
- Beach, M. C., Price, E. G., Gary, T. L., ...& Cooper, L. A. (2005). Cultural competence: A systematic review of health care provider educational interventions. *Medical Care, 43*(4), 356-373.
- Beal, D. J., Cohen, R. R., Burke, M. J., & McLendon, C. L. (2003). Cohesion and performance in groups: A meta-analytic clarification of construct relations. *Journal of Applied Psychology, 88*(6), 989-1004.
- Befus, C. P. (1988). A multilevel treatment approach for culture shock experienced by sojourners. *International Journal of Intercultural Relations, 12*(4), 381-400.
- Behfar, K. J., Mannix, E. A., Peterson, R. S., & Trochim, W. M. (2010). Conflict in small groups: The meaning and consequences of process conflict. *Small Group Research, 42*(2), 127-176. 1046496410389194.
- Bennett, M. J. (1986). A developmental approach to training for intercultural sensitivity. *International Journal of Intercultural Relations, 10*(2), 179-196.

- Berardo, K. (2005). A synthesis and discussion of current research and theories. Retrieved from http://www.diversophy.com/ic_comp/LinkedDocuments/ICCompetence-Berardo.pdf.
- Berlew, D. E., & Hall, D. T. (1966). The socialization of managers: Effects of expectations on performance. *Administrative Science Quarterly*, *11*(2), 207-223.
- Berry, J. W. (1980). Cultural ecology and individual behavior. In *Environment and Culture* (pp. 83-106). New York, NY: Springer US.
- Bhawuk, D. P. S., & Brislin, R. W. (2000). Cross-cultural training: A review. *Applied Psychology: An International Review*, *49*(1), 162-191.
- Bhui, K., Warfa, N., Edonya, P., & Bhugra, D. (2007). Cultural competence in mental health care: A review of model evaluations. *BMC Health Services Research*, *7*(1), 15.
- Bishop, S. L. (2010). Moving to Mars, there and back again: Stress and the psychology and culture of crew and astronaut. *Journal of Cosmology*, *12*, 3711-3722.
- Black, J. S., & Mendenhall, M. (1990). Cross-cultural training effectiveness: A review and a theoretical framework for future research. *Academy of Management Review*, *15*(1), 113-136.
- Black, R. R., & Mouton, J. S. (1964). *The managerial grid*. Houston, TX: Gulf.
- Bloom, B. S. (1956). *Taxonomy of educational objectives*. New York: David McKay Company.
- Bond, M.A. & Pyle, J.L. (1998). The Ecology of Diversity in Organizational Settings: Lessons from a Case Study. *Human Relations*, *51*(5), 589-623.
- Borkan, J. M., & Neher, J. O. (1990). A developmental model of ethnosensitivity in family practice training. *Family Medicine*, *23*(3), 212-217.
- Borman, W. C. (1991). Job behavior, performance, and effectiveness. In M. D. Dunnette & L. M. (Eds.), *Handbook of industrial and organizational psychology* (pp. 271–326). Newbury Park, CA: Sage.
- Boyd, J. E., Kanas, N., Gushin, V. I., & Saylor, S. (2007). Cultural differences in patterns of mood states on board the International Space Station. *Acta Astronautica*, *61*(7), 668-671.
- Boyd, J. E., Kanas, N. A., Salnitskiy, V. P., Gushin, V. I., Saylor, S. A., Weiss, D. S., & Marmar, C. R. (2009). Cultural differences in crewmembers and mission control personnel during two space station programs. *Aviation, Space, And Environmental Medicine*, *80*(6), 532-540. doi:10.3357/ASEM.2430.2009

- Brett, J., Behfar, K., & Kern, M. C. (2006). Managing multicultural teams. *Harvard Business Review*, 84(11), 85-91.
- Brewster, C. (1995). Towards a 'European' model of human resource management. *Journal of International Business Studies*, 26(1), 1-21.
- Brickson, S. (2000). The impact of identity orientation on individual and organizational outcomes in demographically diverse settings. *The Academy of Management Review*, 25(1), 82-101.
- Brislin, R. W., & Yoshida, T. (Eds.) (1994). *Improving intercultural interactions: Modules for cross-cultural training programs*. Thousand Oaks, CA: Sage.
- Brodbeck, F. C., Frese, M., Akerblom, S., Audia, G., Bakacsi, G., Bendova, H., ... & Wunderer, R. (2000). Cultural variation of leadership prototypes across 22 European countries. *Journal of Occupational and Organizational Psychology*, 73(1), 1-29.
- Brown, H. D. (1980). The optimal distance model of second language acquisition. *TESOL Quarterly*, 14(2), 157-164.
- Brown, A. L., Adams, B. D., Famewo, J. J., & Karthaus, C. L. (2008). *Trust in culturally diverse teams*. Contractor Report submitted to Defence Research and Development (DRDC Toronto CR 2008-097). Toronto, Canada.
- Budworth, M. H., & DeGama, N. (2012). Invited reaction: Factors affecting cross-cultural adjustment: Training, experience, and individual differences. *Human Resource Development Quarterly*, 23(3), 331-340.
- Burke, C., Stagl, K. C., Klein, C., Goodwin, G. F., Salas, E., & Halpin, S. M. (2006). What type of leadership behaviors are functional in teams? A meta-analysis. *The Leadership Quarterly*, 17, 288-307.
- Burke, C., Stagl, K. C., Salas, E., Pierce, L., & Kendall, D. (2006). Understanding team adaptation: A conceptual analysis and model. *Journal Of Applied Psychology*, 91(6), 1189-1207. doi:10.1037/0021-9010.91.6.1189
- Caligiuri, P., Phillips, J., Lazarova, M., Tarique, I., & Burgi, P. (2001). The theory of met expectations applied to expatriate adjustment: the role of crosscultural training. *International Journal of Human Resource Management*, 12(3), 357-372.

- Campbell, J. P., McCloy, R. A., Oppler, S. H., & Sager, C. E. (1993). A theory of performance. In N. Schmitt, W. C. Borman, and associates (Eds.), *Personal selection in organizations* (pp. 35-69). San Francisco: Jossey-Bass.
- Campinha-Bacote, J. (2002). The process of cultural competence in the delivery of healthcare services: A model of care. *Journal of Transcultural Nursing, 13*(3), 181-184.
- Carlson, J. R., Carlson, D. S., Hunter, E. M., Vaughn, R. L., & George, J. F. (2013). Virtual team effectiveness: Investigating the moderating role of experience with computer-mediated communication on the impact of team cohesion and openness. *Journal of Organizational and End User Computing, 25*(2), 1-18.
- Cannon, M. D., & Witherspoon, R. (2005). Actionable feedback: Unlocking the power of learning and performance improvement. *The Academy of Management Executive, 19*(2), 120-134.
- Cannon-Bowers, J. A., Salas, E., & Converse, S. A. (1993). Shared mental models in expert team decision making. In N. J. Castellan, Jr.(Ed.), *Current issues in individual and group decision making* (pp. 221-246). Hillsdale, New Jersey: Lawrence Erlbaum Associates.
- Cant, R. P., & Cooper, S. J. (2011). The benefits of debriefing as formative feedback in nursing education. *Australian Journal of Advanced Nursing, 29*(1), 37-47.
- Cargile, A. C., & Giles, H. (2012). Intercultural communication training: Review, critique, and new theoretical framework. *Communication Yearbook, 19*, 385-423.
- Celaya, L., & Swift, J. S. (2006). Pre-departure cultural training: US managers in Mexico. *Cross Cultural Management: An International Journal, 13*(3), 230-243.
- Chatman, J. A., & Flynn, F. J. (2001). The influence of demographic heterogeneity on the emergence and consequences of cooperative norms in work teams. *Academy of Management Journal, 44*(5), 956-974.
- Chen, G. M. (1993). Intercultural communication training: A classroom case. *Speech Communication Annual, 7*, 33-46.
- Chen, Z., Lam, W., & Zhong, J. A. (2007). Leader-member exchange and member performance: a new look at individual-level negative feedback-seeking behavior and team-level empowerment climate. *Journal of Applied Psychology, 92*(1), 202.

