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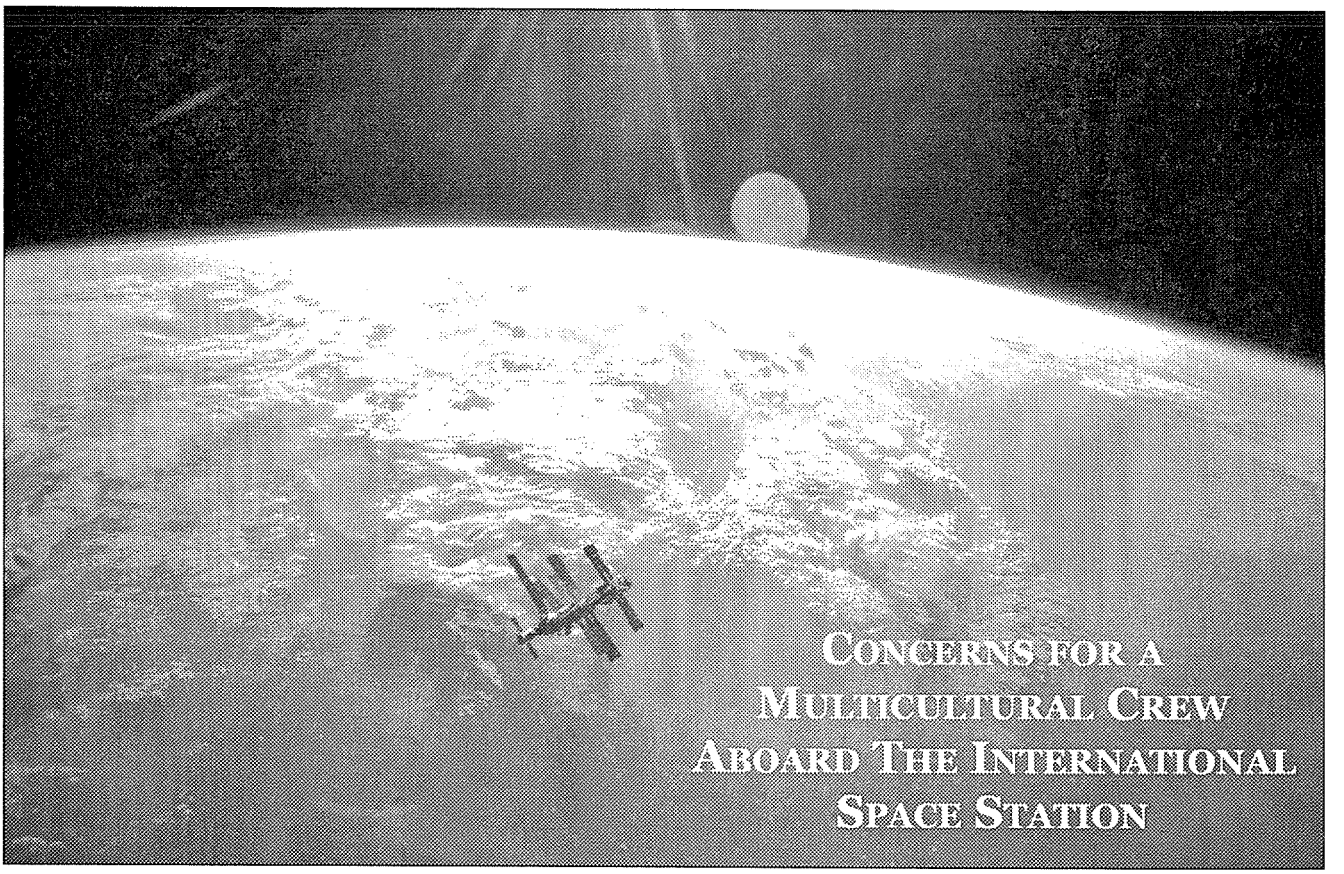

Concerns for a Multicultural Crew Aboard The International Space Station

Mary L. Lozano and Clifford Wong

Under the leadership of the United States, thirteen nations are working to build the International Space Station (see Fig. 1), the world's first science and technology laboratory in space and the largest international scientific cooperative project in history. By the year 2003, the National Aeronautics and Space Administration (NASA) and its partners will have completed approximately 45 missions in an effort to fully assemble the Space Station. [Crewmembers will occupy ISS beginning in October 2000.]

