A DESCRIPTIVE ANALYSIS OF THE NATIONAL AERO-
NAUTICS AND SPACE ADMINISTRATION'S
TEACHER IN SPACE PROGRAM

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PREFACE

Manned space flight, long popular in fiction and possible in theory, became fact through a number of related events stemming from World War II: rocket tests that began as an extension of wartime German technology; high-altitude high-speed jet and rocket aircraft research and development; and perfection of atmosphere reentry capabilities for ballistic missile systems.

Building upon previous achievements, new plateaus in air and space transportation have been reached--military aviation, air mail, commercial passenger service, the jet age, and manned space flight. Now, a new era is upon us. The beginning of regularly scheduled runs of the National Aeronautics and Space Administration's (NASA) Space Shuttle to and from earth orbit in the 1980's marked the coming of the space age. The Shuttle turned formidable and costly space missions into routine and economical operations that generate maximum benefits for all people. The Shuttle opened space to men and women of all nations.

Long before the success of the Apollo moon-circling mission (December 21-27, 1968), Americans began signing up for trips to the moon. Not for two decades would the first private citizen in space become reality. And by then, over one million people had submitted their names for a trip into outer space.

On August 27, 1984, NASA launched one of the most ambitious educational initiatives in its 27-year history: the Teacher in Space Project. This dissertation traced the development of the Teacher in Space Program.

It began with an investigation of a basic question: "Why does man explore?" From there, it reviewed the development of the "unique personality" and the evolution of the space flight participant program. Chapters III and IV outline the Teacher in Space Program. The remainder of the text considers educational innovations which have resulted from the Teacher in Space Program.

I would like to take this opportunity to acknowledge the help and patience of Dr. Kenneth E. Wiggins, chairman of my advisory committee, and my friend. Dr. Wiggins has graciously given of his time, both personally and professionally, and the benefit of his experience in advising and directing not only the writing of this dissertation, but of my entire doctoral experience. Others who have been of immeasurable assistance to me, both in the courses taken and in personal support, are Dr. L. Herbert Bruneau of the Zoology Department, Dr. James M. Seals of the Applied Behavioral Studies in Education Department, and Dr. Daniel Selakovich of the Curriculum and Instruction Department. I am also grateful to Mr. William D. Nixon, Mr. Larry B. Bilbrough, and Ms. Pamela M. Bacon of NASA Headquarters, who so generously gave of their time and expertise in supplying data and documents to support my investigation. Mrs. Barbara Morgan and Mrs. Judy Garcia were also very unselfish of their time in sharing with me their personal experiences and thoughts as first and second back-ups, respectively, for the Teacher in Space Program. Others who were of immeasurable value were Dr. Doris Grigsby, Oklahoma State Department of Education; Mr. Alan Ladwig and Mr. Nat Cohen, both of NASA Headquarters, Washington, D.C.; Mrs. Terri Rosenblatt-Adams of the Teacher in Space Foundation, Washington, D.C.; and Ms. Mary Chaplin, Educational Research, Oklahoma State University. Without the generous input of these most gracious individuals, accurate documentation would have been exceedingly difficult.

In addition, I wish to acknowledge the support of my parents, Revere and Mary Young. Without their continued encouragement, this part of my educational career might well have never happened. Their unconditional love has been a source of strength and inspiration for which I shall always be thankful.

Lastly, I wish to dedicate this dissertation to my grandfather, Herman H. Bresser, who has lived to witness the transition of man's quest for flight, beginning with the Wright brothers' first flight of 12 seconds in 1903, the thrill of the first transcontinental flight in 1911, the excitement of the first man on the moon in 1969, and the anguish of the Challenger loss in 1986. My life has been enriched, not only by his love for me, but also by his sharing of memories of the past, enthusiasm for the present, and his eager anticipation of the future.

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CHAPTER I

INTRODUCTION

"It is a terrible thing," Tolstoy said," to watch a man who doesn't know what to do with the incomprehensible, because generally he winds up playing with a toy named God" (cited in Michener et al., 1976, p. 8). Pasteur saw nothing particularly terrifying or unsatisfying about this situation, saying that the only thing to do in the face of the incomprehensible is to kneel before it. But that which is most incomprehensible of all is not a distant planet, but the human mind itself; kneeling under these circumstances may represent the ultimate vanity. But the attempt to comprehend the mind, rather than worship it, is an exercise to be devoutly consummated, if not wished (Michener et al., 1976).

The question, "Why does man explore?" is one on which we must reflect upon from whence we have come and to where we must go. Therefore, our question involves not just science but philosophy as well, for our answer has to come out of our view of life, out of our concept of history, out of our understanding of human progress, and mostly out of instinctive awareness that we can always do better than we are doing if we emancipate ourselves from our fears in order to search the horizon for new prospects. So we look to our traditions and our philosophy as we expand the human presence in the universe (Michener et al., 1976).

Man's interest in aerospace is rooted in ancient history. History is the story of the defiance of the unknown and of what happens when man tries to extend his reach. Such defiance is necessary because conventional wisdom has never been good enough to run a civilization. Not all problems are old problems; therefore, new approaches and new truths must be discovered. The suggestion here is that the more difficult and complex the undertaking, the more likely it is that knowledge will be gained which can be applied more fruitfully, far beyond the undertaking itself (Michener et al., 1976).

Man is a creature who wants to know where he is. Significant to this knowledge is the fact that not only have our lunar voyages allowed man to set foot on the moon, but they have enabled man to literally set eye on the earth. Man is able for the first time to develop a true perspective of that beautiful wet, blue ball, as Archibald MacLeish described it, which possesses the millions upon millions of conditions that exist in that precise and exquisite combination that make life possible (Michener et al., 1976).

Life is growth--individuals and species grow in size, number, and territory. The peripheral manifestation of growing is exploring the outside world. Plants develop in the most favorable direction, which implies that they have explored the other orientations and found that they are inadequate (Michener et al., 1976)

Some plants send feelers to great distances; they send avant-garde shoots before they invade the space that has been acknowledged propitious. For young animals, the world is to be explored and discovered from birth on, and that exploration ends only with death; for the young fox, the wilderness is unlimited, for a fish, the oceans are infinite. Still, in the animal world, the physical need for exploration develops as well as in individuals as in collectives--tribes, schools, swarms, packs. In fact, if the baby human shows the same motivation as a young cat, to explore with all his sensors the strange environment he was born into, the big difference is that the baby soon learns to stand erect. That radical change came in evolution the day described so well by Ovid, a few years after the birth of Christ: "God elevated the forehead of man and ordered him to contemplate the stars" (cited in Michener et al., 1976, p. 52). The human species is the only one that has the ability to transfer to the new wave of men, through language, printed material, and electronic media, the results of the exploration of the world performed by previous generations (Michener et al., 1976).

What an incredible moment we live in! What an important generation is our own! We live during the single moment of transition from stone tools to space ships. Until our century, the ground in many parts of the world had been littered with debris of our ancestors of the recently ended stone age: arrowheads, pottery shards, carvings, ruined temples, mounds that were forgotten cities. A hundred years from now, most of these will have been picked up, plowed under, plundered, or (in a few cases) preserved. We live in the last century to have abundant, untouched records of our ancient past. We live in the last century to see undiscovered tribes of aborigines living in neolithic isolation, unaware of a world bustling with computers, television, hot and cold running water, and electric lights at night (Hartmann, Miller, and Lee, 1984).

Today, as we contemplate the history of aerospace, we stand on the threshold of immense dimension, with unlimited possibilities. Great triumphs of technology and exploration do not begin as full-fledged plans. They begin as dreams. Jules Verne said that what one person can imagine, another can do. Imagination preceeds implementation. Martin Luther King, Jr. said, "I have a dream," not, "I have a plan" (cited in Hartmann, Miller, and Lee, 1984, p. 7). Dreams preceed plans, and dreams are images. It will be up to a new generation to develop the social modes that allow it. The older generation has produced a world where such ventures are possible, but where the leading nation spends roughly one-third of its annual budget on military security, and only 2% to 3% (including some from the military) on exploring its interplanetary surroundings. Yet this fledgling adventure of the mind may provide the answer to many of the problems that afflict the Earth's society today (Hartmann, Miller, and Lee, 1984).

Man is going out into the universe. He goes there because he loves life. He goes there because he is terrified of death. He goes there because, as Ahab said, "This was rehearsed by thee and me a billion years before the oceans rolled" (cited in Michener et al., 1976, p. 87). It is in man's genetics--he is set by genetics to do this thing and so he is going out. Most men are essentially optimistic about it, and he will make it. No one knows how far out into the galaxy man will go, but indeed he will (Michener et al., 1976).

Science at its best provides us with better questions, not absolute answers. The more we know, the more informed we are in our speculations. The liberation of human beings from Earth's gravity has enabled the species to become less detached from the universe. As a result of these explorations, we have been able to perceive larger relations. As a result, we will have an increased sense of human uniqueness (Michener et al., 1976).

The effect is philosophical. To be able to rise from the earth; to be able, from a station in outer space, to see the relationship of the planet Earth to other planets; to be able to contemplate the gift of life unencumbered by proximity; to be able to meditate on journeying through an infinity of galaxies; to be able to dwell on the encounter of the human brain and spirit with the universe--all this enlarges the human imagination. We went to Mars, not because of our technology, but because of our imagination (Michener et al., 1976).

As long as human beings do not persuade themselves that they are creatures of failure, as long as they can do all these things, they can look at the world and, beyond that, the universe, and be unafraid of their fellow humans, facing choices, not with dread, but with great expectations (Michener et al., 1976).

CHAPTER II

SPACE FLIGHT PARTICIPANT PROGRAM

Long before the success of the Apollo 8 moon-circling mission (December 21-27, 1968), Pan American Airlines (Pan Am) and TransWorld Airlines (TWA) began to receive a small trickle of unsolicited requests for moon flight reservations. Taking these requests lightly, Pan Am began to make joking references to the reservation in its television and radio commercials and newspaper advertisements. That swelled the trickle into a stream which later became, after the Apollo 8 triumph, something of a deluge. As the number of names on the list began to run into the thousands, Pan Am had to begin processing them into its computers, just as reservations for flights to Europe and Hawaii are processed (McCarthy, 1968).

While biding their time on the long and steadily lengthening waiting list, the would-be travelers to the moon could give some thought to another kind of fabulous journey, being offered as a prize in the "Man on the Moon" contest sponsored by Today, the Cape Kennedy daily newspaper, and about 200 other newspapers across the United States. The winner would be the contestant who guessed the precise moment--year, month, day, hour, minute, and second--when the first American astronaut would step out of his capsule and onto the surface of the moon (McCarthy, 1968).

On January 12, 1972, National Aeronautics and Space Administration (NASA) engineer George M. Low and NASA administrator Jim Fletcher met with presidential aide John Ehrlichman and President Richard M. Nixon to discuss the possibility of launching ordinary citizens into space. "The President liked the fact that ordinary people would be able to fly in the Shuttle, and that the only requirement for a flight would be that there is a mission to be performed" (cited in Low, 1972, n.p.). In summary, President Nixon was noted to have said, ". . . space flight is here to stay. Men are flying in space now and will continue to fly in space, and we'd best be a part of it" (cited in Low, 1972, n.p.).

In 1972, Pan Am closed out a reservations list after collecting the names of 90,000 would-be moon travelers. Spokesmen for the airline admitted that such a trip would not be possible before the twenty-first century. That did not deter thousands of people, however, from playing the odds for a $10 to $25 registration fee. Some were assigned reservations. First on the list was Austrian journalist Gerhard Pistor, who walked into a travel bureau in Vienna in 1963 and put down $20 on a rocket flight to the moon (Tatro, 1972).

In November of 1975, George M. Low sent a memorandum to John Yardley, suggesting that he convene an innovative group to try and develop "exciting payloads" for some of the first shuttle flights. Among the ideas for consideration was:

> Flying Phillipe Cousteau on an early Shuttle flight and letting him document on film what he sees; then, of course, a subsequent production of a Costeau special. Or as an alternative, fly Walter Cronkite and let him report what he sees from space (Low, 1976, n.p.).

In June of 1976, a study team made up of representatives from the offices of Legislative Affairs, General Counsel, Public Affairs, Advanced Programs, Space Medicine, STS Operations, and the Space Shuttle Program continued to study the possibility of sending a "unique personality" into space. At this time the study group expressed concern that sending a unique personality into space might be misconstrued by taxpayers as a misuse of tax money, or, "in the event of catastrophe the public may view the flying of a non-test pilot on a test flight as irresponsible (Preliminary Report, 1976, p. 2). The study group considered the actual selection of who would fly as "one of the most troublesome aspects (Preliminary Report, 1976, p. 2). The preliminary report of the study group stated that:

> . . . consideration has been given to the following categories which might yield either a unique personality in his own right or by virtue of his occupation or organizational affiliation: News Media, Popular Science, Eminent Scientist, Politician/Prominent Statesman, 'Layman,' Space Science Student, Prominent Transportation Figure, Artist (Poet, Painter, Writer), Humanitarian, Entertainer. The general ground rules were that the individual and/or his activity in connection with OFT flight should produce something of high public interest as well as contribute to the widest practicable dissemination of information concerning spaceflight activity and results thereof. The latter consideration is consistent with Section 203(a) (3) of the Space Act and would provide the legal basis for such activity in the event a non-space professional were chosen (Preliminary Report, 1976, p. 1).

During the next five years, official memorandums concerning the idea of flying a "unique personality" or a "space flight participant" in the shuttle grew in numbers and in seriousness. Finally, on February 25, 1982, NASA administrator James Beggs approached Daniel Fink, senior vice-president of Corporate Planning and Development, General Electric Company, as to a procedure for handling the vast number of unsolicited applications from the public at large who wished to fly on the shuttle. Mr. Beggs stated that he did not think the selection should be handled by NASA. He suggested to Mr. Fink that an ad hoc group be organized and briefed on the situation and then be allowed to respond to the issue (Beggs, 1982). In June of 1982, Daniel Fink, chairman of the NASA Advisory Council, established an ad hoc task force of the Council, chaired by Council member John Naugle. James Michener, Willis Hawkins, Sylvia Fries, and Florence Scheer, who helped formulate NASA's policy on public access to space operations, and Astronaut Richard Truly were later asked to join the task force to provide expert help. The task force began work in July, 1982, and completed their work with the issuance of the "Report of the Informal Task Force for the Study of Issues in Selecting Private Citizens for Space Shuttle Flight" (Appendix A).

The final rule adopted by NASA for flight of private citizens (termed "Space Flight Participants") established the Space Flight Participant Evaluation Committee at NASA headquarters for directing and administering the program. That committee first met on March 15, 1984, to assist in completing the rule-making process and to begin considering setting up the first project in the program. That meeting and the next meeting (April 2, 1984) considered such questions as category of participant (e.g., journalist, teacher, artist), candidate flight opportunities, training requirements and time lines, selection procedures, and the announcement process. The committee unanimously recommended to the administrator that the first opportunity should go to an educator, specifically an elementary or secondary school teacher, who would be selected on the basis of his or her ability to communicate the experience and the meaning of space flight to the broadest segment of the U.S. primary and secondary school students. The NASA administrator, James M. Beggs, subsequently accepted the recommendations.

NASA to Fly Educator

During a Department of Education ceremony recognizing 202 outstanding public secondary schools, President Ronald Reagan announced:

> One area where those wonders and benefits is most apparent is space. It's long been a goal of our space shuttle, the program, to some day carry citizen passengers into space. Until now, we hadn't decided who the first citizen passenger would be. But today, I am directing NASA to begin a search in

> all of our elementary and secondary schools and to choose as the first citizen passenger in the history of our space program one of America's finest--a teacher.
>
> . . . when that shuttle lifts off, all of America will be reminded of the crucial role that teachers and education play in the life of our nation. I can't think of a better lesson for our children and our country (White House Records, 1984, p. 1190).

Application Process

In the month following President Reagan's announcement, 2,500 would-be "teachernauts" made NASA one of the most popular postal addresses in Washington, D.C. Most heartening for students, perhaps, was that their teachers were not following directions.

The time to apply had not yet begun, and all the letters sent in would not be used to select the teacher who would fly in late 1985 or early 1986. NASA was trying to encourage people to sit tight until an "announcement of opportunity" was readied.

Only when the agency spelled out how applications would be made would the formal process of selecting a teacher begin. NASA had a recorded message for teachers interested in applying, and a call to that number clearly told them not to apply yet. One reason teachers were told not to apply for the Teacher in Space Project at that time was that no formal application had been devised, nor had any program of handling the forthcoming applications been developed. The reason for this was that in order to prevent any advanced leaks of who the first citizen in space might be, only President Reagan and immediate staff knew that it would be an educator (Ladwig, 1987).

Immediately following President Reagan's announcement, NASA officials selected the Council of Chief State School Officers (CCSSO) to coordinate the selection process. The CCSSO was a nonprofit organization comprised of the public official responsible for education in each state. State superintendents and commissioners of education in the 50 states, the District of Columbia, and six extra-state jurisdictions were the sole members of the CCSSO (Rosenblatt, 1987).

In November of 1984, an Announcement of Opportunity (AO) (Appendix C) was published, and almost one-half million were distributed nationwide (CCSSO, 1985a). Teachers responding to the AO were sent an Application Packet (Appendix D). These application materials included a biographical information form, an essay question for the applicant's philosophy of teaching, an essay question for the applicant to describe how the experience could best be shared during the post-flight period, an essay question describing the experiment the teacher proposed to conduct during the shuttle mission, a medical standards summary, a legal agreement summary, and a Privacy Act notice. Incorrect or incomplete applications were automatically disqualified and could not be resubmitted. Materials other than the application itself were not considered (CCSSO, 1985a).

Over 450,000 AO's for the Teacher in Space Project were distributed in November, 1984, by NASA and the CCSSO (CCSSO, 1985a). Almost 46,000 teachers responded to the announcement and were sent applications.

During the application period (December 1, 1984 to February 1, 1985), 11,416 applications were submitted to the Teacher in Space Project for review. Of this total, 10,690 appilcations met the basic eligibility requirements (CCSSO, 1985a).

Of the 114 nominees, 59 were male and 55 were female (Appendix E). Seventeen of the applicants were elementary school teachers, 20 taught at the middle school level, and 77 were high school teachers. Thirty-four taught humanities, 41 taught high school science, 16 were middle school science teachers, 4 taught high school mathematics, and 2 taught middle school mathematics (CCSSO, 1984). The average number of years taught was 14, and the ages ranged from 27 to 65 (Current News, June 25, 1985). Among these teachers were doctors, authors, Fulbright scholars, a young woman who had climbed the Himalayas, and at least one grandmother (Appendix I).

To state that all were eager to fly would be an understatement. One man wrote that he would go even if they had to strap him onto the outside of the shuttle. Most wrote lengthy, polished statements enumerating the benefits a flight on the shuttle would have on their lives. Others expressed enthusiastic sentiments explaining what they had to offer the space program. One gentleman simply stated in his application that the thought of a shuttle ride made him "as tickled as a kid with a green egg" (Appendix I).

CHAPTER III

SELECTION PROCESS

The CCSSO worked with the state department of education in all 50 states, the District of Columbia, three territories, and three federal agencies in selecting the 114 candidates gathered in Washington during the week of June 22-28.

While in Washington, each of the 114 nominees met with members of the National Review Panel. Recruited by Terri Rosenblatt, director of the Teacher in Space Project for the CCSSO, the members of the National Review Panel included three former astronauts, a former U.S. Commissioner of Education, three university and college presidents and administrators, a former state governor, a former U.S. congresswoman, four educators, a former NASA official, two professional actors, and a physicist (Appendix F). The 14 men and 6 women represented government, education, science, medicine, business, sports, and the arts. Among them were LeRoy Hay, the 1983 National Teacher of the Year; former astronauts Donald Slayton, Eugene Cernan, and Harrison Schmitt; the presidents of Duke Univerisity, American University, and Vassar; Dr. Robert Jarvik, the inventor of the artificial heart; Wesley Unseld, a former professional basketball player; and actress Pam Dawber, the television girlfriend of Mork, the extraterrestrial from Ork in Mork and Mindy (Rosenblatt, 1987). Some of the choices appeared logical; others seemed less sensible. When asked about the decision to include Pam Dawber and Wes Unseld, Rosenblatt (1987) replied:

> Pam knew what it was like to become famous overnight. She knew what it was like to leave a hotel room for a cup of coffee in the morning and get mobbed before reaching the lobby. She could tell the teachers how winning this thing would change their lives, and she could ask each of them if they were ready for it. As for Wes Unseld, well, Wes knew the importance of being a team player and what it takes to be one. He would know which teacher had the stuff that it would take to work closely with the rest of the crew and to take orders from the crew conmmander (n.p.)

The 20 panel members were divided into five teams of four members each (Appendix G). Panel members evaluated 22 to 24 of the 224 applications before going to Washington. Each panel member also reviewed five-minute videotapes of each nominee.

On June 26 and 27, the National Review Panel gathered in Washington to meet informally with all 114 nominees and to conduct 15-minute personal interviews with the 15-16 candidates assigned to their subcomittees. Each of the five subcommittees met the morning of June 27 and selected the top four candidates from their group. Each subcommittee then reviewed the videotapes of the top four candidates selected by the other subcommittes. The full National Review Panel then met to choose the 10 finalists. State and agency nominees not selected as finalists would serve as educational resources for their state educational agency.

National Awards Conference

One hundred and thirteen nominees (one nominee had left teaching after being selected and was then disqualified) attended a teacher workshop and orientation program which was held from June 22 to June 27, 1985, in Washington, D.C. (Ladwig, 1987). The workshop was designed to inform the participants of current developments in the Aeronautics and Space Education Program and related materials available for classroom use (Appendix H).

Because NASA could offer the shuttle flight experience to only one of the teachers, the agency felt that it was important to provide appropriate recognition and educational opportunities to all of the nominees. Accordingly, at the opening banquet for the awards conference, Mr. Beggs reminded the candidates:

> You are all winners, whether you fly or not. That is why tonight we are appointing you all Ambassadors from the space program to your states, your districts, your schools, at home and abroad--wherever you can reach young minds. As our Ambassadors to young America, we hope you will spread the word that space has become not just a place we visit, but a place where we are learning to do new, exciting and useful things to benefit life on Earth. We hope you will share with our young people the opportunities and promise of the space program, and the excitement we all feel as we move to push back this new frontier with a permanent presence in space (cited in Ladwig, 1985, p. 6).

Following the banquet, astronaut Michael Smith, who would pilot Mission 51-L on which the Teacher in Space would fly, briefed the teachers on the objectives of that special mission (Ladwig, 1985).

NASA's associate deputy administrator, Ann Bradley, who also served as the chairperson of the Space Flight Participant Evaluation Committee, concluded the conference program by challenging the assembled teachers to return to their respective states and participate actively in their roles as Space Ambassadors. Referring to the nominees as the "Class of 51-L," in honor of the flight on which the teacher would fly, Ms. Bradley invited all the applicants to attend a class reunion at the Kennedy Space Center in January to witness the launch and to participate in an advanced level education conference. With assistance from astronaut Robert Overmeyer, Ms. Bradley presented each teacher with a certificate which recognized them as nominees for the Teacher in Space Project (Ladwig, 1985).

To prepare the Space Ambassadors for their new role and to enable them to ignite the imaginations of their students, the conference agenda included major presentations as well as workshops. The presentations featured key officials who discussed the nation's space program from a perspective of past accomplishments, future plans, and matters of policy (Appendix H).

On Sunday, June 23, Alan Ladwig, manager of the Space Flight Participant Program, announced that the winner would report for training in early September, more than four months before lift-off. He told them:

> It's a big commitment. Please understand what you're getting yourselves into, and don't say we didn't warn you. We can't afford to have you come up in the middle of training and say, 'Well, I've had second thoughts about this and I want to go home.' That's not part of the deal (Ladwig, 1987, n.p.).

After Ladwig's lecture, the teachers split into four groups, each named for a shuttle: Atlantis, Challenger, Columbia, and Discovery. They spent the afternoon in workshops--"Living Aboard the Space Shuttle," "Flying Aboard the Space Shuttle," "Looking Toward the Heavens" (NASA, June 22, 1985). They then passed the evening dining and dancing on a cruise down the Potomac (Hohler, 1986).

On Monday, NASA's public affairs director Frank Johnson addressed the teachers. He told them that they would be required to give autographs and to make more appearances that they would wish. Of course, the unsaid fact was that the life of the first private citizen in space would no longer be private. For the next year, and maybe more, the winning teacher would be the most visible spokesperson for a space agency that relied on public support for its $7.6 billion budget. And that meant that they had better be prepared for the press. To help the teachers adjust to media demands, Johnson had brought along Walter Pfister, a broadcasting journalist who had coached most of NASA's top management and its astronauts (Hohler, 1986).

Chester Lee, director of NASA's customer service division, explained to the teachers that NASA's inability to stay on schedule made it increasingly difficult to sell cargo space on the shuttle. Mr. Lee stated that, while they wanted to maintain their schedule, it took second place to safety. He went on to explain the review procedures, including flight maintenance reviews, where their top management ensured that everything possible had been done to prevent unacceptable risks on the most heavily instrumented vehicle in the world (Hohler, 1986).

Following Lee's lecture, the teachers marched single file into the press conference, where they lined up on risers, 23 to a row, shoulder to shoulder, and posed for the cameras. That evening they walked to the National Air and Space Museum. On a movie screen which was five stories high and seven stories wide, they watched "The Dream is Alive," a spectacular 37-minute portrait of space flight that had been produced from footage of three earlier missions. They looked over Judy Resnik's shoulder as she released a communications satellite into orbit. They saw her eating and sleeping in space. They watched as Bob Crippen and Dick Scobee tried to maneuver the Challenger to within arm's reach of a distressed satellite, the shuttle's maneuvering fuel running dangerously low. They witnessed the glory of a launch, a space walk, and a landing, and many shed tears of exhilaration (Hohler, 1986).

The next morning, NASA flew in two astronauts--Resnik and Joseph Allen--to share the wonders of space flight. Resnik and Allen represented the new breed of astronaut: men and women who possessed the right stuff, not because they were fearless aviators but because they were scientists, people who knew computers and lasers as well as pilots knew dead-stick landings. They each had flown in space, and now they had come to show and tell (Hohler, 1986).

The next experience for the teachers was a trip to Capitol Hill. Just back from his journey, the first sitting senator in space, Jake Garn of Utah, had invited the teachers to hear him explain the glories of space travel, and to meet their representatives. The flight had reduced the rest of his life to a trifling afterthought, Mr. Garn told them. But, he warned with a foreboding frown about the rigors of training, particularly the "vomit comet" (Hohler, 1986).

The next afternoon the teachers rode to the White House. The president was in a humorous mood, and as the teachers sipped iced tea and lemonade in the East Room, he quoted a British Royal Astronomer who said two years before the first "Sputnik" was launched, "Space travel is utter bilge" (cited in Hohler, 1986, p. 89). Invoking another expert, Reagan said, "The acceleration which must result from the use of rockets inevitably would damage the brain" (cited in Hohler, 1986, p. 89). He then told the teachers:

> Your shuttle doesn't blast off for awhile yet, so there's still time to back out. By the way, for the lucky one who does go up in the Shuttle, I have only one assignment--take notes--there will be a quiz after you land (cited in Hohler, p. 89).

The President then praised the teachers and their role the space program by saying:

> You save our past from being consumed by forgetfulness and our future from being engulfed in ignorance. When one of you blasts off from Cape Canaveral next January, you will represent hope and opportunity and possibility; you will be the emissary to the next generation of American heroes. And your message will be that our progress, impressive as it is, is only just a beginning: that our achievements, as great as they are, are only just a launching pad into the future. Flying up above the atmosphere, you'll be able to truly say that our horizons are not our limits, only new frontiers to be explored (cited in Hohler, 1986, p. 89).

The party was nearly over for the class of 51-L. At the closing ceremonies in the hotel ballroom the next afternoon, William Nixon, NASA's education chief, gave each teacher a NASA pin, a Teacher in Space patch, and a "Space Ambassador's Kit" (a duffel bag stuffed with 50 pounds of slides, videotapes, books, and more educational material than they could use in a year). Alan Ladwig paid them a final tribute, and then Terri Rosenblatt explained that 10 of them could expect a call at home the next day. The judges were deciding which 10 (Hohler, 1986).

The 20 judges--the actress and the basketball star, the astronauts and the college presidents, the inventory and the rocket scientist--had gathered in a conference room that NASA had borrowed from the Office of the Controller of Currency in a building next to the hotel. The deliberations lasted for several hours as the judges reviewed applications and videotapes, compared interview notes, debated the merits of substance and style, and lobbied for their personal favorites. By the time they had finished, most of the teachers were on their way home (Hohler, 1986).

Ten Finalists Named

Early the next morning, Terri Rosenblatt began notifying the 10 finalists. Each winner was told to keep the news a secret until Monday, when they would be introduced by NASA at a press conference in Washington, D.C. Rosenblatt then told each winner that they would report to the Johnson Space Center in Houston, Texas, in one week for physical and psychological testing and a brief encounter with an astronaut's training regime. Those who were still interested in space flight would be interviewed the following week by a committee of senior NASA officials. Then there would be a winner (Hohler, 1986).

On Monday, NASA administrator James Beggs presented the 10 finalists to the media (Appendix H). Among them was a Fulbright scholar, a world explorer, a beauty pageant winner, a politician, and a Girl Scout leader.

Training for Space Flight

The 10 finalists traveled to NASA's Johnson Space Center in Houston on July 7, 1985. They were booked for six nights at the Super 8 Motel three miles from the Space Center. NASA could have afforded more elegant logding, but the finalists faced a rigorous schedule and they needed no distractions. And the Super 8 Motel was the last place reporters would look for them (Hohler, 1986).

On Monday they began the most intensive physical and psychological tests of their lives: pressure tests; high-altitude tests; respiratory tests; claustrophobia tests; psychiatric tests; strength tests; dental tests; blood tests; urine tests; and more prodding, poking, and probing than they had ever imagined. And then they were to face the clincher--the vomit comet. "Some of them had a romanticized view of what they were getting into," Rosenblatt said. "Pretty soon they were grappling with the fact that this was a major commitment, something that could change their lives" (cited in Hohler, 1986, p. 93).

Early Tuesday morning, a government van whisked the 10 finalists to NASA's "high-tech holy land," a 1600 acre compound of bright green grass, man-made ponds, and a hundred cream-colored concrete buildings that stood on streets with names like Gamma Link and Beta Link (Hohler, 1986).

Most of Johnson Space Center's 13,000 workers were scientists, engineers, and technicians. Everyone spoke a cold, abbreviated language that required a dictionary to decipher.

> If you asked for a TACO at the Johnson Space Center, you got 'a test and checkout operation.' TLC had nothing to do with affection--it meant 'telecommand'--and LSD was 'low speed data.' But, if someone mentioned MT, you needed more than a dictionary. You needed a clue. Did they mean magnetic tape or a master timer? A master tool or a mechanical technician? Maybe mean time, mission time or mountain time? Maximum

> torque, perhaps? Or mission trajectory? It was all very confusing.
>
> Now the TIS (teacher-in-space) candidates who hoped to be aboard STS (shuttle transportation system) flight 51-L ('5' means that the mission was budgeted in the 1985 fiscal year, '1' that it would lift off from the Kennedy Space Center and 'L' for the twelfth letter of the alphabet, that it would be the twelfth mission of the fiscal year) upon L/O (lift-off) from launch pad 39B at KSC (Kennedy Space Center) were at JSC to see the MDs. 'NASA?' asked Barbara Morgan. 'What is that: the National Association for the Suggestion of Acronyms? (Hohler, 1986, pp. 100-101).

The candidates started the day at Building 8, where each one donated seven vials of blood, answered 668 questions about their medical history, and spent three hours submitting to X-rays, an eye test, a dental checkup, Dr. Hein's dreaded proctology examination, a pulmonary-function study, and a series of procedures they had never heard of, including a musculoskeletal test in which technicians measured every inch of their bodies. "My gosh," said Christa McAuliffe, "they even know the height of my bellybutton" (Hohler, 1986, p. 101).

Next came the treadmill. Each candidate had a dozen electrodes attached to their body, a blood-pressure gauge to their arm, and breathing apparatus to their head. Each wore a green hospital smock, white ankle socks, and jogging shoes. Moving slowly at first, at an easy stroll pace, the treadmill gained speed until the easy stroll turned into a trot and then to a vigorous jog. Some tried to grip the railings, but the technicians forbade it. Instead, they had to drape their arms over them and run until the machine slowed to a stop 13 minutes later (Appendix J).

The teachers faced the press the next morning--the networks, the dailies, the magazines, the hometown papers, the wire services, and the cameras. They rushed from one interview to another, posing before a mock shuttle the astronauts used for training. They politely answered the questions; they were eager to cooperate. They gushed, giggled, smiled, and explained what teachers do and why each wanted to be the first teacher to go into space.

The teachers excused themselves. It was time for the claustrophobia test. A personal rescue sphere (PRS) lay in Building 37 on an observation room's floor (Hohler, 1986). Since only two space suits fit on board the shuttle, NASA expected the commander and the pilot to slip into the space suits in case of emergency. The rest of the crew would then be zipped into the thick, inflatable nylon balls and carried weightlessly to another shuttle or an orbiting space station.

At present, the PRS was a test laboratory, a tiny dark bubble in which the teachers were fitted with transmitters and electrodes and zipped in, one by one, to determine how they might react aboard the shuttle, where the living space--kitchen, bathroom, sleeping area, living room, and recreation area--measured 10 feet by 13 feet; no place for claustrophobia. No one told them when they would be released (Hohler, 1986).

> Morgan passed the time by humming Bach's Brandenburg Concerto No. 4. 'The magic of Bach played in my head and I relaxed and enjoyed myself,' she said. 'My EEG readouts probably looked like sheet music.'
>
> Foerster felt 'embronic' in the bubble. 'It was dark and warm,' he said, 'and I started fantasizing that I was lost in space.'
>
> Methia, who was mildly claustrophobic, entered the ball in terror, but even he managed to keep his composure.
>
> When the technicians unzipped Christa McAuliffe fifteen minutes after zipping her in, she asked if she could take the ball home with her (Hohler, 1986, p. 104).

The next morning, the teachers went back to school. For five and a half hours they attended crash courses on the perils of space flight--decompression sickness, hyperventilation, respiratory and circulatory problems, spatial disorientation, hypoxia, and more. They scribbled notes, bombarded the instructors with questions, and volunteered for all the demonstrations. Even Christa, who had never completely conquered her childhood motion sickness, wanted so badly to impress NASA's instructors that she volunteered for a ride on the spatial disorientation chair, a sort of earth-bound vomit comet.

The purpose of the automated chair was to help astronauts prepare for the first dizzying moments of weightlessness in space. Christa climbed in, fastened her safety belt, and closed her eyes. The chair started to spin, quickly gaining speed, and within seconds it spun so fast that she thought, seat belt or no seat belt, she would be hurled halfway across Texas. Then her inner ear started to revolt and she lost her equilibrium.

> 'Are you still spinning?' the instructor asked her after awhile.
>
> 'No?' she said, hoping for her stomach's sake that she wasn't.
>
> 'Take a look,' he said.
>
> Sure enough, the room spun faster than the carnival rides that had turned her stomach twenty-five years earlier. She suddenly felt ill. She wanted to get off. She wanted to lie down. She wanted to go home. She wanted no part of the vomit comet (Hohler, 1986, p. 105).

Which, of course, was what all this was leading up to. But now it was time for the altitude chamber--a ghastly green cylinder that turned fingers blue and stole one's sense of reason. An instructor drilled the finalists for several hours about the chamber. An emergency aboard the KC-135 or the space shuttle could lead to hypoxia, he told the group, an oxygen deficiency in the body tissue that was characterized by such symptoms as blurred vision, dizziness, a tingling sensation, incoordination, hyperventilation, and personality changes that included belligerence and euphoria. Each person experienced different symptoms, but for that person the same symptoms would always recur. The purpose of the altitude chamber was for them to learn their symptoms and how to respond to them. "When you recognize the symptoms, you must get oxygen immediately," the instructor said. "People die from hypoxia" (Hohler, 1986, p. 106).

The chamber was large enough for 10 teachers, 4 instructors, and Ladwig, who had decided to ride the KC-135 as well. Wearing oxygen masks, they sat across from each other on steel benches, breathing pure oxygen for 25 minutes to purge their bodies of nitrogen that could create deadly bubbles in their blood. They used the time to adapt to the masks, which required them to forcibly exhale instead of inhale, reversing their natural breathing patterns. Some of them adapted better than others (Hohler, 1986).