- Cheng, C. Chua, R. Y. J., Morris, M. W., & Lee, L. (2012). Finding the right mix: How the composition of self-managing multicultural teams' cultural value orientation influences performance over time. *Journal of Organizational Behavior*, 33, 389-411.
- Cherrie, S. F. (1998). *Multinational mine-strike recovery operation*. Retrieved on April 25, 2002 from <http://call.army.mil/products/trngqtr/tq2-98/cherrie.htm>.
- Chhokar, J. S., Brodbeck, F. C., & House, R. J. (Eds.) (2007). *Culture and leadership across the world: The GLOBE book of in-depth studies of 25 societies*. New York, NY: Lawrence Erlbaum Associates.
- Choi, I., & Nisbett, R. E. (2000). Cultural psychology of surprise: Holistic theories and recognition of contradiction. *Journal of Personality and Social Psychology*, 79(6), 890-905.
- Chu, P., Spires, E., & Sueyoshi, T. (1999). *Cross-cultural differences in choice behavior and use of decision aids: A comparison of Japan and the United States*. Paper presented at the 200 Command and Control Research and Technology Symposium, June 26-28, 2000, Naval Postgraduate School, Monterey, CA.
- Conyne, R. K., Wilson, F. R., Tang, M., & Shi, K. (1999). Cultural similarities and differences and differences in group work: Pilot study of a U.S.-Chinese task group comparison. *Group Dynamics: Theory, Research and Practice*, 3(1), 40-50.
- Corley, A. (2011). One minute with... The Mars 500 crew. *New Scientist*, 212(2839), 33. doi: 10.1016/S0262-4079(11)62841-8
- Conyne, R. K., Wilson, F. R., Tang, M., & Shi, K. (1999). Cultural similarities and differences and differences in group work: Pilot study of a U. S.-Chinese task group comparison. *Group Dynamics: Theory, Research, and Practice*, 3(1), 40-50.
- Costa, A. C., Roe, R. A., & Taillieu, T. (2001). Trust within teams: The relation with performance effectiveness. *European Journal of Work and Organizational Psychology*, 10(3), 225-244.
- Cousins, K.C., Robey, D., & Zigurs, I. (2007). Managing strategic contradictions in hybrid teams. *European Journal of Information Systems*, 16(4), 460-478. doi:10.1057/palgrave.ejis.3000692

- Cox, T. H., Lobel, S. A., & McLeod, P. L. (1991). Effects of ethnic group cultural differences on cooperative and competitive behavior in a group task. *Academy of Management Journal*, 34(4), 827-847.
- Crisp, R. J., & Turner, R. N. (2010). *Essential social psychology*. California: Sage Publications.
- Crisp, R. J., & Turner, R. N. (2011). Cognitive adaptation to the experience of social and cultural diversity. *Psychological Bulletin*, 137(2), 242-266. doi:10.1037/a0021840
- Cross, T. L. (1989). Towards a culturally competent system of care: A monograph on effective services for minority children who are severely emotionally disturbed.
- Dameron, S. (2002). The development process of cooperative relationships within design teams. *Travail Humain*, 65(4), 339-361.
- Dameron, S. & Joffre, O. (2007). The good and the bad: The impact of diversity management on co-operative relationships. *International Journal of Human Resource Management*, 18(11), 2037-2056. doi:10.1080/09585190701639786.
- David, E. M., Rubino, C., Keeton, K. E., Miller, C. A., & Patterson, H. N. (2011). *An examination of cross-cultural interactions aboard the International Space Station*. NASA Technical Report No. TM-2011-217351. Human Research Program, Behavioral Health and Human Performance Element, Space Medicine Division.
- Day, D. V., Gronn, P., & Salas, E. (2004). Leadership capacity in teams. *The Leadership Quarterly*, 15(6), 857-880.
- Deardorff, D. K. (2011). Assessing intercultural competence. *New Directions for Institutional Research*, 149, 65-79.
- De Dreu, C. K. (2006). When too little or too much hurts: Evidence for a curvilinear relationship between task conflict and innovation in teams. *Journal of Management*, 32(1), 83-107.
- De Dreu, C., & Beersma, B. (2005). Conflict in organizations: Beyond effectiveness and performance. *European Journal of Work and Organizational Psychology*, 14(2), 105-117.
- DeDreu, C. K. W. & Weingart, L. R. (2003). Task conflict versus relationship conflict, team performance, and team member satisfaction: A meta-analysis. *Journal of Applied Psychology*, 88(4), 7412-749.

- Delise, L. A., Allen Gorman, C., Brooks, A. M., Rentsch, J. R., & Steele-Johnson, D. (2010). The effects of team training on team outcomes: A meta-analysis. *Performance Improvement Quarterly*, 22(4), 53-80.
- Desphande, S. P., & Viswesvaran, C. (1992). Is cross-cultural training of expatriate managers effective: A meta-analysis. *International Journal of Intercultural Relations*, 16, 295-310.
- Dion, K. L. (2004). Interpersonal and group processes in long-term spaceflight crews: perspectives from social and organizational psychology. *Aviation, Space, and Environmental Medicine*, 75(Supplement 7), C36-C43.
- Dinwoodie, D. L. (2005). Solving the dilemma: A leader's guide to managing diversity. *Leadership in Action*, 25(2), 3-6.
- Doorenbos, A. Z., Schim, S. M., Benkert, R., & Borse, N. N. (2005). Psychometric evaluation of the cultural competence assessment instrument among healthcare providers. *Nursing Research*, 54(5), 324-331.
- Draguns, J. G., & Harrison, A. A. (2011). Cross-cultural and spaceflight psychology: Arenas for synergistic research. In D. A. Vakoch (Ed.), *On orbit and beyond: Psychological perspectives on human spaceflight* (pp. 211-228). New York, NY: Springer.
- Driskell, J. E., & Johnston, J. H. (1998). Stress exposure training. In J. A. Cannon-Bowers, & E. Salas (Eds.), *Making decisions under stress: Implications for individual and team training*. Washington, DC: American Psychological Association.
- Earley, P. C., & Gibson, C. B. (2002). *Multinational work teams: A new perspective*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Earley, P. C., & Mosakowski, E. (2000). Creating hybrid team cultures: An empirical test of transnational teams functioning. *Academy of Management Journal*, 43(1), 26-49.
- Eby, L. T., & Dobbins, G. H. (1997). Collectivistic orientation in teams: An individual and group-level analysis. *Journal of Organizational Behavior*, 18(3), 275-295.
- Elias, M. (2007). Astronauts' manners can get lost in space. *USA Today*.
- Elron, E. (1997). Top management teams within multinational corporations: Effects of cultural heterogeneity. *The Leadership Quarterly*, 8(4), 393-412.
- Erez, M., & Earley, P. C. (1993). *Culture, self-identity, and work*. New York: Oxford University Press.

- Farh, J. L., Lee, C., & Farh, C. I. C. (2010). Task conflict and team creativity: A question of how much and when. *Journal of Applied Psychology, 95*(6), 1173-1180.
- Ferdman, B. M., & Brody, S. E. (1996). Models of diversity training. In D. Landis & R. S. Bhagat (Eds.), *Handbook of intercultural training, 2nd ed.*, 282-303. Thousand Oaks, CA: Sage.
- Fiedler, F. E., Mitchell, T., & Triandis, H. C. (1971). The culture assimilator: An approach to cross-cultural training. *Journal of Applied Psychology, 55*(2), 95.
- Fischer, U., & Orasanu, J. (1999, May). Say it again, Sam! Effective communication strategies to mitigate pilot error. In *Proceedings of the Tenth International Symposium on Aviation Psychology*. Columbus, OH.
- Fisher, R., Ury, W. L., & Patton, B. (2011). *Getting to yes: Negotiating agreement without giving in*. New York, NY: Penguin Books.
- Foldy, E.G. (2004). Learning from diversity: A theoretical exploration. *Public Administration Review, 64*(5), 529-538. doi:10.1111/j.1540-6210.2004.00401.x
- Ford, J. K., Kraiger, K., & Merritt, S. M. (2010). An updated review of the multidimensionality of training outcomes: New directions for training evaluation research. In S. W. J. Kozlowski & E. Salas (Eds.), *Learning, training, and development in organizations* (pp.135-165). New York, NY: Taylor and Francis.
- Fowler, S. M., & Blohm, J. M. (2004). An analysis of methods for intercultural training. In D. Landis, J. M. Bennett, & M. Bennett (Eds.), *Handbook of intercultural training* (3rd ed., pp.37-84). Thousand Oaks, CA: Sage.
- Fowler, S. M., & Blohm, J. M. (2007). Experiential learning in intercultural training. In M. Silberman (Ed.), *The handbook of experiential learning* (pp. 341-359). San Francisco, CA: John Wiley & Sons, Inc.
- Fritzsche, D. J., Leonard, N. H., Boscia, M. W., & Anderson, P. (2004). Simulation debriefing procedures. *Developments in Business Simulation and Experiential Learning, 31*, 337-338.
- Gaertner, S. L., & Dovidio, J. F. (2000). *Reducing intergroup bias: The common ingroup identity model*. New York, NY: Psychology Press.
- Gaertner, S. L., Mann, J., Murrell, A., & Dovidio, J. F. (1989). Reducing intergroup bias: The benefits of recategorization. *Journal of Personality and Social Psychology, 57*(2), 239.