As we enter the 21st century, we can expect international space flight missions to be made up of crew members from different nationalities and cultures. Of importance are the potential effects of cultural and interpersonal communication factors on crew interaction, crew operations, and crew-machine interface for multicultural space flight crews. Space-farers from different countries will be living and working together within the confined and isolated quarters of the space station. The International Space Station crew will consist of U.S., Russian, Canadian, European, and Japanese personnel. Mission duration can range from 90 to 180 days for space station visits and approximately two years for a round-trip manned mission to Mars. Effective and efficient multicultural crew interaction and operations will assume a major role in flight safety and mission success.

United States astronaut Norman Thagard, in a *Washington Post* article, described his 115-day experience aboard the Mir as one of "extreme cultural isolation," adding:

> I worry really more about longer flights. You're one American on a Russian spacecraft, no one else really speaks English and there were times when I went days without talking to our folks in the mission control center in Moscow, all of which adds up to a fair amount of isolation. It's something we'll have to look at for longer flights (Harwood, July 8, 1995).

NASA Administrator Daniel S. Goldin agrees with Thagard's emphasis on the social problems surrounding long space missions, and believes that Thagard's observations might "turn out to be one of the major findings of this mission."

The international nature of manned space flight missions will require crew members from different cultures to live and work together

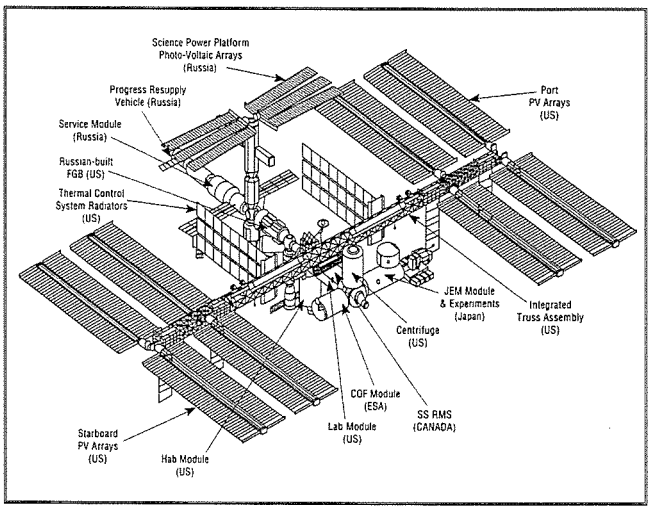

Figure 1. Prototype of the International Space Station. Illustration by Ronald T. Acklin, University of Dayton. Adapted from NASA.

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effectively for long periods of time in space. Different nations will participate in joint manned space exploration missions because the sheer cost and complexities involved will make it extremely difficult for one nation to undertake such endeavors alone. The potential impact of cultural dynamics on multicultural crew operations and interaction is an extremely important issue. Smooth and efficient multicultural crew interaction (crew-to-crew and crew-to-ground personnel) and crew operations are crucial for flight safety and mission success.

In the past, within one country's astronaut corps, candidates typically were all Caucasian males who were socially, educationally, and physically similar. Despite the homogeneity of the crew, members sometimes did experience tense moments, but these personal differences were minimized for the sake of the mission. Reports of strained relationships from actual manned space flight experience raised concern, especially when these incidents occurred in homogeneous crews that were rigorously selected and highly trained for the mission (Oberg & Oberg 1986; Lebedev 1990). While the Apollo and Gemini crews functioned well together in space, many of these former astronauts stated that interpersonal problems might grow in intensity as missions grow longer and crews increase in number and become more culturally mixed.

If American astronauts experienced conflicts with crew members of their own culture, how much more disruptive would interpersonal problems be with multicultural crews? It is not surprising that conflicts and misunderstandings occurred on space shuttle missions when American and foreign crew members flew together. Differences in such cultural factors as personal hygiene, gender roles, religious practices, and language resulted in tense moments. Similar situations are known to have occurred on long-term Soviet Russian space missions with astronauts from other nations (Oberg & Oberg, 1986).