Once the steel doors had been locked and the oxygen sucked out of the sealed chamber, the occupants climbed to a simulated height of 6,000 feet. From there the teachers experienced a simulated plunge of 1,000 feet to be sure they could clear their ears. Then they soared to 35,000 feet and descended to 28,000 feet, where the test began. The occupants on one side of the chamber removed their masks first.

Still haunted by his "personal demon"--a mild case of claustrophobia--Dick Methia feared the altitude chamber more than the personal rescue sphere, he said, because he "didn't fully understand what was going to happen, and once I realized there was no escaping, the idea of physical danger became even more acute" (Hohler, 1986, p. 107).

At 28,000 feet, the oxygen was so thin that the symptoms of hypoxia appeared quickly. Methia, like the other teachers, held a sheet of paper on which he was to record his symptoms as he answered a series of questions: name, address, telephone number, and several basic mathematical problems. As the other teachers recognized their symptoms, they replaced their masks and replenished the oxygen in their bodies. Methia did not (Hohler, 1986).

His personality had changed. The instructors noticed his fingers turning an icy blue from a lack of oxygen and told him to replace his mask. He refused. They ordered him to replace his mask and again he refused. Then they tried to replace it for him, but he resisted. "I don't need your help," he said. "I'll do it. I'll do it." Finally, they overpowered him and replaced it. "I became extremely arrogant," he said later. "Had I been a pilot, I would have arrogantly crashed my plane" (Hohler, 1986, p. 107).

Once Methia came to his senses, the teachers on the other side of the chamber removed their masks. No one else reacted as Methia had, and the teachers were dismissed. But some of them still felt uneasy about the KC-135; others suddenly felt more confident.

"I learned more in that chamber than just the symptoms of hypoxia" Morgan wrote later in her hometown newspaper, the Central Idaho Star News. "I learned to trust the equipment. I knew I could trust the instructors. There is no way that NASA would put ten innocent teachers in danger" (Hohler, 1986, p. 107).

The teachers moved from the altitude chamber into a decompression chamber, where they experienced a sudden decompression from 8,000 feet to 30,000 feet. It began with a loud bang, and the chamber quickly filled with fog, just as it would, the instructor said, if the cabin of their aircraft suddenly lost pressure. No one had a problem, and everyone left smiling.

The next day the teachers toured Mission Control, and wriggled into the mock space shuttle at Building 9A. They ate lunch in the Space

Center cafeteria with several NASA officials and astronauts Bob Crippen, Dale Gardner, and Judy Resnik. As the teachers left the cafeteria, an army of autograph seekers mobbed them.

No one in the history of U.S. manned space flight had left the launch pad without clearance from Dr. Terrence McGuire, NASA's consulting psychiatrist. The agency's flight safety record was perfect, but McGuire needed to be sure that everyone who boarded the shuttle, particularly the first space flight participant, could tolerate high-level stress.

How high?

> 'Threat to life, a real emergency,' McGuire told Neil Chesanow of New Woman magazine. 'Everything is going fine, and then suppose--well, a seal breaks. And suddenly you're in big trouble. In a situation like that, you need clarity of mind and the ability to move now' (Hohler, 1986, p. 110).

NASA had never shot an ordinary person into space, so in the teachers' case, McGuire also needed to know whether they had the ability to get along with the crew for four months of training and six days in orbit. He judged each of the teachers over a one hour written examination and a two hour personal interview.

> 'Astronauts are extremely intelligent, highly trained individuals,' he said. 'Most have their doctorates in some hard science. They are a very perfectionist, very adventuresome group of people. They expect good performance, good judgment, logical thinking, dedication to the mission, and reliability. You need a person who can fit in' (Hohler, 1986, p. 110).

The morning of the KC-135 flight, the teachers were up at daybreak. Following breakfast, they rode to nearby Ellington Air Force Base for the final briefing and the flight. The KC-135 would produce weightlessness by flying in a parabolic arc, shaped like the big dipper of a roller coaster. After climbing six miles high, the pilot would shift into a power dive, plummeting at a 45-degree angle that created twice the force of gravity, similar to the force shuttle riders felt upon lift-off and landing. At the bottom of the dive, he would pull up the nose and coast for 30 to 40 seconds. The jet would not be supported by gravity, and the occupants would not be supported by the plane. They would be weightless, the closest nine of them would come to the feeling of space flight.

After being reviewed on the emergency escape procedures, including the parachutes, the teachers were reminded about the frequency of illness aboard the jet, and each was handed an air sickness bag. They received a dose of Scopedex, a combination of scopolamine, to help prevent air sickness, and dexedrine, to prevent the drowsiness caused by the scopolamine (Hohler, 1986).

At 9:00 a.m., a half hour before the flight, the teachers pulled on black combat boots and green fatigue jumpsuits and boarded the KC-135. Minutes later the jet soared six miles above the Gulf of Mexico and turned into the "grandaddy roller coaster of all time." All but Christa unbuckled themselves from their seats in the rear of the jet and moved into the hollow cushioned area of the cabin that stretched 30 feet toward the cockpit. As the jet dived, they struggled against the increased force of gravity. Then the nose rose suddenly and they were free. They were floating (Appendix K).

Resnik and Dale Gardner, another veteran astronaut, emptied a bag of toys--tennis balls, paper airplanes, pieces of string, a water bottle, a Frisbee--and the teachers frolicked in 40 seconds of free-form aerial gymnastics, bouncing off the walls, somersaulting through the cabin, even skimming a Frisbee across the ceiling (NASA, June, 1986).

During its two hours in the air, the jet dived 27 times, and Michael Metcalf, the former Air Force pilot, lost his breakfast early in the flight. Ladwig fared no better, and Christa felt queasy. Upon landing, the teachers smiled for the cameras on the runway, but the flight crew hurried them on. It was lunch time (Hohler, 1986).

After lunch the teachers changed into their street clothes and faced the press in an auditorium at the Space Center's museum. Two dozen reporters sat in the front of the auditorium, and twice as many tourists, many of them children, sat in the back. The teachers sat in alphabetical order on the stage. One by one they talked about what the ride had meant to them. When the press conference ended, the children in the back of the auditorium bounded down the aisles to the stage, eager for autographs and full of questions (Hohler, 1986).

After they had signed their last autographs, the teachers hurried to Mission Control to watch the final minutes of the 43-hour countdown to Challenger's eighth flight. Only senior NASA officials, a flight crew's immediate family, and representatives of companies with cargo aboard the shuttle were usually allowed to observe a launch from the heavily guarded communications room, but NASA had made an exception for the teachers. They settled into plush theater seats at the back of the room as the countdown continued (Hohler, 1986).

With six seconds to go, Challenger's three main engines ignited in rapid succession, roaring and belching sun-bright flames. Three seconds later, a sensor detected a faulty coolant valve and suddenly the engines shut down. Challenger trembled on the launch pad as hoses cooled the engines with thousands of gallons of water, sending a mammoth steam cloud ballooning from beneath the vehicle. Fullerton ordered the crew to unstrap their flight harnesses and prepare for an emergency escape (Ladwig, 1985).

In the mission control viewing room, the teachers sat mesmerized, waiting for the danger to pass. Then Crippen tried to describe the crew's frustration, and Ladwig mentioned the risks of space flight before asking if any of them wanted to withdraw from the competition. No one did (Ladwig, 1987).

That night, their last in Houston, the teachers packed for a quick trip to the Marshall Space Flight Center in Alabama before entering the last leg of the space race--a flight to Washington for their final interviews and the announcement of the winner.

Weary from the week in Houston, they arrived for a celebration in Huntsville, home of the Marshall Space Flight Center and birthplace of the booster rockets that sent Alan Shepard aloft, Neil Armstrong to the moon, and a fleet of space shuttles safely into orbit. It was July 13, 1985, the Space Center's 25th birthday, and the teachers joined 3,000 employees and townspeople for an anniversary picnic in the steamy summer heat (Ladwig, 1985).

Before they had time to digest their hot dogs, the teachers were whisked across a parking lot to sample the rides at the U.S. Space Camp. Dressed in astronaut blues and space camp baseball caps, the teachers each landed a shuttle simulator on a video runway and placed an American flag on a mock moon by riding a mechanical arm to the roof of the domed camp. The teachers toured the Alabama Space and Rocket Park. Then they tried two more rides. The first was a multi-axis chair that rotated more violently than the spatial disorientation chair in Houston. None of the teachers was anxious to try it, but none of them dared to pass it up. The knew NASA was watching. (Ladwig, 1987).

All 10 teachers tried the chair and only two became ill--Bob Foerster and Christa McAuliffe. Foerster went to lie down in a nearby dormitory while Christa stayed, trying to recover in time for the next ride--the Lunar Odyssey, a centrifuge that spun at about 35 mph to simulate gravitational force stronger than shuttle riders felt upon lift-off (Ladwig, 1987).

The Lunar Odyssey simulated a flight to the moon. A circular chamber would spin, pushing the occupants back in their seats as a narrator described the journey and video images of the mission flashed on the domed ceiling. The riders experienced the roar of the lift-off and the silence of space travel. The adventure lasted about 15 minutes (Ladwig, 1987).

Selecting Who Would Fly

Just after dusk, the 10 teachers boarded a NASA jet for a flight from Huntsville to Washington, where only 45 minutes of the next five days really mattered. In alphabetical order--from Beres to Wenger--the teachers would walk three blocks from the L'Enfant Plaza to NASA's white marble headquarters and face the space agency's brass in the final interviews. Each of them would get 45 minutes, no more, no less (Hohler, 1986).

The teachers met no actresses or basketball stars on this trip. NASA's selection committee (Appendix L) consisted of seven senior officers, among them the general counsel, the external relations officer, the equal opportunity supervisor, the space flight director, and Ann Bradley, the committee's chairperson. Like the earlier judges, they had studied the videotapes and the applications of each candidate, but none of that mattered much anymore. What they needed to know was which one of the finalists could best promote the space program and handle the pressure--the time away from home, the media, the training, the flight. Once and for all, they planned to find out (Rosenblatt, 1987).

> 'Some of our questions were intended to throw them off guard so we could see how they reacted,' Bradley said. 'We had never chosen someone like this before, and we knew whoever we picked was going to get a lot of attention. Some reporters aren't too kind, you know.'
>
> Most of the questions were familiar: 'What's going to happen to your family?' 'How would you feel about living out of a suitcase for several months?' 'Do you see yourself as an inspiration to people?' 'How do you know the shuttle won't scare you?'
>
> 'What do you mean by that?' they wanted to know. 'What do you mean you think? Don't you know?'
>
> 'Politics never came up,' said Robert Nysmith, a member of the selection committee. 'It was a zero consideration.'
>
> Bradley had blocked out several hours for the judges to deliberate, but they needed only a few minutes. Their first vote was unanimous (Hohler, 1986, p. 124).

The committee forwarded its recommendations to Mr. Beggs, who was responsible for the final decision on who the first citizen in space would be. Consistent with the presidential participation in launching the Teacher in Space Project, it was determined that the public announcement of the nation's first space Flight Participant should also receive Executive Branch attention (Ladwig, 1985).

That night, across the river in Maryland, NASA's chief administrator James Beggs lay in bed and wondered about the recommendation the selection committee had made to him earlier in the day. He told them he would sleep on it, and by breakfast the next morning he had decided to accept their recommendation (Hohler, 1986).

Christa was going up in space. Ladwig (1987) stated:

> All the teachers were outstanding people, but some of them concentrated too much on how wonderful it would be to fly in the space shuttle, rather than on how they would use the experience to get teachers excited about the space program. Christa was the one who most clearly understood what we had in mind (n.p.).

Dr. Terrence McGuire, NASA's psychiatrist who judged each of the teachers in Houston, would not reveal the details of the interviews because of the confidentiality of the doctor-patient relationship, but said that each of the teachers had passed his test and that he had ranked them in order of their psychological suitability as a space flight participant. Christa had ranked the highest. Of Christa, Dr. McGuire said:

> In my opinion, she was the most broad-based, best balanced person of the ten. A lot of people just don't see themselves as being okay these days. Someone like Christa has a more objective view of who she is and what she's about. That means understanding and accepting her vulnerabilities as well as her strengths. That doesn't mean she thinks she's perfect, that she isn't changing or doesn't want to change. But she has a good idea of who she is, and what she sees is pretty good. That's very unusual today. I know this doesn't sound very scientific, but I think she's neat (cited in Hohler, 1986, p. 111).

Of the selection in Washington in June, Christa's judges had nominated her first, and none of the others had protested. Konrad Dannenberg, one of the four judges that interviewed her, said:

> She was outgoing, very enthusiastic. I think we all were very favorably impressed by her spirit, her speaking abilities and her ideas about communicating the space experience. The judges who didn't interview her saw those qualities in her application and her videotape. She was chosen quickly (Hohler, 1986, p. 90).

On July 19, the finalists met Secretary of Education William Bennett, who offered to substitute teach one day at the school of the winning teacher. The teachers were tucked away in a conference room on the seventh floor at NASA headquarters. Lunch was delivered, the door closed, everyone in the room believed no one else in the city knew where they were hiding (Hohler, 1986).

> Minutes later, a reporter walked in. 'Any word yet on the winner?' he asked.
>
> Suddenly, the ten teachers and their two NASA protectors were on the run, whispering and tiptoeing through the tiled

corrridors, their movable feast on a squeaky cart, searching for another hideout.

The name of the first private citizen in space was hot news, particularly in cities that claimed a teacher in the final ten. The Washington Post, with finalists from Virginia and Maryland, sent its top NASA writer and a White House reporter after the name. In Christa's hometown, the Concord Monitor tried everything: the reporter they had sent to Washington, friends at the Post, friends in the Senate, Christa's husband. They tried them twice, sometimes three times, with no success.

The answer was now in room 7002 of NASA headquarters, an unoccupied office overlooking a Holiday Inn. Amid a clutter of boxes and dusty computers, the teachers sat on couches, finishing roast beef sandwiches and lukewarm soads. They had made their final phone calls and now chatted, waiting to learn the winner's name before being whisked to the White House.

In room 7002, Christa sat next to Niki Wenger. Nearby sat Ann Bradley. Her job was to tell the teachers who had won, and she was waiting for the right opportunity. It was a little after noon on July 19, 1985.

As Bradley sipped from a can of Coke, Christa told Wenger about her husband, Steve. Steve believed his unusual housekeeping methods made him the perfect star for a sequel to Mr. Mom, and he joked about writing the 'Space Husband's Cookbook,' featuring a chapter on 'Snickers: The Forgotten Breakfast Food.' When Christa started to tell Wenger about Steve's romance with cornflakes, Bradley lowered her Coke can and cut her off.

'Excuse me, Christa,' she blurted out, 'but you better tell your husband to stock up on a lot more cornflakes.'

The other teachers looked at each other like puzzled students.

Bradley kept staring at Christa. 'You're the one. You're going,' Bradley said. 'You're the one going up in space' (Hohler, 1986, pp. 7-8).

Christa was not the brightest of the 10 finalists. One of them was a prize-winning playwright and poet; another had been invited by the French government to study language, literature, and culture there for a year. Most of them had graduated from schools more prestigious than Christa's alma mater of Framingham State College. One had even graduated Phi Beta Kappa from Stanford University.

On paper, some of them seemed to push Christa to the back of the class. There was a former fighter pilot, a film producer, and a world adventurer. Several of them knew much more about space and science than Christa knew, and the projects most of them had proposed for the six-day journey made Christa's idea of keeping a diary look pretty ordinary.

Which, of course, was the difference. Christa was the girl next door, and more. No other finalist matched her potential for getting NASA's message across to so many people. Christa was the one who could speak to and be understood by the middle-aged accountant in Portland, Oregon, who never watches television but is home with the flu; a truck driver who just made a run from Chicago to Orlando and is winding down with a beer and a few minutes of television; the 83-year-old widow in Queens, New York, who watches television all the time because she has nothing better to do (Ladwig, 1987).

Christa needed help, and with Steve out of reach she needed her nine friends to rally around her on the day she faced the nation. As she started to explain that she might need them for a much longer time, Bradley picked up on another cue: "Excuse me, but Christa's really going to need a support person over the next few months, someone who can serve as sort of a cheerleader. So, Barbara Morgan, you're the alternate" (Hohler, 1986, p. 11).

There was no glitz in Barbara Morgan's world. She rarely wore makeup, her clothes were simple and tasteful, and for fun on a Saturday night she played the flute in a small chamber orchestra. The finalists called her a cheerleader because of her uncanny knack of knowing exactly when and how to lift the spirits of a slumping colleague.

So Christa and Barbara, the girl next door and the cheerleader, would represent the five billion people of the world who had never entered space (Appendix M).

> 'By the way, did you write an acceptance speech?' Beres asked Christa as the teachers gathered.
>
> 'Oh m'gosh, no,' Christa said. 'I forgot.'
>
> She had also forgotten her hair brush and lipstick, which she borrowed from her friends before the ten of them and two NASA administrators squeezed into a pair of gray government station wagons for a ride to the White House. Christa composed her victory statement on the way.
>
> At once Christa seemed to be a traditional mother and a daring pioneer. The space shuttle never tempted her as a billion-dollar carnival ride. Christa loved her husband and children too much to dash away for a year of high-tech fantasies. She went to Washington because she wanted to teach about a new frontier, about personal challenge and about the power of her much-maligned profession.
>
> 'Imagine me teaching from space, all over the world,' she said. 'Touching so many people's lives--that's a teacher's dream' (Hohler, 1986, pp. 11-12).

On July 19, in the Roosevelt Room of the White House, Vice-President George Bush introduced Christa McAuliffe, the high school social studies teacher from Concord, New Hampshire, as the individual who would represent America's teaching profession on this, the ultimate field trip. Barbara Morgan, an elementary school teacher from McCall, Idaho, was announced as the backup candidate (Ladwig, 1985).

For two weeks, NASA media experts had lined up the teachers in alphabetical order or made sure they divided the men and women. This time the teachers were on their own, and Christa stood closest to Bush.

Beggs said it was not easy picking a winner, but "I'm confident that when the shuttle lifts off, our winning candidate will soar with it right into the hearts and minds of young people around the country, indeed, around the world" (Hohler, 1986, p. 14). The vice-president then introduced Morgan, shaking her hand and presenting her a trophy, a bronze statuette of a teacher pointing a student toward the stars. Then he raised his voice a notch. "And the winner, the teacher who will be going into space, is Christa McAuliffe" (Hohler, 1986, p. 14). Christa shook his hand, cradled a trophy like Morgan's, and waited for Bush to step back from the podium. She leaned toward the microphone (Appendix N).

The team spirit that had developed among the finalist candidates was evident at the ceremony. Upon accepting a trophy from the vice-president, a tearful but exuberant Christa proclaimed, "I've made nine wonderful friends over the last two weeks, and when the shuttle goes, there might be one body, but there's going to be ten souls that I'm taking with me" (Hohler, 1986, p. 14).

CHAPTER IV

SPACE SHUTTLE MISSION 51-L

Carrying the first Space Flight Participant into space would not be the only first for Challenger, whose lift-off would mark the first use of pad 39-B for a shuttle launch. Pad B was last used for the Apollo-Soyuz Test Project in July, 1975, and had since been modified to support the shuttle program.

While the launch of high school teacher Christa McAuliffe brought renewed national attention to a sagging shuttle program, the TIS Program was not the only business at hand for 51-L. The 25th space shuttle mission also included a science payload programmed for 40 hours of comet Halley observations and the second of NASA's Tracking and Data Relay Satellites (TDRS-B).

The TDRS-B would be the second TDRS advanced communications spacecraft to be launched from the orbiter Challenger. The first was launched during Challenger's maiden flight in April of 1983. The concept of using advanced communications satellites was developed following studies in the early 1970s which showed that a system of communication satellites operated from a single ground terminal could support the space shuttle and other low-earth orbit space missions more effectively than a worldwide network of ground stations.

For the Spartan-Halley mission, NASA's Goddard Space Flight Center and the University of Chicago's Laboratory for Atmospheric and Space Physics (LASP) had recycled several instruments and designs to produce a high-yield space craft to watch Halley's Comet when it would be too close to the sun for other observatories to do so. By recording ultraviolet light emitted by the comet's chemistry when it was closest to the sun and most active, scientists would be able to determine how fast water is broken down by sunlight, search for carbon and sulfur and related compounds, and thus understand how the tail evolves. This single instrument could provide scientists with more knowledge about comets than had been gathered since 340 B.C., when Aristotle taught that comets were part of the earth's atmosphere (Littmann and Yeomans, 1985).

Aboard Challenger, payload specialist Greg Jarvis would perform experiments to investigate fluid dynamics in microgravity. Hughes hoped that these experiments would improve their understanding of how fluids act in orbiting spacecraft and could therefore lead to the design of more efficient and less costly spacecraft.

The first legal tender American coinage would also make the trip into space. Two complete sets of the newly-minted U.S. Liberty coins would be aboard the Challenger. The Liberty coins--a silver dollar, half dollar, and $5 gold coin--were minted by authorization from Congress to honor the Statue of Liberty's centennial anniversary in 1986 and to help raise funds for the restoration and future maintenance of the statue and Ellis Island. They were the first and only government-issue coins to feature the Statue of Liberty (NASA, January, 1986).

Training for the 51-L

On September 9, Christa Mcauliffe and Barbara Morgan reported to the Johnson Space Center to begin four months of preflight training. The training for Space Flight Participants was to be the same as had been developed for the Payload Specialist candidates (Appendix D). The requirements included 114 hours of activities designed to familiarize the candidates with the orbiter environment, safety procedures, flight operations, and crew systems. During the training cycle, the teachers would be prepared for the mission through self-study of workbooks and video tapes, classroom briefings, simulators, and flights on the KC-135, a T-38 jet, and the Shuttle Training Aircraft (Ladwig, 1986).

They were to be trained as payload specialists, shuttle guests who had thus far fallen into three categories: engineers for private companies with cargo aboard the shuttle, foreign dignitaries, and American politicians. Their formal training was to last 114 hours, about the time it took a student to complete Christa's "Women's History" course and a tiny fraction of the time it took an astronaut to prepare for space flight. They would spend 12 hours in the shuttle mission simulator, fly in supersonic jets, and ride the vomit comet, but mostly they would learn the basics--how to work, eat, sleep, and go to the bathroom in space (Ladwig, 1985).

The teachers chose wardrobes before they trained. They were fitted for sky-blue flight suits, sturdy black boots for the launch, and leather-soled wollen moccasins for flailing about in weightlessness. They picked up their red, white, and blue helmets and tried on the inflatable rubber pants that would keep their blood circulating during the plunge back to earth (Appendix P). They selected personal items that ranged from a toothbrush and skin cream to a Swiss army knife and a sleeping mask (Ladwig, 1985).

On their second day of training, the teachers critiqued NASA's space cuisine, sampling some of the 140 food and beverage items Christa could order for her orbital meal (Appendix Q). They graded them from 1 to 10, with 10 being at the top of the scale. Christa gave a 5 to a powdered strawberry breakfast drink, a 7 to the rice pilaf, and 8 to scrambled eggs, a 9 to Texas barbecued beef, and a 9+ to her favorite--broccoli and cheese. Christa gave none of the 40 samples less than a five, admitting that "after cafeteria food, everything tastes terrific" (Hohler, 1986, p. 161).

About half of their 114 hours of training was book work--lessons on how to read the 50-pound flight data file; how to enter and exit the shuttle; how to operate the cameras (Appendix R), the galley, and the one million dollar toilet; how to do everything in a weightless environment, from capping toothpaste to extinguishing a fire. When a lesson was finished, a computer test was taken. If the test was passed, a reward was given--a supersonic jet ride; a session in the KC-135; a morning in the shuttle simulator; or most often, a day in the shuttle mock-up, an earthbound reproduction of the actual orbiter (Hohler, 1986).

The mock-up helped Christa and Barbara memorize the floor plan of the flight deck and the middeck beneath it. Each learned where to find her color-coded food tray, her clothes locker, and her sleeping bag. They familiarized themselves with the galley and the bathroom. They learned the location and range of the cabin's mounted cameras. They prepared to turn the middeck into history's first cosmic classroom (Hohler, 1986).

Crew of the 51-L

Christa's crew mates turned out to be just who Alan Ladwig, the manager of the Space Flight Participant Program, had been looking for when he asked that they accompany the first teacher into space (Ladwig, 1987). There was Dick Scobee, a teacher's husband, the first enlisted man to rise through the ranks to the astronaut corps. There was Mike

Smith, who had a master's degree in science and three children in Houston's public school system; Greg Jarvis, a satellite engineer for the Hughes Aircraft Company; Judy Resnik, a doctor of electrical engineering; Ellison Onizuka, an aerospace engineer who was the astronaut's liaison to NASA's Shuttle Student Involvement Program (SSIP); and Ronald McNair, who spoke louder and more often than any of them about the power of knowledge (Hohler, 1986).

A school teachers' son, McNair had studied his way from the cotton, tobacco, and bean fields of a small town in South Carolina to the cosmic frontier. McNair was a symbol of a modern age. The second black American to reach space, Ron had graduated from a segregated high school at the age of 16, earned a Ph.D. in physics from the Massachusetts Institute of Technology, and studied laser physics in France. He had married a teacher and spent his adult life urging young people to do what he had done, to push themselves (Luxenberg et al., 1986).

"Yes, I did go to the very school you are now attending. . ." McNair wrote to students at his former elementary school after his first space flight in 1984 (cited in Luxenberg et al., 1986, p. 100). He went on to say:

> Yes, it is true, astronauts are usually from New York, Los Angeles, Philadelphia, and Boston. But let the fact that one of them is from LAKE CITY, S.C., serve as a lesson to you that it doesn't matter where you come from, who your relatives are, how much money you have or who you are. Whether or not you reach your goals in life depends entirely on how well you prepare for them and how badly you want them (cited in Luxenberg et al., 1986, p. 100).

The moment he chose to leave his small world and compete against the best and the brightest at MIT, he said, he became a winner:

> Not because I went to MIT. Many people go to MIT who are not winners. Not because I finished MIT. Many people finish MIT who are not winners. I became a winner because I was willing to hang it over the edge and just dangle it, just a little bit.

> That's why I say to you students . . . be a winner. Hand it over the edge (cited in Luxenberg et al., 1986, p. 114).

Even after the thrill of space flight ("God, I felt like I was born there," Hohler, 1986, p. 163), McNair had considered teaching at the University of South Carolina, and upon his return to Massachusetts he had urged the state legislature to increase teacher's salaries. Christa saw a kindred spirit in Ron McNair (Hohler, 1986).

McNair's personality reflected his interests. A fifth degree black belt karate champion, he had won an Amateur Athletic Union gold medal, taught martial arts for several years, and had even studied their scientific foundations as a physicist at the Hughes Research Laboratories in California. He played the saxophone in the "Contra Band," and 18-piece group of Space Center employees, and in jam sessions at Houston clubs. In training, he was cool and in control. His conversation was a product of his curiosity; idle chatter bored him. Questions came easily. He asked Christa about her home, her family, her students, her dreams.

One day McNair asked Christa where she saw herself in 10 years. "I guess I see myself in New Hampshire and in education, maybe in administration or curriculum development," she answered. "I want to have a bigger impact on the system and how it works." McNair asked, "Do you think you could make a bigger impact than you'll make with this mission?" Christa replied that she wasn't sure, but she couldn't wait to find out (Hohler, 1968, p. 163).

Dick Scobee had worried Christa. She knew her sudden rise to fame had bred contempt among not just a few people in the space agency. She knew her promise to "humanize" space travel had not set well with astronauts who also claimed to be human. She knew she was an outsider who had been thrust into one of the world's most exclusive clubs without a vote by its members. Little had frightened her as much as the thought of the crew rejecting her as a public relations gimick, a useless commodity who had yanked a seat out from under one of their brethren. She wondered just how deeply they resented her and she wondered most about Scobee (Hohler, 1986).

At first sight, Scobee seemed like the astronauts of her youth, wholesome and handsome, tall, blue-eyed, and ruggedly built, with a square jaw and an air of self-confidence. And right from the start, Scobee left no doubt that he was in charge, that Christa was a member of the team--that she had been chosen for a space mission, not a carnival ride. "Those are no firecrackers they'll be lighting under our tails," he told her, "those things are for real" (Hohler, 1986, p. 149).

Scobee eased up, however, and Christa soon realized that he was not the macho jet jocky she had feared. He was much like her, an ordinary person who had accomplished the extraordinary. Scobee, the son of a railroad engineer, had been more interested in planes than trains as a youngster. He had enlisted in the Air Force right out of high school and had served as a propeller mechanic in San Antonio. He had met June Kent there at a Baptist church hayride, and they were married a few months later. He was 20 years old; she 16 (Hohler, 1986).

Attending mostly night classes, Dick Scobee spent six years earning a degree in aerospace engineering from the University of Arizona. Then his career began to take off. He earned his Air Force wings, flew a combat tour in Vietnam, and qualified for the elite Edwards Air Force Base, the original home of the "right stuff." Still, Scobee figured he was too tall (six foot one), too old (31), and too inexperienced (five years of flying) to ever become an astronaut. He was wrong.

Scobee had gone to Washington to review the preliminary plans for Christa's shuttle lessons. After talking to her for awhile, he began to see a little of himself in her, a person of modest background and modest talents who had maintained humility in the face of extraordinary success. He liked her. He explained that his wife was a professor at the University of Houston and was thrilled about the Teacher in Space Program, even though teachers above the high school level had not been allowed to apply. He told he that he liked her lesson plans, and he asked her about her family. When she told him that her daughter Caroline was entering kindergarten that fall, Scobee told her that she could report a few days late for training so she could see her children off to their first day of school. He admitted that he might have mellowed a bit since he had recently become a grandfather (Hohler, 1986).

Later, he said to Christa:

> You know, shuttle missions are taken for granted these days, but this one is unique. No matter what happens, this mission will always be remembered as the teacher-in-space mission, and you should be proud of that. <u>We're</u> all proud of it" (Hohler, 1986, p. 150; Appendix S).

Greg Jarvis was a friendly, unassuming man who was balding, color blind, a bit chubby in the midsection, and wanted nothing more than to fly. Jarvis would have flown already had it not been for politics. Like Christa, he had won a contest. Jarvis had been selected over 600 other Hughes engineers to become a payload specialist assigned to fly with one of the company's satellites on the shuttle Discovery six months earlier. But because he had been bumped from the flight after two months of training by Senator Jake Garn of Utah, the shuttle and the satellite had left without him. Garn had been chairman of the subcommittee that oversaw NASA's budget. Jarvis had then been reassigned to fly with a Hughes satellite on the Columbia in December, but then he had been bumped by

Representative Bill Nelson of Florida, who was head of the House Subcommittee on Space Science and whose congressional district included the Kennedy Space Center. Jarvis then landed on Challenger. Hughes had sent up 19 satellites on the space shuttle, but none would fly on mission 51-L (Ladwig, 1987). "You look at an astronaut, who is just about a perfect human being, and here you are, your hair falling out, and they call you. It's like a dream" (Luxenberg et al., 1986, p. 130).

Christa soon learned that Jarvis was a fitting addition to the teacher's mission. A tireless student who planned to carry banners from his alma maters (Northeastern University and the State University of New York at Buffalo) into space, Jarvis had continued to take evening courses at the age of 41, and he was working on a thesis for his second master's degree when he arrived in Houston. He had arranged to carry the diploma aboard the shuttle and to receive the first degree conferred in space. Once, before he had decided on an engineering career, Jarvis had considered teaching history (Luxenberg et al., 1986).

Christa liked Greg Jarvis. He was a regular guy. He drove a rusting 1968 Dodge Dart and spent hours riding his bicycle with his wife, Marcia, along the coast near their home in Hermosa Beach, California. He and Christa visited often at Peachtree Lane. They drank wine and talked about Boston, where he had lived in a basement apartment on Beacon Street while attending Northeastern. They talked about ice cream, his addiction to banana splits, and Christa's penchant for peppermint (Hohler, 1986).

A complex woman, Judy Resnik had spent her life excelling in a male-dominated world. She had been a straight A student and the only girl in the mathematics club at Firestone High School in Akron, Ohio. She had decided against a career as a concert pianist, instead pursuing mathematics and science at Carnegie-Mellon University in Pittsburgh, where she graduated near the top of her mostly male class. In 1978, after earning her doctorate in electrical engineering at the University of Maryland, Resnik and five other women had broken the exclusively male ranks of NASA's astronaut corps. She was proud and independent, and she credited only herself for her success. She bristled when people decribed her as the "second woman in space" or as "the first Jewish astronaut." "I am an astronaut," she said. "Not a woman astronaut. Not a Jewish astronaut. An astronaut" (Luxenberg et al., 1986, p. 88).

She had another side as well. At Carnegie-Mellon she had been selected the runner-up to the homecoming queen. At the Space Center she was known as J. R. She worked hard, she played hard, and she was intensely private about almost everything. Everything, that is, except her unrequited love for the actor, Tom Selleck. Resnik's crewmates on her first space flight had surprised her by taping a poster of Selleck to the inside of the shuttle's bathroom door. "Excuse No. 1," it said on her coffee cup, "I'm saving myself for Tom Selleck" (Luxenberg et al., 1986, p. 93).

Judy Resnik had little use for the space flight participants, she told friends. She believed congressmen were just "invading our space," and asked, "What are we going to do with these people?" (Luxenberg et al., 1986, p. 95). But, she admired the teachers. She had even grown fond of them (Luxenberg et al., 1986).

Ellison Onizuka, the grandson of Japanese immigrants who had worked on sugar plantations in Hawaii, lived less than a few blocks from Dick Scobee in a modest, brown-brick, track-style house in the Meadowgreen subdivision. It was the first house he had owned, and when he was not watching his two daughters play in the local youth soccer leagues or puttering with his car in the driveway, Onizuka was tending a garden in his small back yard. Besides his Asian-American features, he hardly looked like the astronauts of Christa's youth. He was short and rather pudgy, with a receeding hairline and long sideburns. He often wore jeans and white socks to work. Onizuka had a reputation as an exacting engineer, but he was one of the most popular astronauts among civilians and fellow members of the corps at the Space Center. Before each of his shuttle launches, Ellison gave the staff at Mission Control a box of pineapples, papayas, and macadamia nuts to enjoy during the flight. He organized parties at Pe-Te's Cajun Restaurant, and hosted a real Hawaiian luau each year in his back yard (Hohler, 1986).

Pilot Mike Smith jogged through his lakeshore neighborhood, waterskied with his wife and three children, and attended Sunday morning Bible classes at a Baptist church a short walk from the Space Center. During the last prelaunch interview, a reporter had asked Smith how he felt about waiting five years to fly on a shuttle. "Well, it's been a little bit long," he said, "but we were told it was gonna be five years when we got here, so what can I say?" When asked if his three children were excited about the launch, he replied, "Sure. They're really anxious to get to Florida so they can go to Disney World." When everyone had stopped laughing, Scobee mentioned that Smith had been chosen to fly Challenger again nine months after mission 51-L. "Will you be the commander?" Smith was asked. "No, I'll be the pilot again, but that's all right with me," he said. "If they want to fly me every nine months, that's just great" (Hohler, 1986, p. 204).

Although Scobee had already given Christa the crew's blessing, her other crewmates accentuated it soon after she arrived for training. To her surprise, they asked her to leave the room one day before a photo session. She returned to find them wearing shorts, short-sleeved shirts, white knee socks, and black mortarboards with dangling tassels. They toted apples and Cabbage Patch Kid lunch boxes. Resnik had a child's purse on her shoulder, and they had brought Christa's teddy bear, Radar, given to her by the producers of Sesame Street. They put a NASA cap on Radar, gathered around Christa, and smiled for the cameras. Christa laughed. They liked her, and she knew it. She had said from the start that she would never pretend to be an astronaut. She had told them she had won the ride of a lifetime and that she intended to go as a team player. Now the crew had accepted her, and she had never been prouder (Hohler, 1986).

So here they were, the crew of 51-L (Appendix T), among them a military pilot, a Jewish woman, an Asian-American, a Black, and a mother--symbols of NASA's commitment to carry America's cultural rainbow toward the stars (Hohler, 1986; Appendix U).

Lessons From Space

For its part, NASA developed lesson plans (Appendix V) and publications to augment its programs designed to assist teachers in educating their students about science and technology in general and the space program in particular. The activities encompassed mission-related curriculum materials, teacher guides, films, video tapes, laser discs, lithographs, posters, and a special edition of NASA's quarterly newsletter, Report to Educators (NASA, Winter, 1985).

Much of the content for these educational initiatives were built around the onboard activities that Christa was to conduct during the mission. As a Space Flight Participant, she would be allowed one mid-deck stowage locker. The two cubic foot locker capacity would carry the equipment and supplies for Christa's in-orbit classroom.