- Gagné, R. M. (1985). *The conditions of learning and theory of instruction*. New York: Holt, Rinehart and Winston.
- Galinsky, A. D., Wang, C. S., & Ku, G. (2008). Perspective-takers behave more stereotypically. *Journal of Personality and Social Psychology*, 95(2), 404-419.
- Gardner, R. (2013). Introduction to debriefing. *Seminars in Perinatology*, 37(3), 166-174.
- Gelfand, M. J., & Brett, J. M. (Eds.) (2004). *The handbook of negotiation and culture*. Stanford, CA: Stanford University Press.
- Gelfand, M. J., Erez, M., & Aycan, Z. (2007). Cross-cultural organizational behavior. *Annual Review of Psychology*, 58(4), 479-514.
- Gibson, C. G. (1999). Do they do what they believe they can? Group efficacy and group effectiveness across tasks and cultures. *The Academy of Management Journal*, 42(2), 138-152.
- Gibson, C. B., & Zellmer-Bruhn, M. E. (2001). Metaphors and meaning: An intercultural analysis of the concept of teamwork. *Administrative Science Quarterly*, 46(2), 274-303.
- Gibson, C.B., & Zellmer-Bruhn, M. (2002). Minding your metaphors: Applying the concept of teamwork metaphors to the management of teams in multicultural contexts. *Organizational Dynamics*, 31(2): 101-116.
- Gomez, C., Kirkman, B. L., & Shapiro, D. L. (2000). The impact of collectivism and in-group/out-group membership on the evaluation generosity of team members. *Academy of Management Journal*, 43(6), 1097-1106.
- Grahn, J. L., & Swenson, D. X. (2000). Cross-cultural perspectives for quality training. *Cross Cultural Management: An International Journal*, 7(3), 19-24.
- Griggs, L.B., & Louw, L. (1995). Diverse teams Breakdown or breakthrough?. *Training & Development*, 49(10), 22-30.
- Grove, C. L., & Torbiörn, I. (1985). A new conceptualization of intercultural adjustment and the goals of training. *International Journal of Intercultural Relations*, 9(2), 205-233.
- Gudykunst, W. B. (2004). *Bridging differences: Effective intergroup communication*. New York, NY: Sage Publications.

- Gudykunst, W. B. (1998). Applying anxiety/uncertainty management (AUM) theory to intercultural adjustment training. *International Journal of Intercultural Relations*, 22(2), 227-250.
- Gudykunst, W. B., Guzley, R., & Hammer, M. R. (1996). Designing intercultural training. In D. Landis & R. S. Bhagat (Eds.), *Handbook of intercultural training* (2nd ed., pp. 61-80). Thousand Oaks, CA: Sage Publications.
- Gudykunst, W. B., Matsumoto, Y., Ting-Toomey, S., Nishida, T., Kim, K., & Heyman, S. (1996). The influence of cultural individualism-collectivism, self-construals, and individual values on communication styles across cultures. *Human Communication Research*, 22, 510-543.
- Gushin, V. I., Efimov, V. A., Smirnova, T. M. et al., (1998). Subject's perceptions of the crew interaction dynamics under prolonged isolation. *Aviation, Space, and Environmental Medicine*, 69, 556-561.
- Gushin, V. I., Kholin, S. F., & Ivanovsky, Y. R. (1993). Soviet psychophysiological investigations of simulation isolation: Some results and prospects. In S. L. Bonting (Ed.), *Advances in space biology and medicine*, Vol 3. London: JAI Press.
- Gushin, V. I., Pustynnikova, J. M., & Smirnova, T. M. (2001). Interrelations between the small isolated groups with homogeneous and heterogeneous composition. *Journal of Human Performance in Extreme Environments*, 6(1), 26-33.
- Guzzo, R. A., & Dickson, M. W. (1996). Teams in organizations: Recent research on performance and effectiveness. *Annual Review of Psychology*, 47(1), 307-338.
- Hackman, J. R. (1987). The design of work teams. In: J. W. Lorsch (Ed.), *Handbook of Organizational Behavior* (pp. 315-342). Englewood Cliffs, NJ: Prentice-Hall.
- Hackman, J. R., & Oldham, G. R. (1976). Motivation through the design of work:s Test of a theory. *Organizational Behavior and Human Performance*, 16(2), 250-279.
- Hackman, J. R., & Wageman, R. (2005). A theory of team coaching. *Academy of Management Review*, 30(2), 269-287.
- Hall, E. T., & Hall, M. R. (1990). *Understanding cultural differences*. Garden City, NY: Intercultural.
- Halpern, D. F. (1998). Teaching critical thinking for transfer across domains: Disposition, skills, structure training, and metacognitive monitoring. *American Psychologist*, 53(4), 449.

- Hambrick, D. C., Cho, T., & Chen, M. (1996). The Influence of Top Management Team Heterogeneity on Firms' Competitive Moves. *Administrative Science Quarterly*, 41(4), 659-684.
- Hamilton, B. H., Nickerson, J. A., & Owan, H. (2003). Team Incentives and Worker Heterogeneity: An Empirical Analysis of the Impact of Teams on Productivity and Participation. *Journal Of Political Economy*, 111(3), 465-497.
- Hammer, M. R., Bennett, M. J., & Wiseman, R. (2003). Measuring intercultural sensitivity: The intercultural development inventory. *International Journal of Intercultural Relations*, 27, 421-443.
- Hancock, P. A., & Szalma, J. L. (Eds.). (2008). *Performance under stress*. Surrey, UK: Ashgate Publishing, Ltd..
- Harrison, R., & Hopkins, R. L. (1967). The design of cross-cultural training: An alternative to the university model. *The Journal of Applied Behavioral Science*, 3(4), 431-460.
- Harrison, D. A., & Klein, K. J. (2007). What's the difference? Diversity constructs as separation, variety, or disparity in organizations. *Academy of Management Review*, 32(4), 1199-1228.
- Harrison, D. A., Price, K. H., Gavin, J. H., & Florey, A. T. (2002). Time, teams, and task performance: Changing effects of surface-and deep-level diversity on group functioning. *Academy of Management Journal*, 45(5), 1029-1045. doi:10.2307/3069328
- Harrison, G. L., McKinnon, J. L., Wu, A., & Chow, C. W. (2000). Cultural influences on adaptation to fluid workgroups and teams. *Journal of International Business Studies*, 31(3), 489-505.
- Hartley, C., & Lapinsky, T. (1999). Piglish: A language leaning simulation. *Intercultural sourcebook: Cross-cultural training methods*, 2, 131-142.
- Helmreich, R. L. (1980) Psychological considerations in future space missions. *Human Factors of Outer Space Production*.
- Helmreich, R. L. (2000). Culture and error in space: Implications from analog environments. *Aviation Space and Environmental Medicine*, 71(9; PART 2), A133-A139.
- Helmreich, R., & Merritt, A. (1998). *Culture at work in aviation and medicine: National, organizational and professional influences*. Brookfield, VT: Ashgate.