The International Space Station crew is going to be even more heterogeneous with crew size just as large or larger than current space shuttle missions. Not only will there be crew members of different sex, ethnicity, scientific and educational backgrounds, and professional status, there will also be a growing number of crew members from different cultures. For the joint multicultural space venture to generate successful results, those involved need to be well prepared for interacting with people from cultures other than their own. Confined participants on isolated missions will experience hardships and social deprivation because they are relegated to a micro society unlike anything they have ever dealt with before. As pointed out by Connors, Harrison & Akins (1985), prolonged isolation and confinement intensify the "effects of attitudinal dissimilarities, need incompatibilities, annoying habits, irritating mannerisms, and other sources of interpersonal friction, while reducing the opportunity to express dissatisfaction" (p. 10). Based on a series of reviews from 60 American and former Soviet space simulation studies, Kanas (1987) suggests that much research is needed in the area of interpersonal issues with regard to crew heterogeneity, such as mixed gender and diverse cultural groups.

The McDonnell Douglas Study

In 1992, an independent research and development (IRAD) project was conducted at McDonnell Douglas to provide information on how key cultural and interpersonal communication factors could affect multicultural crew operations and interaction during international manned space flight missions. The objective of the project was to identify and derive key cultural and interpersonal communication factors for multicultural space flight crews.

To achieve the study's objective, a *literature search* was conducted, *interviews* were arranged with active duty and retired astronauts, and a *survey* and a multicultural crew factors *questionnaire* were designed and administered to national and international space agency personnel. Unfortunately, at the time of the study, Russia was not one of the international partners of the space station effort. Russian subjects are therefore not included.

Literature Review. Given the scarcity of data collected from actual manned space flight missions, a literature search was required to identify relevant earth-bound multicultural interactions to determine the importance of multicultural factors for manned space flight, and to establish the significance of these factors to actual space flight crews. Multicultural communications literature identified 11 cultural and interpersonal communication factors considered to be relevant for international manned spaceflight operations. These factors appear in Table 1.

Interviews. Seven astronauts were interviewed for the IRAD; two were retired and five were active-duty astronauts. All of them had had flight experience with multicultural crews. The interviews provided an opportunity to add to the information accessed from the literature about those cultural and interpersonal communication factors that astronauts believe will have a significant effect on multicultural space flight crews.

- **Verbal communication**
- **Nonverbal communication**
- **Tolerance and respect**
- **Attitudes, norms, beliefs**
- **Interpersonal interest**
- **Task-oriented and relationship-oriented behavior**
- **Assertiveness**
- **Conflict resolution**
- **Decision-making processes**
- **Role structures**
- **Human-machine interfaces**

Table 1. Cultural and interpersonal communication factors derived from the multicultural communications literature.

The seven astronauts provided additional insight into areas they believed would have significant effects on multicultural space flight crews. They referred to the following as major issues for international manned space flight:

Crew personal hygiene standards and grooming habits. Body odor has different effects on different people, and cultural differences in personal hygiene standards can affect interpersonal relationships.

Verbal and nonverbal communication. Technical language requires extensive training. Crew members need to understand all systems and the language associated with each system. Humor is very important for space flight, especially in confined and isolated places because it helps to release tension. However, in multicultural crews, the culture might dictate what is humorous to one crew member and not to another.

Gender. Cultural differences in gender roles, norms, and stereotypes may be extremely important. Such differences have actually created tension and conflict between crew members on actual missions.

Profession. Professional background and level of professional expertise can affect interpersonal relationships.

Decision-making processes. For critical or emergency situations that require an immediate response, the two veteran NASA astronauts said that one does not want to sit around trying to get a group consensus about what to do. It is imperative that an individual crew member, such as the commander, make a decision.

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Religious beliefs. This can also create tension and conflict between crew members with differing religious beliefs, thus affecting mission performance and psychological health. In fact, religious differences have caused problems among crews on actual manned space flight missions.