Planning for the onboard events began in August when the 10 finalists met in Washington, D.C., to develop a list of potential activities for Christa to conduct during her six-day field trip. Working with Christa, the STS 51-L crew, the JSC mission planners, and the Teacher in Space Project Manager, William Nixon had worked to establish the basis for a classroom in space to fit within the locker constraints and flight plan capabilities (Nixon, 1987).

The course activities included both live broadcast and filmed events. The first lecture, "The Ultimate Field Trip," was to have taken place on mission day four as the orbiter Challenger circled the earth at a 153-mile orbit. The objective of the lecture was to acquaint the audience with the comparison of daily life on the shuttle to daily life on earth. During the 20-minute period, Christa was to take viewers on a tour of the shuttle and describe the support systems and their use. Highlights of the tour were to include a look at the flight deck controls and systems to include a review of the role of the mission commander and pilot. From the flight deck, viewers would also gain a crews-eye view of the cargo bay and a description of the objectives for the 51-L mission (Ladwig, 1985).

Floating "below" the middeck, viewers would tour the Waste Management System and observe the crew demonstrating hygiene techniques. For the previous five years, NASA had sponsored the Shuttle Student Involvement Project (SSIP), which provided opportunities for high school students to propose experiments to be flown on the shuttle. The SSIP experiments on the 51-L mission, as well as experiments sponsored by professional scientists, would be discussed as part of the middeck tour (Ladwig, 1985).

The preparation and techniques of microgravity eating would also be demonstrated. The need to exercise in space would be emphasized, as a crew member goes for a 17,000 mile per hour jog on the treadmill. The field trip would conclude with at look a how crew members use their leisure time and how they tuck themselves in for a sleep period (Hohler, 1986).

An exciting aspect of the field trip was to include a two-day hookup of the lecture with two classes of students on earth. Not only would the students observe the lecture live, but they would also be given the opportunity to ask Christa questions about the mission (NASA, Winter, 1985).

The second live lecture opportunity was proposed to occur on mission day six, "Where We've Been, Where We're Going--Why?" would give the audience a better understanding of why we utilize and explore space. During the lecture, Christa would demonstrate the advantages of manufacturing in the micro-gravity environment. To illustrate the unique physical properties of space, Christa would demonstrate how elements react when mixed, such as water and oil, crystal growth formation, and the reaction of fluids (NASA, Winter, 1985).

With a look ahead to a permanent presence in space, the space station concept would be reviewed. The reasons for a modular design of the station would be discussed, as well as what factors must be considered when developing a habitable environment. Questions would be raised on aspects of daily life that would differ on long-term missions, either on the space station or on colonizing trips, as well as what new technology might be required (Hohler, 1986).

In addition to the live broadcast lectures, several of Christa's ongoing activities would be filmed for post-flight dissemination.

Demonstrations of these topics would be recorded for 16-mm film and 35-mm still photography (NASA, Winter, 1985).

Christa spent hours in the shuttle mock-up, practicing her field trip through the cabin and her lesson on the value of space flight. Several weeks into the training, she performed her first dress rehearsal. Standing on the mock-up's flight deck, Christa smiled and greeted viewers with a brief narrative of what she would be showing on her tour of the shuttle's flight deck.

Her next stop would be the rear of the flight deck, where she would point out a window to the payload bay, explain that it was big enough to hold a school bus, and describe its cargo--a communications satellite, which was to have been deployed over Hawaii 10 hours into the mission, and an observation satellite, which was to have been released to study Halley's comet on the third day of the flight, and retrieved on the fifth day (Hohler, 1986).

Then she would float down to the middeck to discuss the bathroom and sleeping bags. Ron McNair would be waiting at the galley to demonstrate how the astronauts injected hot or cold water into plastic containers for their food and drinks. He would sip quickly from one of the drinks, then open a clothing locker so Christa could describe the fishnet restraints that kept the clothing from floating away. Near the end of the lesson she would float to the treadmill and talk about the need to exercise in space. As she spoke, the rest of the crew would float to the middeck, encircle her and hold hands while she assembled a model space station and described the next generation of space flight (Hohler, 1986).

She would explain that as the Challenger passed over Mexico, an observation satellite NASA had launched nine years earlier was making the first close encounter with Uranus, providing more information about the planet in a day than astronomers had learned in the 205 years since it was discovered. Christa would then discuss the satellite that the Challenger's crew had deployed to study Halley's comet on its first pass by the earth in the space age. And she would mention the network of communications satellites that had turned the earth into a global village.

Unlike the first lesson, the second one would be confined to the middeck. She would illustrate how space benefits manufacturing by shaking a bottle of oil and water, than a bag of marshmallows and M and M candies, to demonstrate that neither liquids nor solids separate in weightlessness as they do in gravity, allowing at least 70 combinations of metals to be created in space that could not be created on earth. She would explain that insulin was easier to produce in weightlessness and that space had improved medical research by allowing scientists to develop latex micron beads that measure tiny bacteria or viruses in the bloodstream. Three student experiments were to fly on Challenger, she would explain, including one that required 12 Leghorn eggs and an incubator for a study on the effects of weightlessness on chicken embryos. Its purpose was to help determine how animals (humans among them) reproduced in space. It was sponsored by the Kentucky Fried Chicken Company (NASA, 1985). Both her lessons would end with a five-minute question-and-answer period with students from Concord High School and Barbara Morgan's school in Idaho.

Television viewers were to be able to access the live lessons in two ways. Individuals with a satellite dish could receive the lessons directly from the RCA satellite (Satcom F-2R, Transponder 13). The satellite had an orbital position of 72 degrees West Longitude, a frequency of 3954.5 MHz vertical polarization, and an audio monaural of 6.8 MHz (Ladwig, 1985).

A second way to view the live lessons would have been through the Public Broadcasting Service (PBS). NASA and PBS reached an agreement for PBS to carry the live lessons via a second satellite, Westar IV, Transponder 12. PBS offered the programs to member stations, which were requested to preempt regular instructional television or classroom programming that day to carry the lessons live. Westar IV was to downlink the lessons from the Satcom F-2R satellite (Campion, 1985).

Another opportunity to involve students and teachers with the mission would be built around NASA's Mission Watch Program. Co-sponsored with Satellite Communication for Learning Worldwide (SCOLA), Mission Watch would provide a program whereby schools with access to satellite dish antennas would receive information regarding the mission two weeks in advance of the launch. Information sent to the schools would include orbiter charts, a profile outlining the mission objectives, the crew schedule, and instructions on how to access the satellite that would broadcast the Mission Watch Program (Ladwig, 1985).

Prior to launch, backup candidate Barbara Morgan hosted a one-hour educational satellite broadcast during which mission managers and principal investigators gave briefings on the cargo and experiments assigned to 51-L. Students from selected schools would be able to call in and ask questions of the principal investigators of the experiments. Students throughout the nation would be able to participate in Mission Watch and look in on the activities of the crew during the entire mission (Ladwig, 1985).

CHAPTER V

POLICY DECISIONS ON CONTINUATION OF THE TEACHER IN SPACE PROGRAM

Following the explosion of the Challenger, NASA was confronted with strong and continuing refrains from the public at large that the space program be resumed as a moral commitment to the deceased crew members of the Challenger. Many appeals were made to continue the Teacher in Space Program as well. Several complex issues had to be seriously weighed, including the feelings of the grieving family members of the crew and the NASA family. Moreover, the print and broadcast media were probing and speculating about literally every aspect of NASA's action or inaction. The development of a policy analysis paper by the Educational Affairs Division for Dr. William R. Graham, then acting administrator of NASA, was the principle means for delineating the key issues for resolution (Ladwig, 1986).

The first issue was whether a decision could be made to continue the Teacher in Space Program without knowing what caused the Challenger accident, how long it would take to correct it, and when a teacher would realistically be expected to fly again, given other projected critical mission requirements. Dr. Graham's decision on February 13, 1986, to continue to Teacher in Space Program was based on three factors.

The first factor was the policy guidance of President Reagan who, in his January 28, 1986, message to the nation said that there would be more teachers in space. He reaffirmed this position during a February 7, 1986, visit to the Thomas Jefferson High School for Science and Technology in Alexandria, Virginia, in announcing planned development of the National Aero-Space Plane, popularly referred to as the "Orient Express." He said:

> I don't believe that this tragedy in any way should affect the policy we had. The space program belongs to all of us and to the people and the people can benefit and you bet, teachers are still on the list to go up (Ladwig, 1986, p. 7).

The second factor was the realization that the three underlying goals of the Teacher in Space Program were then being and could be further actualized, independently of when the next teacher would fly. The goals were: to use aeronautics and space as a catalyst to enhance all subject areas and grade levels of our education system; to increase awareness in the education community of the impact of technology and science on this country's future in preparing students for the future; and to increase the prestige of the teaching profession. These goals represent an ongoing process rather than a single event. A teacher flying on the shuttle as part of the Challenger mission was, as noted by Bruce Murray (former head of NASA's Jet Propulsion Laboratory), an appropriate symbol of the importance of education (Rogers, 1986). The decision to continue the program was made in consultation with major education organizations such as the U.S. Department of Education, the National Education Association (NEA), the American Federation of Teachers (AFT), and the National Science Teachers Association (NSTA) (Ladwig, 1986).

The third factor was whether the backup candidate, Barbara Morgan, should be asked to assume the mantle of the next Teacher in Space designee. Since her credentials for the position had been well established through the initial competitive selection process, and she had trained side-by-side with Christa McAuliffe, Barbara was a logical candidate. Although deeply hurt by the loss of her close friends, Ms. Morgan demonstrated during the crisis a level of courage and inspiration, composure, educational commitment, and articulation that led the acting administration to offer her the opportunity to be the next Teacher in Space when flights were safely resumed. After consultation with her own family and the other families of the crew members, Barbara Morgan accepted the offer (Ladwig, 1986).

The second issue was whether the eight teacher finalists would continue their one-year contracts with NASA (September 1, 1985 through August 31, 1986) and be extended, since the Teacher in Space Program was to continue. With four months remaining on their contracts, on April 14, 1986, after two months of deliberation, the acting administrator decided to extend their contracts for an additional year, through August 31, 1987. This action was consistent with the earlier decision to continue the Teacher in Space Program, and would allow the finalists to complete their specific educational projects, as well as help NASA respond to the many requests for public presentations to schools and professional and civic organizations around the country (Ladwig, 1986).

Teacher in Space Designee

The original Teacher in Space plan was that Christa McAuliffe, after completing the Challenger mission, would travel extensively throughout the country to share the experience of space flight with teachers, students, and other groups and organizations. In addition, presentations were to be made at local, state, and national organizations; interviews were to be conducted with newspaper, television, and radio media. Teacher in Space designee Barbara Morgan not only assumed Christa

McAuliffe's post-flight schedule, but conducted an intensive and exhaustive public speaking schedule in her own right.

In a remarkable display of inspiration, poise, and graciousness in handling a barrage of emotional and probing questions, Ms. Morgan, during the seven-month period from March, 1986 through August, 1986, traveled to 20 states, some two or more times, and made over 70 public appearances to audiences totaling in the thousands, and to all of the major television networks. Scores of requests for speaking engagements either had to be declined or transferred to the finalists. The content of her presentations varied, depending upon the type of audience (i.e., teachers, elementary or secondary students, college students, national professional associations, and civic organizations). Frequent themes covered the personal lessons that she learned from each member of the Challenger crew, which had learning implications for all people, a narrated videotape covering the preflight training of Christa and the finalists, an underscoring of the importance of strengthening and supporting the teaching profession, and the need for students to prepare for the future by upgrading their efforts in science and mathematics courses, as well as all educational disciplines (Ladwig, 1986).

Barbara Morgan often fielded tough questions about the cause of the Challenger accident, her personal feelings and those of the crew members' families, her judgment about NASA management, and inquiries about the future of the space program and when she expected to fly on the shuttle. As the weeks and months evolved and the public healing process advanced, Ms. Morgan increasingly conveyed the message that:

> . . . it is time for us to stop looking back at the Challenger accident and move forward. . . . We can keep reacting to the accident or we can do what we need to do . . . get a vision, move on, and make the space program something to be proud of (Ladwing, 1986, p. 8).

Audiences often responded with standing ovations, personal testimonies of support, and teachers frequently displayed an uplifted sense of personal esteem in identifying Barbara Morgan as "one of us" (Ladwig, 1986, p. 8). This was clearly consistent with one of the main goals of the program--to raise the prestige of the teaching profession.

Eight Finalists

While Christa and Barbara were busy training for mission 51-L, NASA had not forgotten the other eight of the original 10 finalists. Under the auspices of Educational Affairs and Oklahoma State University, contractual agreements were signed by each of the eight finalists to work with NASA for one year. Each teacher was assigned to either NASA headquarters or one of their several research centers (Appendix W).

Each teacher was assigned a NASA Aerospace Education Specialist. These specialists served as mentors to the teachers and conducted intensive training sessions so that the teachers would become accurate in their knowledge of present space activities.

The teachers proved to be enthusiastic students and zealous advocates of NASA's space program. In addition to the "usual" activities such as presentations to Rotary groups, classrooms, television appearances, magazine and newspaper interviews, several of the finalists participated in some not so "usual" activities.

Judy Garcia, who was assigned to NASA Headquarters in Washington, D.C., was asked to participate in selecting a Chilean participant in the NASA International Summer Student Program. Following Garcia's visit to Chile, the American Embassy in Santiago sent a telegram to the State Department in Washington, D.C., crediting Garcia with:

> . . . distinguishing herself as a tireless publicist for mankind's future in space, excellence in education and international cooperation. She effectively conveyed to her audiences the details of her purpose in NASA as well as the enthusiasm and dedication that got her there. Equally adept with students of varying ages, their instructors and the officials who decide the courses of study of these first two groups, Garcia was in addition a pleasure to work with. Again, her great appeal to students below the university level was a real plus for post programming (Norton, 1986, p. 2).

Most of the finalists were at the Kennedy Space Center viewing the launch when the Challenger exploded and each of them deeply felt the pain of losing one of their colleagues. In a February 1, 1986, open letter addressed to the "NASA Family," the finalists wrote:

> All of us in the Teacher in Space Program share your grief over the loss of the Challenger crew. Christa McAuliffe was our friend, but she also became a part of the NASA family. Like a family, we have shared a common sadness. Now we stand ready to rededicate ourselves to our common goals (Morgan, 1986a, n.p.).

An unanticipated effect of the Challenger accident was a greatly expanded demand for public presentations by the finalists, from schools, teacher organizations, and professional and civic groups throughout the United States and other countries (such as Canada, New Zealand, Australia, and Chile). In the eyes of the public, each of the finalists was, in effect, seen as a backup for Christa McAuliffe and each was accorded the esteem and recognition of a hero, and a teacher hero at that. Their rigorous medical examinations, training, and their acquired knowledge of NASA operations prepared them well for communicating the aerospace experience in ways that the general public could easily understand.

A negative spillover effect of the demand for their public appearances was a sharp reduction in available time to conduct and complete other more technical aspects of their contracted projects. The projects included:

1. Preparing videotapes for teachers and students on aerospace careers.

2. Preparing publications of interdisciplinary space program curriculum support materials.

3. Writing aerospace education articles for professional journals.

4. Informing authors and publishers about aerospace information and materials for inclusion in textbooks.

5. Helping to create a Public Broadcasting Service of educational programs, using shuttle missions and the space program as a focus.

However, their increased public speaking engagements also provided an enormously important public service by conveying an educational uplift, a sense of determination that the nation's space program would continue to go forward, and that students and teachers must prepare themselves if progress is to continue. During the period of September, 1985, through July, 1986, the eight finalists spoke at 314 elementary, junior, and senior high schools, made 78 classroom visits, spoke at 35 colleges and universities, conducted 106 teacher workshops and conferences, made presentations at 19 civic groups, and played the lead role in 219 special events. The eight finalists reached an estimated 206,000 people (Ladwig, 1986).

Role of the Space Ambassadors

During the 51-L Space Ambassador Conference, all ambassadors were assigned to regions aligned with the NASA Center geographical responsibilities. During the remainder of the school year, responsibility from managing the Ambassadors was transferred from NASA Headquarters to the field centers. Inherent within this transfer was the desire to form a closer network between the Teacher Resource Rooms and the Ambassadors. A plan developed by the Space Ambassadors to form a professional educational association resulted in the formation of the Teacher in Space Educational Foundation (TISEF) (Appendix X). Although NASA does not provide any monetary support for this organization, it does support the creation and development of the TISEF. Such an organization could provide NASA a very strong "partner" in disseminating aeronautics and space related educational information (Ladwig, 1986).

Since then, NASA has drawn from the talents of the 103 finalists in the Teacher in Space Project. These educators represent all grade levels and academic disciplines. Using their increased knowledge of NASA's space and aeronautics programs gained by their experiences at conferences and workshops, the Space Ambassadors have taken an active role in educating their respective schools and communities. Most of the finalists have undertaken their Space Ambassador role as they continue with their established educational careers, while a few have been granted full-time sabbaticals. For example, Debo Harris, on sabbatical, has chosen four workshop topics to convey information about space age technology and the nation's future in space to students in Louisiana. Robin Kline of Arizona has been given release time to conduct presentations which have averaged 500 participants per week (Ladwing, 1987).

The Space Ambassadors' enthusiasm for NASA's space program has provided them the challenge to share their knowledge and to motivate thousands of adults and students throughout the United States, as well as in its territorial and overseas schools. These educational programs are beneficial to our nation's educational system as we seek to expand our horizons in preparation for the future.

The role designated for the Space Ambassadors was to make presentations and to conduct seminars relating NASA activities and results of space exploration to students, teachers, and interested members of local communities. Additionally, as a result of the training received from NASA, they were to serve as a point of expertise for teachers concerning NASA educational materials and how they could be obtained. These functions were in addition to their regular teaching responsibilities.

The remarkable aerospace activities of the Space Ambassadors has clearly surpassed the agency's original expectations. They have conducted nearly 2,300 aerospace lectures, workshops, and other activities, from which 45 publications have been generated. The activities they have conducted have been attended by 4.1 million people, 60% of whom were students and teachers (Appendix W). The amount of enthusiasm and innovative aerospace education activities generated by these teachers has been further enhanced by the support of many of their principals and education administrators at the county and state levels. For some, such factors as release time, flexible class scheduling, and financial backing for substitute teachers, travel, and materials reflect the support of their administrators (Ladwig, 1986).

The following examples illustrate how the Space Ambassadors have effectively implemented the three major goals of the Teacher in Space Program (Ladwig, 1986):

Goal 1. To use aeronautics and space as a catalyst to enhance all subject areas and grade levels of our education system.

The Norfolk, Virginia, Schools' Science and Technology Advanced Research Program (NORSTAR) was developed by Virginia's Space Ambassador. The curriculum design incorporates an interdisciplinary and integrated approach which facilitates the most effective learning processes for areas of study, including physics, mathematics, computer applications, and communication skills through a team approach to solving problems. Development of lifelong process skills is a major goal of this program.

As a result of the effectiveness of this program, the NORSTAR space flight organization structure was utilized as a special project prototype for the Space Sciences Academy held at Stanford University this past summer. The Academy, a program for high school students across the country, has been a proving ground for experimental, space-related educational projects which are multidisciplinary and integrated. Academy staff included Space Ambassadors from Virginia, Utah, Connecticut, Texas, and Maryland.

The creative Space Ambassadors from Michigan and Washington designed an educational program, using live interactive satellite television programs, to link classrooms with interesting places and events from around the country. During the 1986-87 school year, the Space Ambassadors, as co-producers of Apple Seed Productions, planned to conduct a series of live, interactive field trips from remote locations that were designed to bring the world into the classroom. Students would be able to communicate directly with the site hosts by using hand-held microphones. The scheduled broadcasts include an undersea observation, a walk through the active crater of Mount St. Helens, and a visit to a General Motors Robotic Plant.

One of Missouri's Space Ambassadors has utilized the information he obtained from NASA to work with the Citizen Education Clearing House (CECH) Program. In this program, he works with sixth grade teachers to develop curriculum in all areas. Their theme for 1986 was "Space: Past, Present, and Future."

An educational outreach program was conducted by the Space Ambassador from Arizona when she accompanied students to aerospace centers in

California. A contrasting approach by a Nevada Space Ambassador has been the use of sign language to help teach hearing-impaired students about living in space.

Establishing an audiovisual resource center for aerospace education and developing an introductory high school course in aerospace science are activities of one of the Space Ambassadors from Hawaii. The West Virginia Space Ambassador is developing an aerospace workshop for teachers of that state for which they could earn college credits. With the prospect of having a multiplier effect, the Space Ambassador from West Virginia received a grant for all the teachers in her school to have a Young Astronaut chapter in their classrooms. In Louisiana, the Space Ambassador is conducting aerospace workshops throughout the state and is working with the state's Educational Space Sciences Resource Center.

Space Ambassadors from New Mexico and the Bureau of Indian Affairs visited a number of Eastern Navajo Agency schools. The Ambassadors shared their NASA experiences with students and teachers.

A Space Ambassador from Vermont helped her elementary students construct a full-scale model of a shuttle mid-deck. The children then acted out their jobs aboard the shuttle.

Goal 2. To increase the awareness in the education community of the impact of technology and science on this country's future.

Presenting aerospace education concepts to teacher associations and national conventions, appearing before state congressional bodies, developing space education proposals, conducting aerospace education workshops and seminars, authoring publications, and distributing aerospace education materials to teachers reflect some of the voluminous activities of the Space Ambassadors that support this goal.

Specific examples include a presentation to the Minnesota State Science Teachers' Convention, the New Jersey Earth Science Teachers' Conference, the Nebraska State Teacher Delegate Assembly, an appearance before the Kentucky State Senate, and an appointment to the Colorado Department of Education Technology Committee. The two Space Ambassadors from Kansas set up an aerospace booth at the NSTA Regional Convention in Wichita and the Kansas NEA Convention.

One of the Wisconsin Space Ambassadors spoke at the Principal's Convention, the State Superintendents' Convention, and conducted two summer aerospace education workshops for teachers. Florida's Space Ambassador has been appointed as the "Christa McAuliffe Ambassador for Education" and is doing statewide aerospace presentations. At the University of Arkansas/Little Rock, the Arkansas Space Ambassador spoke to 500 students in the Summer of Laureate Program. A keynote speech was delivered to the Southern Oregon Science and Humanities Symposium by the Oregon Space Ambassador. Alaska's Space Ambassador spoke at the Engineers' Week Awards Banquet, and during summer travels she spoke to students in China and Japan about the NASA programs.

In the area of aerospace educational materials and publications, one of the Space Ambassadors from Nebraska compiled a bibliography of various NASA materials and mailed it to 10,000 teachers throughout the Nebraska Department of Education. The Space Ambassador from Georgia published an aerospace education article in the Fernbank Quarterly, a nationally distributed museum publication. In California, a Space Ambassador published "The Ultimate Field Trip: Space" in the professional journal, California English. A Louisiana Space Ambassador published "Lessons Learned From a Teacher in Space Ambassador" in Louisiana Life Magazine. An Illinois Space Ambassador provided effective ideas for integrating aerospace concepts within various curricula when his article appeared in the Oasis Magazine.

Goal 3. To increase the prestige of the teaching profession.

The concept of prestige involves performance of activity by individuals or groups which results in honor being conferred by others who respect and value such performance. Among the many examples are the aerospace education activities of the two Space Ambassadors from Kentucky which resulted in each being officially funded by the Kentucky State Board of Education. The Delaware school system budgeted money for one of its Space Ambassadors to conduct aerospace education activities in the state.

The governor of Kentucky appointed one of its Space Ambassadors to serve as "Kentucky's Ambassador of Good WIll." This Space Ambassador was to be a participant in the first exchange program between the Young Astronauts of America and the Young Cosmonauts of the Soviet Union in the fall of 1986.

Arizona's Space Ambassador received the Scott Crossfield Teacher of the Year Award for 1985. This award recognizes excellence in teaching aerospace education. The Space Ambassador from Maine received a letter of appreciation from the governor, and the Ambassador from Maryland received the Dean's Special Achievement Award from George Washington University's School of Education and Human Development.

Some other recognitions included receiving the Home Town Hero Award in Rhode Island and Connecticut; Nebraska's Outstanding Aerospace Education Award; Teacher of the Year for the Salisbury, North Carolina City Schools; appointment to the Burlington, Iowa, United Nation's Task Force on "Peaceful Uses of Outer Space"; and selection to address the Tennessee Legislature when they honored the seven Challenger astronauts. Space

Ambassadors from Wyoming and North Dakota were among the winners of the 1985 Presidential Awards for Excellence in Science and Math Teaching.

In summary, the Teacher in Space designee, the eight finalists, and the 103 Space Ambassadors have been extremely effective in accomplishing the three major goals of the Teacher in Space Program (Ladwig, 1986; Appendix Y).

CHAPTER VI

SIGNIFICANT LESSONS LEARNED

The foundation on which the institution of education rests is the human imperative to acquire and nurture the capacity to learn from life's experiences. The Teacher in Space Program, in the context of the Challenger shuttle mission and the subsequent tragic accident, provides three critical lessons for learning at both the individual and organizational levels.

Lesson one teaches that America's citizens clearly feel a sense of personal ownership for the space program. It represents and captivates the pioneering character and aspirations of the American culture in a manner seemingly unlike any other galvanizing force in our society. Those individuals and organizations with leadership responsibility for the future space program must continue to formulate policies in a consultative framework with the public, and in a manner that is educational and appropriately participative. As we move inexorably toward a permanent presence in space, there must be realization that in sending humans into space we are sending a culture (indeed a civilization) with all kinds of people. Thus, the country's citizens must play a major role in molding the way our future course is planned in space.

Lesson two teaches us that we must learn from our failures as well as our successes. NASA administrator Dr. James C. Fletcher, in his June 24, 1986, statement to NASA employees, clearly demonstrated that this lesson is being taken to heart when he said:

> The lessons of failure are hard but they are almost always signposts on the road to progress. Because we are taking these lessons to heart, the shuttle will fly again as a safe vehicle and NASA will be a stronger team. With the new spirit of dedication and motivation, NASA will earn its way back. We have made a good start in facing our faults and in correcting our mistakes. We are strengthening the management of the agency and its program (cited in Ladwig, 1986, p. 15).

Lesson three reaffirms the belief that an educated work force is essential to the future of the country's aerospace program. We must continue to use the inspirational and intellectual excitement that aerospace technology generates to motivate students in science, mathematics, technology, and all of the educational disciplines. The Teacher in Space Program has demonstrated that it can be an extremely valuable resource in helping NASA to achieve that end. Today's students are tomorrow's work force (Ladwig, 1986).

Public Response to the Challenger Accident

On January 28, 1986, after a series of delays, the Challenger Space Shuttle suddenly exploded 73 seconds after launch from Kennedy Space Center. All seven of the brave crew members perished. This nationally and internationally felt tragedy invoked a deep sense of heartfelt grief for the families of the crew members, the NASA family, the nation, and foreign countries around the world. But a chronicle of events as related to the Teacher in Space Project revealed that the country took to heart President Reagan's leadership message to the nation on January 28, 1986, immediately following the Challenger accident. He said: ". . . there will be more shuttle flights and more shuttle crews, and yes, more civilians, more teachers in space. Nothing ends here. Our hopes and our journey continues. . . ." (cited in Ladwig, 1986, p. 3).

Widely spread expressions of grief over the Challenger accident, intertwined with strong entreaties that the nation's space program must continue, characterized the sentiments of citizens from every corner of the country. Seasoned observers of national and international catastrophies likened the public emotions to those associated with the tragic assassination of President Kennedy some 23 years ago. It revealed, more vividly than before, that American citizens have a deep pride in and feel a sense of personal ownership regarding the nation's space program.

Transcending the spectrum of age, expressions ranged from the second grader who sent NASA two dollars to help rebuild the shuttle, to the traveling salesman who said, "The space age must go on; it makes me so proud to be an American every time I see that big bird head to the heavens" (Ladwig, 1986, p. 4). Perhaps most prophetic of all was the 92-year-old grandmother who said, "The Challenger is gone, but not the challenge" (Ladwig, 1986, p. 4).

In the months following the accident, NASA's mail room was filled with over 500,000 letters and thousands of dollars in donations and pledges. Moreover, the protocol office received stacks of Bibles, teddy bears, memorial plaques, and religious memoriabilia with requests that they be forwarded to the family of Christa McAuliffe. While the nation was deeply moved by the deaths of all of the seven astronauts, Christa became a focal point of expression considering that the "Teacher in Space" title had been ascribed to the 51-L shuttle mission and that she had been the first NASA space flight participant.

A content analysis of letters, newspaper articles and editorials, and memorials around the country revealed a consistent theme. It was a deeply felt sorrow, a demand that the cause of the accident be found and fixed; and a passionate plea that the space program not stop. The theme also conveyed that the seven Challenger crew members symbolized the pioneering bravery and courage to take risks that have been a part of the American tradition. Entreaties about the importance of education were common, as might be expected, given the Teacher in Space billing of the Challenger 51-L mission (Ladwig, 1986).

One of the most poignant educational messages was conveyed in an article by school teacher Kathy Cawthon of Hampton, Virginia. Ms. Cawthon asserted that education is not a profession often associated with risk-taking and acts of heroism. Feeling like a hero when breaking up a fight or helping a sick child to a clinic is, according to Ms. Cawthon, easily compensated by the teachers' position of authority, protected by volumes of knowledge, and cushioned by the security of the school bus, school bells, and retreats to the teachers' lounge for quiet and adult conversation. Christa McAuliffe's message to the teaching profession was, said Ms. Cawthon, a lesson in humility, not because she was going into space, but because she had the courage to do so. Ms. Cawthon said, "A good teacher is a leader first who says, 'I'll go in front, you follow, and don't be afraid'" (Ladwig, 1986, p. 4).

In August of 1986, Market Opinion Research conducted their second public opinion survey that year to determine attitudes toward the U.S. Space Program (Mancini, 1986). The first survey was conducted in early January prior to the Challenger accident (Ladwig, 1986). The second was conducted in early August, after the Rogers Commission Report and before the President's announcement to build a replacement orbiter.

Since early January, public support had increased across the board. Findings of special interest were:

1. 85% supported the position of building a new shuttle and pressing ahead with the civilian space program.

2. 89% supported resuming shuttle flights, knowing that there will always be risks associated with manned space flight.

3. 76% supported resuming flying with astronauts and key civilian passengers.

4. 69% supported proceeding with the new NASA space station.

5. 52% disagreed that space program expenditures should be cut. Three questions testing increased funding for space were agreed to by 56+%, with a two-to-one ratio of agrees to disagrees.

6. 83% supported the policy of encouraging private industry to provide space services (including launch services) (Mancini, 1986, n.p.).

In a statement by President Reagan (released by the White House on August 15, 1986) the following remarks were made:

> It has been over six months since the tragic loss of the Challenger and her gallant crew. We have done everything humanly possible to discover the organizational and technical causes of the disaster and to correct the situation. The greatest tribute we can pay to those brave pathfinders who gave their lives on the Challenger is to move forward and rededicate ourselves to America's leadership in space (The White House, 1986, n.p.).

Effects of the Accident on School Children

With millions of children of both preschool and school age having watched the Challenger accident on television, persistent questions from the news media focused on whether many of the children had been traumatized and whether NASA was going to establish a national program to provide therapeutic treatment and support. NASA decided against taking any formal programmatic action, based upon a considered judgment that America's children were much more resilient than the press was allowing. The agency believed that a national structure of support throughout the country already existed in terms of wise and strong parents, skillful and sensitive teachers, school counselors and psychologists, as well as therapeutic community agencies (Ladwig, 1986).

Subsequent events sustained NASA's judgment. One illustration of childrens' resiliency was the response of a group of first graders with whom Senator Jake Garn visited in a school shortly after the accident. Rather than focusing on the accident as such, the children were curious about how astronauts go to the bathroom in space and how space crafts avoid "running into all that other junk up there" (Ladwig, 1986, p. 2). In another example, a New York Times and a CBS poll was undertaken to gauge the effects of the disaster on the children. The children turned out to be more confident about space travel than their parents. Two-thirds of the children wanted to travel in space, despite the Challenger accident, in contrast to 50% of their parents. In that poll, children were as distressed and full of grief as their parents, but they were resilient and looked ahead (Ladwig, 1986).

Many organizations, such as the private sector sponsored Young Astronaut Council, provided helpful tips to its 7,000 chapter leaders on helping children to cope. Suggestions included helping children to express their feelings, being alert for delayed reactions to the tragedy, integrating the experience with other death experiences familiar to children, and making adult responses to children immediate and honest. Several television programs, such as "Punky Brewster," included the Challenger accident in a special program. Many school teachers designed classroom activities (such as mock shuttle building and crew preparation for space missions) as a constructive way to handle feelings about the accident (Ladwig, 1986).

In March of 1987, the researcher attended a presentation by Mrs. June Scobee in Oklahoma City, Oklahoma. She addressed several hundred elementary and junior high-aged children from across the state of Oklahoma. When Mrs. Scobee asked the children who would like to travel into space aboard a shuttle, nearly all of the youngsters eagerly thrust their hands into the air, calling out "I would!" Mrs. Scobee was obviously delighted with the response and continued on with a slide presentation which included pictures of the Challenger and crew, among them her husband, Dick Scobee, commander of the ill-fated mission 51-L.

Mrs. Scobee addressed the issue of the shuttle accident and told her audience that in the first weeks following the explosion, she received enough letters from around the world to fill her living room. She said that most of the letters were from school children who told her how sorry they were about the accident, and that they hoped the space program would continue; that it was important for the children of the nation that the space program continue. The children of the audience enthusiastically echoed this sentiment.

There was no indication of trauma among this group of inquisitive youngsters. The children listened attentively as Mrs. Scobee continued her presentation with colorful slides and an exciting description of the Challenger Center that is to be built in Washington, D.C., with a prototype at the Johnson Space Center in Houston, Texas. The Challenger Center will be a "hands-on" facility to encourage the quest for education in children so that the dreams of the 51-L crew may live on.

Dr. S. J. Soter (1986) of Evanston, Illinois, in conjunction with Drs. Robert Decker and Barry Wilson of the University of Northern Iowa, conducted a survey to evaluate the stress effects of the Challenger accident on adolescents involved in the Mission Watch Program. The conclusion of their in-depth study stated that the subjects in the sample were not traumatized by what they had seen on January 28, 1986. Dr. Soter stated that the news media coverage gave the impression that the shuttle disaster was going to be experienced by children as a trauma and this would precipitate possible severe stress-related symptoms that would require psychotherapeutic intervention. This assumption was reinforced by a psychologist and a psychiatrist who were quoted on television and in the newspapers. These "experts" assumed that because of the identification with Mrs. McAuliffe, students would be profoundly affected.

During the first few days after the shuttle's disaster, Dr. Soter (1986) said that he was truly amazed at how this tragedy had transpired the media event, but then it was over. What was left, however, was a feeling that the subjects of Dr. Soter's survey were too vulnerable emotionally to be involved in future space missions because of the omnipresent possibility of future disasters. However, there is no data to support this theory. There was only the opinion of "experts" who, of course, would state conclusions with little or no data, rather than admit to ignorance on national television (Soter, 1986).

Dr. Soter (1986) stated that the subjects of his survey did experience stress symptoms, but the depth or severity of those symptoms was, to say the least, subclinical. When the subjects' responses were compared to another study which looked at responses of adults to the death of spouses or significant others, the subjects of this study on the whole showed <u>less</u> intense responses to the items. Dr. Soter suggested that they perceived the explosion of the shuttle not as trauma but rather as a tragic incident that evoked feeling to a slight degree.

When the data was gleaned for response to difference due to sex, it was found that there was basically very little difference in response patterns. What did show up as a difference was the stereotypical way in which each sex defends against feelings. Girls appeared more open to their feelings and more open about the use of defenses. Boys, on the other hand, were more primitive in their use of denial. Typically, boys say, "It doesn't bother me." It is the more "macho" way of dealing with feelings. The difference is both age and stage universal for young people in this age group. To put it more simply, they reacted in a typical adolescent fashion (Soter, 1986).

The data also told us that involvement in Mission Watch did not cause subjects to feel stress more intensely. Dr. Soter (1986) believed that two significant items reflected a normal response to a tragic event; namely, that people tend to form memory patterns which attach themselves to environmental things and thus become stimuli for memories, and also that the subjects involved with Mission Watch did have feelings. What was significantly different was that the feelings lasted for a longer period of time than it did for those who were less involved (Soter, 1986). Another surprising result was that a vast majority of the subjects were involved in Mission Watch because they were interested in space and the space program, not solely because a teacher was an astronaut (Soter, 1986).