- Hinds, P. J., & Mortensen, M. (2005). Understanding conflict in geographically distributed teams: The moderating effects of shared identity, shared context, and spontaneous communication. *Organization Science*, 16(3), 290-307.
- Hofstede, G. (1980). *Culture's consequences: Comparing values, behaviors, institutions, and organizations across nations*. Beverly Hills, CA: Sage Publications.
- Hofstede, G. (1984). The cultural relativity of the quality of life concept. *Academy of Management Review*, 9(3), 389-398.
- Hofstede, G. (1993). Cultural constraints in management theories. *The Academy of Management Executive*, 7(1), 81-94.
- Hofstede, G. (2001). *Culture's consequences: Comparing values, behaviors, institutions, and organizations across nations*. Thousand Oaks, CA: Sage Publications.
- Hollenbeck, J. R., Ilgen, D. R., Segoe, D. J., Hedlund, J., Major, D. A., & Phillips, J. (1995). Multilevel theory of team decision-making: Decision performance in teams incorporating distributed expertise. *Journal of Applied Psychology*, 80(2), 292-316.
- House, R. J., Hanges, P. J., Javidan, M., Dorfman, P. W., & Gupta, V. (Eds.) (2004). *Culture, leadership, and organizations: The GLOBE study of 62 societies*. Thousand Oaks, CA: Sage.
- Humes, M. & Reilly, A. H. (2007). Managing Intercultural Teams: The eOrganization exercise. *Journal of Management Education*, 32(1), 118-137.
- Ilgen, D. R., LePine, J. A., & Hollenbeck, J. R. (1997). Effective decision making in multinational teams. In: P. C. Earley & M. Erez (Eds), *New perspectives in international Industrial-Organizational psychology* (pp. 377-409). San Francisco, CA: Jossey-Bass.
- Inclan, J. (1983). Psychological symptomatology in second generation Puerto Rican women of three socioeconomic groups. *Journal of Community Psychology*, 11(4), 334-345.
- Jackson, S. E., Joshi, A., & Erhardt, N. L. (2003). Recent research on team and organizational diversity: SWOT analysis and implications. *Journal of Management*, 29(6), 801-830.
- Jackson, S. E., May, K. E., & Whitney, K. (1995). Understanding the dynamics of diversity in decision making teams. In: R. A. Guzzo & E. Salas (Eds), *Team Decision Making Effectiveness in Organizations* (pp. 205-261). San Francisco, CA: Jossey-Bass.
- Janis, I. L. (1972). *Victims of groupthink: A psychological study of foreign-policy decisions and fiascoes*. Boston, MA: Houghton Mifflin.

- Jarvenpaa, S. L., Knoll, K., & Leidner, D. E. (1998). Is anybody out there? Antecedents of trust in global virtual teams. *Journal of Management Information Systems*, 14(4), 29-64.
- Jehn, K. A. (1995). A multimethod examination of the benefits and detriments of intragroup conflict. *Administrative Science Quarterly*, 40, 256-282.
- Jehn, K. A. (1997). A qualitative analysis of conflict types and dimensions in organizational groups. *Administrative Science Quarterly*, 42(3), 530-557.
- Jehn, K. A., Northcraft, G. B., & Neale, M. A. (1999). Why differences make a difference: A field study of diversity, conflict, and performance in workgroups. *Administrative Science Quarterly*, 44(4), 741-763.
- Jentsch, F., Hoelt, R. M., Fiore, S. M., & Bowers, C. A. (2004). "A Frenchman, a German, and an Englishman...": The impact of cultural heterogeneity in teams. In M. Kaplan (Ed.), *Advances in human performance and cognitive engineering research* (Volume 4) (pgs. 317-340). Oxford, UK: Elsevier.
- Johnson, J. P., Lenartowicz, T., & Apud, S. (2006). Cross-cultural competence in international business: Toward a definition and a model. *Journal of International Business Studies*, 37(4), 525-543.
- Joshi, A. & Roh, H. (2009), The role of context in work team diversity research: A meta-analytic review, *Academy of Management Journal*, 52(3), 599-627.
doi:10.5465/AMJ.2009.41331491
- Judge, T. A., Hulin, C. L., & Dalal, R. S. (2012). Job satisfaction and job affect. In S. W. J. Kozlowski (Ed.). *The Oxford handbook of industrial and organizational psychology*. New York: Oxford University Press.
- Jung, D. I., & Yammarino, F. J. (2001). *Perceptions of transformational leadership among Asian Americans and Caucasian Americans: A level of analysis perspective* [Publication No. 102]. Ciber Working Paper Series, San Diego, CA: San Diego State University.
- Kahane, L., Longley, N., & Simmons, R. (2013). The effects of coworker heterogeneity on firm-level output: Assessing the impacts of cultural and language diversity in the National Hockey League. *Review of Economics & Statistics*, 95(1), 303-314.
- Kanas, N. (2004). Group interactions during space missions. *Aviation, Space, and Environmental Medicine*, 75(7), C3-C5.

- Kanas, N., & Ritsher, J. (2005). Leadership issues with multicultural crews on the international space station: Lessons learned from Shuttle/Mir. *Acta Astronautica*, 56(9-12), 932-936.
- Kanas, N., Salnitskiy, V. P., Boyd, J. E., Gushin, V. I., Weiss, D. S., Saylor, S. A., Kozerenki, O. P., & Marmar, C. R. (2007). Crew member and mission control personnel interactions during international space station missions. *Aviation, Space, and Environmental Medicine*, 78(6), 601-607.
- Kanas, N., Salnitskiy, V., Grund, E. M., et al. (2001). Psychosocial issues in space: Results from Shuttle/Mir. *Acta Astronaut*, 49, 243-260.
- Kanas, N., Sandal, G., Boyd, J. E., Gushin, V. I., Manzey, D., North, R., ... & Wang, J. (2009). Psychology and culture during long-duration space missions. *Acta Astronautica*, 64(7-8), 659-677. doi: 10.1016/j.actaastro.2008.12.005
- Kanas, N., Weiss, D. S., Marmar, C. R. (1996). Crew member interactions during a Mir space station simulation. *Aviation Space and Environmental Medicine*, 67, 969-975.
- Kane, A. A., Argote, L., & Levine, J. M. (2005). Knowledge transfer between groups via personnel rotation: Effects of social identity and knowledge quality. *Organizational Behavior and Human Decision Processes*, 96(1), 56-71.
- Kankanhalli, A., Tan, B. Y., & Wei, K. (2006). Conflict and performance in global virtual teams. *Journal of Management Information Systems*, 23(3), 237-274.
- Kaushal, R., & Kwantes, C. T. (2006). The role of culture and personality in choice of conflict management strategy. *International Journal of Intercultural Relations*, 30, 579-603.
- Kealey, D. J. (2004). Research on intercultural effectiveness and its relevance to multicultural crews in space. *Aviation Space and Environmental Medicine*, 75(7, Section 2, Suppl), C58-C64.
- Kealey, D. J., & Protheroe, D. R. (1996). The effectiveness of cross-cultural training for expatriates: An assessment of the literature on the issue. *International Journal of Intercultural Relations*, 20(2), 141-165.
- Kerr, N. L., & Tindale, R. S. (2004). Group performance and decision making. *Annual Review of Psychology*, 55, 623-655.
- Kidwell, R. E., Mossholder, K. W., & Bennett, N. (1997). Cohesiveness and organizational citizenship behavior: A multilevel analysis using work groups and individuals. *Journal of Management*, 23(6), 775-793.

- Kirchmeyer, C. (1993). Multicultural task groups. *Small Group Research*, 24(1), 127-148.
- Kirkman, B. L., & Rosen, B. (1999). Beyond self-management: Antecedents and consequences of team empowerment. *Academy of Management Journal*, 42(1), 58-74.
- Klein, H. A. (2004). Cognition in natural settings: The cultural lens model. In M. Kaplan (Ed.), *Advances in Human Performance and Cognitive Engineering Research*, Vol 4, 249-280. The Netherlands, Elsevier.
- Klein, H. A., Klein, G., & Mumaw, R. J. (2001). *Culturally sensitive aviation demands* (Technical Report Prepared for the Boeing Company under General Consultant Agreement 6-111-10A-0112). Fairborn, OH: Wright State University.
- Kluckhohn, F. R., & Strodtbeck, F. L. (1961), *Variations in value orientations*. Evanston: Row, Peterson and Company.
- Kluger, A. N., & DeNisi, A. (1996). The effects of feedback interventions on performance: a historical review, a meta-analysis, and a preliminary feedback intervention theory. *Psychological Bulletin*, 119(2), 254.
- Kolb, D. A. (1984). *Experiential learning: Experience as the source of learning and development* (Vol. 1). Englewood Cliffs, NJ: Prentice-Hall.
- Kotler, Philip (1986), "Global Standardization - Courting Danger," *Journal of Consumer Marketing*, 3 (Spring), 13-15.
- Kokt, D. (2003). The impact of cultural diversity on work team performance: A South-African perspective. *Team Performance Management*, 9(3/4), 78-83.
- Kraft, N., Lyons, T., & Binder, H. (2003). Intercultural crew issues in long-duration spaceflight. *Aviation, Space, And Environmental Medicine*, 74(5, Section 1), 575-578.
- Kraiger, K., Ford, J. K., & Salas, E. (1993). Application of cognitive, skill-based, and affective theories of learning outcomes to new methods of training evaluation. *Journal of Applied Psychology*, 78(2), 311-338.
- Kraut, A. I. (1976). Behavior modeling symposium: Developing managerial skills via modeling techniques: Some positive research findings—a symposium. *Personnel Psychology*, 29(3), 325-328.
- Kring, J. P., & Kaminski, M. A. (2011). Gender composition and crew cohesion during long-duration space missions. In D. A. Vakoch (Ed.), *Psychology of space exploration*. The NASA History Series. Washington, DC: National Aeronautics and Space Administration.