Survey. Based on the information gathered, a survey was designed and distributed to manned space flight personnel from NASA, the Canadian Space Agency (CSA), the European Space Agency (ESA), and the National Space Development Agency (NASDA). The respondents consisted of astronauts, crew trainers, administrators, and engineers and scientists from aerospace companies associated with the Space Station program. Survey respondents were instructed to rate the importance of each factor for multicultural crew interaction and operations on the 5-point rating scale for on-duty and off-duty mission segments - 5 points for "very important" and 1 point for "not very important." Fourteen cultural and interpersonal communication factors were rated by the respondents and appear in Table 2.

- **Language Nonverbal communication styles**
- **Task- and relationship-oriented behavior**
- **Patience and tolerance**
- **Decision making processes**
- **Assertiveness**
- **Interpersonal interest**
- **Respect for other cultures**
- **Personal hygiene and cleanliness**
- **Gender roles and stereotypes**
- **Conflict management and resolution**
- **Trust in people**
- **Scheduling and time management**
- **Sense of humor**

Table 2. Cultural and interpersonal communication factors rated in the McDonnell Douglas survey.

A total of 37 survey respondents were included among the NASA, CSA, ESA, and NASDA groups. Although the subject population was quite small, the respondent groups were matched closely in terms of education, occupation, and age with the type of person that applies to the astronaut corp. It should be emphasized that the groups did not represent the cultural population at large.

For on-duty segments, there were significant differences ($p<.05$) between how Japanese and Western respondents perceived the importance of these factors compared to how American, Canadian, and European respondents viewed the importance of these factors. This fits well with Hofstede's (1980, 1983) and Hall's (1976) cultural dimension framework. While cultures differ in some degree to where they fall along the dimensions of individualism-collectivism, high context-low context communication, uncertainty avoidance, power distance, and masculinity-femininity, Western cultures are generally much closer to each other on these dimensions than they are to the Japanese culture. However, the results also revealed that there were factors in which the American, Canadian, and European respondents differed among themselves.

Questionnaire. Shortly after performing an analysis of the survey responses, a multicultural crew factors questionnaire was created. The questionnaire's 74 respondents (different respondents also from NASA, CSA, ESA, and NASDA) answered multiple-choice questions that dealt with (1) language, (2) cultural flexibility and personal space, (3) management styles, and (4) crew-machine interface design. As with the survey, the answers exposed cultural variations and similarities among the international respondents. For example, the Japanese expressed the most difficulty with the English language. The Japanese also differed significantly from Westerners in the difficulty they face in discussing religion, politics, or finance. The Japanese also referred to discomfort in the acceptance of a female leader. Americans placed a higher value on religion than did the other groups. Although cleanliness and dental care were rated as important to everyone, the Japanese found personal appearance and hair less important than either the Americans, Canadians, or Europeans. While most Westerners valued independent thinking, less than half of the Japanese respondents felt similarly.

What the Study Accomplished. The main thrust of the IRAD was to determine how differences in cultural norms and beliefs could impact multicultural crew operations and interaction on international manned space flight missions. Three major aims were achieved by this study. First, the study played a major role in igniting the interest and concern of national and international manned space flight personnel in multicultural crew factors. Second, it identified 14 key cultural and interpersonal communication factors that could impact multicultural crew interaction and operations. Finally, it assessed some of the attitudinal trends and patterns of American, Canadian, European, and Japanese manned space flight personnel regarding these 14 "multicultural" factors.

Working for the Future

For most present-day short-duration spaceflight missions, these cultural and interpersonal communication factors should not pose a significant threat to the interaction and operations of highly trained and highly selected astronaut crew members. However, for longer duration missions with larger multicultural crews, there is that threat. Disagreements and conflicts occurred on international Space Shuttle and Mir missions that disrupted crew interaction to varying degrees. When a crew begins to live and work together in a confined and isolated spacecraft for a long duration, these factors can become more pronounced, resulting in hostilities within the space station environment. Wouldn't it be more effective and efficient to deal with these issues on the ground when crew members are in training rather than attempting to manage these problems while the crew is in-orbit or in-flight?

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