Differences in Perspective

Notwithstanding the broadly based groundswell of support for the space program and its associated educational thrust as documented by a variety of polls (Anderson, 1986), the Challenger accident led to some differing perspectives regarding motives for creating the Teacher in Space Program. One of those perspectives asserted that the program was a public relations effort to build a broader base of public support. The other perspective questioned the propriety of flying a "non-astronaut civilian" on the space shuttle (Ladwig, 1986, p. 5).

However, a review of NASA's policy and program deliberations prior to the Teacher in Space Program made it clear that the enhancement of education was one of the prime motives. For example, one of the agency's official program objectives cited in its September, 1984, "Management Principles for Achieving Excellence" was to "Expand the effectiveness of the educational projects to double by FY 1985" (Ladwig, 1986, p. 5). Thus, the Teacher in Space Program was one way to foster the cause of science, mathematics, and technology. Comparatively low science and mathematics scores of many of America's students, a declining supply of qualified science teachers, and declining interest in science and mathematics have been of great concern to NASA (Ladwig, 1986).

Regarding the propriety of flying a nonastronaut civilian on the space shuttle, NASA's authorizing legislation and extensive administrative history were key factors in deciding upon the Teacher in Space as the agency's first space flight participant. For example, under Section 203(a)(3) of the National Aeronautics and Space Act of 1958, NASA was directed to "provide for the widest practical and appropriate dissemination of information concerning its activities and the results thereof" (Ladwig, 1986, p. 6) Thus, the thought of including nonastronauts as participants on manned space missions was considered from the very beginning of the National Space Transportation System (NSTS) in 1972 as one of the many possible ways to meet this statutory provision (Ladwig, 1986).

A review of this long evolutionary policy development issue revealed that nine years prior to the announcement of the Teacher in Space Program, NASA formed an in-house task force to begin looking into what type of "unique personality" might be considered to fly on a shuttle mission, as well as how such individuals might be selected. The first shuttle mission was on April 12, 1981, and it was only after some 24 consecutively successful shuttle missions of astronauts, mission specialists, and payload specialists that a civilian teacher would be allowed to fly.

Against this history, a very energetic degree of skepticism would be necessary to justify the claim that the Teacher in Space Program was merely a publicity stunt. However, it had been conceded that good education is good public relations (Ladwig, 1986).

Future of the Teacher in Space Program

> . . . we'll continue our quest in space. There will be more Shuttle flights and more Shuttle crews and, yes, more volunteers, more civilians, more teachers in space. Nothing ends here. Our hopes and journeys continue.
>
> President Ronald Reagan
> January 28, 1986
> (cited in Church, 1986, p. 38)

Following the Challenger accident, NASA issued a proposed operational plan for the future of the Teacher in Space Program. In this plan, NASA stated that public sentiment indicated that the country had been galvanized as seldom before in support of a common quest. In order to enhance the impact that this support could have on education, NASA strongly supported moving forward aggressively and visibly. NASA felt that there should be an ongoing education participation in space flight to promote long-term planning within the educational community. The proposal further stated that emphasis on the continuation of the Teacher in Space Program would reassure the nation's school children that adults could continue in a reasoned manner in the face of adversity. The effects of this recommendation would be to continue many of the initiatives begun under the Teacher in Space effort and to continue to focus on the goals of the program (Ladwig, 1986).

On February 12, 1986, following a meeting with leaders of educational associations and Teacher in Space finalists, Dr. William Graham, acting NASA administrator, affirmed the agency's plan to continue the educational programs developed in conjunction with the Teacher in Space Project. NASA's Educational Affairs Division, under the direction of Dr. Robert Brown, had received widespread support for the continuation of the program from teachers, students, the private sector, and the general public since the tragedy. Educational organizations and entities such as the Department of Education, National Educational Association, American Federation of Teachers, National Science Teachers Association, the Young Astronaut Council, the U.S. Space Camp, and the Public Broadcasting Service also supported continuation (Campion, 1986).

In a press release, NASA stated:

> The Teacher in Space Program will continue to be an active component of NASA's Educational Affairs Division. Although the decision has not been made as to when TIS designee Barbara Morgan will fly, the educational goals on which the TISP rest will continue to be implemented through the activities of the Teacher in Space Education Foundation (TISEF), . . . Barbara Morgan, the finalists, and the Space Ambassadors. The goals of the TISP are entirely compatible with the educational purposes of the Educational Affairs Division which converts NASA's emerging technologies such as the Space Station, Space Telescope, and the National Aero-Space Plane into educational formats that can be used for educational motivation at the elementary, secondary, and university levels (Ladwig, 1986, p. 13).

In a magnanimous appearance before the NEA's Annual Meeting in Louisville, Kentucky, on July 4, 1986, after accepting the Friend of Education Award on behalf of his wife, Christa, Steven McAuliffe said:

> . . . if I could leave you with one thought this morning, it is this: if you in this hall do not carry on that work--if you sit on the sidelines, reflect back on Christa as a hero, or glorious representative or canonized saint, rather than putting your energies into accomplishing for her what she wanted to do, then I think her efforts will have been in vain. And you will have done what she refused to do--you will have turned the Teacher in Space Program into a feeble substitute for desperately needed help; you will have turned it into a public relations ploy for teachers (cited in Ladwig, 1986, p. 15).

CHAPTER VII

THE TEACHER IN SPACE PROGRAM AND ITS IMPLICATIONS FOR EDUCATIONAL CHANGE

> The Teacher in Space Program has been one of NASA's most successful efforts. It has provided NASA the unique opportunity to extend its educational efforts into different disciplines and all grade levels as well as to the general public. NASA has seen tangible evidence of many school systems reemphasizing the importance of science and math. Teachers have reacted enthusiastically to the educational excitement that space technology generates. Students have reacted similarly when the Space Ambassadors, the Finalists, and the TIS designee have met with them (Brown, 1986d, p. 1).

It is important to understand and effectively communicate the three objectives which undergird the Teacher in Space Program and have been a part of the continuing set of goals of NASA's educational programs since the early 1960s. Those objectives were:

> To develop within the educational community an increased awareness of the importance of mathematics, science, and technology as it related to our future;
>
> To use aeronautics and space as a catalyst in the teaching of all disciplines (mathematics, science, social studies, the humanities, etc.);
>
> To raise the prestige of the teaching profession in terms of its critical role in helping all students to become more scientifically literate (NASA, February, 1986, n.p.).

A distillation of the thousands of letters that NASA has received in Headquarters since the shuttle accident reveals a clear and consistent theme: deep personal sorrow and grief, and imperative that we find out the cause of the accident and that the problem be fixed, and a plea that the space program and its associated educational activities be continued.

Letters from children as well as adults continue to consistently convey this message.

With the guidance provided by President Reagan as to the status of the Space Flight Participant Program, future shuttle missions and Space Station, the Office of External Relations (Educational Affairs Division) recommended that NASA move forward immediately in a cautious but deliberate manner to continue the goals of the Teacher in Space Program, but stopping short of announcing that Barbara Morgan will be the next Teacher in Space. The effect of this recommendation would be to continue many of the initiatives started under the Teacher in Space Program while allowing NASA and the administration more time to understand the facts surrounding the tragedy and the issues surrounding the fate of the civilian passenger program.

Educational Facilitators

Role of PBS

PBS has been a strong advocate of the Teacher in Space Program. Even after the tragic conclusion to STS 51-L, they indicated a desire to develop a final Teacher in Space Program and to continue a program for students to explain future shuttle missions. NASA felt that this step was an important one and should be initiated. It has been proposed by NASA that PBS schedule a 15 to 30 minute in-school program that would be produced and funded by PBS. Barbara Morgan would be featured in the program. NASA would be a consultant to the program, not the originator. The timing of this program would be after a meeting with representatives of educational professional associations.

Role of the Young Astronaut Council

The Young Astronaut Council (YAC) can play a pivotal role in assisting NASA to continue the momentum begun by the Teacher in Space Program. First, the YAC can be a supplier of self-generated, space-related information to elementary and junior high level Space Ambassadors. Second, NASA intends to ask the YAC to be one of the few distributors of NASA publications to the educational public. NASA will maintain control of writing, design, layout, and "seed copy" printing to ensure content and quality. Interested organizations such as the YAC will then receive "printers negatives" so that they may produce and distribute large quantities of publications at their own expense.

Role of the "Educators" and the Professional Education Associations

Prior to the 51-L mission, a conference was held in Orlando, Florida, for approximately 250 educators from throughout the United States and Canada. Representatives from major national education associations from throughout the U.S. (e.g., National Education Association, American Federation of Teachers, National Alliance of Black Educators, National Science Teachers, National Council of Social Studies) attended. The theme of the conference was "Partnership in Education." It was the intent to further develop and cement these partnerships to further NASA educational goals.

Live Lessons and Filmed Activities From Space

The major objective of flying a teacher was to use that individual's unique skills and ability to communicate the experience of space to the educational community and the general public. The live lessons/filmed activities was one unique method to communicate that experience. It has been recommended that this phase of the Teacher in Space Project be reinitiated when the agency determines that the teacher will fly.

Teacher in Space Lesson Guide

The guide produced for mission 51-L is still relevant today. It represents the collective input of all 10 Teacher in Space finalists and numerous professional educational associations. The concepts presented within the guide have received a most favorable peer review.

First, NASA plans to keep the guide in place and use it as originally intended, pending the decision to fly another teacher. Second, there are plans to develop another version of the guide that will be an actively based, stand alone, document that is independent of flying another teacher. The Educational Affairs Division will disseminate the modified version through normal distribution methods (i.e., Teacher Resource Rooms, "Partnerships," etc.), and will integrate the inherent concepts into all of NASA's educational outreach programs and workshops.

An important message that needs to be understood within and outside of NASA is that the important TIS Programs is only one of many educational programs and projects that Educational Affairs administers, among its elementary and secondary activities, university programs, and educational publications. TIS has had the synergistic effect of bringing those programs more into the public focus and creating a greater opportunity to achieve the overall Educational Affairs objectives.

NASA's Educational Goals

The remaining portion of this chapter provides a comprehensive statement of the educational objectives that guide the activities of the Teacher in Space Program, and which will be pursued by NASA in the future. NASA's Educational Affairs Division focuses on the general objectives of: (1) training and updating teachers in aerospace education techniques, (2) stimulating interest in aeronautics and the space sciences among students, and (3) developing a scientifically literate public.

The Educational Affairs Division is further guided by a NASA Productivity goal which calls for it to "Develop Model National Programs" and to encourage their emulation by other governmental agencies and industry in fiscal year 1986 (goal 8.4).

The following programs, projects, and activities are supportive of both the TIS objectives and the long-standing goals of the Division:

Goal 1. To use aeronautics and space as a catalyst in the teaching of all disciplines (mathematics, science, social studies, the humanities, etc.) within the elementary and secondary school. In this way, students receive a well-rounded education which will result in a scientifically literature public.

Curriculum Materials: NASA's "curriculum enrichment" publications have been channeled toward specific grade levels or disciplines. These are teacher-oriented publications, neither textbooks nor courses of study, but compilations of suggestions for classroom activities. The first, published in the 1960s, were for the elementary school teacher; there followed others for junior high school and industrial arts teachers, an Aerospace Curriculum Resource Guide, K-12 that spanned all disciplines, and a series that covered several scientific disciplines. A significant aspect of these materials is that they were prepared by the nation's top educators and tested in the classroom.

Space Exposed Experiment Developed for Students (SEEDS): The SEEDS Project, a cooperative effort of the Educational Affairs Division and the Park Seek Company of Greenwood, South Carolina, has the potential to involve five million students in a national experiment designed to generate interest in science. The project has placed 12.5 million tomato seeds on the Long Duration Exposed Facility (LDEF), which was delivered to space by the shuttle and placed into low-earth orbit in April, 1984. Upon retrieval, the flight seeds and earth-based control seeds, along with instructional materials, will be distributed to classrooms nationwide (grades 5 through university level). SEEDS will involve a large number of students in a national project to generate interest in science and related disciplines, will offer students an opportunity to participate in a firsthand experience with materials fown in space, will emphasize an interdisciplinary approach to the project, and will involve students in all phases of the research process.

Partnerships in Education Program: President Ronald Reagan proclaimed October 1, 1983, through June 30, 1984, as the National Year of Partnerships in Education, and on October 13, 1983, inaugurated the National-Partnerships-in-Education Program. To implement this program, he encouraged agencies of the private sector and the federal government to establish partnerships to improve the quality of education in communities across the country. He further requested that in addition to the Federal Executive Department and Agency, each applicable regional and field office identify and establish a school during the 1983-1984 school year.

To foster the objectives of this program, the Educational Affairs Division designed and implemented the District of Columbia/NASA Project for the Teaching of Science and Mathematics for Understanding and Application, the Science/Mathematics Education Project, and the Adopt-A-School Program with Johnson and Ballou Senior High Schools, and requested all NASA Center Educational Program Offices to devise an Adopt-A-School Program.

Aerospace Education Services Project (AESP): For 25 years, AESP has provided scientific and technical information on NASA activities and research to both teachers and students, using teacher workshops, classroom instruction, and school assembly programs, for both elementary and secondary school levels. Thus, AESP involves both teachers and students, at all levels, in space-related learning activities. To date, 53 million people have been directly impacted by this project.

Operation Lift-Off: Operation Lift-off is an expansion of NASA's current educational endeavors to focus on the elementary school community. This program's intention is to rely on the development and refinement of information and materials currently in the NASA system as well as to develop new prototype concepts for educational materials and for the creation of a more efficient delivery system. These pilot programs will use the latest technology and the cooperation of the private sector so that dissemination of NASA-related educational materials can be broad scale. Through this program, NASA endeavors to increase student and teacher interest in the study of science, mathematics, and technology in order to ensure their ability and willingness to be active and informed contributors in our increasingly technological society.

Goal 2. To develop within the educational community an increased awareness of the importance of mathematics, science, and technology as it relates to our future. NASA also endeavors to provide teachers with expertise and resources to enable them to relate aerospace concepts to their classroom instruction.

Curriculum Materials: NASA's curriculum materials were developed to provide aerospace-related information for the educational community, particularly the classroom teacher. A balanced program includes publications in four categories: Publications that are short, concise, cost-effective, and quick to produce giving NASA an opportunity to inform educators of current activities, missions, and programs (NASA's Report to Educators, Winter, 1985), a quarterly newsletter approved for a circulation of 100,000, and educational briefs); publications such as NASA Facts: Manned Space Flight--the First Decade (NASA, 1979) which discusses a mission, activity, or results of a program; pedagogic publications designed to enhance discipline areas by connecting aerospace concepts with those taught in the classroom (Teacher in Space Lesson Plans; Teachers' Guide, NASA, 1985; Comet Halley Returns: A Teachers' Guide, 1985-86, NASA, July, 1984), and lithographs with texts on the reverse to include information for teachers and classroom activities. In addition, reprints, bibliographies, and career pamphlets are developed and distributed.

Educators' Conferences: NASA sponsors several national conferences for educators each year. These are planned around major NASA events, such as the Voyager 2 Encounter With Uranus, Comet Halley Watch, and Space Shuttle launches. Hundreds of educators are selected to attend these conferences, where they tour NASA facilities and receive briefings on NASA programs. In addition, NASA supports conferences held by national professional educational organizations, on both national and regional levels, with speakers, exhibits, and materials.

Urban Community Enrichment Program (UCEP): The Urban Community Enrichment Program (UCEP) is a specially designed project of the Educational Affairs Division. The program was launched in 1981 in six District of Columbia Middle Schools, as a small exploratory effort aimed at increasing student awareness and interest in aerospace career opportunities. In addition to stirring the imagination and enthusiasm of young people, UCEP has proven to be a useful supplemental teaching aid for classroom instructors, complementing the ongoing curricula.

Two to three public school systems are selected each year. The target grades are five to eight. UCEP is conducted in 15 to 20 schools which the school system selects for three consecutive days each, over an eight-week period. The program consists of assembly "lectures" and demonstrations by an Aerospace Education Specialist, and structured small group sessions in which the same specialist spends time in the classroom sharing scientific information and activities with students. Each phase of UCEP is planned and organized to benefit and enhance the educational growth and development of school children and provide information to teachers, administrators, and parents.

NASA Educational Workshop for Mathematics and Science Teachers (NEWMAST): NEWMAST provides selected precollege mathematics and science teachers with an opportunity to observe and particiapte in current and state-of-the-art research and development activities in space science and technology at NASA Centers. Thus, the participants can learn the latest results of projects directly from the principle investigators themselves, and take that new information back to their classrooms to incorporate it into their instruction. In that way, teachers and their students can benefit from the excitement and importance of aerospace and its accompanying skills.

Operation Lift-Off: Since 1984, NASA's elementary educational program has provided teachers with NASA-related materials and workshops to help them to stimulate their students' interest in science, mathematics, and technology. Several program components make up Operation Lift-Off: audiovisual materials (including those for the visually and hearing impaired), printed materials, computer software, educational television, preservice and in-service workshops, and Teacher Resource Rooms. By helping to develop these programs with outside organizations, Operation Lift-Off can help to supplement curriculum instruction and meet the needs of the elementary educational community.

Goal 3. To increase the prestige of the teaching profession. National recognition of outstanding teachers and training have enhanced public perception of educators.

International Science and Engineering Fair (ISEF): At the annual ISEF, a team of NASA judges selects eight student winners for their exhibits in aeronautics and space-related categories; each receives a Certificate of Merit and a trip with his/her high school teacher to a special NASA event. NASA has honored teachers and their schools with participation in this program since 1961. Since 1963, through the Center Education Offices, NASA has participated in state and regional science fairs affiliated with the ISEF.

Space Shuttle Student Involvement Program (SSIP): NASA has joined with the National Science Teachers Association for six years in sponsoring and conducting the SSIP, which provides an opportunity for students to propose experiments that might be suitable for possible flight aboard the space shuttle. The students' teacher-advisers share honors and recognition at all SSIP award-events.

<u>NASA Educational Workshop for Mathematics and Science Teachers (NEWMAST)</u>: NEWMAST recognizes and honors excellent precollege mathematics and science teachers and provides them a leadership program to assist them in updating and renewing their science and mathematics background using space science and technology. To meet these objectives, this project enables the participants to interact directly with NASA scientists and engineers in their research laboratories and development centers.

<u>Summer High School Apprenticeship Research Program (SHARP)</u>: The summer High School Apprenticeship Research Program (SHARP), which started in 1979, offers a select group of approximately 125 high school students the opportunity to participate in an intensive science and engineering apprenticeship program. The students selected have shown aptitude for and interest in science and engineering careers. The program lasts approximately eight weeks at a participating NASA center or facility.

The SHARP program utilizes teachers with demonstrated skills in teaching as well as in administration as faculty coordinators. These faculty coordinators are responsible for recruiting and selecting the students; for orienting mentors and apprentices; for coordinating the laboratory work experience, reports and enrichment activities of the apprentices; and for evaluating the total program. Teachers gain valuable experience and prestige by working closely with some of the top scientists and engineers in NASA.

The actions outlined in this chapter represent a deliberate plan to continue the momentum developed by the Teacher in Space Program. Such a plan responds to the positive feedback received by organizations and the educational community's desire and support for continuation of the program. The plan has been informally discussed with the many individuals and/or organizations (e.g., National Educational Association, American

Federation of Teachers, National Science Teachers Association, Young Astronaut Council, NASA Chief Scientist, NASA Space Flight Participant Program Manager, NASA Center Educational Programs Officers). It represents many of the ideas and suggestions of the nine Teacher in Space finalists, the Space Ambassadors, and many other private citizens. Careful consideration must be given to NASA's institutional responsibility to the educational community.

Since the early 1960's, NASA has developed excellent working relationships with educators at all levels--elementary through graduate school. The Teacher in Space Program was one of many administration initiatives to focus public attention on the need for a quality educational system in this country. From the time that A Nation at Risk (1983) was published, the American educational system and the public in general have worked together to reach a common goal. The goals and concepts inherent through the Teacher in Space Program are part of that movement. The NASA institution must retain its historical commitment to the educational community, at this time and under these circumstances (Ladwig, 1986).

Conclusion

America's heritage is based on man's pioneering spirit. America was founded and rose to greatness through the courage and strength of her pioneers. In an incredibly short period of time, a new frontier has opened up before us, providng humanity with its greatest challenge and a promise of riches and rewards beyond compare.

Next to putting man on the moon, the 1972 approval to proceed to develop the Space Transportation System with its manned orbiting shuttle was perhaps the most forward-looking technological decision in the history of the U.S. space program. Although many program and technological problems beset this endeavor, in April of 1981, the Columbia orbiter was launched--the first time man had ever flown into space and returned in the same craft. The shuttle was a true spaceship. This was the pivotal point of space technology.

Our national space effort has had a tremendous impact on the totality of American life--economically, politically, and spiritually. It is our greatest potential for humanity to date. The likelihood of yielding discoveries and technological advances that can, if used wisely, bring untold good to mankind is without doubt.

The space program was hurt deeply by the loss of Challenger. But more than the multi-billion dollar aircraft and her scientific and technological cargo, it was the loss of the seven human beings, the realization that shuttle flights involve much more than a wonderous display of mechanical and electrical wizardry that set off spontaneous expressions of grief across the nation and around the world. "When something like this happens," said a Moscow factory worker named Yelenda, "we are neither Russians nor Americans. We all feel sorry for those who died and for their families" (Magnuson, 1986, p. 31).

Shuttle Mission 51-L will always be remembered as the "Teacher in Space" mission. Not for its triumph but rather because of its tragedy did the Teacher in Space Program receive more widespread publicity than any event in our nation's history since the assassination of President John F. Kennedy. Although the nation mourned the loss of all seven crew members, it was Sharon Christa McAuliffe, the school teacher from Concord, New Hampshire, for whom Americans, most notably America's children, grieved most. Almost immediately after the Challenger disaster, school children from around the country began sending nickels and dimes to NASA to help replace the shuttle. "It was an affirmation for life" (Magnuson, 1986, p. 30). For students, explained Jay Shaeffer of Belmont High School in Los Angeles, "A teacher in space becomes their teacher. How many people know an astronaut? Everyone knows a teacher" (Magnuson, 1986, p. 30).

Americans have learned the harsh lesson that glory and adventure often go hand-in-hand with danger and death. In the stunned aftermath of the accident, John Glenn put it as aptly as anyone when he said that this was the moment we had been postponing for the last 25 years, and the tragedy was that we could not postpone it forever (Fink, 1986). Knowledge sometimes demands sacrifices of the bravest and the best. The future is not free; human progress has been and will continue to be a struggle against all odds. From the Challenger and her crew we have learned again that the foundation on which this nation stands was built upon heroism and noble sacrifice.

They flew for all of us. They were, each of them, human like each of us. Their ambition and their courage took root in the familiar circumstances and routines that each of us can identify with. On that last morning, although they were in preflight isolation, they were still a part of us. "They got up and dressed, had breakfast and went to work" (Gray, 1986, p. 32).

The nation still grieves for the loss of the crew, and is concerned about NASA's recovery and return to space flight. But, this tragedy can be turned into a triumph. We, as a nation, can let it remind us of our humanity and imperfections and vulnerability; but at the same time we can also let it prompt us to create an even better, even more dedicated and committed space program than ever before. We cannot honor the lives that have been lost in the space program unless we honor the ideals for which they lived. Therefore, we must perfect as best we can the program for which they died.

We have made a strong start along the road to conquering the frontier of outer space and there is no turning back, even in the face of disaster. To withdraw now would be the ultimate tragedy. The young of this nation hold the key to the fate of our future. Their idealistic enthusiasm was dealt a fierce blow that will be softened only by the passage of time. But even now it has been evidenced that enthusiasm is growing with a renewed vitality and dedication. This enthusiasm can and must be encouraged with the decision to press on with the shuttle program. Whether we succeed or fail will depend upon the knowledge learned from our mistakes. Only through a deep commitment to the pursuit of knowledge can we hope to improve our world and our lives. It is not just our duty, it is our responsibility to dedicate ourselves to a profound search for excellence in education, for only with quality educational opportunities for our children today, will our children have a tomorrow.

BIBLIOGRAPHY

A Nation at Risk: The Imperative for Educational Reform. National Commission on Excellence in Education. Washington, D.C.: U.S. Government Printing Office, 1983.

Anderson, J. "U.S. Space Program Due for a Push." Washington Post, September 10, 1986, p. A-11.

Beggs, J. M. Correspondence to Daniel J. Fink regarding private citizen in space. NASA Headquarters, Washington, D.C., February 15, 1982.

Brown, R. W. Correspondence to Center Educational Program officers regarding division activities and information on the continuation of the Teacher in Space Program. NASA Headquarters, Washington, D.C., March 14, 1986a.

Brown, R. W. Correspondence to directors of Public Affairs, NASA Field Centers, requesting input for Teacher in Space Program. NASA Headquarters, Washington, D.C., May 2, 1986b.

Brown, R. W. Correspondence to NASA Ames Research Center Public Affairs officer regarding Agenda for Action: Discussion Paper on NASA's Educational Affairs Program (NASA's Five-Year Educational Efforts Plan), August 5, 1986c.

Brown, R. W. Press briefing. Remarks prepared for delivery. (Unpublished document.) NASA Headquarters, Washington, D.C., March 18, 1986d.

Brown, R. W. Correspondence regarding continuation of the Teacher in Space Program. NASA Headquarters, Washington, D.C., July 8, 1986e.

Campion, E. "NASA News" (release #85-99). NASA Headquarters, Washington D.C., July 1, 1985.

Campion, E. "NASA News: Teacher in Space Finalists Named" (release #85-156). NASA Headquarters, Washington, D.C., July 1, 1985.

Campion, E. "NASA News: Teacher in Space to Continue" (release #86-12). NASA Headquarters, Washington, D.C., February 12, 1986.

Church, G. J. "Putting the Future on Hold." Time Magazine, February 10, 1986, p. 38.

Cohen, N. B. Correspondence regarding "Working Group for Flight of Private Citizens." NASA Headquarters, Washington, D.C., September 17, 1983.

Cohen, N. B. Personal interview. NASA Headquarters, Washington, D.C., January 21, 1987.

Council of Chief State School Officers (CCSSO). "Brief Biographies of the Teacher in Space Nominees." (Unpublished document.) NASA Headquarters, Washington, D.C., June, 1984.

Council of Chief State School Officers (CCSSO). "History of NASA Teacher in Space Project." (Unpublished document.) NASA Headquarters, Washington, D.C., March, 1985a.

Council of Chief State School Officers (CCSSO). "National Selection Panel for NASA Teacher in Space Project Announced" (press release). NASA Headquarters, Washington, D.C., June 24, 1985b.

Council of Chief State School Officers (CCSSO). Programs and Addendums for the Teacher in Space National Awards Conference. NASA Headquarters, Washington, D.C., June, 1985c.

Craig, L. E. "A Tribute to Barbara Morgan." Congressional Record (Extension of Remarks, #E4266). NASA Headquarters, Washington, D.C., September 30, 1985.

Cunningham, C. "Civilian Space Travel is Nearing Reality." Toronto Record, February 22, 1984, p. 3.

David, L. V. "Public Attitudes About Space as Surveyed by the National Commission on Space." (Unpublished paper presented at the 37th Congress of the International Astronautical Federation, Innsbruck, Austria, October 11, 1986.)

Fink, D. E. "Triumph and Tragedy." Aviation Week and Space Technology, 124(5), February 3, 1986, p. 11.

Futrell, M. H. Correspondence to NASA Administrator James C. Fletcher. NASA Archives, Washington, D.C., July 22, 1986.

Garcia, J. Personal interview. Stillwater, Oklahoma, October 15, 1986.

Glenn, J. Correspondence to National Congress on Aviation and Space Education. NASA Archives, Washington, D.C., March 21, 1986.

Graham, W. R. Remarks Prepared for Delivery Following Challenger Accident (press briefing). NASA Headquarters, Washington, D.C., February 13, 1986.

Gray, P. "Seven Who Flew for All of Us." Time Magazine, 127(6), February 10, 1986, p. 32.

Grigsby, D. Correspondence regarding "Mission Watch" data related to pre- and launch-time observations and resulting indices. NASA Headquarters, Washington, D.C., February 7, 1986.

Guerny, G. "NASA News: More Than 10,000 Teachers Apply for Space Flight" (release #85-26). NASA Headquarters, Washington, D.C.

Guerny, G. "NASA News: NASA Seeks Teacher for Early 1986 Shuttle Mission" (release #84-155). NASA Headquarters, Washington, D.C.

Hanchette, J. "Want to Ride the Shuttle? Apply Early, Limber Up." USA Today, November 10, 1982, p. A-8.

Hartmann, W. K., Miller, R., and Lee, P. Out of the Cradle: Exploring the Frontiers Beyond Earth. New York: Workman, 1984.

Hohler, R. T. 'I Touch the Future . . .' The Story of Christa McAuliffe. New York: Random House, 1986.

Kelly, J. "Teachernaut's Lesson: 'Move Forward.'" USA Today, August 4, 1986, p. A5.

Ladwig, A. Personal interview. NASA Headquarters, Washington, D.C., January 21, 1987.

Ladwig, A. "The Space Flight Participant Program: Taking the Teacher and Classroom Into Space." (Paper of the 36th Congress of the International Astronautical Federation, Stockholm, Sweden, October 7-12, 1985.)

Ladwig, A. "Teacher in Space Program: The Challenge to Education in the Space Age." (Paper of the 37th Congress of the International Astronautical Federation, Innsbruck, Austria, October 4-11, 1986.)

Littmann, M. and Yeomans, D. K. Comet Halley: Once in a Lifetime. Washington, D.C.: American Chemical Society, 1985.

Low, G. M. "Memorandum for the Record: Meeting With the President." NASA Headquarters, Washington, D.C., January 12, 1972.

Low, G. M. Correspondence addressing development of exciting payloads for some of the first shuttle flights, March 24, 1976.

Luxenberg, S. et al. Challengers: The Inspiring Life Stories of the Seven Brave Astronauts of Shuttle Mission 51-L. New York: Pocket Books, 1986.

Magnuson, E. "A Nation Mourns." Time Magazine, 127(6), February 10, 1986, pp. 30-31.

Mancini, P. F. Correspondence (internal letter #2451m) to G. W. Jeffs on Public Opinion Survey on Attitudes Toward Space, August 22, 1986.

McCarthy, J. "Flight One to the Moon." This Week, September, 1968, pp. 9-10.

Mecham, M. "NASA to Teachers: Follow Directions, Please, When Applying for Shuttle Flight." Washington Post, October 2, 1984, p. A-1.

Michener, J., Cousins, N., Morrison, P., Cousteau, J., and Bradbury, R. Why Man Explores. Washington, D.C.: U.S. Government Printing Office, 1976.

Morgan, B. Correspondence from the nine Teacher in Space finalists to the "NASA Family" following the Challenger disaster. NASA Headquarters, Washington, D.C., February 1, 1986a.

Morgan, B. Personal interview. Stillwater, Oklahoma, June 15, 1986b.

National Aeronautics and Space Administration (NASA). "NASA News: Background Information on Teacher in Space Project." NASA Headquarters, Washington, D.C., December 1, 1985.

National Aeronautics and Space Administration (NASA). Comet Halley Returns: A Teachers' Guide, 1985-86. (Educational Programs, Office of Public Affairs.) Greenbelt, Maryland: Goddard Space Flight Center, July, 1984.

National Aeronautics and Space Administration (NASA). Current News. Washington, D.C.: U.S. Government Printing Office, June 25, 1985.

National Aeronautics and Space Administration (NASA). "Informal Task Force for the Study of Issues in Selecting Private Citizens for Space Shuttle Flight." (Unpublished memorandum, Executive Summary, Advisory Council, Washington, D.C.), June 16, 1983.

National Aeronautics and Space Administration (NASA). National Aeronautics and Space Administration's Management Principles for Achieving Excellence: NASA's Goals and Objectives. Washington, D.C.: U.S. Government Printing Office, 1984.

National Aeronautics and Space Administration (NASA). NASA Facts: Manned Space Flight--The First Decade. Washington, D.C.: U.S. Government Printing Office, 1979.

National Aeronautics and Space Administration (NASA). "NASA News: Space Flight Participant Fact Sheet." NASA Headquarters, Washington, D.C., August 27, 1984.

National Aeronautics and Space Administration (NASA). "NASA News: The Shuttle Era." NASA Headquarters, Washington, D.C., March, 1981.

National Aeronautics and Space Administration (NASA). Program and Addendums for the Teacher in Space National Awards Conference. NASA Headquarters, Washington, D.C., June 22, 1985.

National Aeronautics and Space Administration (NASA). Correspondence, "The NASA Teacher in Space Project Objectives." NASA Headquarters, Washington, D.C., March 7, 1986.

National Aeronautics and Space Administration (NASA). Press Kit: Mission 51-L. Washington, D.C.: U.S. Government Printing Office,

National Aeronautics and Space Administration (NASA). Report to Educators. Washington, D.C.: U.S. Government Printing Office, Winter, 1985.

National Aeronautics and Space Administration (NASA). "Space Transportation System 14 CRF Part 1214." Federal Register, December 23, 1983.

National Aeronautics and Space Administration (NASA). Spinoff 1986. Washington, D.C.: U.S. Government Printing Office, 1986.

National Aeronautics and Space Administration (NASA). Teacher in Space Lesson Plans: A Teachers' Guide." Washington, D.C.: U.S. Government Printing Office, 1985.

National Aeronautics and Space Administration (NASA). "Teacher in Space Project--Announcement of Opportunity." NASA Headquarters, Washington, D.C., 1984a.

National Aeronautics and Space Administration (NASA). "Teacher in Space Project--Application Packet." NASA Headquarters, Washington, D.C., 1984b.

National Aeronautics and Space Administration (NASA). "Teacher in Space Project--the Future." (Unpublished inter-office document, NASA Archives, Washington, D.C., February 6, 1986.)

National Aeronautics and Space Administration (NASA). "Teacher in Space" (training film). Shown in Oklahoma City, Oklahoma, by Barbara Morgan, June 6, 1986.

National Commission on Space. Pioneering the Space Frontier. New York: Bantam Books, 1986.

Nixon, W. Personal interview. NASA Headquarters, Washington, D.C., January 20, 1987.

Norton, D. R. Correspondence (Department of State), Washington, D.C., September 26, 1986.

Pincus, W. "NASA's Push to Put Citizen in Space Overtook Fully 'Operational' Shuttle." Washington Post, March 5, 1986, p. A-8.

Rahn, D. J. "NASA News: NASA to Fly Educator on Shuttle Mission" (release #84-122). NASA Headquarters, Washington, D.C., August 27, 1984.

Rogers, E. "Manned Flight Seen Crucial to Space Programs' Future." Washington Times, June 9, 1986, p. A-7.

Rosenblatt, Terri. Personal interview. NASA Headquarters, Washington, D.C., January 22, 1987.

Schulke, F., Penelope, D., and McPhee, R. Your Future in Space: The U.S. Space Camp Training Program. New York: Crown, 1986.

Soter, S. J. "A Survey on the Stress Effects on Adolescents Involved in the Mission Watch Program." (Addendum Report, Evanston, Illinois, December, 1986.)

Soter, S. J. and Westrum, W. "Project Evaluation Report: STS 51-L Mission Watch Project Teacher in Space Program." University of Northern Iowa, December, 1986.

Tatro, N. "90,000 Names on Waiting List for Commercial Moon Flight." Miami Herald, November 30, 1972, p. 21.

Trento, J. J. Prescription for Disaster. New York: Crown, 1987.

"Unique Personality for Space Shuttle OFT Flights." (Preliminary Report.) NASA Headquarters, Washington, D.C., June 8, 1976, pp. 1-2.

The White House. "Statement by the President" (press release.) Office of the Press Secretary, Washington, D.C., August 15, 1986.

The White House Records. "Administration of Ronald Reagan." NASA Archives, Washington, D.C., August 27, 1984, p. 1190.

The White House Records. "Administration of Ronald Reagan." NASA Archives, Washington, D.C., July 19, 1985, p. 913.

The White House Records. "Administration of Ronald Reagan." NASA Archives, Washington, D.C., June 26, 1987, p. 851.