- Kuang, J. C. Y., & Davis, D. D. (2001). *Culture and team performance in foreign flightcrews*. Paper presented at the 109th Annual Convention of the American Psychological Association. San Francisco, CA.
- Kupka, B., Everett, A. M., & Cathro, V. (2008). Home alone and often unprepared—intercultural communication training for expatriated partners in German MNCs. *The International Journal of Human Resource Management*, *19*(10), 1765-1791.
- Kurtzberg, T. R., & Amabile, T. M. (2001). From Guilford to creative synergy: Opening the black box of team-level creativity. *Creativity Research Journal*, *13*(3-4), 285-294. doi:10.1207/S15326934CRJ1334_06
- Landis, D., & Brislin, R. W. (Eds.). (1983). *Handbook of intercultural training* (Vol. 1). New York, NY: Pergamon Press.
- Lane, H., & DiStefano, J. (1992). *International management behavior: From policy to practice*. Boston: PWS-Kent.
- Langan-Fox, J., Anglim, J., & Wilson, J. R. (2004). Mental models, team mental models, and performance: Process, development, and future directions. *Human Factors and Ergonomics in Manufacturing & Service Industries*, *14*(4), 331-352.
- Langfred, C. W. (2007). The downside of self-management: A longitudinal study of the effects of conflict on trust, autonomy, and task interdependence in self-managing teams. *Academy of Management Journal*, *50*(4), 885-900.
- Lau, D. C., & Murnighan, J. K. (1998). Demographic diversity and faultlines: The compositional dynamics of organizational groups. *Academy of Management Review*, *23*(2), 325-340.
- Lau, D. C., & Murnighan, J. K. (2005). Interactions within groups and subgroups: The effects of demographic faultlines. *Academy of Management Journal*, *48*(4), 645-659.
- Lederman, L. C. (1992). Debriefing: Toward a systematic assessment of theory and practice. *Simulation & Gaming*, *23*(2), 145-160.
- LePine, J. A., Piccolo, R. E., Jackson, C. L., Mathieu, J. E., & Saul, J. R. (2008). A meta-analysis of teamwork processes: Tests of a multidimensional model and relationships with team effectiveness criteria. *Personnel Psychology*, *61*, 273-307.
- Lewer, J. (2008). Management practice, productivity and plant closure: A case study. *The Association on Employment Practices and Principles (AEPP)*, 266.

- Lingard, L., Espin, S., Whyte, S., Regehr, G., Baker, G. R., Reznick, R., ... & Grober, E. (2004). Communication failures in the operating room: An observational classification of recurrent types and effects. *Quality and Safety in Health Care, 13*(5), 330-334.
- Linn, M. W., Hunter, K. I., & Perry, P. R. (1979). Differences by sex and ethnicity in the psychosocial adjustment of the elderly. *Journal of Health and Social Behavior, 20*(3), 273-281.
- Littrell, L. N., Salas, E., Hess, K. P., Paley, M., & Riedel, S. (2006). Expatriate preparation: A critical analysis of 25 years of cross-cultural training research. *Human Resource Development Review, 5*(3), 355-388.
- Littrell, L. N., & Salas, E. (2005). A review of cross-cultural training: Best practices, guidelines, and research needs. *Human Resource Development Review, 4*(3), 305-334.
- Luthans, K. W., & Farner, S. (2002). Expatriate development: The use of 360-degree feedback. *Journal of Management Development, 21*(10), 780-793.
- Marks, M. A., Mathieu, J. E., & Zaccaro, S. J. (2001). A temporally based framework and taxonomy of team process. *Academy of Management Review, 26*(3), 356-376.
- Marks, M. A., Sabella, M. J., Burke, C. S., & Zaccaro, S. J. (2002). The impact of cross-training on team effectiveness. *Journal of Applied Psychology, 87*(1), 3-13.
- Markus, H., & Wurf, E. (1987). The dynamic self-concept: A social psychological perspective. *Annual Review of Psychology, 38*(1), 299-337.
- Mathieu, J. E., Heffner, T. S., Goodwin, G. F., Salas, E., & Cannon-Bowers, J. A. (2000). The influence of shared mental models on team process and performance. *Journal of Applied Psychology, 85*(2), 273-283.
- Mathieu, J. E., Heffner, T. S., Goodwin, G. F., Cannon-Bowers, J. A., & Salas, E. (2005). Scaling the quality of teammates' mental models: Equifinality and normative comparisons. *Journal of Organizational Behavior, 26*(1), 37-56.
- Mathieu, J., Maynard, M. T., Rapp, T., & Gilson, L. (2008). Team effectiveness 1997-2007: A review of recent advancements and a glimpse into the future. *Journal of Management, 34*, 410-476.
- Mayer, R. C., Davis, J. H., & Schoorman, F. D. (1995). An integrative model of organizational trust. *The Academy of Management Review, 20*(3), 709-734.

- Maznevski, M., & Peterson, M. F. (1997). Societal values, social interpretation, and multinational teams. In C. S. Granrose & S. Oskmap (Eds.), *Cross-cultural work groups* (pp. 61-89). Thousand Oaks, CA: Sage Publications.
- McFadden T, Helmreich R. L, Rose R., & Fogg L. (1994). Predicting astronaut effectiveness: A multivariate approach. *Aviation, Space, And Environmental Medicine*, 65(10, Section 1), 904–909.
- McGrath, J. E. (1962). *Leadership behavior: Some requirements for leadership training*. Washington, DC: U.S. Civil Service Commission, Office of Career Development.
- McLeod, P. L., Lobel, S. A., & Cox, T. H. (1996). Ethnic diversity and creativity in small groups. *Small Group Research*, 27, 248-264.
- Mendenhall, M., & Oddou, G. (1985). The dimensions of expatriate acculturation: A review. *Academy of Management Review*, 10(1), 39-47.
- Mendenhall, M. E., Stahl, G. K., Ehnert, I., Oddou, G., Osland, J. S., & Kuhlmann, T. M. (2004). Evaluation studies of cross-cultural training programs. In D. Landis, J. M. Bennett, & M. J. Bennett (Eds.), *Handbook of intercultural training* (3rd ed., pp. 129-143). Thousand Oaks, CA: Sage.
- Mesmer-Magnus, J. R., & DeChurch, L. A. (2009). Information sharing and team performance: A meta-analysis. *Journal of Applied Psychology*, 94(2), 535.
- Mesmer-Magnus, J. R., & Viswesvaran, C. (2007). Expatriate Management: A review and directions for research in expatriate selection, training, and repatriation. In M. M. Harris (Ed.), *Handbook of research in international human resource management: 1* (pp. 183-224). New York, NY: Taylor & Francis.
- Miller, J. (2004). Critical incident debriefing and social work. *Journal of Social Service Research*, 30(2), 7-25.
- Milliken, F. J., Bartel, C. A., & Kurtzberg, T. R. (2003). Diversity and creativity in work groups: A dynamic perspective on the affective and cognitive processes that link diversity and performance. In P. Paulus & B. A. Nijstad (Eds.), *Group creativity: Innovation through collaboration*. New York: Oxford University Press.
- Milliken, F. J., & Martins, L. L. (1996). Searching for common threads: Understanding the multiple effects of diversity in organizational groups. *Academy of Management Review*, 21(2), 402-433.

