The research completed under this Cooperative Agreement over a decade addressed a number of issues relevant to the performance of teams in demanding environments. Initial work, conducted in the aviation analog environment, focused on developing new measures of performance related attitudes and behaviors. The attitude measures were used to assess acceptance of concepts related to effective teamwork and personal capabilities under stress. The behavioral measures were used to evaluate the effectiveness of flight crews operating in commercial aviation.

Assessment of team issues in aviation led further to the evaluation and development of training to enhance team performance. Much of the work addressed evaluation of the effectiveness of such training, which has become known as Crew Resource Management or CRM. The research demonstrated that CRM is effective in changing the attitudes and behavior of crews. It has now been mandated for airlines around the world. During the course of this work, members of the research group worked with more than thirty airlines and with the United States Air Force and Navy to assess the value of such training for military crews. The assessment methods developed as part of the research are now widely used by civil and military organizations around the world. In recognition of the value of the research, the Principal Investigator received the Distinguished Service Award of the Flight Safety Foundation in 1994. In the same year, he received the Laurels Award for the research from Aviation Week and Space Technology. One of the conclusions of this research was that the same training approach would be highly applicable to astronauts, especially for crews embarking on long duration flights in the space station.

A second line of investigation was into personality characteristics that predict performance in challenging environments such as aviation and space. A new personality inventory was developed and validating as predicting the performance of pilots in commercial aviation. Several major airlines now use the instrument to screen applicants for pilot positions.

The personality and performance research was also extended to include the astronaut corps and a set of performance measures for astronauts was developed. Both personality characteristics of current astronauts and their performance (rated by peers and leaders) was assessed. Significant relationships between personality and rated performance were isolated. Experimental research into selection was initiated by voluntary, confidential
testing of three cohorts of astronaut candidates. Criterion measures of the performance of selected astronauts have not yet been obtained.

A third line of investigation of team performance grew out of the study of flight crews in different organizations. This led to the development of a theoretical model of crew performance that included not only individual attributes such as personality and ability, but also organizational and national culture. Initial research has focused on measuring the influence of national culture on flight crew attitudes and behavior. A new assessment inventory, the Flight Management Attitudes Questionnaire was developed and preliminary data have been obtained from more than 10,000 pilots in twenty countries including Asia, North and South America, Europe, the Middle East, and Africa. Initial results suggest that national culture strongly influences team behavior, especially in areas related to command and leadership and the use of automation. This research is highly relevant to spaceflight as current and future missions will increasingly be conducted by multi-national crews.

A final line of investigation involved beginning to assess whether the methodologies and measures developed for the aviation analog could be applied to another domain – the performance of medical teams (surgeons, anesthesiologists, and nurses) working in the operating room. Preliminary results suggest that the degree of generality is high.

**Dissemination of Research Findings**

Results of the research have been widely distributed through publications in the scientific literature, including refereed journals, book chapters, and one edited book. Appendix A lists sixty-eight publications during this period. Many invited addresses to the scientific community were also delivered, along with technical reports for use by related researchers. Appendix B lists selected reports and invited addresses.

**Graduate Education**

The project has also supported the graduate work of a number of students at the doctoral and masters level. Several of these have continued to work in NASA and other government agencies including the Federal Aviation Administration and the U.S. Air Force following graduation. Appendix C lists individuals and dissertation and thesis titles for six doctorates and two masters' degrees supported by the research project.
Appendix A: Publications Resulting from NASA Cooperative Agreement NCC2-286
February 1, 1984 through June 30, 1995


Appendix B: Technical Papers and Invited Addresses
Resulting from NASA Cooperative Agreement NCC2-286


Appendix C: Dissertations and Theses
Resulting from NASA Cooperative Agreement NCC2-286

February 1, 1984 through June 30, 1995