APPENDIXES

APPENDIX A

REPORT OF THE INFORMAL TASK FORCE FOR THE STUDY OF THE ISSUES IN SELECTING PRIVATE CITIZENS SPACE SHUTTLE FLIGHT

REPORT OF THE INFORMAL TASK FORCE FOR THE STUDY OF ISSUES IN SELECTING PRIVATE CITIZENS FOR SPACE SHUTTLE FLIGHT

EXECUTIVE SUMMARY

June 16, 1983

I. Background

Ultimately, humans expect to live, work, and vacation in space or on the moon or Mars. Many want to do so immediately; others recognize that technology and economics will limit such an experience to all but a small fraction of their compatriots, but hold out hope that their children and grandchildren may participate. Recognizing the widespread public interest in space flight, NASA early established a policy to enable people to participate both directly and vicariously in the space program to the maximum extent permitted by technology and concern for human safety.

The first astronauts were experienced, highly trained test pilots. They were followed by highly-trained scientist/astrospecialists. Payload specialists are scientists and engineers selected, not for their skill as astronauts, but for their scientific skills and knowledge of the payload with which they fly. They have only sufficient flight training to enable them to function successfully in space with the minimum hazard to themselves, their shipmates, and the Shuttle.

For the vast majority who could not fly, real time TV coverage was provided from the Apollo flight deck, the moon, Skylab, and Apollo-Soyuz. Press conferences were held and pictures were released of planetary encounters and landings, even as the missions were in progress.

The Shuttle opens a new era for human participation in space flight. NASA's Administrator, James M. Beggs, plans to continue NASA's tradition of providing the maximum possible human participation in space flight and the earliest and most thorough dissemination of the results. Also he has received a large number of requests from people who want to fly on the Shuttle. In February of 1982, he requested the NASA Advisory Council to provide an analysis of the factors that must be considered in any decision to fly private citizens as passengers on the Shuttle. Accordingly, Daniel J. Fink, the chairman of the NASA Advisory Council, established an Ad Hoc Task Force of the Council chaired by Council member John Naugle. James Michener, Willis Hawkins, Sylvia Fries, and Florence Skelly, also members of the Council, joined him. Julian Scheer, who helped formulate NASA's policy on public access to space operations, and Astronaut Richard Truly were later asked to join the Task Force to provide expert help. We began work in July of 1982 and complete our work with this report. The report, therefore, summarizes the information gathered, the results of our discussions, and the recommendations which we made to Mr. Beggs.

II. Approach

We first identified the factors that must be considered and the information required for that purpose. We found much of that information through fact finding sessions at NASA Headquarters and at the Johnson and Kennedy Space Centers. We then prepared a preliminary statement of possible views on the purposes for flying private citizens and on criteria for and possible methods of selection. We sent this statement to a large number of selected people requesting their comments, suggestions, and recommendations.

We then analyzed the many responses and drew from them to develop our conclusions and recommendations. We agreed on the key points to be included in the report, drafted it for appropriate revision by the Task Force members, and presented the completed report to the full Council at its May 18 meeting for consideration.

III. Results of the Fact Finding

Our fact finding addressed four questions, the exploration of which was felt to be imperative at the outset of the study. The questions were:

- Is it feasible to fly passengers on the Shuttle? Are there flight opportunities, and if so, when and for how many? What are the medical and training requirements and is it likely that private citizens would pass them?

- If it is feasible, what material purpose would be served by the flight of private citizens and what role would they play during and after a mission?

- What criteria should be used in their relationship?

- What process should be followed in their selection?

The results of the fact finding are contained in the paragraphs which follow:

A. Feasibility of Flying Private Citizens

1. Mission Opportunities

A limited number of seats for passengers are available in the mid 1980s. At the present, there appear to be seven flight opportunities in calendar year (CY) 1984, eight in 1985; six in 1986, and at least two in 1987. There are, however, competing demands for those seats from other potential fliers, such as additional payload specialists and foreign astronauts. We concluded that the flight of three to four passengers in the mid to late 1980s was a reasonable number to use for our considerations.

2. Medical Requirements

A passenger should be of good mental, physical, and emotional health, as demonstrated by passing an appropriate medical examination. (The physical requirements are not as rigorous as those for astronauts.) The principal objective of the medical examination would be to guard against the development of medical/psychological situations in space that would be hazardous. Therefore, the medical examinations would be to (a) screen out candidates whose characteristics might create hazardous situations during missions, and (b) provide the appropriate prophylaxis for other situations.

The early adaptive changes experienced by humans in space include fluid shifts, cardiovascular deconditioning, vestibular symptoms of the space adaptation sickness, and loss of red cell mass. These do not appear to NASA physicians to be hazardous. All of the individuals flown by NASA have been brought safely back to Earth and have resumed their normal lives. NASA plans to fly payload specialists who are not professional astronauts. On the basis of NASA's evaluation of the situation, it is reasonable to extend the possibility of space flight to private citizens.

The incidence of space adaptation sickness cannot at present be predicted. People may need to be screened for their adaptability to the cramped quarters of the Shuttle.

3. Training Requirements

In our fact finding, we were told by astronaut participants that the flight experience is not particularly stressful, if the person is trained as to what to expect. That training assists the individuals to adapt easily to the habitability requirements and the mission activities. The actual vibration, noise, and g forces during a nominal launch/ascent are tolerable (and not particularly eventful, if a passenger is seated on the mid deck without a view). The reentry experience is analogous to that of landing in an airplane (again without a view). Another astronaut was far more enthusiastic about the "ride" to and from orbit.

Approximately one hundred hours of training spread over the two months prior to launch seemed to be a reasonable training requirement and was used for the purposes of the study.

B. Purpose of Flying Private Citizens

We first examined NASA's authority to fly private citizens. The Space Act and its legislative history would allow NASA to fly passengers in connection with these purposes:

- "...the widest practicable and appropriate dissemination of information concerning its (NASA's) activities and the results thereof" (203 (a) (3)).
- "the preservation of the role of the United States as a leader in aeronautical and space science and technology and in the application there of to the conduct of peaceful activities within and outside the atmosphere" (102 (c) (5)).

The Act and its Congressional interpretation do not appear either to give or imply a charter to NASA for objectives not related to those in the Space Act, such as operating a tourist service.

Having determined that the flight of private citizens, at least for these purposes, would be permissible, we next turned to a critical examination of the objectives and purposes for flying passengers and on criteria and processes for their selection. We also determined that we should solicit the views of a large number of people on our tentative conclusions.

IV. Objectives of Flight of Private Citizens

The Task Force outlined two options, flying people selected from the public at large, and flying carefully selected persons for specific purposes, such as:

- expansion of human knowledge;

- o contribution to human culture;
- o education of those who fly, and through their experience, the public;
- o stimulation of interest in the use of the Space Shuttle.

A large majority of the respondents favored a purpose-oriented approach. The most common reasons are that such an approach (a) promised the more useful results, and (b) would be widely acceptable because it is comparable to what is done on military and scientific expeditions.

A large majority expressed general approval of the first three purposes outlined above. While a few favored "stimulation of interest in the use of the Shuttle," others felt this would be adversely viewed as self-serving and would trivialize the space program. Some felt that objective, independent professionals would not want to be perceived as promoters.

B. Criteria for Selecting Private Citizens

Based on our earlier fact finding, we suggested candidate suitability criteria which we felt a private citizen must meet. Specifically, each should:

- o be highly motivated to fly on the Shuttle;
- o be willing to set aside the two month period required for qualification and training;
- o be willing to accept an assigned role on the mission and direction from the command pilot;
- o have demonstrated the capability to function as a part of a small, highly knit team operating in a hazardous situation;
- o have a proven or promising capability to communicate their experience to their compatriots;
- o be willing to forego any extraordinary personal financial profits they might otherwise derive from the flight;
- o be willing to undergo a full investigation by the Federal Bureau of Investigation;
- o be of good mental, physical, and emotional health.

Our respondents generally favored these criteria. There was concern that a background investigation might be misconstrued as to its purpose. It was also suggested that if people were flown because of their demonstrated excellence, their reliability could be assumed. The only criticism of the demonstrated capability criterion was that too few people will have had the opportunity to demonstrate that attribute, and therefore NASA should screen for this during training. The only criticism of the assigned role criterion was that it sounded too authoritarian. In fact, the assigned role would be mutually determined in the mission planning of the full range of flight activities.

The capability to communicate the experience turned out to be quite important. The majority of those expressing a preference favored someone who could do so. This criterion also matched closely the education-related purposes noted earlier. Some respondents suggested a plan to ensure the spectrum of factual/descriptive, emotional/vicarious, and subjective/creative perspectives.

C. Selection Procedures

The Task Force identified two quite different possible procedures to select those to fly. For the option which considers flight of people from the general public, NASA could conduct a national lottery in which any U.S. citizen could participate. Winners of the lottery who satisfy the preceding general criteria would be eligible for selection by the Administrator of NASA for flight on the Shuttle.

For the selection of people for specific purposes (the other option), NASA could announce the availability of flights on the Shuttle for persons whose background and capabilities would qualify them to accomplish the purposes established by NASA for flying private citizens. Applicants' professional qualifications would be reviewed by their peers and NASA would select from among those who are given the highest ratings by their peers and who meet the above general criteria.

1. Purpose-Oriented Approach

The large majority of the respondents who favored a purpose-oriented approach favored a peer group selection process, suggesting that it stands the best chance of ensuring the quality of the person and the product. However, critics suggested:

- o The review process would have to be so open as to appear fair and not an "old boy network."
- o It would help assure a valuable product.
- o It is not clear in many fields which are the appropriate organizations for peer review.

2. Lottery Approach

Those who favored flying people selected from the general public by a national lottery procedure offered the following advantages:

- o It would most directly involve the true benefactors of the STS, i.e., the taxpayers.
- o It is quite possible that, with multiple candidates, some would be excellent professional representatives of society.
- o The purpose of flying private citizens might more likely be realized through a spontaneous reactions of pasengers than through a mandated effort.
- o It would be the fairest way to make the selection.

Critics of the lottery open to everyone suggest, however, that:

- o It is less workable (the number of applicants who could meet the elegibility criteria would swamp the system).

- o There is less guarantee of a valuable result and more risk of the undesirable.

- o It would place NASA in a difficult public relations position should it have to reject the winner.

- o Candidates are more likely to renege on their commitment.

3. Additional Comments

Some of the respondents suggested that NASA, while keeping overall administrative control, should give up two specific roles by having another body decide on the application categories or make the final selections, or should move to random procedures.

Other suggestions made by respondents included:

- o General public candidates should be selected by Congress.

- o The "professionsls" should apply by professional category. NASA should screen, using space-related criteria. A committee of appropriate professional organizations (established by NASA) should screen to see if candidates have minimal professional capability. The surviving applicants should then make their case to the committee and the committee should select the "most promising." A lottery should be used to select the order in which the fly.

- o Candidates should be selected by NASA because it has the final responsibility and, therefore, should have the authority. Rigerous qualifications should be set. The evaluative process should involve medical and psychological screening, orientation rides in high performance aircraft, high stress training exercises and emergency procedures.

- o Candidates should be nominated by appropriate professional organizations.

- o The opportunity to fly passenger(s) should be auctioned to media organizations which would then have the incentive to publicize/ disseminate the events through their extensive chains. This was suggested because it is anticipated that the media would lose interest after the first flight unless it served their particular purposes.

V. Conclusions

On the basis of our fact finding and our evaluation of the responses to the extensive survey, we reached the following conclusions:

- o There is disagreement on the value of the space flight experience. Some respondents were extremely enthusiastic about the possible content and significance of the flight experience, while others were quite skeptical. The task force believes that the only way to decide is to take a small step which has value in itself and see what light it sheds on what the next step, if any, should be.

- o Because of the importance we attach to associating initial flights of private citizens to purposes contained in the Space Act, we concluded that the first step should involve a limited number of private citizens we might call "observers," who would be most likely, as a result of their experiences, to contribute to human knowledge, culture, and education of others.

- o NASA must decide on how to treat the cost/benefit question. There is a growing cost consciousness in the country that would question the program. If candidates pay the costs, the process would exclude those of modest means. If the government pays the cost, taxpayers might consider the program too costly for the general benefits.

- o The analysis of the responses provides strong evidence that the necessarily complex explanation of the program will be misunderstood by substantial proportions among interested groups, and probably the public at large.

- o Those who are most committed to the space program will be the most watchful and critical of (a) the perceived "trivialization" of the program, (b) the opportunities lost to them, and (c) the relation of the program to science and technology.

- o NASA should avoid the appearance of being self-serving. Therefore, NASA should not appear to be using the program to build public support. NASA should avoid public relations gimmicks.

- o There are questions of flight risk, liability, and the control of extraordinary profits that may be difficult to answer in detail. It has been suggested that those who fly should be brought into NASA as NASA employees during the time of mission-related activities with employee rights and responsibilities similar to those of the flight crew. A portion of any personal profits earned as a result of the flights might be given to an appropriate charity or foundation.

- o The agreement between NASA and the persons who fly should include a privacy provision to protect the crew.

- o The details of the administrative process for selection of passengers need to be given thorough thought because of the workload and the possibility for litigation. There must also be a mechanism for withdrawal that would not be embarrassing to NASA or the candidate, or result in litigation.

VI. Recommendations

A. Flight of Observers

NASA should take the next step in opening space fight to all people by flying observers consistent with the purposes in the Space Act. The data from this first step should also be useful to both candidates and decisionmakers in proposing how to make the best use of further opportunities.

To Explain what we mean, the following examples illustrate, but do not exhaust, the options for meeting these purposes:

- o An observer/communicator could provide a comprehensive visual mission history, as well as real time reports.

- An observer/communicator could provide a written and interpretative history that also covers the scientific, technical, and institutional achievements that make the program possible.

- An educator/communicator could teach on the science, engineering, and biological principles integral to manned space flight and illustrated by Shuttle missions. These ground and inflight segments could be part of a course for high school students.

B. Suitability Criteria

The Task Force recommends the following suitability criteria for the initial program. Candidates should be:

- highly motivated to fly on the Shuttle as evidenced by his/her proposal on the use of such an opportunity;

- able to successfully undergo the necessary one hundred hours of training spread over two months;

- able to pass the medical examinations to minimize the possibility of mission termination or a situation in space hazardous to that person or the crew;

- adaptable to the living situation and working relationships required by mission conditions;

- willing to accept appointment as a NASA employee during the time of mission-related activities with employee rights and responsibilities similar to those of members of the space flight crew.

C. Selection Procedures

- Proposals from applicants to some kind of announcement of opportunity for flight. The proposal should include how the individual's selection would fulfill the purposes.

- A screening by NASA or its agent to eliminate those clearly not meeting suitability criteria.

- Appropriate peer review by panels to select the best proposals.

- Lottery among the finalists, if necessary, to select those to train and fly.

The actual selction process may differ somewhat in detail from that outlined here but should contain the key elements listed. We feel that the details should be left to NASA for later design.

D. Later Program Expansion

The Task Force encourages consideration of flying people for other purposes after this first small step is taken and as more opportunities develop.

For example, there are now many legitimate competing requests, such as those representing the wide variety of the arts, and currently not enough seats to fairly accommodate all of them or enough criteria to fairly choose among them. The data from the initial observer program might be helpful in assessing how the program could be open to a broader spectrum of private citizens in the future.

Further, while the Space Act and its interpretation suggest that passengers from the general pubic are not authorized, this should not be taken to preclude their participation in the future when the Space Act might be changed and more suitable accommodations could be made available.

VII. Rationale for Our Recommended Approach

We concluded we should recommend an initial program to fly a few observers because:

- This program most directly implements Congress' purposes in the Space Act and would add significant value to NASA's continuing efforts to implement these purposes through its history, education, and pubic information programs.

- The opportunity to provide a more comprehensive description and general understanding of space flight than has been possible before would certainly justify a cost per observer.

- This program would give other possible users a better understanding of the content and significance of this opportunity and therefore the value it might have for them. Similarly, it would give those who must make the decision a better understanding of which purposes and users might best be able to use the limited opportunities.

- Planning for a minimum program at this time is the best way to assure that seats will be available for this opportunity. At this point, we do not know the demand to fly payload specialists, foreign astronauts, NASA astronauts for flight training, and others for whom requirements might arise; therefore, we chose a conservative approach to ensure this opportunity.

- This approach would give NASA experience in administering such a program before embarking on a more ambitious one. As in any new program, there will be unanticipated problems to be solved and lessons to be learned. At the end of this phase, management's review could result in improved administration of the program.

- Such a program would be widely accepted as a logical part of NASA's responsibilities and less likely to be misunderstood as a self-serving promotional event. It could also give the general public a better understanding of other uses.

On January 23, 1983, NASA published its "proposed rule with request for comments"; 14 CFR Part 1214, subpart 1214.17. The intended effect of this rule was to increase the access of the general public to the STS. This Subpart was not a solicitation of applications to participate in space flight; applications received before specific flight opportunities were announced would not be accepted. This was, however, a major step forward in the "Citizen Observer/Participants" segment of the Shuttle program.

APPENDIX B

SPACE FLIGHT PARTICIPANT PROGRAM,

EXECUTIVE SUMMARY

NASA NEWS

NATIONAL AERONAUTICS and
SPACE ADMINISTRATION

Washington, D.C. 20546
AC 202-453-8400

Gene Guerny
Headquarters, Washington, D.C.
(Phone: 202/453-2199)

For Release
November 8, 1984
2:00 p.m.

RELEASE NO; 84-155

NASA SEEKS TEACHER FOR EARLY 1986 SHUTTLE MISSION

The National Aeronautics and Space Administration, in conjunction with the Council of Chief State School Officers, has released the Announcement of Opportunity (AO) specifying the eligibility requirements for selection of a teacher in NASA's Space Flight Participant Program.

Through the program, NASA will extend Shuttle flight opportunities to a wide segment of private citizens with the purpose of communicating the experience of space flight to the public through educational and information programs. NASA eventually intends to fly various categories of Space Flight Participants two to three times per year.

Teachers meeting the requirements may request an application packet, which will be available after December 1, 1984, from the NASA Teacher in Space Project, Council of Chief State School Officers, 400 North Capitol Street, N.W., Suite 379, Washington, D.C. 20001. The application period is from December 1, 1984, to February 1, 1985.

The AO is open to elementary and secondary level teachers in all public, private and parochial schools in the United States and U.S. territories and in Department of Defense overseas dependents schools and Department of State overseas schools and in the Bureau of Indian Affairs. The teacher must:

- Be a U.S. citizen;
- Be a full-time classroom teacher;
- Have been a full-time classroom teacher for the past five years;
- Provide verification of teacher eligibility and consent to participate which will be included in the aplication packet;
- Meet all medical requirements as defined;
- Not be a spouse of a current or former NASA employee.

The school in which the teacher teaches, if it is non-public, must advertise that it does not discriminate in admissions based on race.

Teachers applying for this flight opportunity will submit an application to illustrate their qualifications and excellence as an educator and to demonstrate how they would share the experience with the public.

All applications received will be screened to eliminate those not meeting the basic requirements. Remaining applications will be forwarded to State Review Panels which will evaluate the proposals and select two teachers per state as nominees. The 120 nominees (two per state, plus U.S. territories, Departments of Defense and State dependent schools and Bureau of Indian AFfairs schools) will be forwarded to a National Review Panel for further evaluation. All state nominees will attend a teachers' workshop and recognition banquet in the summer of 1985 in Washington, D.C. The workshop will inform the participants of current developments in the space program, and applicants will undergo further evaluation and screening by the National Review Panel in the form of personal interviews.

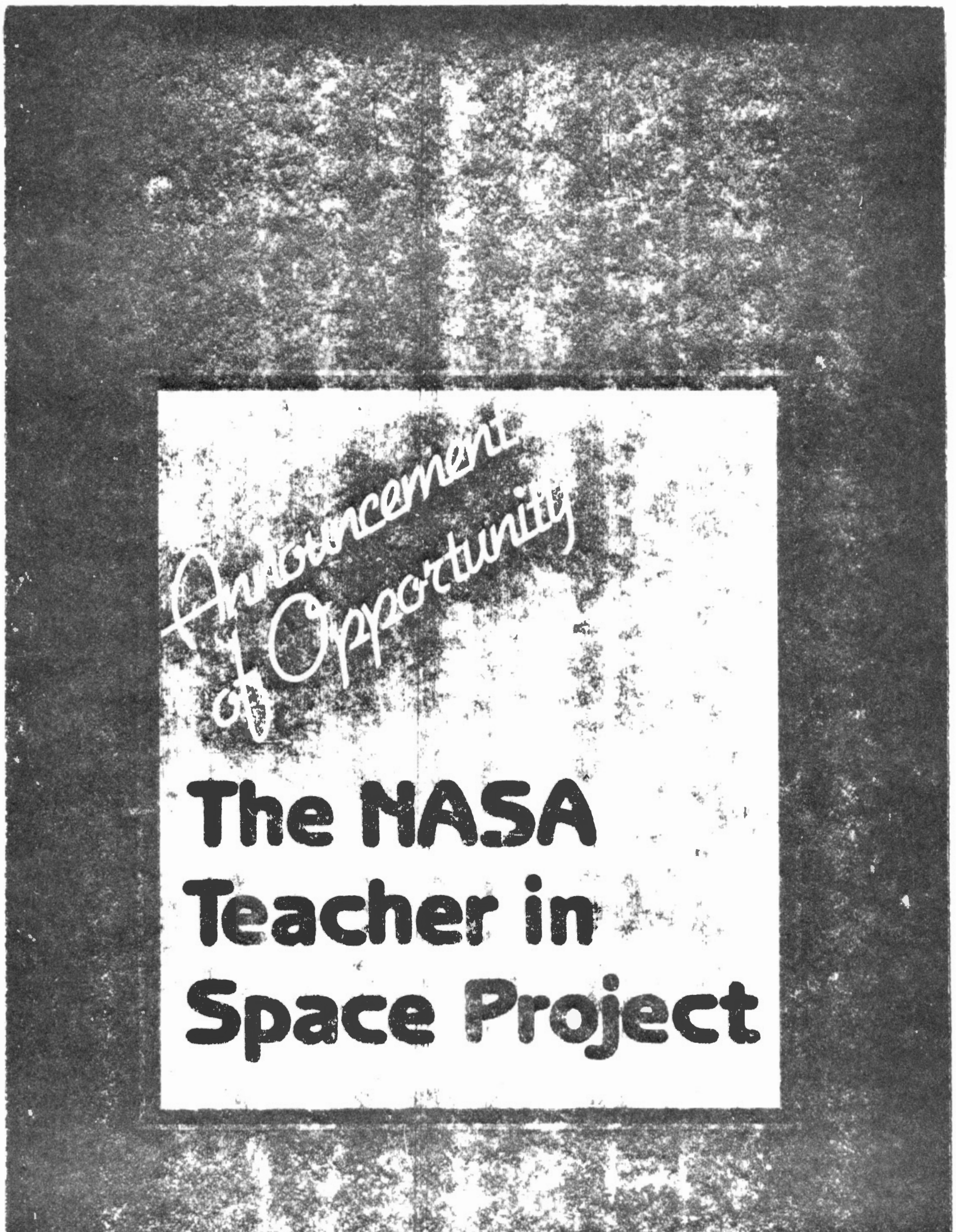
From the state-level nominees, the National Review Panel will recommended ten teachers as semifinalists for consideration by the NASA Space Flight Participant Evaluation Committee. This Committee is comprised of seven senior NASA officials.

The semifinalists will go to NASA's Johnson Space Center, Houston, for thorough medical examinations, in-depth briefings and interviews by the NASA Evaluation Committee. Based on results of the physical examinations and the interviews, the Evaluation Committee will determine which applicants are qualified to undergo necessary training and will recommend five finalist candidates.

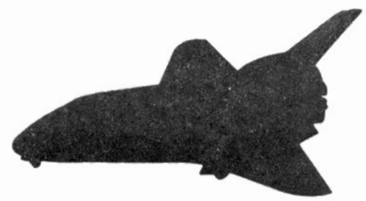
The names of the five finalists will be submitted to the NASA Administrator, who, along with the Evaluation Committee, will select the primary and back -up candidates to undergo training for space flight. The specific flight opportunity is under review; however, the goal is to fly the first teacher on a mission in early 1986.

APPENDIX C

ANNOUNCEMENT OF OPPORTUNITY


Announcement of Opportunity
The NASA Teacher in Space Project

The NASA Teacher in Space Project



The National Aeronautics and Space Administration (NASA), in cooperation with the Council of Chief State School Officers (CCSSO), is responsible for the selection of the first private citizen, who will be a teacher, to fly on a Space Shuttle mission. The Teacher in Space Project is a part of the Space Flight Participant Program, which will provide unique opportunities for U.S. citizens to participate in the space program.

Because teachers routinely communicate their knowledge and experience to large numbers of students, parents, and community members, the teacher selected will play an important role both as a symbol of the teaching profession and, following the flight, as a teacher of the public at large about the experience of space flight.

NASA and CCSSO invite teachers at the elementary and secondary levels to consider the opportunity described in this announcement and examine the criteria for eligibility. After full consideration of the requirements and responsibilities involved, interested teachers can request an application by returning the form in this announcement.

Teacher Eligibility

This opportunity is open to elementary and secondary level teachers in all public and non-public schools in the United States and U.S. territories, Department of Defense overseas dependents' schools, Department of State overseas schools, and Bureau of Indian Affairs' schools. Additionally, the teacher must:

- Be a U.S. citizen
- Be a current full-time classroom teacher
- Have been a full-time classroom teacher for the past five consecutive years
- Have verification of eligibility and consent to participate (will be included in the application)
- Meet medical requirements as defined
- If teaching at a non-public school, the school must advertise an open admissions process through the local written media indicating that it does not discriminate based on race.
- Not be a spouse of a current or former NASA employee

Selection Process

All applications will be screened to eliminate those not meeting the basic requirements. Remaining applications will be forwarded to the state or agency review panels, which will evaluate the proposals in accordance with predetermined standards and criteria and select two teachers per state/agency as nominees. The chief state school officer or agency administrator will be responsible for selection of the nominees. DODDS teachers' applications will be forwarded to DODDS regional and Office of Dependents Schools, Washington, D.C. Review Panels. The 120 nominees will be forwarded to a National Review Panel for further evaluation. All state and agency nominees will attend a teachers' workshop and recognition banquet to be held in the Summer of 1985 in Washington, D.C. The purpose of the workshop will be to inform the participants of current developments in the space program and provide information and training on NASA educational materials available for the classroom. The workshop will also provide the opportunity for further evaluation and screening of the applicants by the National Review Panel.

From the state-level nominees, the National Review Panel will recommend 10 teachers as semi-finalists for consideration by the NASA Space Flight Participant Evaluation Committee. This Committee is comprised of seven senior NASA officials.

The 10 semi-finalists will be taken to NASA's Johnson Space Center for thorough medical examination, briefings about the space flight experience, and interviews by the NASA Evaluation Committee. Based on results of the physical examinations and the interviews, the Evaluation Committee will determine which applicants are qualified to undergo necessary training and will recommend five finalists.

The names of the finalists will be submitted to the NASA Administrator who will select the primary and back-up candidates to undergo training to prepare them for space flight.

Authority to officially designate candidates for training, certify candidates as qualified Space Flight Participants, and assign Space Flight Participants to specific Space Shuttle flights is reserved to the Administrator.

Application Packet

The application elements will include a biographical information form; an essay question for the applicants to describe how the experience can best be shared during the post-flight period; a medical standards summary; a legal agreement summary; and a Privacy Act notice. The application period will run from December 1, 1984 to February 1, 1985. Applications must be received at the Council no later than February 1, 1985. Incomplete or incorrect applications will be automatically disqualified and cannot be resubmitted. Material other than the application itself will not be considered, nor will it be returned to the applicant.

Selection Criteria

Selection of the teacher will be based on the following:

(1) Recommendations of the State, Agency and National Review Panels.

(2) Ability to successfully undergo the necessary training period to ensure adaptation to flight experience and mission activities.

(3) Ability to pass medical and psychological examinations to minimize the possibility of hazard to the individual, other crew members or safe mission completion.

(4) Adaptability to living and working in space.

(5) Willingness to enter into a consent agreement with NASA covering pre-flight, flight, and post-flight activities (a commitment of approximately 18 months), with individual rights and responsibilities set forth in that agreement.

(6) Satisfactory completion of a background investigation conducted to NASA's standards and adjudicated by the NASA Security Officer.

All applicants will be judged by State, Agency, and National Review Panels selected by the Council of Chief State School Officers, agency administrators, and the chief state school officers. Applications will be evaluated on the following criteria:

A. Creativity and Originality

The applicant has developed a proposal to share the flight experience with the public which demonstrates creativity and originality.

B. Communications Skills

The applicant has demonstrated strong capability as a communicator in both written and oral formats through the application mechanism.

C. Professional Background

The applicant has demonstrated professional commitment through a history of seeking to consistently upgrade teaching skills.

D. Community Involvement

The applicant has demonstrated knowledge about and is actively involved in local community activities as well as being well informed about regional, national, and international issues.

Relationship of Participant to NASA

The intent of this opportunity is for the teacher to help communicate the space flight experience to the public. The selected teacher will be required to maintain a relationship with NASA for one year and be available for public lectures, consultation, and other activities.

It is expected that the selected teacher and the back-up candidate will be released from their teaching responsibilities by their local Board of Education and/or administration during the pre-flight, flight, and post-flight period, but will continue as employees of their respective schools and/or school districts. NASA will make arrangements with the local school system to provide suitable financial arrangements including salary, retirement and other benefits for the selected teachers. The selected teacher and the back-up candidate are expected to return to classroom teaching upon conclusion of the commitment made to NASA.

It is anticipated that the 110 state or agency nominees who are not selected as semi-finalists will serve as educational resources for their state education agency or other agency upon completion of the selection process.

Medical Requirements Summary

The purpose of medical selection standards for Space Flight Participants is to screen for medical conditions which could adversely affect either the Participant or the mission. A new medical standard (Class IV) has been established for the Space Flight Participant. Successful candidates will meet the following minimum qualifications:

1. The absence of any disease, injury, or other condition associated with functional impairment which would be likely to interfere with safe and efficient mission completion, emergency egress, use of personal equipment or required preflight training.

2. Distant and near visual acuity correctable to 20/40 or better in the better eye.

3. Ability to hear whispered voice at three feet (hearing aid is permissible).

4. Blood pressure less than 160/100.

5. Other medical illnesses and conditions may be disqualifying, in accordance with the Class IV standards. Each condition, if present, will be evaluated. It will be the final judgment of the Administrator, based on NASA medical staff recommendations, whether the individuals with these conditions are qualified for space flight.

The 2 nominees from each state or agency plus 1 back-up candidate for each will undergo preliminary physical examinations by an approved FAA medical examiner. The cost for these exams will be covered by the state education agency or appropriate participating government agency.

Purpose of the Background Investigation

The National Aeronautics and Space Act of 1958 requires the NASA Administrator to establish security requirements and safeguards deemed necessary in the interest of national security. Considering the importance of the Space Shuttle as a national resource, security requirements will be included in the criteria for NASA approval of Space Flight Participant selection.

A background investigation or security assurance should not be taken as a commitment to grant a security clearance. The investigation will focus on ensuring successful performance by the teacher in the space environment.

Purpose of the Consent Agreement

The consent agreement limits the commercial exploitation of the participant's experience. It also includes such other reasonable requirements or limitations with respect to the participant's conduct or activities as may be required to protect the national interest. It also serves as a contract to insure that the participant will be available to work with NASA to communicate with the public for a period of one year following the mission.

Training Requirements for the Teacher in Space Participant

A training schedule has been developed to provide the participant with the necessary level of familiarity with the Orbiter. This training stresses safety, habitability, and in-flight responsibilities. Self-study materials are available, and participants will be requested to complete these prior to arrival at the Johnson Space Center for more detailed training sessions.

Participants will undergo approximately 120 hours of training over eight weeks prior to flight, as well as certain testing requirements at an earlier stage. Training will include manuals, course work, simulators, and hands-on experience. Topics will include a basic STS orientation, environment familiarization, orbit systems, safety, crew systems, and flight operations. The training will take place at NASA's Johnson Space Center in Texas and the Kennedy Space Center in Florida

Responsibilities of the Teacher During the Mission

The primary role for the teacher in space will be to participate fully in the daily activities that occur during a Shuttle mission. Specific responsibilities will be developed in coordination with the teacher and ideas that were developed in the application packet.

It is expected that the teacher will be involved with demonstrations, life on the Shuttle, Earth observations and selected photographic and filming activities. It is likely that the teacher could conduct the experiments associated with the Shuttle Student Involvement Project or other experiments developed to be performed in the mid-deck of the Orbiter. Depending on the discipline of the teacher, other activities may be developed

The selected teacher will also be responsible for knowing how to operate certain Orbiter systems (i.e., hatches, food and hygiene systems) and for proficiency in those normal and emergency procedures which are required for safe and efficient crew operations. All participants will be subject to the authority of the commander.

When Will the First Teacher Fly on the Shuttle?

A specific flight opportunity is still under review; however, the goal is to fly the first teacher on a mission in early 1986.

How Much Will it Cost an Individual to Participate?

The teachers selected as state or agency nominees, the 10 semi-finalists, the selected teacher and the back-up candidates will incur no direct costs for participation in the program. All expenses will be covered either by NASA or through the Council.

Send for Your Application:

Application packets will be distributed beginning December 1, 1984. If you would like to receive an application packet, please complete the following form and return it to:

The NASA Teacher in Space Project
Council of Chief State School Officers
400 North Capitol Street—Suite 379
Washington, D.C. 20001
(202) 393-1178

Your Name: ____
First   Middle Initial   Last Name

Address: ____
Number and Street or P.O. Box No.

____
City   State   Zip Code

I am a ☐ male ☐ female.

I teach
- ☐ elementary school.
- ☐ middle school.
- ☐ junior high school.
- ☐ senior high school.

The major subject area I teach is
- ☐ English.
- ☐ Science.
- ☐ History.
- ☐ Social Studies.
- ☐ Art.
- ☐ Foreign Language.
- ☐ Geography.
- ☐ Mathematics.
- ☐ Vocational Education.
- ☐ Other.

CHIEF STATE SCHOOL OFFICERS • COUNCIL •

Council of Chief State School Officers
400 North Capitol Street
Suite 379
Washington, D.C. 20001

NASA
National Aeronautics and Space Administration

NASA Teacher in Space Project
Council of Chief State School Officers
400 North Capitol Street—Suite 379
Washington, D.C. 20001

APPENDIX D

APPLICATION PACKET


Application Packet
The NASA Teacher in Space Project

The NASA Teacher in Space Project

Congratulations on deciding to apply for the NASA Teacher in Space Project. We are pleased that you are interested in this historic activity. Please read the following information carefully and be sure that you are eligible to apply before preceding to complete the application form. Applications must be completed in their entirety. Incomplete applications will be discarded and given no further consideration.

Teacher Eligibility

This opportunity is open to elementary and secondary level teachers of all subject areas in all public and non-public schools in the United States and U.S. territories, Department of Defense overseas dependents' schools, Department of State overseas schools, and Bureau of Indian Affairs' schools. The teacher must meet the following requirements:

- Be a U.S. citizen.
- Be a current full-time classroom teacher (as defined by your state contract).
- Have verification of eligibility and consent to participate (enclosed in this application packet.)
- Have completed the past five years as a full-time classroom teacher.
- Not be a spouse of a current or former NASA employee.
- Meet medical requirements as defined.

Additionally, please note:

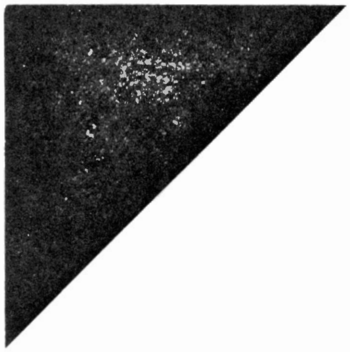
- If you are teaching at a non-public school, the school must make an annual public declaration that it does not discriminate based on race.
- In the event that you currently have or have had *approved* leave in the past 5 years which did not constitute a break in service, you are eligible to apply.

Medical Standards Summary

The purpose of medical selection standards for the teacher selected to travel on the Space Shuttle is to screen for medical conditions which could adversely affect either the participant or the mission. A new medical standard has been established for the Space Flight Participant Program (Class IV). Successful candidates will meet the following minimum qualifications:

1. The absence of any disease, injury, or other condition associated with functional impairment which would be likely to interfere with safe and efficient mission completion, emergency egress, use of personal equipment or required preflight training
2. Distant and near visual acuity correctable to 20/40 or better in the better eye
3. Ability to hear whispered voice at three feet (hearing aid is permissible)
4. Blood pressure less than 160/100
5. Other medical illnesses and conditions may be disqualifying, in accordance with the Class IV standards. Each condition, if present, will be evaluated. It will be the final judgment of the Administrator, based on NASA medical staff recommendations, whether the individual with these conditions is qualified for space flight.