- Miranda, A. O., & Umhoefer, D. L. (1998). Depression and social interest differences between Latinos in dissimilar acculturation stages. *Journal of Mental Health Counseling, 20*(2), 159-171.
- Mitchell, A. M., Sakraida, T. J., & Kameg, K. (2003). Critical incident stress debriefing: Implications for best practice. *Disaster Management & Response, 1*(2), 46-51.
- Mohammed, S., Ferzandi, L., & Hamilton, K. (2010). Metaphor no more: A 15-year review of the team mental model construct. *Journal of Management, 36*(4), 876-910.
- Moon, T. (2013). The effects of cultural intelligence on performance in multicultural teams. *Journal Of Applied Social Psychology, 43*(12), 2414-2425. doi:10.1111/jasp.12189
- Mor, S., Morris, M., & Joh, J. (2013). Identifying and training adaptive cross-cultural management skills: The crucial role of cultural metacognition. *Academy of Management Learning & Education, 12*(3), 453-475.
- Moreland, R. L., & Levine, J. M. (1982). Socialization in small groups: Temporal changes in individual-group relations. *Advances in experimental social psychology, 15*, 137-192.
- Morgeson, F. P., & Humphrey, S. E. (2008). Job and team design: Toward a more integrative conceptualization of work design. *Research in Personnel and Human Resources Management, 27*, 39-91.
- Morris, M., & Peng, K. (1994). Culture and cause: American and Chinese attributions for social and physical events. *Journal of Personality & Social Psychology, 67*(6), 949-971.
- Morris, M. A., & Robie, C. (2001). A meta-analysis of the effects of cross-cultural training on expatriate performance and adjustment. *International Journal of Training & Development, 5*, 112-125.
- Morris, M.W., Williams, K.Y., Leung, K., Larrick, R., Mendoza, M.T., Bhatnagar, D., ... & Hu, J. (1998). Conflict management style: Accounting for cross-national differences. *Journal of International Business Studies, 29*(4), 729-747.
- Mort, T. C., & Donahue, S. P. (2004). Debriefing: the basics. In W. Dunn (Ed.) *Simulators in critical care and beyond* (pp. 76-83). Des Plaines, IL: Society of Critical Care Medicine.
- Neuliep, J. W. (2006). *Intercultural communication: A contextual approach*. (3rd ed.). Thousand Oaks, CA: Sage.

- Newell, A., & Rosenbloom, P. S. (1981). Mechanisms of skill acquisition and the law of practice. In J. R. Anderson (Ed.), *Cognitive skills and their acquisition* (pp. 1-56). Hillsdale, NJ: Lawrence Erlbaum Associates.
- Nisbett, R. E., Peng, K., Choi, I., Norenzayan, A. (2001). Culture and systems of thought: Holistic versus analytic cognition. *Psychological Review*, *108*(2), 291-310.
- Noe, R. A. (1986). Trainee's attributes and attitudes: Neglected influences on training effectiveness. *Academy of Management Review*, *11*, 736-749.
- Noe, R. A., Dachner, A. M., Saxton, B., Keeton, K. E., & EASI, N. (2011). Team training for long-duration missions in isolated and confined environments: A literature review, an operational assessment, and recommendations for practice and research (NASA/TM-2011-216162). Houston, TX: NASA.
- Nouri, R., Erez, M., Rockstuhl, T., Ang, S., Leshem-Calif, L. & Rafaeli, A. (2013). Taking the bite out of culture: The impact of task structure and task type on overcoming impediments to cross-cultural team performance. *Journal of Organizational Behavior*, *34*(6). 739-763. doi:10.1002/job.1871
- Oertig, M., & Buergi, T. (2006). The challenges of managing cross-cultural virtual project teams. *Team Performance Management*, *12*(1/2), p. 23-30.
- Oetzel, J. G. (1998). Culturally homogeneous and heterogeneous groups: Explaining cultural communication processes through individualism-collectivism and self-construal. *International Journal of Intercultural Relations*, *22*(2), 135-161.
- Olson, G. M., & Olson, J. S. (2000). I2i trust in e-commerce. *Communications of the ACM*, *43*(12), 41-44.
- Orasanu, J. (1990). *Shared mental models and crew decision making* (Cognitive Science Laboratory Report No. 46). Princeton, NJ: Princeton University.
- Paige, R. M. (1986). Trainer competencies: The missing conceptual link in orientation. *International Journal of Intercultural Relations*, *10*, 135-158.
- Palinkas, L., Johnson, J., Boster, J., Rakusa-Suszczewski, S., Klopov, V., Fu, X., & Sachdeva, U. (2004). Cross-cultural differences in psychosocial adaptation to isolated and confined environments. *Aviation, Space, And Environmental Medicine*, *75*(11), 973-980.
- Parsons, T., & Shils, E. A. (1951). Values, motives, and systems of action. *Toward a general theory of action*, *33*, 247-275.

- Pearce, C. L., & Conger, J. A. (2002). *Shared leadership: Reframing the hows and whys of leadership*. Sage Publications.
- Pekerti, A. A. (2005). Cross-cultural perceptions in the leadership process: Theoretical perspective on the influence of culture on self-concepts and manager-worker attributions. *Thunderbird International Business Review*, 47(6), 711-735.
- Pelled, L. H., Eisenhardt, K. M., & Xin, K. R. (1999). Exploring the black box: An analysis of work group diversity, conflict, and performance. *Administrative Science Quarterly*, 44(1), 1-28.
- Peterson, R. S., & Behfar, K. J. (2003). The dynamic relationship between performance feedback, trust, and conflict in groups: A longitudinal study. *Organizational Behavior and Human Decision Processes*, 92, 102-112.
- Pillai, R., & Meindl, J. R. (1998). Context and charisma: A “meso” level examination of the relationship of organic structure, collectivism, and crisis to charismatic leadership. *Journal of Management*, 24(5), 643-671.
- Porter, T. W., & Lily, B. S. (1996). The effects of conflict, trust, and task commitment on project team performance. *International Journal of Conflict Management*, 7(4), 361-376.
- Ptak, C. L., Cooper, J., & Brislin, R. (1995). Cross cultural training programs: Advice and insights from experienced trainers. *International Journal of Intercultural Relations*, 19(3), 425-453.
- Rahim, M. A. (1983). A measure of styles of handling interpersonal conflict. *Academy of Management Journal*, 26, 368-376.
- Rahim, M. A. (2002). Toward a theory of managing organizational conflict. *The International Journal of Conflict Management*, 13(3), 206-235.
- Rall, M., Manser, T., & Howard, S. K. (2009). Key elements of debriefing for simulator training. *European Journal of Anesthesiology*, 17(8), 515-526.
- Randel, A. E. & Earley, P.C. (2009). Organizational culture and similarity among team members' salience of multiple diversity characteristics. *Journal of Applied Social Psychology*, 39(4), 804-833. doi:10.1111/j.1559-1816.2009.00461.x
- Raybeck, D. (1991). Proxemics and privacy: Managing the problems of life in confined environments. In A.A. Harrison, Y.A. Clearwater, C.P. McKay (Eds.), *From Antarctica to outer space*. New York, NY: Springer.

- Rentsch, J. R., Gunderson, A., Goodwin, G. F., & Abbe, A. (2007). *Conceptualizing multicultural perspective taking skills*. (TR 1216). Arlington, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.
- Rentsch, J. R., & Woehr, D. J. (2004). Quantifying congruence in cognition: Social relations modeling and team member schema similarity. In E. Salas & S. Fiore (Eds.), *Team cognition: Understanding the factors that drive process and performance* (pp. 11-31). Washington DC: American Psychological Association.
- Reynolds, A. L., & Pope, R. L. (1991). The complexities of diversity: Exploring multiple oppressions. *Journal of Counseling & Development, 70*(1), 174-180.
- Rico, R., Maria Alcover de la Hera, C., & Tabernero, C. (2011). Team effectiveness, A review of research from the last decade (1999-2009). *Psychology in Spain, 15*(1), 57-79.
- Ritsher, J. B. (2005). Cultural factors and the international space station. *Aviation, Space, and Environmental Medicine, 76*(Supplement 1), B135-B144.
- Roberts, K. H., & Bea, R. (2001). Must accidents happen? Lessons from high-reliability organizations. *Academy of Management Perspectives, 15*(3), 70-78.
- Robinson, G., & Dechant, K. (1997). Building a business case for diversity. *Academy Of Management Executive, 11*(3), 21-31. doi:10.5465/AME.1997.9709231661
- Rogler, L. H., & Cooney, R. S. (1984). *Puerto Rican Families in New York City: Intergenerational Processes*. Maplewood, NJ: Waterfront Press.
- Rokeach, M. (1973). *The nature of human values*. New York: Free Press.
- Rosen, M. A., Salas, E., Wilson, K. A., King, H. B., Salisbury, M., Augenstein, J. S., ... & Birnbach, D. J. (2008). Measuring team performance in simulation-based training: Adopting best practices for healthcare. *Simulation in Healthcare, 3*(1), 33-41.
- Rouse, W. B., & Morris, M. W. (1986). On looking into the black box: Prospects and limits in search of mental models. *Psychological Bulletin, 100*, 359-363.
- Salas, E., & Burke, C. S. (2002). Simulation for training is effective when.... *Quality and Safety in Health Care, 11*(2), 119-120.
- Salas, E., Burke, C.S., & Cannon-Bowers, J.A. (2002). What we know about designing and delivering team training: Tips and guidelines. In K. Kraiger (Ed.), *Creating, implementing, and managing effective training and development: State-of-the-art lessons for practice* (pp. 234-259). San Francisco, CA: Jossey-Bass.

- Salas, E., Burke, C. S., Wilson-Donnelly, K. A. Fowlkes, J. E., (2004). Promoting effective leadership within multicultural teams: An event-based approach. In D. Day, S. J. Zaccaro, & S. M. Halpin (Eds.), *Leader development for transforming organizations* (pp.293-323). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.
- Salas, E., Tannenbaum, S. I., Kraiger, K., & Smith-Jentsch, K. A. (2012). The science of training and development in organizations: What matters in practice. *Psychological Science in the Public Interest*, 13(2), 74-101.
- Salgado de Snyder, V. N. (1987). Mexican immigrant women: The relationship of ethnic loyalty and social support to acculturative stress and depressive symptomatology. *Spanish Speaking Mental Health Research Center Occasional Papers*.
- Sandal, G. M. (2001). Psychosocial issues in space: Future challenges. *Gravitational and Space Research*, 14(2).
- Sandal, G. M. (2004). Culture and tension during an International Space Station simulation: Results from SFINCSS'99. *Aviation, Space, And Environmental Medicine*, 75(7, Section 2, Suppl), C44-C51.
- Sandal, G. M. (2005). Psykologi i verdensrommet. *Tidsskrift For Norsk Psykologforening*, 42(4), 301-309.
- Sandal, G. M. (2007). Psychosocial issues in space: Future challenges. *Gravitational and Space Biology Bulletin*, 14(2), 47-54.
- Sandal, G. M., Vaernes, R., & Ursin, H. (1995). Crew compatibility and interaction. *Advances in Space Biology and Medicine*, 5, 213-231.
- Sandal, G. M., Bye, H. H., & van de Vijver, F. J. (2011). Personal values and crew compatibility: Results from a 105 days simulated space mission. *Acta Astronautica*, 69(3-4), 141-149. doi: 10.1016/j.actaastro.2011.02.007
- Sandal, G. M., & Manzey, D. (2009). Cross-cultural issues in space operations: A survey study among ground personnel of the European Space Agency. *Acta Astronautica*, 65(11), 1520-1529.
- Santy, P. A., Holland, A. W., Looper, L., & Macondes-North, R. (1993). Multicultural factors in an international crew debrief. *Aviation, Space, and Environmental Medicine*, 64, 196-200.

- Saunders, T., Driskell, J. E., Johnston, J. H., & Salas, E. (1996). The effect of stress inoculation training on anxiety and performance. *Journal of Occupational Health Psychology, 1*(2), 170.
- Sawyer, T. L., & Deering, S. (2013). Adaptation of the US army's after-action review for simulation debriefing in healthcare. *Simulation in Healthcare, 8*(6):388-397.
- Schwartz, S. H. (1999). A theory of cultural values and some implications for work. *Applied Psychology: An International Review, 48*(1), 23-47.
- Schweder, R., & Bourne, E. J. (1992). Does the concept of the person vary cross-culturally? In: A. J. Marsella & G. M. White (Eds), *Cultural conceptions of mental health and therapy* (pp. 97-137). Dordrecht: Reidel.
- Shachaf, P. (2008). Cultural diversity and information and communication technology impacts on global virtual teams: An exploratory study. *Information and Management, 45*(2), 131-142. doi:10.1016/j.im.2007.12.003
- Schein, E. (1985). *Organizational Culture and Leadership*. San Francisco: Jossey-Bass.
- Sessa, V. I. (1996). Using perspective taking to manage conflict and affect in teams. *The Journal of Applied Behavioral Science, 32*(1), 101-115.
- Shaw, M. E. (1976). *Group dynamics: The psychology of small group behavior* (2nd ed.). New York: McGraw Hill Book Company.
- Shaw, M. E., Robbin, R., & Belser, J. R. (1981). *Group dynamics: The psychology of small group behavior* (3rd ed.). New York: McGraw Hill Book Company.
- Shipper, F., Hoffman, R. C., & Rotondo, D. M. (2007). Does the 360 feedback process create actionable knowledge equally across cultures?. *Academy of Management Learning & Education, 6*(1), 33-50.
- Shirts, R. G. (1995). Beyond ethnocentrism: Promoting cross-cultural understanding with Bafa Bafa. *Intercultural Sourcebook: Cross-Cultural Training Method, 1*, 93-100.
- Shokef, E. & Erez, M. (2006). Shared meaning systems in multicultural teams. In B. Mannix, M. Neale, & Ya-Ru Chen (Eds.), *National culture and groups: Research on managing groups and teams*. Volume 9, pp. 325-352. San Diego, CA: Elsevier JAI Press.
- Sims, D. E., Salas, E., & Burke, C. S. (2005). Promoting effective team performance through training. In S. E. Wheelan (Ed.), *The handbook of group research and practice* (pp. 407-425). London: SAGE Publications.

- Smith, P. B., Bond, M. H., & Kagitcibasi, C. (2006). *Understanding social psychology across cultures: Living and working in a changing world*. London: Sage Publications.
- Smith-Jentsch, K. A., Cannon-Bowers, J. A., Tannenbaum, S. I., & Salas, E. (2008). Guided team self-correction: Impacts on team mental models, processes, and effectiveness. *Small Group Research*, 39(3), 303-327.
- Smith-Jentsch, K. A., Johnston, J. H., & Payne, S. C. (1998). Measuring team-related expertise in complex environments. In: J. A. Cannon-Bowers & E. Salas (Eds), *Making decisions under stress: Implications for individual and team training* (pp. 61-87). Washington, DC: American Psychological Association.
- Smith-Jentsch, K. A., Zeisig, R. L., Acton, B., & McPherson, J. A. (1998). Team dimensional training: A strategy for guided team self-correction. In J. A. Cannon-Bowers & E. Salas (Eds.), *Making decisions under stress: Implications for individual and team training* (pp. 271-297). Washington, DC: American Psychological Association. doi: 10.1037/10278-010
- Smolek, J., Hoffman, D., & Morgan, L. (1999). Organizing teams for success. In E. Sundstrom (Ed.), *Supporting work team effectiveness* (pp. 24-62). San Francisco: Jossey-Bass.
- Spitzberg, B. H. (2001). The status of attribution theory qua theory in personal relationships. In V. Manusov & J. H. Harvey (Eds.), *Attribution, communication, behavior, and close relationships* (pp. 353-371). Cambridge, UK: Cambridge University Press.
- Stahl, G. K., & Caligiuri, P. (2005). The effectiveness of expatriate coping strategies: the moderating role of cultural distance, position level, and time on the international assignment. *Journal of Applied Psychology*, 90(4), 603.
- Stahl, G.K., Makela, K., Zander, L., & Maznevski, M.L. (2010a). A look at the bright side of multicultural team diversity. *Scandinavian Journal of Management*, 26(4), 439-447.
- Stahl, G. K., Maznevski, M. L., Voigt, A., & Jonsen, K. (2010b). Unraveling the effects of cultural diversity in teams: A meta-analysis of research on multicultural work groups. *Journal of international business studies*, 41(4), 690-709. doi:10.1057/jibs.2009.85
- Staples, D. D. & Zhao, L. (2006). The effects of cultural diversity in virtual teams versus face-to-face teams. *Group Decision and Negotiation*, 15(4), 389-406. doi:10.1007/s10726-006-9042-x.