The 2 nominees from each state or agency plus 1 back-up candidate for each will undergo preliminary physical examinations by an FAA medical examiner. The cost for these exams will be covered by the state education agency or appropriate participating government agency.



Project Timeline

February 1, 1985—Deadline for applications.

April 30, 1985—States complete selection of two nominees.

June 1985—National workshop for 120 state and agency nominees.

July 4, 1985—Announcement of ten semi-finalists.

August 1985—NASA Evaluation Committee selects 5 finalists.

September 1985—Announcement of selected teacher and back-up candidate.

Fall 1985—120 hours of training for selected teacher and back-up candidate.

Early 1986—Space Shuttle Mission.

Selection Process

All applications will be screened to eliminate those not meeting the basic requirements. Remaining applications will be forwarded to the state or agency review panels for evaluation and selection of two teachers per state/agency as nominees.

State Review Process

The chief state school officer or agency administrator will be ultimately responsible for selection of the nominees. Each state will determine the process they wish to use to select the state review panels; however, the majority of the states will use the National Teacher of the Year selection panel as the basis for their efforts. The panel will include 1 representative of the non-public school sector. Following review of the applications, the state review panels will interview the final 5 candidates. They will select 2 nominees and 1 backup candidate to undergo the approved FAA medical examination. The 2 nominees names will be forwarded to the Council of Chief State School Officers by April 30, 1985.

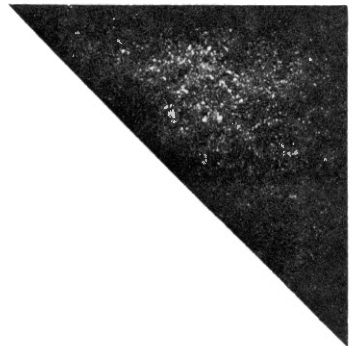
National Workshop and Review Panel

If selected as one of the 120 state nominees, you will be required to attend the national workshop in June, 1985. *Attendance at the national workshop is mandatory*. The procedures for the final review process will be initiated during the national workshop. If selected as one of the 120 state nominees, you will be required by the state education agency to obtain permission from your District Superintendent to participate fully in all further phases of the project.

The procedures for the final review process will be initiated at that time. From the state level nominees, a national review panel will recommend 10 teachers as semi-finalists. They will be evaluated by the NASA officials and will be taken to NASA's Johnson Space Center for thorough medical examination, briefings about the space flight experience, and interviews by the NASA Evaluation Committee. Based on the results of the physical examinations and the interviews, the Evaluation Committee will determine which applicants are qualified to undergo necessary training and will recommend five finalists.

The names of the five finalists will be submitted to the NASA Administrator who will select the primary and back-up candidates to undergo training to prepare them for space flight.

Authority to officially designate candidates for training, certify candidates as qualified Space Flight Participants, and assign Space Flight Participants to specific Space Shuttle flights is reserved to the Administrator.



Selection Criteria

Selection of the teacher will be based on the following:

(1) Recommendations of the state, agency, and national review panels.

(2) Ability to successfully undergo the necessary training period to ensure adaptation to flight experience and mission activities.

(3) Ability to pass medical and psychological examinations to minimize the possibility of hazard to the individual, other crew members or safe mission completion.

(4) Adaptability to living and working in space.

(5) Willingness to enter into a consent agreement with NASA covering pre-flight, flight, and post-flight activities (a commitment of approximately 18 months), with individual rights and responsibilities set forth in that agreement.

(6) Satisfactory completion of a background investigation conducted to NASA's standards and adjudicated by the NASA Security Officer.

All applicants will be judged by state, agency, and national review panels selected by the Council of Chief State School Officers, agency administrators, and the chief state school officers. Applications will be evaluated on the following criteria:

A) **Creativity and Originality**—The applicant has developed a proposal to share the flight experience with the public which demonstrates creativity and originality.

B) **Communications Skills**—The applicant has demonstrated strong capability as a communicator in both written and oral formats through the application mechanism.

C) **Professional Background**—The applicant has demonstrated professional commitment through a history of seeking to consistently upgrade teaching skills.

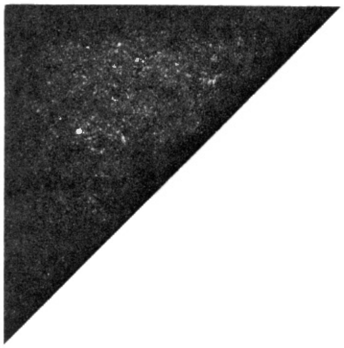
D) **Community Involvement**—The applicant has demonstrated knowledge about and is actively involved in local community activities as well as being well informed about regional, national, and international issues.

Responsibilities of the Teacher During the Mission

The primary role for the teacher in space will be to participate in selected daily activities that occur during a Shuttle mission. Specific responsibilities will be developed in coordination with the teacher and ideas that are developed in the application packet.

It is expected that the teacher will be involved with demonstrations, life on the Shuttle, Earth observations and selected photographic and filming activities. It is likely that the teacher could conduct the experiments associated with the Shuttle Student Involvement Project or other experiments developed to be performed in the mid-deck of the Orbiter. Depending on the discipline of the teacher, other activities may be developed.

The selected teacher will also be responsible for knowing how to operate certain Orbiter systems (i.e., hatches, food and hygiene systems) and for proficiency in those normal and emergency procedures which are required for safe and efficient crew operations. All participants will be subject to the authority of the commander.



Training Requirements for the Teacher in Space Participant

A training schedule has been developed to provide the primary and back-up teachers with the necessary level of familiarity with the Orbiter. This training stresses safety, habitability, and in-flight responsibilities. Self-study materials will be provided to the primary and back-up teachers and they will be required to complete these prior to arrival at the Johnson Space Center for more detailed training sessions.

The primary and back-up teachers will undergo approximately 120 hours of training during the eight weeks prior to flight, as well as certain testing requirements at an earlier stage. Training will include reading of training manuals, completion of course work, exposure to simulators, and actual hands-on experience. Training topics will include a basic Space Transportation System (STS) orientation, environment familiarization, orbit systems, safety, crew systems, and flight operations. The training will take place at NASA's Johnson Space Center in Texas and the Kennedy Space Center in Florida.

Relationship of Participant to NASA

The intent of this opportunity is for the teacher to help communicate the space flight experience to the public. The selected teacher will be required to maintain a relationship with NASA for one year following completion of the mission and will be employed by NASA to give public lectures, do consultations and participate fully in other activities. The teacher will be involved in a rigorous schedule for the year. It is expected that the selected teacher and the back-up candidate will be released from their teaching responsibilities by their local Board of Education and/or administration during the pre-flight, flight, and post-flight period, but will continue as employees of their respective schools and/or school districts. NASA will make arrangements with the local school system to provide suitable financial arrangements including salary, retirement and other benefits for the selected teachers. The selected teacher and the back-up candidate are expected to return to classroom teaching upon conclusion of the commitment made to NASA.

It is anticipated that the 110 state or agency nominees who are not selected as semi-finalists will serve as educational resources for their state education agency or other agency upon completion of the selection process.

Privacy Act Notice

Pursuant to Public Law 93-579 (Privacy Act of 1974), the following statement is furnished to individuals supplying personal information.

Authority

Sections 1302, 3301, and 3304 of Title 5 of the U.S. Code.

Purposes and Uses

The principal purpose for collecting this information is to provide the data necessary to make determinations of qualifications for the NASA Teacher in Space Project. This information may be shared with other federal, state, or local agencies for lawful purposes, consistent with such routine uses as published in the system notice.

Application Instructions

This application must be completed in its entirety by applicants wishing to participate in the NASA Teacher in Space Project. The application must be typed, single spaced, in only the space provided. ***Absolutely no additional materials will be considered and will be discarded upon receipt.*** No reproductions of this application will be accepted. Any application that is discarded may not be resubmitted.

Applications must be postmarked on or before February 1, 1985 or if delivered in person received no later than 5 p.m. on February 1, 1985.

Instructions for Completion of Essay Questions

The essay questions are intended to elicit information regarding:

your creativity/originality

your professional development

your ability to communicate

your level of community involvement

The ability to be concise in your completion of the essay questions is essential. Answers must be typed single space and are to be answered strictly in the space provided. No additional sheets may be used and no additional materials will be considered. If any extraneous material is received, it will be discarded.

Instructions for Completion of Recommendations

Please use the three forms provided for your recommendations. The first is to be completed by a professional colleague, the second by a school administrator and the third by a member of your local community. They *must* be typed single-spaced and included in your application form when it is submitted. References which exceed the space provided on the application form or which are mailed separately will disqualify the application.

Special Instructions

Special Instructions for Teachers in Department of State (A/OS) Assisted Overseas Schools:

Interested teachers must complete the application, seal it in an envelope which identifies the contents as an application for the NASA Teacher in Space Project, address the envelope to the Office of Overseas Schools (A/OS), U.S. Department of State, Washington, D.C. 20520, and give it to the post Administrative Officer. The post Administrative Officer will forward the sealed application to the A/OS by registered air pouch sent no later than February 1, 1985. A/OS will deliver the sealed application packet to the Council of Chief State School Officers headquarters for screening.

Address for Submission of Applications

Teachers from public schools, non-public schools, Bureau of Indian Affairs schools and Department of Defense Overseas Schools must submit their application to the following address:

NASA Teacher in Space Project
Council of Chief State School Officers
400 North Capitol Street—Suite 379
Washington, DC 20001

Suggested References

Aerospace Bibliography. 7th ed. GPO Stock No. 330-000-460-5. 1973. $1.40; 116 pp.

An annotated listing of books, pamphlets, audio-visual aids, and other resources, with a key indicating grade levels for which the various materials are suited.

Information for Teachers/Skylab Student Project. GPO Stock No. 330-000-477-0. 1971. $1.00; 42 pp.

Brief descriptions of the Skylab Program and the NSTA-NASA Skylab Student Project, including experiment selection for flight, experiment performance, and summaries of each of the 25 national winning student experiments. Includes related classroom activities.

Skylab Guidebook. GPO Stock No. 330-000-508-3. 1973. $2.20; 256 pp.

Detailed descriptions of the Skylab program; missions and equipment. Prepared by scientists and engineers who worked on the project.

First to Fly. Moulton, Robert. Lerner Publications Mpls. 1983. $10.95.

The story of the first high school student experiment to fly on the Space Shuttle Columbia in 1982.

Entering Space: An Astronaut's Odyssey. Allen, Stewart, Tabor, and Chang. New York. 1984. $24.95

The most recent account of travel aboard the Space Shuttle written from the perspective of an astronaut.

Background

The NASA Teacher in Space Project
Basic Background Sheet

Please Note: Application form *must* be typed.

Title: Dr. / Mr. / Mrs. / Miss / Ms. Name ______________________
Last   First   Middle Initial

Home Address ______________________

____
City   State   Zip Code

Name of School ______________________

School Address ______________________

____
City   State   Zip Code

Home Telephone (______) __________ Work Telephone (______) __________

Name and Address of School Principal ______________________

____
City   State   Zip Code

Telephone Number (______) __________

Name and Address of School Superintendent/Chief School Administrative Officer (if any) ______________________

____
City   State   Zip Code

Telephone Number (______) __________

Sex: Male ____ Female ____ Social Security Number ______________________

I teach at an:
elementary school ___ middle school ___ junior high school ___ high school ___

Position Title ______________________
Major Subject Area (if any) ______________________ Grade Level ____

Total years of teaching experience: ____ Years in present position: ____

I hold the following academic degree [check highest degree held only]:
____ High school diploma ____ Bachelor's degree ____ Master's degree
____ Doctorate ____ Post-doctoral work

I am currently a full-time classroom teacher: Yes ____ No ____
I have completed the past 5 consecutive years as a full-time classroom teacher: Yes ____ No ____
I am a U.S. citizen: Yes ____ No ____
If married, my spouse is not a current or former NASA employee: Yes ____ No ____

Signature of Applicant ______________________

Verification of Eligibility

Any applications which are not properly completed and signed by the appropriate official as stipulated below will be disqualified.

The information included in the Basic Background Sheet must be verified:

—by the District Superintendent for public school teachers

—by the appropriate chief school administrative officer for non-public school teachers or U.S. Government teachers

I have verified to the best of my ability that this applicant for The NASA Teacher in Space Project is a U.S. citizen, a full-time classroom teacher at present and has completed the past 5 consecutive years as a full-time classroom teacher. Further, this teacher possesses the requirements necessary to teach in this building. If representing a non-public school, I attest that we make a public annual declaration that we do not discriminate based on race.

Signature of Appropriate Official ____________________

Name of Appropriate Official ____________________

Title of Official ____________________

Address ____________________

City ____________ State ________ Zip Code ________

Date of Signature ____________ Telephone (____)________

Legal Summary/Consent Agreement

1. The participant shall agree to submit to physical and psychological exams and to make medical records available to NASA as part of such exams.

2. The participant shall agree to undergo a complete background investigation conducted by the U.S. Government.

3. The participant shall agree to enter into a contract with NASA which includes the following:

(a) agreement to adhere to the general rules and regulations pertaining to the conduct of flight crews assigned to STS missions which includes:

(i) submitting to authority of STS Flight Commander during launch and flight activities;

(ii) limitation of personal effects which may be brought aboard the Orbiter;

(iii) participation in pre-flight, flight, and post-flight press conferences; and

(b) agreement to enter into a one-year sabbatical from classroom teaching commencing after the conclusion of the space flight in order to lecture throughout the United States concerning the personal experiences related to having participated in a space flight and other post-flight activities.

(c) agreement to be restricted from making appearances, lecturing, or writing for publications other than that approved by NASA during the period which encompasses training, flight, and the post-flight tour.

4. There are no restrictions pertaining to compensation, lecturing or writing activities that are ensued after participant completes his/her contract with NASA.

5. Unless currently employed as a teacher in a U.S. Government assisted school, the participant shall not be deemed an employee of the United States Government during the period of the contract. Therefore the rights to participate under U.S. Government health plans, U.S. Government life insurance plans, accrual of time for U.S. employees pension plan, the right to institute a claim under the Federal Employees Compensation Act or the right or benefits normally available to United States Government Employees would not be available to participant.

6. The participant agrees to obtain consent from school administrator to take leave as required.

7. The participant agrees to attend the national workshop if selected as a state/agency nominee and, if selected as a national semi-finalist, to go to Houston for further testing.

Signature of Applicant ______________________________

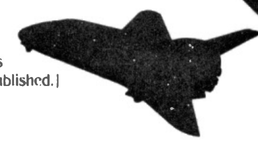
Date of Signature ______________________________

Describe your professional development activities. [Please include your educational coursework, professional association memberships, offices held, training you may have undertaken or conducted and other relevant activities.]

Note: Do not write below this line.

Essays

Describe your communication skills. [Please include your experience in oral and written communications including public speaking, your feelings about public speaking, and mention anything you may have written or published.]



Note: Do not write below this line.

Describe your involvement in your community. [This question is intended to demonstrate your commitment to your community through service-oriented activities including volunteer work, civic activities and public offices held.]

Note: Do not write below this line.

Describe your philosophy of teaching.

Note: Do not write below this line.

How do you help your students to develop a national and international awareness?

Note: Do not write below this line.

Why do you want to be the first U.S. private citizen in space?

Note: Do not write below this line.

Space Shuttle Question

Please read the following description of the environment in the Space Shuttle and then write 2 pages describing what kind of special project you would like to conduct while on the mission. This project does not have to be scientific in nature and should demonstrate originality, creativity and strong communication skills. It should be feasible to conduct aboard the Space Shuttle. You can get an idea of the actual environment on the Space Shuttle by reading the suggested references included in the Application Instructions. Proposed activities should not require time of other crew members as they will have their own mission responsibilities during the flight. Activities involving the placement of payloads in the cargo bay or involving extravehicular activities (space walks) will not be considered. NASA is under no obligation to allow the participant to actually conduct the proposed project.

Space Shuttle Description

The successful flights of the Space Shuttle have convincingly demonstrated that the nation has entered a new era of space transportation. Routine operations and expanded experimental investigations have become commonplace, and new capabilities for the Shuttle will be demonstrated throughout the next decade. With a gross liftoff weight exceeding four million pounds, the Space Shuttle is launched like a rocket and maneuvered into Earth orbit where it performs its assigned missions lasting up to eight days and then returns for a landing similar to that of an airplane. The spacecraft is then readied for another flight with new payloads, experiments and flight crew. The crew normally consists of five people—the commander, the pilot, and three mission specialists.

The Space Shuttle has been designed to support an extensive range of operations that make use of the special properties of space—weightlessness, the broad view of Earth, and the ability to observe the rest of the universe unobscured and undistorted by Earth's atmosphere.

In the weightless environment it is necessary to restrain oneself in order to work. Managing equipment or tools in space requires procedures that are dramatically opposed to managing such activities on Earth. Moving things around is easy, but keeping them in a particular place is not.

Below is a listing of typical support equipment that is carried on board the Shuttle that can be made available for various experiments and other activities. In developing ideas for on-board activities, you might want to consider the availability of these items:

Support Equipment

Tools

Rachet/torque wrench with sockets; combination and crescent wrenches, screw driver, hammer; vise grip and other pliers, Swiss army knife, scissors.

Equipment

Exerciser (treadmill); food warmer; water dispenser; vacuum cleaner; mirrors; flashlight; stereo tape recorder with cassettes; head sets; binoculars; window filters; trash containers; lines, straps, cables.

Environment/Medical Instrumentation

Sound level meter with octave analyzer; high and low rate and passive radiation dosimeteres; blood pressure cuff; stethoscope; thermometers, otoscope, opthalmoscope, bioinstrumentation system (electrocardiograph device).

Supplies

Tape, dry wipes, packing materials.

Television

Two portable TV cameras with monitors (viewfinders); one color lens; wide angle lens; cassette recorder and cassettes.

Photography

16 mm Data Acquisition Camera, time coded; slow, fast, and normal motion film speeds; 5, 10, and 18 mm, and zoom lens; film magazines. Hasselblad 70mm reflex camera; standard and 250 mm lens; film magazines. Nikon 35 mm single lens reflex; f/1.4 lens; 35 mm film cassettes; 35 mm self-developing CRT camera (photographs Orbiter operational data display on screen on a cathoderay tube; film cassettes. Accessory equipment (i.e., portable light, flash gun, filters, mounting brackets).

Space Shuttle Special Project Description

Note: Do not write below this line.

Note: Do not write below this line.

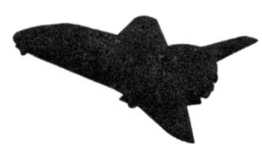
How do you expect to communicate your experience during the year following your return from the space flight mission?

Note: Do not write below this line.

Recommendation from a Professional Colleague

______________________ is applying to participate in The NASA Teacher in Space Project. The teacher who is finally selected will be the first U.S. private citizen to fly on a Space Shuttle mission and will represent the entire teaching profession to the public at large. As a professional colleague of the applicant, please comment on the applicant's ability to communicate effectively, his/her creativity, teaching ability, and capacity for being a good team member.

This form must be typed, single-spaced and must not exceed the space provided on this side of the sheet. When completed, please return the recommendation to the applicant for submission. Thank you for taking the time to complete this form.



Signature of Reference ______________________________

Name of Reference ______________________________

Title of Reference ______________________________

Address ______________________________

____

Telephone (____)______________________ Date ______________

Recommendation from a School Administrator

______________________________ is applying to participate in The NASA Teacher in Space Project. The teacher selected will be the first U.S. private citizen to fly on a Space Shuttle mission and will represent the teaching profession to the public at large. Please comment in particular on the applicant's ability to communicate effectively, his/her creativity, teaching ability, professional development experience and capacity for being a team member.

This form must be typed, single-spaced and must not exceed the space provided on this side of the sheet. When completed, please return the recommendation to the applicant for submission. Thank you for taking the time to complete this form.

Signature of Reference ______________________________

Name of Reference ______________________________

Title of Reference ______________________________

Address ______________________________

____

Telephone (_____)____________________ Date ______________

Recommendation from a Community Member

____________________ is applying to participate in The NASA Teacher in Space Project. The teacher selected will be the first U.S. private citizen to fly on a Space Shuttle mission and will represent the entire teaching profession to the public at large. Please comment in particular on the applicant's ability to communicate effectively, his/her involvement in your community, capacity for being a good team member and evidence of interest in local, regional, national and international issues.

This form must be typed and single-spaced and must not exceed the space provided on this side of the sheet. When completed, please return the recommendation to the applicant for submission. Thank you for taking the time to complete this form.

Signature of Reference ____________________

Name of Reference ____________________

Title of Reference ____________________

Address ____________________

____

Telephone (____)______________ Date ____________

NASA Teacher in Space Project
Council of Chief State School Officers
400 North Capitol Street - Suite 379
Washington, DC 20001

National Aeronautics and Space Administration

NASA Teacher in Space Project
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NASA
National
Aeronautics and
Space
Administration

APPENDIX E

LIST OF NOMINEES

NASA TEACHER IN SPACE LIST OF NOMINEES

STATE	SCHOOL	CITY
ALABAMA		
Sophia Ann Clifford	Erwin High	Birmingham
Pamela Sue Grayson	Minor High	Birmingham
ALASKA		
Mildred J. Heinrich	Robert Service High	Anchorage
Richard C. Houghton	Napaaqtugmiut High	Noatak
ARIZONA		
Robert Carpenter	Secrist Middle	Tucson
Robin Kline	Tonalea Elementary	Scottsdale
ARKANSAS		
William A. Dempsey	Arkansas Sr. High	Texarkana
Mary Beth Greenway	Parkview High	Little Rock
BUREAU OF INDIAN AFFAIRS		
Stanley Renfro	Wingate High	Ft. Wingate
Sherry Woodside	Wingate Elementary	Ft. Wingate
CALIFORNIA		
William M.Dillon, Jr.	Penninsula High	San Bruno
Gloria M.McMillan	La Jolla High	La Jolla
COLORADO		
James Kim Natale	Pomona High	Arvada
Robert Stack	Shawsheen High	Greely
CONNECTICUT		
Robert Mellette	Conte Arts Magnet	New Haven
David Warner	Westminster	Simsbury
DELAWARE		
Henry E. W. Bouchelle	Pilot	Wilmington
Stephanie Gerjovich-Wright	Stanton Middle	Wilmington

DEPARTMENT OF DEFENSE		
Mary Smothers	Kaiserslautern American High	APO, New York
Kenneth VanLew	Frankfurt High	APO, New York
DISTRICT OF COLUMBIA		
Wm. A. Barwick, Jr.	Woodrow Wilson High	D.C.
Nancy J. Cooksy	Eastern High	D.C.
FLORIDA		
Susan Forte	Georgestone Vocational	Pensacola
Michael D. Reynolds	Duncan U. Fletcher Sr.	Neptune Beach
GEORGIA		
Thomas P. Garmon	Benjamin E. Mays High	Atlanta
Carol G. Hickson	Fernback Science Center	Atlanta
GUAM		
Dale J. Jenkins	St. John's	Tumon Bay
M. Bernadette McCorkle	Vocational High	Barrigada
HAWAII		
Joseph Ciotti	St. Louis High	Honolulu
Arthur Kimura	McKinley High	Honolulu
IDAHO		
David M. Marquart	Boise High	Boise
Barbara R. Morgan	McCall-Donnelly Ele.	McCall
ILLINOIS		
John D. Baird	Quincy Sr. High	Quincy
Lynne M. Haeffele	Bloomington High	Bloomington
INDIANA		
Robert S. Foerster	Cumberland Elementary	West Lafayette
Stephen L. Tucker	West Vigo High	W. Terre Haute
IOWA		
A. John Cazanas	Rockford Sr. High	Rockford
Lori M. Goetsch	Mt. Pleasant Jr. High	Mount Pleasant

KANSAS		
Wendell G. Mohling	Shawnee Mission NW High	Shawnee Mission
Barry L. Schartz	Goddard High	Goddard
KENTUCKY		
Sue Ellen W. Darnell	North Marshall Jr. High	Calvert City
Judy A. White	L.C. Curry Elem.	Bowling Green
LOUISIANA		
Deborah Harris	Rusheon Jr. High	Boissier City
Denise Van Bibber	Alexandria County	Alexandria
MAINE		
Gordon L. Corbett	Yarmouth Intermediate	Yarmouth
Wiliam C. Townsend	Summer Memorial High	East Sullivan
MARYLAND		
Kathleen Beres	Kenwood High	Baltimore
David R. Zahren	G. Gardner Shugart Middle	Hillcrest Heights
MASSACHUSETTS		
Richard Methia	New Bedford High	New Bedford
Charles Sposato	Farley Middle	Framingham
MICHIGAN		
Derrick Fries	Seaholm High	Birmingham
Sharon Newman	West Hills Middle	West Bloomfield
MINNESOTA		
Steve L. Brehmer	Wanamingo Public	Wanamingo
Katherine Koch-Laveen	Apple Valley High	Apple Valley
MISSISSIPPI		
Connie Moore	Oak Grove High	Hattiesburg
JoAnne Reid	Weir Attendance Center	Weir
MISSOURI		
Christopher W. Brown	McCluer N. Senior High	Florissant
Richard K. Kavanaugh	Park Hill R-5	Kansas City
MONTANTA		
Paul Dorrance	Helena High	Helena
Patricia Johnson	Capital High	Helena

NEBRASKA		
Roger U. Rea	Northwest High	Omaha
James R. Schaffer	Lincoln East High	Lincoln
NEVADA		
Ericka J. Turner	Chaparral High	Las Vegas
Joan C. Turner	Las Vegas High	Las Vegas
NEW HAMPSHIRE		
Sharon C.McAuliffe	Concord High	Concord
Robert Veilleux	Central High	Manchester
NEW JERSEY		
Jeannine M. Duane	Black River Middle	Chester
Binnie J. Thom	Walter C. Black	Hightstown
NEW MEXICO		
Jennifer Dotson	Jones Ranch School	Jones Ranch
Laura Reeves	Rio Grande High	Albuquerque
NEW YORK		
Susan A. Agruso	East Islip High	Islip Terrace
Edward F. Duncanson	Crispell Middle	Pine Bush
NORTH CAROLINA		
Ernest W. Morgan	Morganton Jr. High	Morganton
Cynthia B.Zerger	Salisbury High	Salisbury
NORTH DAKOTA		
Sherry L. Hanson	A.L. Hagen Jr. High	Dickinson
Donald L. Hoff	Velva High	Velva
OHIO		
Gail B. Klink	Newark High	Newark
James B. Rowley	Centerville High	Centerville
OKLAHOMA		
Freda D. Deskin	Pauls Valley Middle	Pauls Valley
Frank E. Marcum	Booker T. Washington High	Tulsa
OREGON		
Stephen Boyarsky	Medford High	Medford
Michael Fitzgibbons	Forest Grove High	Forest Grove
PENNSYLVANIA		
Patricia Palazzolo	Clairton High	Clairton
Charles Tremer	Southern Lehigh	Center Valley

PUERTO RICO

Nancy M. Lee	Roosevelt Roads Middle	Ceiba
John G. Wells	Roosevelt Roads Middle	Ceiba

RHODE ISLAND

Ronald Reynolds	Barrington High	Barrington
Leisa Sadwin	Halliwell	North Smithfield

SOUTH CAROLINA

Michael H. Farmer	Riverside High	Greer
Myra J. Halpin	Goose Creek High	Goose Creek

SOUTH DAKOTA

Kevin M. Falon	Lincoln Sr. High	Sioux Falls
Gerald E. Loomer	Rapid City Central High	Rapid City

TENNESSEE

Carolyn H. Dobbins	McMurray Middle	Nashville
Bonnie D. Fakes	Lebanon High	Lebanon

TEXAS

Peggy Lathlaen	Westwood Elementary	Friendswood
Stephen A. Warren	Stephen F. Austin High	Austin

UTAH

John W. Barainca	Brighton High	Salt Lake City
Linda J. Preston	Park City High	Park City

VERMONT

Gail Breslauer	Fayston Elementary	Waitsfield
Michael Metcalf	Hazen Union	Hardwick

VIRGINIA

Ronald C. Fortunato	Norfolk Tech. Voc. Center	Norfolk
Judith M. Garcia	Jefferson School for Science & Technology	Alexandria

VIRGIN ISLANDS

Carol Eby	Peace Corps Elem.	St. Thomas
Rosa Hampson	Elena Christian Jr.	Christian-sted

WASHINGTON

Francis B. Call	Islander Middle	Mercer Island
Michael R. Jones	Kellogg Middle	Seattle

WEST VIRGINIA		
Nancy M. Wenger	Vandevender Jr. High	Parkersburg
Melanie B. Vickers	St. Albans Jr. High	St. Albans
WISCONSIN		
Ellen Baerman	Wisconsin Hills Elementary	Brookfield
Larry Scheckel	Tomah Senior High	Tomah
WYOMING		
Julie M. Gess	Evanston High	Evanston
Michael G. Pearson	McCormick Jr. High	Cheyenne

APPENDIX F

NATIONAL SELECTIION PANEL

NATIONAL SELECTION PANEL

Konrad K. Dannenberg, until his retirement, was NASA's Deputy Director for the MIssions and Payload Planning Program. Mr. Dannenberg was responsible for a wide range of research and development activities, including combustion engineering, rocket engine development, space vehicle design, test, check-out and launching, as well as space station design and experiments. In earlier experiences, Mr. Dannenberg was with NASA's Marshall Space Flight Center for several years, and was also Director of the Jupiter program for the Army Ballistic Missile Agency. Born and educated in Germany, Mr. Dannenberg received his M.S. in Mechanical Engineering from the Hanover Technology Institute.

Sidney P. Marland, Jr., former U.S. Commissioner of Education is President Emaritus of the College Entrance Examination Board, the national non-profit membership association of 2,400 colleges and universities. During his tenure in Washington, D.C. as United States Commissioner of Education and Assistant Secretary of Education, Dr. Marland was instrumental in the creation and implementation of the National Institute of Education and the Basic Educational Opportunity Grants Program. He began his career as a Superintendent of Schools in Connecticut after serving in World War II where he distinguished himself with the Bronze Star, Legion of Merit and the Distinguished Service Cross. Dr. Marland received his B.A. and M.A. degrees from the University of Connecticut in 1936 and 1950. He received his Ph. D. degree from New York University in 1955 in educational administration. Numerous monographs, essays and journal articles have expanded his audience beyond academia over the years.

Terri Sanford, former Governor of North Carolina, is president of Duke University. A lawyer by training, Dr. Sanford received his B.A. and J.D. from the University of North Carolina. His career has been a long and varied one, alternating between the public and private sectors. After completing law school, Dr. Sanford became Assistant Director of the Institute of Government at the University of North Carolina. Later as a practicing lawyer, Dr. Sanford went on to become a partner in the firm of Sanford, Adams, McCullough and Beard. From 1961 to 1965, he was elected Governor of North Carolina, and in 1969 he assumed his present position as President of Duke University. Dr. Sanford is the author of several publications, and has served on numerous commissions such as Urban America, the ITT International Fellowship Commission, the American Council of Young Political Leaders, and the Carnegie Commission for Educational Television.

Hortense Golden Canady is the National President of Delta Sigma Theta Sorority, Inc. as well as Assistant Director of Student Financial Services for Lansing Community College in Lansing, Michigan. Preceeding this position at the college, she was a researcher with Registered laboratories for the Department of Public Health in Lansing, Michigan as well as serving as the director of Community Nursery School. Mrs. Canady has had extensive experience serving on innumerable community organization boards. She has been the Treasurer of the Greater Lansing Area United Negro College Fund since 1962. Mrs. Canady was awarded the President's Award of the National Dental Association in 1979 and the "Black Book Award" for outstanding business and professional leaders by Dollars and Sense magazine. In 1980 she was selected "Citizen of the Year" by the N.A.A.C.P. Educationally, she received a B.A. degree in Biology from Fisk University and an M.A. degree in Management from Michigan State Unversity.

Richard Berendzen is an author, astronomer, and President of The American University in Washington, D.C. Dr. Berendzen completed his undergraduate degree at M.I.T., and his Master's and Doctorate at Harvard University, where he was also a teaching fellow and lecturer. From 1965 to 1973, Dr. Berendzen was a faculty member at Boston University, where he taught astronomy and later became Acting Dean of the department. He came to The American University in 1974 and assumed the position of Dean for the College of Arts and Sciences, and subsequently became University Provost in 1976. In 1980, Dr. Berendzen was named to his present position as President. Active in the field of astronomy, Dr. Berendzen has received numerous academic awards and is the author of a number of articles and publications. In addition, he is a frequent guest on radio and television shows featuring his views on higher education.

Anne Campbell is a former Commissioner of Education from the state of Nebraska, a position she held from 1974 until her retirement in 1983. She is currently the Vice President of the National P.T.A. Prior to assuming her role as Commissioner, Dr. Campbell was Director of Public Affairs for the University of Nebraska and earlier hald the position of Administrative Assistant of Governmental Services for the Nebraska Public Schools. In addition, Dr. Campbell worked as a lobbyist and Director of Professional Services for the Nebraska State Education Association, and was the Superintendent of Schools for Madison County, Nebraska. Receiving her undergraduate degree from the University of Northern Colorado, Dr. Campbell completed her M.S. in Supervision and Administration at Wayne State College, Nebraska and her Doctorate in Educational Administration from the University of Nebraska.

Harrison H.Schmitt, Jack Schmitt to his friends, has the extraordinarily varied experience of a geologist, scientist, astronaut, pilot, administrator, educator, writer and United States Senator. As a former astronaut he served as the Lunar Module Pilot for the Apollo 17 mission in 1972. As the only scientist to go to the Moon, he was also the last man of twelve to step on the Moon during the Apollo program. Following his participation in this historical project, Dr. Schmitt served as the Special Assistant to the Administrator and then as Assistant Administrator in the Office of Energy Programs. In 1976 he was elected to the U.S. Senate from New Mexico, where he served until 1982. Educated as an undergraduate at the California Institute of Technology, Dr. Schmitt went on to pursue graduate studies at the University of Oslo as a Fulbright Scholar, and completed his Ph.D. at Harvard University. In 1970, he was awarded the Distinguished Service Medal from NASA.

Esteban Soriano has served since early 1985 as the Coordinator of Program and Resource Development for the Lawrence Berkley Laboratory Office of Educational and Cooperative Research Programs with Minority Institutions. In this capacity, he designs and implements programs to increase the number of mathematics and science students and professionals. Prior to this recent assignment, he held the position of Executive Director of the Mathematics, Engineering, Science Achievement (MESA) national program where his versatility and verve were again required in the drafting and execution of strategies to increase the number of ethnic students who would become professionals in science and math. Before he entered educational administration, Soriano held a number of administrative and research development positions in the private sector. His educational preparation includes a Ph.D. in Communication Research from Stanford University and a B.S. in Marketing/Advertising from California State University, Fresno.

Edward F. Gibson is a physicist, educator, and former astronaut. A native of Colorado, Dr. Gibson completed his undergraduate and graduate work at the University of Colorado, where he was also a Research Assistant. He went on to conduct postdoctoral work at the University of Oregon, and later was a scientist-in-residence at the Naval Radiology Defense Laboratory. In 1969 Dr. Gibson joined the faculty of the California State University at Sacramento, and is currently Project Manager for the Space Station Project. In addition, Dr. Gibson has been quite active as a consultant for a number of organizations, including work on alternative energy sources conducted for the California Energy Commission, and computer-assisted instruction for the

Control Data Corporation. Dr. Gibson is an active member of several academic societies, including the American Physics Society and Phi Beta Kappa.

Virginia Smith has been President of Vassar College since 1977. Before assuming her present position, Ms. Smith was associated with a number of different organizations concerned with higher education. From 1973 to 1977, she was Director of the Fund for the Improvemnent of Postsecondary Education at the Department of Health, Education, and Welfare, a position which was preceded by her experience as Assistant and then Associate Director of the Carnegie Commission on Higher Education. Dr. Smith completed her B.A. and J.D. at the University of Washington, and later completed a Master's in Economics at the University of Washington as well. She gained several years of teaching experience in economics and business at the university level in Washington, and following postgraduate work at Columbia University, was also a Fulbright scholar. Dr. Smith has participated in numerous American delegations abroad addressing issues in higher education, and is a trustee of several educational organizations.

Dennis C. Carey is director of State Local Government Consulting Services for the Hay Group/Washington, D.C. Prior to joining Hay, Dr. Carey served as Secretary of Labor in Delaware, Education Advisor to the Governor, Assistant to the Superintendent of Schools in New Castle County, Delaware, and as a teacher in the Delaware Public Schools. Dr. Carey received his Ph.D. in public administration at the University of Maryland and has done post-graduate work at Princeton and Harvard. He has lectured and published articles on unemployment, trade, education and structured adjustment in the U.S. at various international, national and state conferences and meetings. Three years ago, Dr. Carey swam the English Channel.