- Stasser, G., & Titus, W. (1987). Effects of information load and percentage of shared information on the dissemination of unshared information during group discussion. *Journal of Personality and Social Psychology*, 53, 81-93.
- Stewart, G. L. (2006). A meta-analytic review of relationships between team design features and team performance. *Journal of Management*, 32(1), 29-55.
- Straub, D., Loch, K., Evaristo, R., Karahanna, E., & Srite, M. (2002). Toward a theory-based measurement of culture. *Human factors in information systems*, pp. 13-23.
- Strauch, B. (2010). Can Cultural Differences Lead to Accidents? Team Cultural Differences and Sociotechnical System Operations. *Human Factors*, 52(2), 246-263. doi:10.1177/0018720810362238.
- Stroh, L. K., Black, J. S., Mendenhall, M. C., & Gregersen, H. B. (2005). *International assignments: An integration of strategy, research and practice*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Stuster, J. (2011). *Bold endeavors: Lessons from polar and space exploration*. Annapolis, MD: Naval Institute Press.
- Sue, D. W., Arredondo, P., & McDavis, R. J. (1992). Multicultural counseling competencies and standards: A call to the profession. *Journal of Counseling & Development*, 70(4), 477-486.
- Suedfeld, P., Wilk, K. E., & Cassel, L. (2011). Flying with strangers: Postmission reflections of multinational space crews. In D. A. Vakoch (Ed.), *On orbit and beyond: Psychological perspectives on human spaceflight* (pp. 185-209). New York: Springer.
- Sutton, J. L., & Pierce, L. G. (2003). *A framework for understanding cultural diversity in cognition and teamwork*. Army Research Laboratory, Human Research and Engineering Directorate. Fort Sill Oklahoma.
- Swann Jr, W. B. (1983). Self-verification: Bringing social reality into harmony with the self. *Social Psychological Perspectives on the Self*, 2, 33-66.
- Tafforin, C. (2009). Life at the Franco-Italian Concordia station in Antarctica for a voyage to Mars: Ethological study and anthropological perspectives. *Antrocom*, 5(1), 67-72.
- Tafforin, C. (2013a). Time effects, cultural influences, and individual differences in crew behavior during the Mars-500 experiment. *Aviation, Space, and Environmental Medicine*, 84(10). 1082-1086. doi:10.3357/ASEM.3692.2013

- Tafforin, C. (2013b). Adaptive behavior of an isolated and confined crew during a Mars mission simulation. *Human Ethology Bulletin*, 28(1), 8-14.
- Tafforin, C., & Gerebtzoff, D. (2010). A software-based solution for research in space ethology. *Aviation, Space, and Environmental Medicine*, 81(10), 951-960.
- Tannenbaum, S. I., & Cerasoli, C. P. (2013). Do team and individual debriefs enhance performance? A meta-analysis. *Human Factors*, 55(1), 231-245.
- Tannenbaum, S. I., & Yukl, G. (1992). Training and development in work organizations. *Annual Review of Psychology*, 43(1), 399-441.
- Taylor, P. J., Russ-Eft, D. F., & Chan, D. W. (2005). A meta-analytic review of behavior modeling training. *Journal of Applied Psychology*, 90(4), 692.
- Thatcher, S., & Patel, P. C. (2011). Demographic faultlines: a meta-analysis of the literature. *Journal of Applied Psychology*, 96(6), 1119.
- Thomas, D. C. (1999). Cultural Diversity and Work Group Effectiveness: An Experimental Study. *Journal of Cross-Cultural Psychology*, 30(2), 242-263.
doi:10.1177/0022022199030002006
- Thomas, A., & Doak, R. (2000). The development of shared values: Impact on employee behaviour and on customer perception of service. *South African Journal of Business Management*, 31(1), 7-14.
- Ting-Toomey, S. (1985). Toward a theory of conflict and culture. In W. B. Gudykunst, L. P. Stewart, & S. Ting-Toomey (Eds.), *Communication, cultures, and organizational processes*. Newbury Park, CA: Sage.
- Tinsley, C. H. (2001). How negotiators get to yes: Predicting the constellation of strategies used across cultures to negotiate conflict. *Journal of Applied Psychology*, 86(4), 583-593.
- Torres-Matrullo, C. (1976). Acculturation and psychopathology among Puerto Rican women in mainland United States. *American Journal of Orthopsychiatry*, 46(4), 710.
- Triandis, H. C. (1993). Collectivism and individualism as cultural syndromes. *Cross-Cultural Research*, 27(3/4), 155-180.
- Triandis, H. C. (2000). Culture and conflict. *International Journal of Psychology*, 35(2), 145-152.
- Triandis, H. C. (2000). Dialectics between cultural and cross-cultural psychology. *Asian Journal of Social Psychology*, 3, 185-95 .

- Tröster, C., Mehra, A., & van Knippenberg, D. (2014). Structuring for team success: The interactive effects of network structure and cultural diversity on team potency and performance. *Organizational Behavior & Human Decision Processes*, *124*(2), 245-255. doi:10.1016/j.obhdp.2014.04.003
- Trompenaars, F., & Hampden-Turner, C. (1998). *Riding the waves of culture: Understanding cultural diversity in global business*. New York, NY: McGraw Hill.
- Tung, R. L. (1981). Selection and training of personnel for overseas assignments. *Columbia Journal of World Business*, *16*(1), 68-78.
- US Department of Health and Human Services. (2001). National standards for culturally and linguistically appropriate services in health care. *Washington, DC: USDHHS, OPHS, Office of Minority Health. Harris, KJ, JS Ahluwalia, KS Okuyemi, JR Turner, MN Woods, K. Resnicow, and CL Backinger*, 447-458.
- van de Vijver, F. R., Breugelmans, S. M., & Schalk-Soekar, S. G. (2008). Multiculturalism: Construct validity and stability. *International Journal of Intercultural Relations*, *32*(2), 93-104.
- van Knippenberg, D., & Schippers, M. C. (2007). Work group diversity. *Annual Review of Psychology*, *58*, 515-541.
- Velden, F. S. T., Beersma, B., & De Dreu, C. K. (2007). Majority and minority influence in group negotiation: The moderating effects of social motivation and decision rules. *Journal of Applied Psychology*, *92*(1), 259.
- Vessey, W. B. (2014). Multiteam systems in the spaceflight context: Current and future challenges. In M. L. Shuffler, R. Rico, & E. Salas (Eds.), *Pushing the boundaries: Multiteam systems in research and practice*. Research on Managing Groups and Teams, Vol. 16, p. 135-153. UK: Emerald Group Publishing Limited.
- Wade-Benzoni, K. A., Okumura, T., Brett, J. M., Moore, D. A., Tenbrunsel, A. E., & Bazerman, M. H. (2002). Cognitions and behavior in asymmetric social dilemmas: A comparison of two cultures. *Journal of Applied Psychology*, *87*(1), 87-95.
- Warheit, G. J., Vega, W. A., Auth, J., & Meinhardt, K. (1985). Mexican-American immigration and mental health: A comparative analysis of psychosocial stress and dysfunction. *Stress and Hispanic mental health: Relation research to service delivery* (pp. 76-109). Rockville, MD: National Institute of Mental Health.

- Watson, W. E., BarNir, A., & Pavur, R. (2005). Cultural diversity and learning teams: The impact on desired academic team processes. *International Journal of Intercultural Relations, 29*, 449-467.
- Watson, W. E., Johnson, L., & Merritt, D. (1998). Team orientation, self-orientation, and diversity in task groups their connection to team performance over time. *Group & Organization Management, 23*(2), 161-188.
- Watson, W. E., Johnson, L., & Zgourides, G. D. (2002). The influence of ethnic diversity on leadership, group processes, and performance: An examination of learning teams. *International Journal of Intercultural Relations, 26*, 1-16.
- Watson, W. E., Kumar, K., & Michaelsen, L. K. (1993). Cultural diversity's impact on interaction process and performance: Comparing homogeneous and diverse task groups. *Academy Of Management Journal, 36*(3), 590-602. doi:10.2307/256593
- Weiss, H. M. (1990). Learning theory and industrial and organizational psychology. In M. D. Dunnette & L. M. Hough (Eds.), *Handbook of industrial and organizational psychology*, Vol 1 (2nd ed.), pp. 171-221. Palo Alto, CA: Consulting Psychologist Press.
- Winkler, V. A., & Bouncken, R. B. (2011). How Does Cultural Diversity in Global Innovation Teams Affect the Innovation Process?. *Engineering Management Journal, 23*(4), 24-35.
- Zand, D. E. (1972). Trust and managerial problem solving. *Administrative Science Quarterly, 17*(2), 229-239.

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13. ABSTRACT (Maximum 200 words) Culture has been a factor for space exploration since the mid 1970's when the U. S. first partnered with Russia in the Apollo-Soyuz Test Project. Work has indicated that culturally-based differences in values, beliefs, and preferences for cognition and action can have an impact on interdependent action (Stahl, Maznevski, Voigt, & Jonsen, 2010). The unique nature of spaceflight and long duration, distance exploration missions (LDDEM) drives the question as to whether cultural diversity within spaceflight crews has the same impact on team performance as that reported within the wider literature on cross-cultural teams/cross-cultural diversity. There has been limited research conducted on cultural diversity within long duration spaceflight. This report documents the process and findings of an integrative review to catalog potential challenges brought about by cultural diversity in teams, what has been done to mitigate those challenges, and how this work might be leveraged in LDDEM. This effort incorporates a review of the scientific literature and an operational assessment from individuals with experience in LDDEM.				
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