Wes Unseld is Vice-President of the Washington Bullets and the Capital Centre in Washington, D.C. Since his retirement from professional basketball in 1981, Unseld has proved that he is equally successful as a front office executive as he was as a basketball player. He coordinates special events, serves as a liaison between Georgetown University and the Capital Centre and as head of Capital Centre charities. The six foot seven inch Unseld, who was best known for his bone-jarring picks and fullcourt outlet passes, was chosen by the Bullets on the first round of the 1968 NBA draft, after twice earning All-American honors at the University of Louisville. He was an instant success and in his inttial season was chosen both Rookie-of-the-Year and the League's Most Valuable Player. Unseld also makes major contributions to his community off the court. He serves on several boards including Mount St. Mary's College and does volunteer work at Kernan Hospital.

Phyllis Curtin is the Dean of the School of Fine Arts/School of Music at Boston University. Dr. Curtin was an opera singer for the Metropolitan Opera in New York, the Vienna Staats Opera, and La Scala in Milan. She sang throughout Europe, Australia, New Zealand and Israel as a recitalist. Dr. Curtin sang at the White House for Helmut Schmidt during Gerald Ford's administration. Professionally, Dr. Curtin has a distinguished career as an educator including a period as a Professor of music at Yale University from 1974-1979. She has served on the Opera Panel for the National Endowment for the Arts and has been an artist in residence at Tanglewood Music Center. Dr. Curtin gives masters classes at colleges and conservatories throughout the United States.

Donald K. (Deke) Slayton, former astronaut, is current President and Vice Chairman of Space Services Inc. of America as well as Chairman of Space America Inc.; President, International Formula One Pylon Air Races; Member, Department of Transportation Commercial Space Committee; Consultant, Aerospace Corporations; Director, Columbia Astronautics. Mr. Slayton has had an illustrious career as a NASA astronaut. He was named as one of the Mercury astronauts in April 1959. Slayton became the first Chief of the Astronaut Office in 1962, and in 1963 resigned his commission as an Air Force Major to assume the role of Director of Flight Crew Operations. He served as the Apollo Docking Module Pilot of the Apollo-Soyuz Test Project in 1975. This event signaled a major advance in efforts toward international mutual assistance in space exploration. In 1977, Slayton, as Manager of the Space Shuttle Approach and Landing Test, verified the capability to ferry the Shuttle aboard a 747. During WWII, he flew 56 combat missions and shortly after returning from the war, he earned a B.S. degree from the University of Minnesota in Aeronautical Engineering. He also holds honorary degrees from Carthage College and Michigan Technological University.

Dolores D. Wharton is President of The Fund for Corporate Initiatives, Inc., a non-profit organization devoted to strengthening the role of minorities and women in the corporate world. She is director of many corporations, including Phillips Petroleum Company, Kellogg Company, Gannett Company, and Blue Cross of Northeastern New York, Inc. In May, 1983, Mrs. Wharton was appointed by Governor Mario Cuomo of New York to the Council on Fiscal and Economic Priorities. In addition, Mrs. Wharton is extremely interested and involved in the arts. She is a trustee of the Museum of Modern Art and the Asia Society in New York City as well as a director of the Albany Institute of History and Art. In 1974, she was appointed by President Gerald Ford to a six-year term as a Council member of the National Endowment for the Arts. Mrs. Wharton has a B.A. in Fine Arts from Chicago State University, and was awarded an honorary Doctor of Humane Letters by Central Micihgan University in 1973. Mrs. Wharton has broad and accomplished travel experiences, particularly in Asia.

Robert Jarvik is President and Chief Executive Officer of Symbion, Inc., manufacturer of the JARVIK-7 artificial heart and INERAID artificial ear. He is also actively involved in the invention and design of more advanced products including the JARVIK-8 artificial heart and the implanted electrode components of the artificial ear. He holds the auxiliary faculty position of Research Assistant Professor of Surgery at the University of Utah School of Medicine. Dr. Jarvik graduated from Syracuse University in 1968, and then attended the university of Bologna School of Medicine in Bologna, Italy. He earned a master of arts in occupational biomechanics from New York University in 1971. Dr. Jarvik became involved in artificial heart research, including the design of the JARVIK-3 artificial heart, while he was Research Assistant for the Division of Artificial Organs at the University of Utah. In 1976, he earned a doctorate of medicine from the University of Utah School of Medicine and returned to the artificial heart research program full time. A recipient of numerous awards and honors, Jarvik holds five United States patents and has written over 60 articles and had lectured extensively in the United States and abroad.

Ralph Cualo is the Executive Vice-President in the Office of the President of Harcourt Brace Jovanovich, Inc. In addition, Mr. Caulo is Chief Executive Officer of the Elementary and Secondary Group of Harcourt Brace Jovanovich Publishers. In his latter position, Mr. Caulo is in charge of all publishing activities concerned with elementary and secondary education. Starting in sales, Mr. Caulo has been with Harcourt Brace Jovanovich for eleven years. Previously, he taught history, government, and English at the high school level for ten years. A graduate of California's University of Redlands, Mr. Caulo holds an M.A. in history.

Eugene A. Cernan is a former astronaut and currently serves as President of The Cernan Group in Houston, Texas, a group of space-related technology consulting firms. Captain Cernan was the second man to walk in space as the pilot on Gemini IX, and the last man to leave his footprints on the surface of the moon as Commander of Apollo XVII. He served as Senior United States Negotiator from 1973 through 1975 during discussions with the U.S.S.R. concerning the joint U.S.-Soviet Apollo/Soyuz project. Cernan holds a B.S. in electrical engineering form Purdue University and an M.S. in Aeronautical Engineering from the U.S. Navy Post Graduate School. He retired from the U.S. Navy in 1976 as Captain after serving twenty years as a naval aviator, thirteen of which were dedicated to direct involvement with the U.S. Space Program as a NASA astronaut. Captain Cernan is currently retained as technical consultant by the ABC Television network in support of ABC News and Special Events programming.

Pam Dawber, actress, is best known for her role in the highly acclaimed television series, Mork and Mindy, an innovative situation comedy in which she co-starred with Robin Williams. In March of 1985 Ms. Dawber was featured in "This Wife for Hire", an ABC-TV comedy movie of the week in which she portrayed a homemaker who starts her own "surrogate wife" business for harried single men. In the fall of 1985, she starred in a CBS-TV movie with Kenny Rogers called "Wild Horses". Pam's first love has always been the theater, ever since her high school days as a performer in musicals in Farmington, Michigan. After studying art and vocal music at Oakland Community College, Ms. Dawber began a modeling career at auto trade shows in Michigan, leading to the bright lights of New York City and a successful interlude as a model in the Big Apple. She then auditioned for a part in Robert Altman's "A Wedding" in Los Angeles, and subsequently, through the strange twists of providence, found herself a co-star of the "Mork and Mindy" television series, rather then landing the part with Altman. Pam is very concerned about solar energy and environmental issues and has made speaking appearances across the country.

LeRoy Hay was the 1983 National Teacher of the Year, and is currently a teacher of English at Manchester High School in Connecticut. He is also a part-time teacher at Sacred Heart University in Bridgeport. Chairman of the English Department at Manchester High Shcool, Hay was recently named Distinguished Alumnus of the University of Connecticut. He is frequently published in educational magazines and journals and is the only practicing teacher published in the "Great School Debate". His book was published in the Spring of 1986 on how to reshape schools for the age of information. Hay works as a consultant for school districts around the country on long range planning issues and in the past two years he has done over 200 presentations in thirty-seven states on the future of education (CCSSO media release, NASA files).

APPENDIX G

NATIONAL REVIEW COMMITTEE SUBCOMMITTEES

NATIONAL REVIEW COMMITTEE SUBCOMMITTEES

NSP NAME	STAFF LIAISON
SUBCOMMITTEE A:	
Hortense Canady	Debbie Moechoweitz
Konrad Dannenberg	Thom Jackson
Sidney Marland, Jr.	Roberta Waldman
Terry Sanford	Gerald Brown
SUBCOMMITTEE B:	
Richard Berendzen	Florence Bassett
Anne Campbell	Julia Pierce
Harrisaon Schmitt	Doug Bassett
Esteban	Susan Steele
SUBCOMMITTEE C:	
Edward Gibson	John Bittner
Dennis Carey	Frank Brouillet
Virginia Smith	Tina Burroughs
Wes Unseld	Tommie Williams
SUBCOMMITTEE D:	
Phyllis Curtin	Dottie Phillips
Robert Jarvik	Pam Bacon
Donald Slayton	Larry Bilbrough
Dolores Wharton	Doris Grigsby
SUBCOMMITTEE E:	
Ralph Caulo	S. Garrow
Eugene Cernan	William Keene
Pam Dawber	Kate Vahle
LeRoy Hay	Bud Haggardy

APPENDIX H

NATIONAL AWARDS CONFERENCE


The NASA
Teacher
in Space
Project
USA
Awards
22-27, 1985 Washington

The NASA Teacher in Space Project

Then Mars, then Saturn's rings;
And, growing, hope to show
All other beasts just how
To fly with dreams instead of ancient wings.
So, think on this: we're first! the only ones
Whom god has honored with his rise of suns.
For us as gifts Aldeberon, Centauri,
   homestead Mars.
Wake up, God says. Look there. Go fetch.
The stars. Oh. Lord, much thanks. The stars!

—Ray Bradbury
The Ghosts of Forever

National Awards Conference

Organized by the
National Aeronautics and Space
Administration
and the
Council of Chief State School Officers

June 22-27, 1985
Washington, DC

President
GORDON M. AMBACH
New York Commissioner of Education

President-Elect
FRANKLIN B. WALTER
Ohio Superintendent of Public Instruction

Vice President
FRANK B. BROUILLET
Washington Superintendent of Education

Directors
VERNE A. DUNCAN
Oregon Superintendent of Public Instruction

JERRY L. EVANS
Idaho Superintendent of Public Instruction

DAVID W. HORNBECK
Maryland State Superintendent of Schools

STEPHEN KAAGAN
Vermont Commissioner of Education

WAYNE TEAGUE
Alabama Superintendent of Education

CAROLYN WARNER
Arizona Superintendent of Public Instruction

Executive Director
WILLIAM F. PIERCE

CHIEF STATE SCHOOL OFFICERS • COUNCIL •

June 22, 1985

Dear Teacher in Space Project Nominees:

As part of this historic occasion, it is my pleasure to congratulate you on being selected as one of the 114 state and agency nominees for the NASA Teacher in Space Project, and to welcome you to Washington for what we all hope will be an exciting personal and professional experience this week.

The Council of Chief State School Officers is the membership organization for the 57 commissioners of education and state superintendents of schools in the United States and the extra-state jurisdictions. As the organization selected to oversee the selection process for this project, the chiefs, their staffs, and the Council staff members recognize you as a group of professionals dedicated to excellence. In addition, the NASA Teacher in Space Project has already provided a positive focal point for education in the media nationwide and continues daily to serve as a fine example of the outstanding aspects of our educational system. It is this spirit combined with the commitment and creativity each of you has brought to this historic event that contributes to the increased recognition of educators in our country.

I wish you all the very best as you participate in this week's events. It is my hope that this will be a significant experience that you can share with the students in your schools and the members of your community as part of the effort to further our knowledge and understanding of space.

Sincerely,

William F. Pierce
Executive Director

Education ...a sound investment in AMERICA.

COUNCIL OF CHIEF STATE SCHOOL OFFICERS
379 Hall of the States, 400 North Capitol Street, N.W., Washington, D.C. 20001 • 202/393-8161

NASA

National Aeronautics and Space Administration

Washington, D.C
20546

Office of the Administrator

June 22, 1985

Dear Teacher in Space Participants:

On behalf of the National Aeronautics and Space Administration, it is a pleasure for me to welcome you to Washington, D.C., for the Teacher in Space conference.

As nominees for the Teacher in Space Project, you represent the best of this country's educators--a group of creative, dynamic, and dedicated individuals who have shown a curiosity and interest in what the future in space may hold for us all. As teachers you are also in a unique position to convey that interest to students in your schools and communities. This is one of the reasons NASA selected a teacher as the first U.S. private citizen to participate in a space shuttle mission. What better type of person is there than a teacher who will be able to communicate about this once-in-a-lifetime experience, particularly to our Nation's young people.

It is an honor for us to be working with you on this historic project. We hope that in the next few days you will be able to learn more about our Nation's future in space, and return to your communities with a unique perspective to share with your fellow citizens and students. My congratulations to you as a group of fine professionals and participants in this significant event.

Sincerely,

James M. Beggs
Administrator

The NASA Teacher in Space Project

Program of Events

". . . Today I am directing NASA to begin a search in all of our elementary and secondary schools to choose the first citizen passenger in the history of our space program, one of America's finest—a teacher."

". . . When that shuttle lifts off, all of America will be reminded of the crucial roles teachers and education play in the life of our nation. I can't think of a better lesson for our children and our country."

—President Ronald Reagan
August 27, 1984

Program of Events

Saturday, June 22, 1985

7:00 Welcome Reception (Ballroom)

7:30 Banquet
Speakers:
Mr. James M. Beggs
Administrator
National Aeronautics and Space Administration

Dr. William F. Pierce
Executive Director
Council of Chief State School Officers

Michael J. Smith
Crew Member of STS-51-L Mission

Sunday, June 23, 1985

12:00 "Prepare for Exhilaration and Commitment" (Ballroom B)
Alan Ladwig
Manager, Space Flight Participant Program
National Aeronautics and Space Administration

1:00 "Space Science and Space Policy" (Ballroom B)
Dr. Richard Johnson
Assistant Director for Space Science and Technology
Office of Science and Technology
Executive Branch

2:00 Break

2:30 "Introduction to Workshops" (Ballroom B)
William D. Nixon
Chief, Elementary and Secondary Programs Branch
National Aeronautics and Space Administration

3:00 WORKSHOP SESSION 1 (See list for group assignment)
Columbia—"Living Aboard the Space Shuttle" (LaSalle)
Challenger—"Flying Aboard the Space Shuttle" (Lafayette)
Discovery—"Looking Toward the Heavens" (Montcalm)
Atlantis—"Looking Toward the Earth" (Marquette)

4:00 WORKSHOP SESSION 2
Columbia—"Looking Toward the Earth" (Marquette)
Challenger—"Living Aboard the Space Shuttle" (LaSalle)
Discovery—"Flying Aboard the Space Shuttle" (Lafayette)
Atlantis—"Looking Toward the Heavens" (Montcalm)

5:00 Rehearsal for Press Conference

5:45 Buses depart for Optional Sightseeing Tour on board "The Dandy"

11:00 Return to Hotel
(approximately)

Monday, June 24, 1985

8:00 "The World Looks at NASA" (Ballroom B)
Frank Johnson
Director, Public Affairs Division, NASA
Walter Pfister
President, Executive Television Workshop

9:30 "Accomplishments and Challenges for the National Space Transportation System" (Ballroom B)
Jesse W. Moore
Associate Administrator
Office of Space Flight
National Aeronautics and Space Administration

10:30 Break

10:45 Press Conference (Ballroom B)

12:00 LUNCH (Monet II)

1:00 "Planetary Sciences: Programs and Plans" (Ballroom B)
Dr. Bevan French
Acting Division Scientist
Earth Science and Applications Division
National Aeronautics and Space Administration

2:00 "The International World of Space" (Ballroom B)
Marcia Smith
Specialist in Aerospace Systems
Congressional Research Service

7:40 Walk to the National Air and Space Museum

8:00 Special Showing of the IMAX Film—"The Dream Is Alive"
National Air and Space Museum
6th and Independence Avenue, S.W.

8:45 Reception at the National Air and Space Museum

10:00 Return to hotel

Tuesday, June 25, 1985

8:00 WORKSHOP SESSION 3
Columbia—"Looking Toward the Heavens" (Montcalm)
Challenger—"Looking Toward the Earth" (Marquette)
Discovery—"Living Aboard the Space Shuttle" (LaSalle)
Atlantis—"Flying Aboard the Space Shuttle" (Lafayette)

9:30 "Living and Working in Space" (Ballroom B)
Joseph Allen and Judith Resnick
Johnson Space Center
National Aeronautics and Space Administration

10:30 Break

Program of Events

11:00 WORKSHOP SESSION 4
Columbia—"Flying Aboard the Space Shuttle" (Lafayette)
Challenger—"Looking Toward the Heavens" (Montcalm)
Discovery—"Looking Toward the Earth" (Marquette)
Atlantis—"Living Aboard the Space Shuttle" (LaSalle)

12:30 LUNCH (Monet II)

1:30 WORKSHOP SESSION 5
Columbia—"Working Aboard the Space Shuttle" (LaSalle)
Challenger—"Looking Toward the Future" (Lafayette)
Discovery—"Taking a Closer Look at the Extraterrestrials" (Montcalm)
Atlantis—"Using the Shuttle as a Laboratory" (Marquette)

3:00 End of Session

3:30 Buses depart for Capitol Hill

4:00 Congressional Reception and Photo Session
Special Remarks by Senator Jake Garn
Dirksen Senate Office Building
Room 192

6:00 Free Evening

Wednesday, June 26, 1985

8:00 "Historical Import of the NASA Teacher in Space Project" (Ballroom B)
Dr. William F. Pierce
Executive Director
Council of Chief State School Officers

9:00 Optional Sightseeing

11:00 Personal Interviews with National Selection Panel Judges begin (See appointment sheet in packet)

12:00 LUNCH (Monet II)

1:00 Buses depart for White House

3:15 Personal Interviews with Judges continue

8:00 Reception with National Selection Panel Judges
Musical Performance by Leonard David, Editor, *Space World Magazine* (Monet II)

Thursday, June 27, 1985

8:00 WORKSHOP SESSION 6
Columbia—"Using the Shuttle as a Laboratory" (Caucus)
Challenger—"Working Aboard the Space Shuttle" (Degas)
Discovery—"Looking Toward the Future" (Charles)
Atlantis—"Taking a Closer Look at the Extraterrestrials" (Pierre)

9:30 Break

10:00 WORKSHOP SESSION 7
Columbia—"Taking a Closer Look at the Extraterrestrials" (Pierre)
Challenger—"Using the Shuttle as a Laboratory" (Caucus)
Discovery—"Working Aboard the Space Shuttle" (Degas)
Atlantis—"Looking Toward the Future" (Charles)

11:30 LUNCH (South Foyer)

12:30 WORKSHOP SESSION 8
Columbia—"Looking Toward the Future" (Charles)
Challenger—"Taking a Closer Look at the Extraterrestrials" (Pierre)
Discovery—"Using the Shuttle as a Laboratory" (Caucus)
Atlantis—"Working Aboard the Shuttle" (Degas)

2:00 "Discussion of Ambassador's Kit" (Ballroom B)
William D. Nixon
Chief, Elementary and Secondary Programs Branch
National Aeronautics and Space Administration

2:30 Group Photograph and Press Interviews (Ballroom B/Foyer)

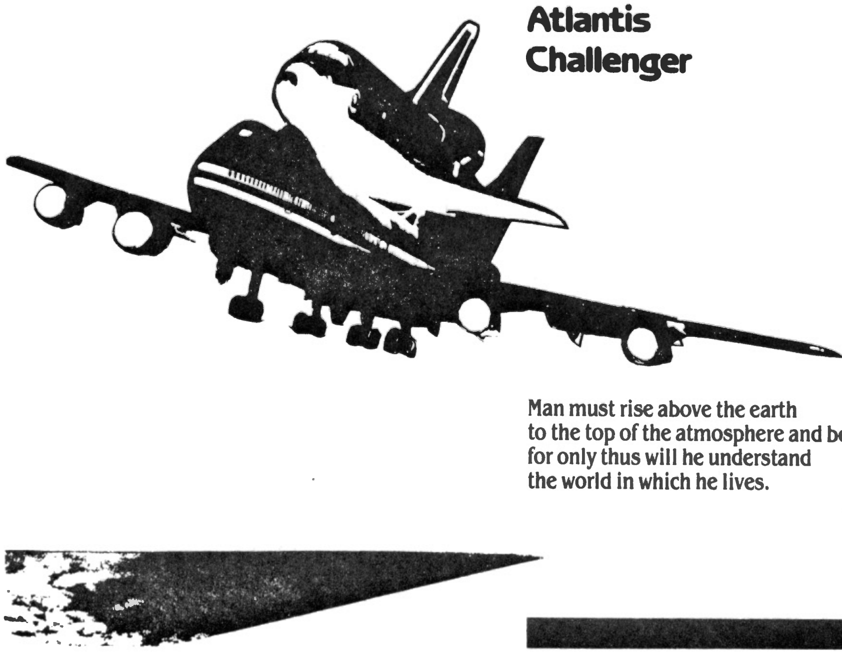
4:00 Closing Session of National Awards Conference (Ballroom B)
Ann P. Bradley
Associate Deputy Administrator
National Aeronautics and Space Administration
Terri Rosenblatt
Director, Teacher in Space Project
Council of Chief State School Officers
Alan Ladwig
Manager, Space Flight Participant Program
National Aeronautics and Space Administration

5:00 Program Ends

The NASA Teacher in Space Project

Workshop Coordinators List and Group Assignments

Columbia
Discovery
Atlantis
Challenger



Man must rise above the earth
to the top of the atmosphere and beyond—
for only thus will he understand
the world in which he lives.

—Socrates

Workshop Coordinators

Living Aboard the Space Shuttle
Mr. John Hartsfield, NASA
Aerospace Education Services Project
Lewis Research Center
National Aeronautics and Space Administration

Flying Aboard the Space Shuttle
Mr. Norman O. Poff, NASA
Aerospace Education Services Project
Headquarters
National Aeronautics and Space Administration

Looking Toward The Heavens
Mr. James McMurtray, NASA
Aerospace Education Services Project
National Space Technology Laboratories
National Aeronautics and Space Administration

Looking Toward the Earth
Dr. Harry B. Herzer, III, NASA
Aerospace Education Services Project
Headquarters
National Aeronautics and Space Administration

Working Aboard The Space Shuttle
Mr. Norman O. Poff

Looking Toward The Future
Mr. James McMurtray

Taking A Closer Look At The Extraterrestrials
Dr. Harry B. Herzer, III

Using The Shuttle As A Laboratory
Dr. Doris Grigsby, NASA
Aerospace Education Services Project
Headquarters
National Aeronautics and Space Administration

Workshop Group Assignments

Columbia (28)
Ellen Baerman
Henry Bouchelle
Gail Breslauer
Frances Call
Freda Deskin
Carolyn Dobbins
Jennifer Dotson
Jeannine M. Duane
Carol Eby
Robert S. Foerster
Derrick Fries
Stephanie Gerjovich-Wright
Donald Jonasson
Richard Kavanaugh
Robin Kline
Peggy Lathlaen
Barbara Morgan
Sharon Newman
Leisa Sadwin
Charles Sposato
Robert Stack
Binnie Thom
Stephen Tucker
Joan Turner
Denise VanBibber
Nancy Wenger
Judy White
Sherry Woodside

Discovery (29)
Kathleen Beres
Steven Boyarsky
Christopher Brown
Robert Carpenter
Joseph Ciotti
Gordon Corbett
William Dillon, Jr.
Edward Duncanson
Michael Fitzgibbons
Ronald Fortunato
Julie M. Gess
Lori M. Goetsch
Rosa Hampson
Sherry Hanson
Deborah Harris
Carol G. Hickson
Richard C. Houghton
Dale Jenkins
Michael R. Jones
Robert Mellette
Ernest W. Morgan
Michael Pearson
Linda J. Preston
Laura Reeves
Mary Smothers
William Townsend
Kenneth VanLew
Robert Veilleux
Cynthia B. Zeger

Atlantis (29)
Susan Agruso
John D. Baird
John Barainca
William Barwick, Jr.
Steve Brehmer
Sophia Ann Clifford
Nancy J. Cooksy
William A. Dempsey
Paul Dorrance
Michael Farmer
Pamela S. Grayson
Lynne M. Haeffele
Myra Halpin
Mildred J. Heinrich
Donald L. Hoff
Patricia Johnson
Arthur Kimura
Katherine Koch-Laveen
Gerald Loomer
Wendell G. Mohling
Connie Moore
James Natale
Roger Rea
JoAnne Reid
Michael Reynolds
Ronald Reynolds
Larry Scheckel
Barry L. Schwartz
David Warner

Challenger (28)
A. John Cazanas
Sue Darnell
Bonnie Fakes
Kevin Falon
Susan W. Forte
Judith Garcia
Thomas Garmon
Mary Beth Greenway
Gail B. Klink
Nancy Lee
Sharon McAuliffe
M. Bernadette McCorkle
Gloria McMillan
Frank W. Marcum
David Marquart
Michael Metcalf
Richard Methia
Patricia Palazzolo
Stanley Renfro
James B. Rowley
James R. Schaffer
Charles Tremer
Ericka J. Turner
Melanie B. Vickers
Stephen A. Warren
John Wells
Bruce Wixted
David R. Zahren

The NASA Teacher in Space Project

Profiles of Speakers

"... The hope is that this new breed of children of the space age will as fearlessly break with traditional thinking as did the Von Brauns of their age . . . In the universities of today, there are students who will surpass the deeds of those visionary optimists of the past. In our underprivileged youths there are those who will surmount difficulties and emerge as leaders despite their disadvantages. Such people will lead the future Lewis and Clark expeditions across the Mississippis of space."

—Eric Burgess
New Worlds:
Discoveries From Our
Solar System

Profiles of Speakers

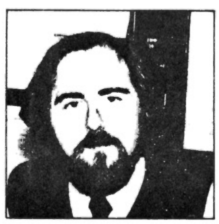
James M. Beggs

James M. Beggs was appointed by President Reagan in 1981 as Administrator of the National Aeronautics and Space Administration (NASA), and is the sixth man to head the nation's civilian space agency. Before joining NASA, he was Executive Vice-President and a director of General Dynamics Corp. in St. Louis, MO. Mr. Beggs served with NASA in a previous capacity, as Associate Administrator for the Office of Advanced Research and Technology from 1968 to 1969. Continuing his work in government, Mr. Beggs was appointed Under Secretary of Transportation in 1969, a position he held until 1973 and followed by his employment with General Dynamics. Additional experience was also acquired during 13 years of service with Westinghouse Electric Corp. Mr. Beggs is a graduate of the U.S. Naval Academy and the Harvard Graduate School of Business Administration and in addition, has received numerous honorary degrees.

Ann P. Bradley

Ann P. Bradley was named Associate Deputy Administrator of NASA in 1984. In her 12 years with NASA, Ms. Bradley has held a number of responsibilities, starting as a Personnel Management Specialist at NASA in Washington, DC. In 1974, she was appointed a Princeton Fellow in Public Affairs and attended the Woodrow Wilson School at Princeton University. She returned to NASA in 1975 as the Executive Assistant to George M. Lowe, Deputy Administrator of NASA, and later went on to assume positions as the Director of Administration and Management Support at NASA's Dryden Flight Research Center at Edwards, California and as Manager of the NASA Resident Office at the Jet Propulsion Laboratory in Pasadena, California. In 1980 she returned to Washington as Deputy Associate Administrator for Management Operations, and in 1982 was awarded NASA's Exceptional Service Medal. Prior to joining NASA, Ms. Bradley served in various personnel management positions with the Office of Economic Opportunity and the Agency for International Development.

Leonard David



Leonard David is editor of *Space World Magazine*, published by the National Space Institute. As a writer and an educator in space education, he has contributed numerous articles to publications such as *OMNI* and *Science Digest* and is the author as well of several papers. Mr. David's previous professional experience includes work with NASA's Shuttle Student Involvement Project, and a variety of other projects designed to promote understanding and knowledge of space. A native of California, Mr. David is a graduate of San Diego State University. He is also an active musician and the winner of several songwriting contests.

Profiles of Speakers

Bevan M. French

Bevan M. French has been NASA's Discipline Scientist for Planetary Materials since 1975, administering an extensive research program on lunar samples, meteorites, and cosmic dust. More recently, Dr. French has become involved in advanced science planning for future planetary missions, and he is now also Program Scientist for the Mars Observer Mission, an unmanned Mars-orbiting satellite to be launched in 1990. Dr. French was associated with NASA from 1964 to 1972 at the Goddard Space Flight Center conducting research on ancient terrestrial meteorite impact structures as well as on lunar samples from several missions. In 1972, Dr. French became Program Director of the National Science Foundation's Geochemistry program, before assuming his present responsibilities at NASA. In addition to research and administration, Dr. French has done a great deal of writing on space science for NASA publications and popular periodicals such as *OMNI*. In 1977, Penguin books published his *The Moon Book*, a nontechnical description of lunar discoveries for the general reader.

Jake Garn

Jake Garn, U.S. Senator from Utah, was a crew member of the Space Shuttle mission Discovery. First elected to the senate in 1974, Senator Garn is currently serving his second term having been re-elected in 1980. Senator Garn is chairman of the Senate Banking, Housing, and Urban Affairs Committee, and serves as well on the Appropriations and Rules and Administration Committees. In addition, he is co-chairman of the Coalition for Peace through Strength and a member of the Senate Republican Policy Committee, the Senate Drug Enforcement Caucus, and the Senate Caucus on the Family. Before being elected to the Senate, Senator Garn was commissioner as well as mayor of Salt Lake City, and the first vice-president of the National League of Cities. He is a graduate of the University of Utah and served as a lieutenant in the U.S. Navy.

Doris K. Grigsby

Doris K. Grigsby has been at NASA Headquarters since July 1983 as an Educational Programs Officer serving as project manager for the Space Exposed Experiment for Students (SEEDS) and the Space Shuttle Student Involvement Program (SSIP). Dr. Grigsby has a wide range of experience as a science educator, having taught at all levels of secondary school in addition to university level courses in Biology, Zoology, Microbiology, Anatomy, and Physiology. She has also conducted graduate workshops in Aerospace Education and Energy Education. Outside of the classroom, Dr. Grigsby has written curriculum projects in Aerospace Education, Environmental Education, and Energy Education for the Oklahoma State Department of Education and has also developed study guides and laboratory manuals in Microbiology and Anatomy & Physiology for the National Science Foundation.

John W. Hartsfield

John W. Hartsfield is an Aerospace Education Specialist with the NASA Aerospace Education Project at Lewis Research Center. Prior to joining the project in 1970, Mr. Hartsfield was the Dean of Students at Lincoln College in Lincoln, Illinois. In addition to his experience in higher education administration, Mr. Hartsfield taught elementary education for several years, including a year in the field of biology, and was also a guidance counselor. A native of Arkansas, he received his Bachelor of Science degree and his Master of Science degree in Education from the State College of Arkansas.

Profiles of Speakers

Harry B. Herzer

Harry B. Herzer is involved with the Aerospace Education Services Project at NASA Headquarters in Washington, DC. Dr. Herzer travels extensively throughout the United States and Canada, lecturing, conducting workshops, coordinating community aerospace awareness programs, and serving as a consultant to schools, colleges, universities, and educational television facilities. A native of Kansas, Dr. Herzer earned a Bachelor of Arts degree in chemistry and a Bachelor of Science degree in natural science from The College of Emporia, a Master of Science degree in physics and chemistry from Kansas State Teachers College, and a doctorate in chemistry and science education from Oklahoma State University. His teaching experience is quite extensive, ranging from the secondary to the university level, and including positions as a visiting professor at several colleges and universities.

Frank S. Johnson, Jr.

Frank S. Johnson Jr. is NASA's Director of Public Affairs, and is responsible for planning and directing the full range of NASA's activities in providing information to and responding to inquiries from the public and the media. Before joining NASA, Mr. Johnson was president and chief executive of Frank Johnson and Associates, Ltd., New York, a company he founded in 1981. His firm provided consulting assistance to a number of major corporations including Newport News Shipbuilding, a Tenneco company for which he was also Vice President of Public Relations. Earlier Mr. Johnson had been Vice President for Public Affairs for Revlon, Inc.; Corporate Director of Public Affairs and Advertising for General Dynamics; Director of Public Affairs for the U.S. Department of Labor; and Vice President of the Chicago Board of Trade. In addition, he has served in a number of information and community relations positions with IBM.

Richard G. Johnson

Richard G. Johnson is Assistant Director for Space Science and Technology in NASA's Office of Science and Technology Policy, Executive Office of the President. His professional background includes experience with the Palo Alto Research Laboratory of the Lockheed Missiles and Space Company, where for 27 years he conducted a broad range of research in low energy nuclear physics and in the space sciences. Dr. Johnson was Manager of the Space Sciences Laboratory for ten years and Senior Science Advisor to the Director of Research for five years. In 1980 he served as a visiting professor at the University of Bern. Active in a number of national and international professional societies, Dr. Johnson is co-discoverer of energetic helium and oxygen ions in the earth's radiation belts and has authored over 60 papers on auroras and radiation belt phenomena.

Alan Ladwig

Alan Ladwig is currently the Manager of the Space Flight Participant Program, NASA's initiative to provide opportunities for private citizens to fly on the Space Shuttle. Working in the Office of Space Flight at NASA headquarters in Washington, DC, Mr. Ladwig is also the Manager for Middeck and Nonscientific Payloads that fly on the Shuttle. Mr. Ladwig has been an active participant in NASA's Speaker's Bureau and has appeared on numerous radio and television programs including Late Night with David Letterman, the Merv Griffin Show, and CBS Nightwatch. In other capacities at NASA, Mr. Ladwig has been Manager of the Shuttle Student Involvement Project as well as the Executive Officer to the Associate Administrator for Space Flight.

Profiles of Speakers

James McMurtray

James McMurtray serves as an Aerospace Education Specialist at the National Space Technology Laboratories near Bay St. Louis, Mississippi. As NSTL's education specialist, Mr. McMurtray presents programs on NASA activities and those of NSTL's resident agencies to universities, public schools, and civic and professional groups throughout Mississippi, Louisiana, and the Gulf States. He also conducts workshops and symposia at NSTL's Visitor's Center. Before coming to NSTL, Mr. McMurtray was director of STARS planetarium in Jackson County, MS, where he developed and produced *STARLIGHT*, an instructional planetarium presentation on the physics of stars. He has extensive experience as a lecturer on astronomy and related sciences at the college, secondary and elementary levels, and is currently adjunct associate professor at Oklahoma State University.

Jesse Moore

Jesse Moore is currently the Associate Administrator for Space Flight at NASA Headquarters in Washington, DC. He is in charge of overseeing the planning, direction, execution, and evaluation of all projects and activities concerned with space transportation systems, including the Space Shuttle. Mr. Moore came to NASA Headquarters in 1978 as the Deputy Director of the Solar Terrestrial Division in the Office of Space Science. He was the Director of the Spacelab Flight Division until 1981, at which time he assumed the position of Director, Earth and Planetary Exploration Division in the Office of Space Science and Applications. In 1983 Mr. Moore was appointed to the position of Deputy Associate Administrator for Space Flight, and in 1984 to his current position. A native of South Carolina, Mr. Moore completed his Master's degree in Electrical Engineering at the University of South Carolina.

William D. Nixon

William D. Nixon heads up the Elementary and Secondary Programs Branch of NASA's Educational Affairs Division. Mr. Nixon plans, develops and implements agency-wide NASA educational programs which provide teacher education instructional materials, audiovisuals, publications, youth activities, and lecture demonstrations. Prior to his current position, he directed the Teacher Services Program in NASA's Education Programs Division and was also Chief of the Educational Programs Branch for the Kennedy Space Center. In addition, Mr. Nixon has worked as a space science lecturer and consultant; has been a producer for educational television in Orlando, Florida; and was a science teacher in the Orange County Schools, Florida.

Walter Pfister

Walter Pfister, a veteran of television news production, is co-owner of the Executive Television Workshop, serving some of the nation's largest and most prestigious corporations and associations. Before assuming his present position, he accumulated over 20 years of experience in network television news, starting in Chicago as a writer for CBS Newsfilms. He went on to manage NBC's Midwest bureau, and later moved to New York as a writer for the Huntley/Brinkley Report. From 1963 to 1975, Mr. Pfister was associated with ABC News as a producer and later as the executive producer for special events. In 1975, he became Vice-President of ABC News, in charge of supervising all special live programming. Mr. Pfister is the recipient of two Emmy Awards, including one for his coverage of President Nixon's historic visit to China in 1972. He has taught broadcast journalism at Brooklyn College, and is a frequent lecturer at colleges and universities across the country.

Profiles of Speakers

William F. Pierce

William F. Pierce has been the Executive Director of the Council of Chief State School Officers since 1978. Before coming to the Council, Dr. Pierce served in several capacities in the former Office of Education, including two different periods as the Acting U.S. Commissioner of Education as well as the Deputy Commissioner for Occupational and Adult Education. In addition, Dr. Pierce was the Deputy Superintendent of Public Instruction in Michigan for three years and was also the State Director of Vocational Education. Along with his administrative experience, Dr. Pierce was a vocational agriculture teacher in California and served as a consultant to Manpower Development Training in Michigan. He has received several academic awards, is a member of various professional organizations, and is the author of a number of articles.

Norman O. Poff

Norman O. Poff is an Aeronautics Education Specialist with NASA and is also an Adjunct Assistant Professor at Oklahoma State University. In his position with NASA, Mr. Poff works as a lecturer on NASA's role in aeronautics research. A native of Roanoke, Virginia, Mr. Poff has taught aeronautics, computer science, economics, math, physics, and physical science in the Roanoke City School System and was also an instructor in the private pilot ground school at Virginia Western Community College. In addition, he has been a flight instructor for Piedmont Aviation. Mr. Poff did his undergraduate work in Economics and Business Administration at Roanoke College, and completed his Master's degree in Science at Hollins College.

Terri Rosenblatt

Terri Rosenblatt is the Director of the NASA Teacher in Space Project for the Council of Chief State School Officers. In addition, she is also the Council's Director of International Education. She has had ten years of experience in international education during which she has directed programs at the International House in New York, the American Assembly of Collegiate Schools of Business in Washington, DC, and the Foreign Student Service Council. Before coming to the Council, Ms. Rosenblatt was also a consultant in international education for her consulting firm, Resources International, Inc. In addition to an undergraduate degree from Mt. Holyoke College in French and German and a Master's in International Administration from the School for International Training, Ms. Rosenblatt has lived in France and England and travelled in Europe and Africa.

Marcia S. Smith

Marcia S. Smith is a specialist in aerospace and telecommunications systems for the Congressional Research Service, Library of Congress. Previously, she was an analyst in aerospace and energy systems for the Congressional Research Service and has worked for the American Institute of Aeronautics and Astronautics. A graduate of Syracuse University, Ms. Smith is an Associate Fellow of the British Interplanetary Society, a member of the American Association for the Advancement of Science, and also serves on the Board of Directors for the American Astronautical Society.

The NASA Teacher in Space Project

List of Nominees and Members of National Selection Panel

"We can lift ourselves out of ignorance,
we can find ourselves as creatures
of excellence and intelligence and skill.
We can be free!
We can learn to fly!!"

Richard Bach
Jonathan Livingston Seagull

List of Nominees

ALABAMA
Sophia Ann Clifford
Erwin High
Birmingham

Pamela Sue Grayson
Minor High
Birmingham

ALASKA
Mildred J. Heinrich
Robert Service High
Anchorage

Richard C. Houghton
Napaaqtugmiut High
Noatak

ARIZONA
Robert Carpenter
Secrist Middle
Tucson

Robin Kline
Tonalea Elementary
Scottsdale

ARKANSAS
William A. Dempsey
Arkansas Sr. High
Texarkana

Mary Beth Greenway
Parkview High
Little Rock

BUREAU OF INDIAN AFFAIRS
Stanley Renfro
Wingate High
Ft. Wingate

Sherry Woodside
Wingate Elementary
Ft. Wingate

CALIFORNIA
William M. Dillon, Jr.
Peninsula High
San Bruno

Gloria M. McMillan
La Jolla High
La Jolla

COLORADO
James Kim Natale
Pomona High
Arvada

Robert Stack
Shawsheen High
Greeley

CONNECTICUT
Robert Mellette
Conte Arts Magnet
New Haven

David Warner
Westminster
Simsbury

DELAWARE
Henry E.W. Bouchelle
Pilot
Wilmington

Stephanie Gerjovich-Wright
Stanton Middle
Wilmington

DEPARTMENT OF DEFENSE
Mary Smothers
Kaiserslautern American High

Kenneth VanLew
Frankfurt High

DEPARTMENT OF STATE
Donald Jonasson
Jakarta International

Bruce Wixted
American of Kuwait

DISTRICT OF COLUMBIA
William A. Barwick, Jr.
Woodrow Wilson High

Nancy J. Cooksy
Eastern High

FLORIDA
Susan W. Forte
Georgestone Vocational
Pensacola

Michael D. Reynolds
Duncan U. Fletcher Sr.
Neptune Beach

GEORGIA
Thomas Phillip Garmon
Benjamin E. Mays High
Atlanta

Carol G. Hickson
Fernback Science Center
Atlanta

GUAM
Dale J. Jenkins
St. John's
Tumon Bay

M. Bernadette McCorkle
Vocational High
Barrigada

HAWAII
Joseph Ciotti
St. Louis High
Honolulu

Arthur Kimura
McKinley High
Honolulu

IDAHO
David M. Marquart
Boise High
Boise

Barbara R. Morgan
McCall-Donnelly Elementary
McCall

ILLINOIS
John D. Baird
Quincy Sr. High
Quincy

Lynne M. Haeffele
Bloomington High
Bloomington

INDIANA
Robert S. Foerster
Cumberland Elementary
W. Lafayette

Stephen L. Tucker
West Vigo High
W. Terre Haute

IOWA
A. John Cazanas
Rockford Sr. High
Rockford

Lori M. Goetsch
Mt. Pleasant Jr. High
Mount Pleasant

KANSAS
Wendell G. Mohling
Shawnee Mission NW High
Shawnee Mission

Barry L. Schartz
Goddard High
Goddard

KENTUCKY
Sue Ellen W. Darnell
North Marshall Jr. High
Calvert City

Judy A. White
L.C. Curry Elementary
Bowling Green

LOUISIANA
Deborah Harris
Rusheon Jr. High
Bossier City

Denise Van Bibber
Alexandria Country Day
Alexandria

MAINE
Gordon L. Corbett
Yarmouth Intermediate
Yarmouth

William C. Townsend
Sumner Memorial High
East Sullivan

MARYLAND
Kathleen Beres
Kenwood High
Baltimore

David R. Zahren
G. Gardner Shugart Middle
Hillcrest Heights

MASSACHUSETTS
Richard Methia
New Bedford High
New Bedford

Charles Sposato
Farley Middle
Framingham

MICHIGAN
Derrick Fries
Seaholm High
Birmingham

Sharon Newman
West Hills Middle
West Bloomfield

MINNESOTA
Steve L. Brehmer
Wanamingo Public
Wanamingo

Katherine Koch-Laveen
Apple Valley High
Apple Valley

MISSISSIPPI
Connie Moore
Oak Grove High
Hattiesburg

JoAnne Reid
Weir Attendance Center
Weir

List of Nominees

MISSOURI

Christopher W. Brown
McCluer N. Senior High
Florissant

Richard K. Kavanaugh
Park Hill R-5
Kansas City

MONTANA

Paul Dorrance
Helena High
Helena

Patricia Johnson
Capital High
Helena

NEBRASKA

Roger U. Rea
Northwest High
Omaha

James R. Schaffer
Lincoln East High
Lincoln

NEVADA

Ericka J. Turner
Chaparral High
Las Vegas

Joan C. Turner
Las Vegas High
Las Vegas

NEW HAMPSHIRE

Sharon C. McAuliffe
Concord High
Concord

Robert Veilleux
Central High
Manchester

NEW JERSEY

Jeannine M. Duane
Black River Middle
Chester

Binnie J. Thom
Walter C. Black
Hightstown

NEW MEXICO

Jennifer Dotson
Jones Ranch School
Jones Ranch

Laura Reeves
Rio Grande High
Albuquerque

NEW YORK

Susan A. Agruso
East Islip High
Islip Terrace

Edward F. Duncanson
Crispell Middle
Pine Bush

NORTH CAROLINA

Ernest W. Morgan
Morganton Jr. High
Morganton

Cynthia B. Zeger
Salisbury High
Salisbury

NORTH DAKOTA

Sherry L. Hanson
A.L. Hagen Jr. High
Dickinson

Donald L. Hoff
Velva High
Velva

OHIO

Gail B. Klink
Newark High
Newark

James B. Rowley
Centerville High
Centerville

OKLAHOMA

Freda D. Deskin
Pauls Valley Middle
Pauls Valley

Frank E. Marcum
Booker T. Washington High
Tulsa

OREGON

Stephen Boyarsky
Medford High
Medford

Michael Fitzgibbons
Forest Grove High
Forest Grove

PENNSYLVANIA

Patricia Palazzolo
Clairton High
Clairton

Charles Tremer
Southern Lehigh
Center Valley

PUERTO RICO

Nancy M. Lee
Roosevelt Roads Middle
Ceiba

John G. Wells
Roosevelt Roads Middle
Ceiba

RHODE ISLAND

Ronald Reynolds
Barrington High
Barrington

Leisa Sadwin
Halliwell
North Smithfield

SOUTH CAROLINA

Michael H. Farmer
Riverside High
Greer

Myra J. Halpin
Goose Creek High
Goose Creek

SOUTH DAKOTA

Kevin M. Falon
Lincoln Sr. High
Sioux Falls

Gerald E. Loomer
Rapid City Central High
Rapid City

TENNESSEE

Carolyn H. Dobbins
McMurray Middle
Nashville

Bonnie D. Fakes
Lebanon High
Lebanon

TEXAS

Peggy Lathlaen
Westwood Elementary
Friendswood

Stephen A. Warren
Stephen F. Austin High
Austin

UTAH

John W. Barainca
Brighton High
Salt Lake City

Linda J. Preston
Park City High
Park City

VERMONT

Gail Breslauer
Fayston Elementary
Waitsfield

Michael Metcalf
Hazen Union
Hardwick

VIRGINIA

Ronald C. Fortunato
Norfolk Tech. Voc. Center
Norfolk

Judith M. Garcia
Jefferson School For
Science & Technology
Alexandria

VIRGIN ISLANDS

Carol Eby
Peace Corps Elementary
St. Thomas

Rosa Hampson
Elena Christian Jr. High
Christiansted

WASHINGTON

Francis B. Call
Islander Middle
Mercer Island

Michael R. Jones
Kellogg Middle
Seattle

WEST VIRGINIA

Nancy M. Wenger
Vandevender Jr. High
Parkersburg

Melanie B. Vickers
St. Albans Jr. High
St. Albans

WISCONSIN

Ellen Baerman
Wisconsin Hills Elementary
Brookfield

Larry Scheckel
Tomah Senior High
Tomah

WYOMING

Julie M. Gess
Evanston High
Evanston

Michael G. Pearson
McCormick Jr. High
Cheyenne

Members of National Selection Panel

Richard Berendzen
President
The American University
Washington, D.C.

Anne Campbell
Former Commissioner of Education
Vice President, National PTA
Lincoln, Nebraska

Hortense Canady
National President
Delta Sigma Theta Sorority, Inc.
Lansing, Michigan

Ralph Caulo
Executive Vice President
Office of the President
Harcourt Brace Jovanovich, Inc.
Orlando, Florida

Eugene A. Cernan
Former Astronaut
President
The Cernan Group
Houston, Texas

Phyllis Curtin
Dean, School of Fine Arts/School of Music
Boston University
Boston, Massachusetts

Konrad K. Dannenberg
Former NASA Engineer
Huntsville, Alabama

Pam Dawber
Actress
Los Angeles, California

Edward F. Gibson
Former Astronaut
Project Manager, Space Station
TRW
Redondo Beach, California

LeRoy Hay
1983 National Teacher of the Year
Teacher, Manchester High School
Manchester, Connecticut

Sidney P. Marland, Jr.
Former U.S. Commissioner of Education
President Emeritus, The College Board
Hampton, Connecticut

Patsy Mink
Former U.S. Congresswoman
Chairperson, City Council
Oahu, Hawaii

Terry Sanford
Former Governor
President
Duke University
Durham, North Carolina

Harrison H. Schmitt
Former Astronaut and U.S. Senator
Consultant
Albuquerque, New Mexico

Donald K. (Deke) Slayton
Former Astronaut
President
Space Services Inc. of America
Houston, Texas

Virginia Smith
President
Vassar College
Poughkeepsie, New York

Esteban Soriano
Coordinator, Educational Programs and Resource Development
Lawrence Berkeley Lab
Berkeley, California

Wes Unseld
Vice President
Washington Bullets/Capital Center
Washington, D.C.

Dolores D. Wharton
President
The Fund for Corporate Initiatives, Inc.
Albany, New York

CCSSO Ad Hoc Committee for the NASA Teacher in Space Project

Doug Bassett
Public Information Officer
State Department of Education
Denver, Colorado

Frank Brouillet
Superintendent of Public Instruction
Olympia, Washington

Gerald R. Brown
Office of the Deputy Superintendent
Washington, D.C.

William Keene
State Superintendent of Public Instruction
Dover, Delaware

Alan Ladwig
Manager
Space Flight Participant Program
National Aeronautics and Space Administration
Washington, D.C.

Dottie Phillips
Teacher of the Year Coordinator
NASA Teacher in Space Coordinator
State Department of Education
Columbus, Ohio

William F. Pierce (Chair)
Executive Director
Council of Chief State School Officers
Washington, D.C.

Terri Rosenblatt
Director
NASA Teacher in Space Project
Council of Chief State School Officers
Washington, D.C.

Roberta Waldman
Teacher of the Year Coordinator
NASA Teacher in Space Coordinator
Department of Education
Harrisburg, Pennsylvania

NASA Evaluation Committee

Ann P. Bradley
Associate Deputy Administrator
Office of the Administrator

S. Neil Hosenball
General Counsel
Office of General Counsel

Russell Ritchie
Acting Associate Administrator
Office of External Relations

Jesse W. Moore
Associate Administrator
Office of Space Flight

C. Robert Nysmith
Associate Administrator
Office of Management

Frank B. McDonald
Chief Scientist
Office of the Chief Scientist

Harriett G. Jenkins
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Office of Equal Opportunity Programs

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Alan Ladwig
Manager
Space Flight Participant Program
National Aeronautics and Space Administration

Tina Burroughs
Program Support Assistant
Space Flight Participant Program
National Aeronautics and Space Administration

"I believe that there are moments in history when challenges occur of such a compelling nature that to miss them is to miss the whole meaning of an epoch. Space is such a challenge. It is the kind of challenge William Shakespeare sensed nearly 400 years ago when he wrote:

There is a tide in the affairs of men,
Which, taken at the flood, leads on to fortune;
Omitted, all the voyage of their life
Is bound in shallows and in miseries.
On such a full sea are we now afloat,
And we must take the current when it serves
Or lose our ventures.

We risk great peril if we kill off this spirit of adventure, for we cannot predict how and in what seemingly unrelated fields it will manifest itself. A nation which loses its forward thrust is in danger, and one of the most effective ways to retain that thrust is to keep exploring possibilities. The sense of exploration is intimately bound up with human resolve, and for a nation to believe that it is still committed to forward motion is to ensure its continuance."

—James A. Michener, author

Excerpts from testimony before the Senate Subcommittee on Science, Technology and Space

National Aeronautics and Space Administration

NASA Teacher in Space Project
Council of Chief State School Officers
400 North Capitol Street—Suite 379
Washington, D.C. 20001

APPENDIX I

THE TEN FINALISTS


Teacher in Space Project
NASA

NASA'S TEN TEACHER IN SPACE FINALISTS

July 1, 1985 Photo No. 85-H-216
85-HC-187

Headquarters, Washington, D.C. -- The National Aeronautics and Space Administration and the Council of Chief State School Officers announced today the ten finalists in the NASA Teacher in Space Project. They are as seen from left to right in this photograph: (1) Barbara R. Morgan, McCall, Idaho. (2) Richard A. Methia, New Bedford, Mass. (3) Kathleen Anne Beres, Baltimore, Md. (4) Robert S. Foerster, West Lafayette, Ind. (5) Nikki Mason Wenger, Parkersburg, West Va. (6) Michael W. Metcalf, Hardwick, Vt. (7) Peggy J. Lathlaen, Friendswood, Tx. (8) David M. Marquart, Boise, Idaho. (9) Sharon Christa McAuliffe, Concord, N.H. (10) Judith Marie Garcia, Alexandria, Va.

TEACHER IN SPACE FINALISTS

BIOGRAPHIES

David M. Marquart of Boise High School, Boise Idaho. A film maker and amateur radio operator, Mr Marquart teaches business and computer science. He has been a teacher for twenty years.

Barbara R. Morgan of McCall-Donnelly Elementary School, NcCall, Idaho. In addition to her eleven-year teaching career, Ms. Morgan has found time to travel extensively in Central America and in Ecuador, where she taught English, and to participate in community music, folk culture, dance and drama groups.

Robert S. Foerster of Cumberland Elementary School, West Lafayette, Indiana. Mr. Foerster teaches sixth grade math, computer and science courses. He lectures frequently to students and local, state and national groups on computers and the future of technology and serves as a consultant to the U.S. Department of Education.

Kathleen Anne Beres of Kenwood High School, Baltimore, Maryland. Ms. Beres teaches biology and field biology. She also climbs mountains -- in the Andes, the Himalayas and elsewhere, and recently crossed the Atlantic with three companions in a thirty-one foot sailboat.

Richard A. Methia of New Bedford High School, New Bedford, Massachusetts. Mr. Methia teaches English and writes poetry, short stories and award-winning plays. He is chairman of New Bedford's Human Relations Commission and participates in a wide variety of community programs to help young people.

Sharon Christa McAuliffe of Concord High School, Concord, New Hampshire. Ms. McAuliffe is a social studies teacher and a board member of the New Hampshire Council for the Social Studies. She is active in the Girl Scouts and in many community programs.

Peggy J. Lathlean of Westwood Elementary School, Friendswood, Texas. Ms. Lathlean has been teaching for twelve years and is associated with the National Association for Gifted Children and the Creative Problem-Solving Institute. She is president of the International House Foreign Students Program.

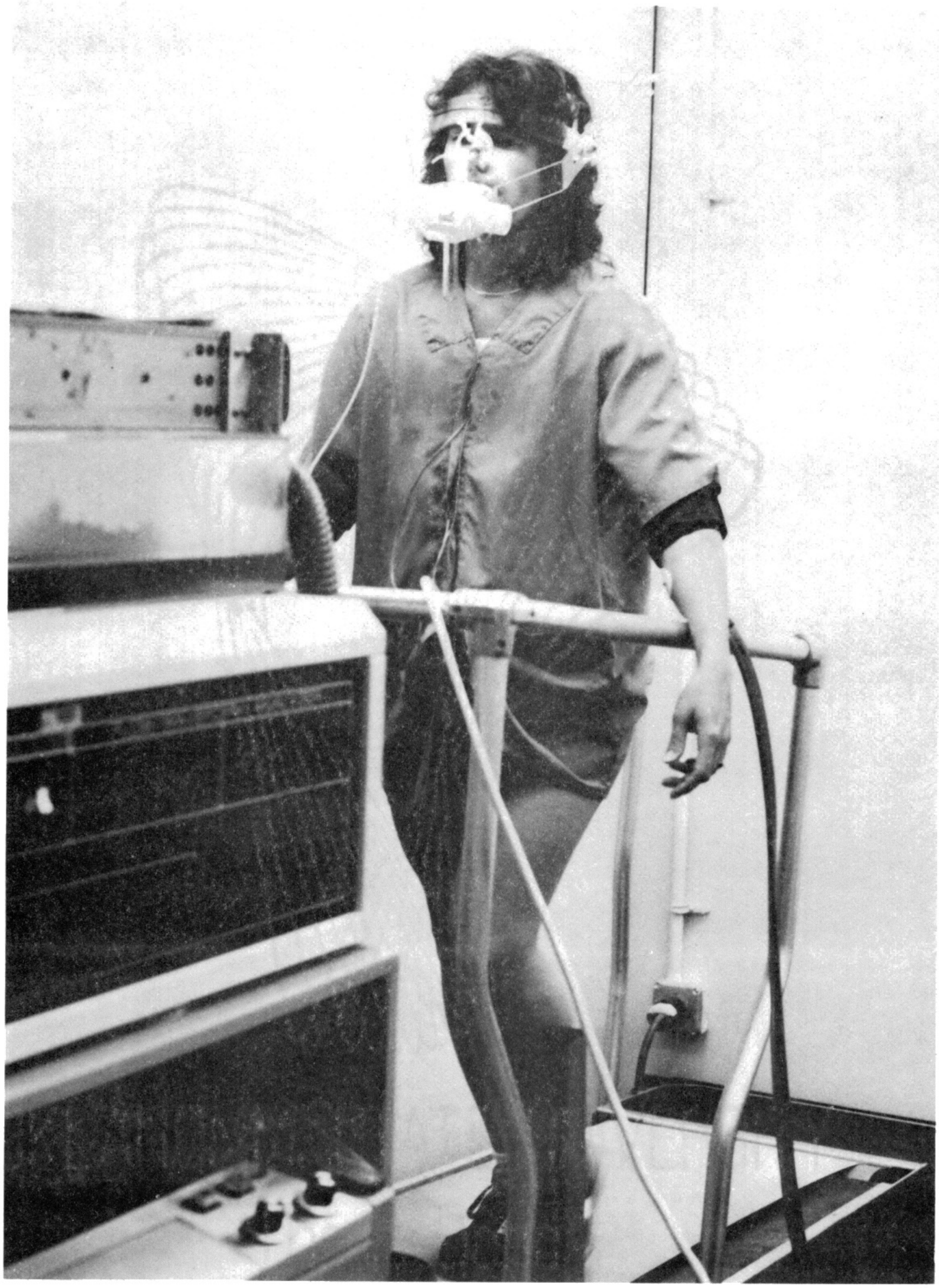
Michael W. Metclaf of Hazan Union School, Hardwick, Vermont. Mr. Metclaf, a former Air Force Captain and Air Evac pilot, teaches geography and government to grades seven through twelve. He owns and operates a small waste management business, is a town selectman on Hardwick's governing body and a member of the town's zoning board.

Judit Marie Garcia of Thomas Jefferson School for Science and Technology in Alexandria, Virginia. A teacher of French and Spanish, Ms. Garcia heads her school's language department. She studied language, literature and culture in France under the auspices of the French Government.

Niki Wenger of Vandevender Junior High School, Parkersburg, West Virginia. Ms. Wenger teaches gifted students and conducts seminars in her community on computer education and gifted education. She is director and founder of the Northwest Youth Sports Association and serves as treasurer and membership chairman of her state's Gifted Children Association.

APPENDIX J

CHRISTA McAULIFFE ON THE TREADMILL



APPENDIX K

ABOARD THE KC-135

APPENDIX L

NASA HEADQUARTERS SPACE FLIGHT PARTICIPANT EVALUATION COMMITTEE

NASA HEADQUARTERS

SPACE FLIGHT PARTICIPANT EVALUATION COMMITTEE

Ann Bradley, Chairperson
Associate Deputy Administrator

Neil Hosenball
General Counsel

Dr. Carolyn Huntoon*
Associate Director, Johnson Space Center

Dr. Harriett Jenkins
Assistant Administrator for Equal Opportunity Programs

Dr. Frank McDonald
Chief Scientist

C. Robert Nysmith
Associate Administrator for Management

Russell Ritchie
Acting Associate Administrator for External Relations

*substituting for Jesse More, Associate Administrator for Space Flight

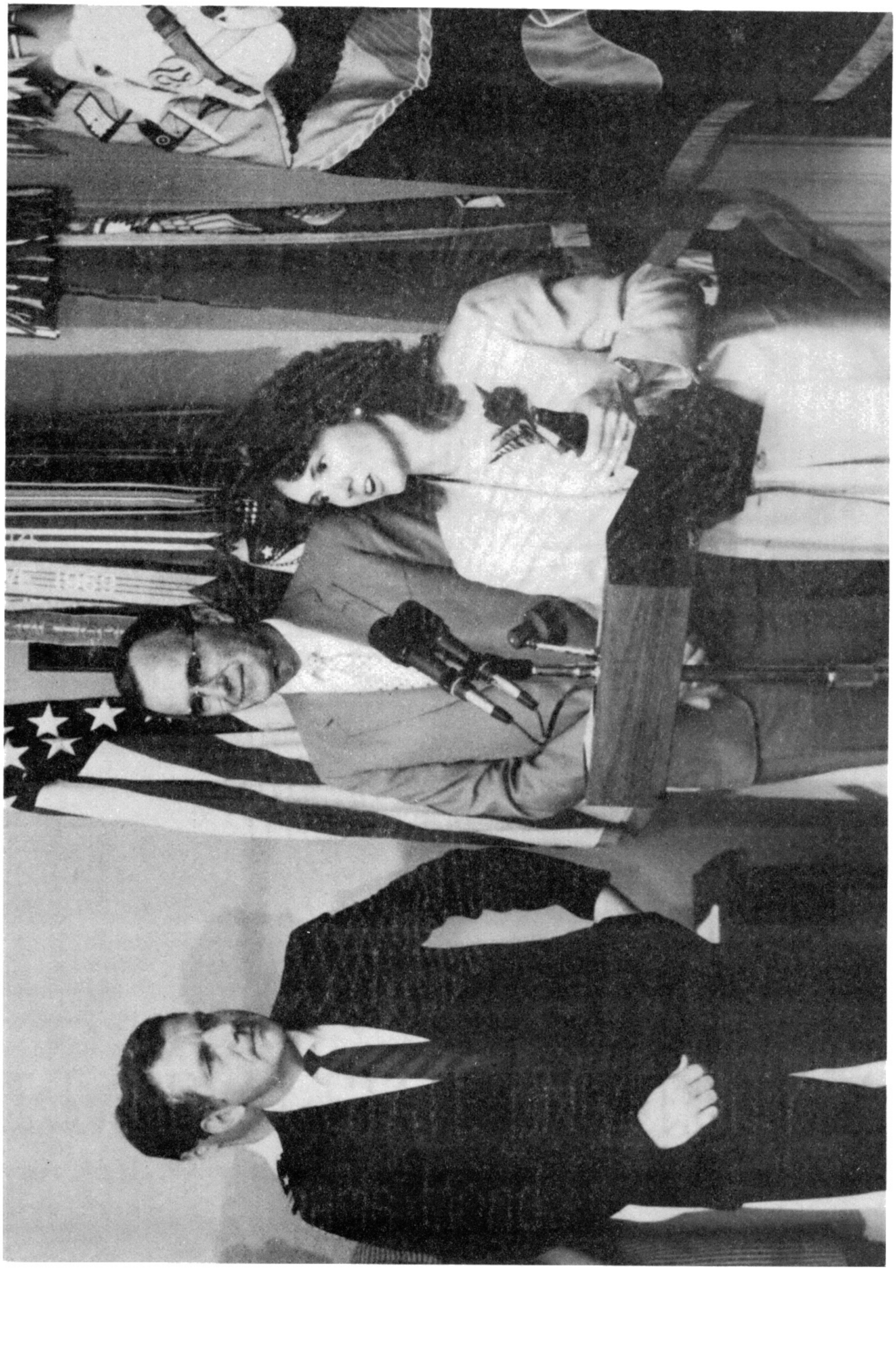
APPENDIX M

CHRISTA McAULIFFE AND BARBARA MORGAN


NASA
BARBARA
NASA
CHRISTA

APPENDIX N

CHRISTA McAULIFFE NAMED AS TEACHER IN SPACE



APPENDIX O

SPACE FLIGHT PARTICIPANT TRAINING COURSES

APPENDIX O

SPACE FLIGHT PARTICIPANT TRAINING COURSES

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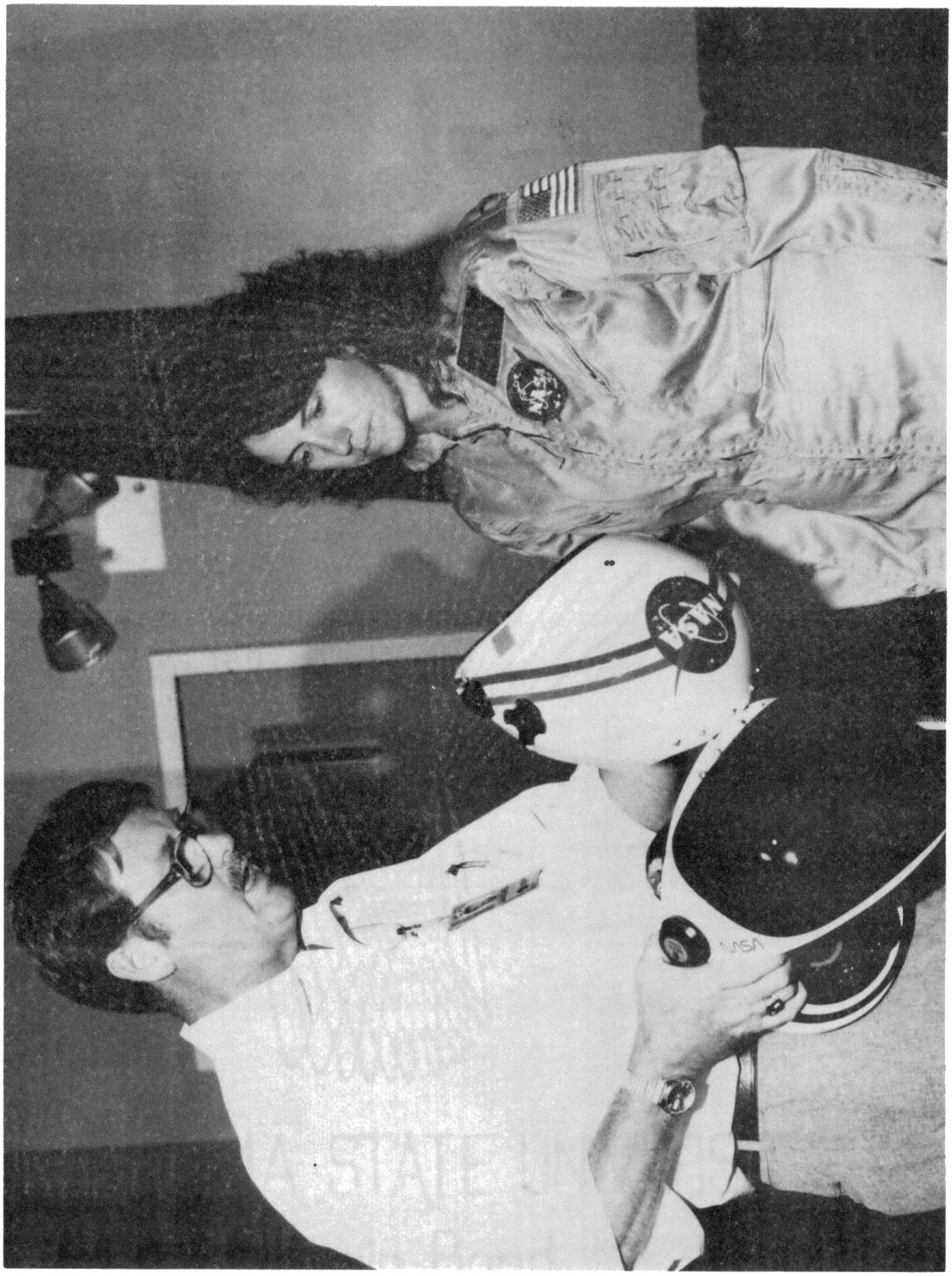
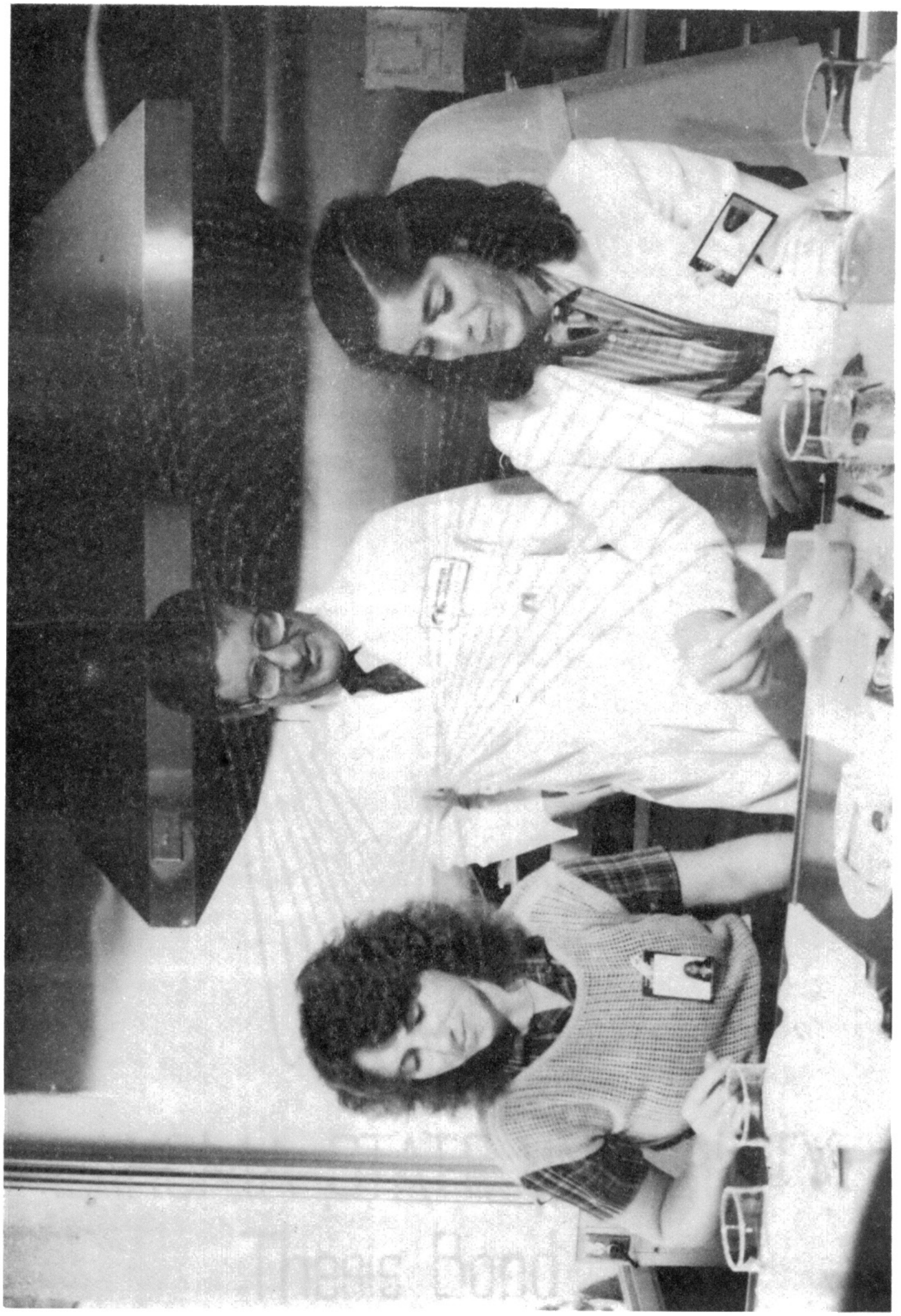
SPACE FLIGHT PARTICIPANT TRAINING COURSES


NASA

APPENDIX Q

CHRISTA AND BARBARA TASTE TESTING SPACE FOOD



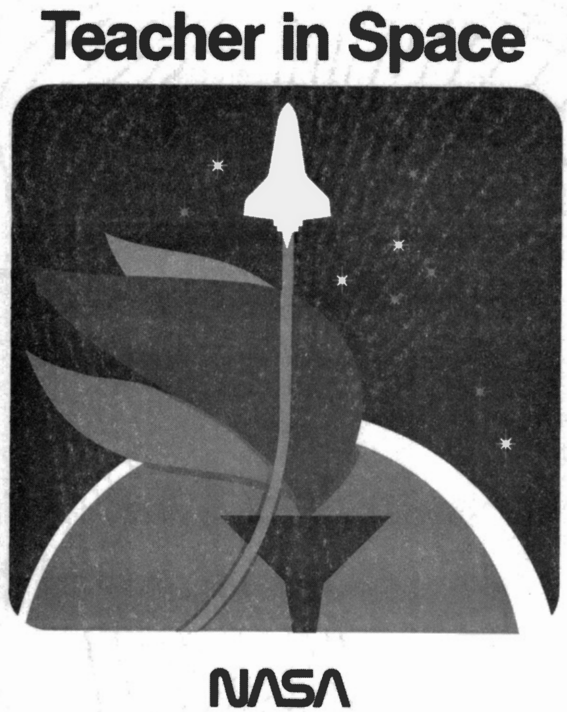
APPENDIX R

CHRISTA AND BARBARA LEARNING TO USE

THE SHUTTLE CAMERA

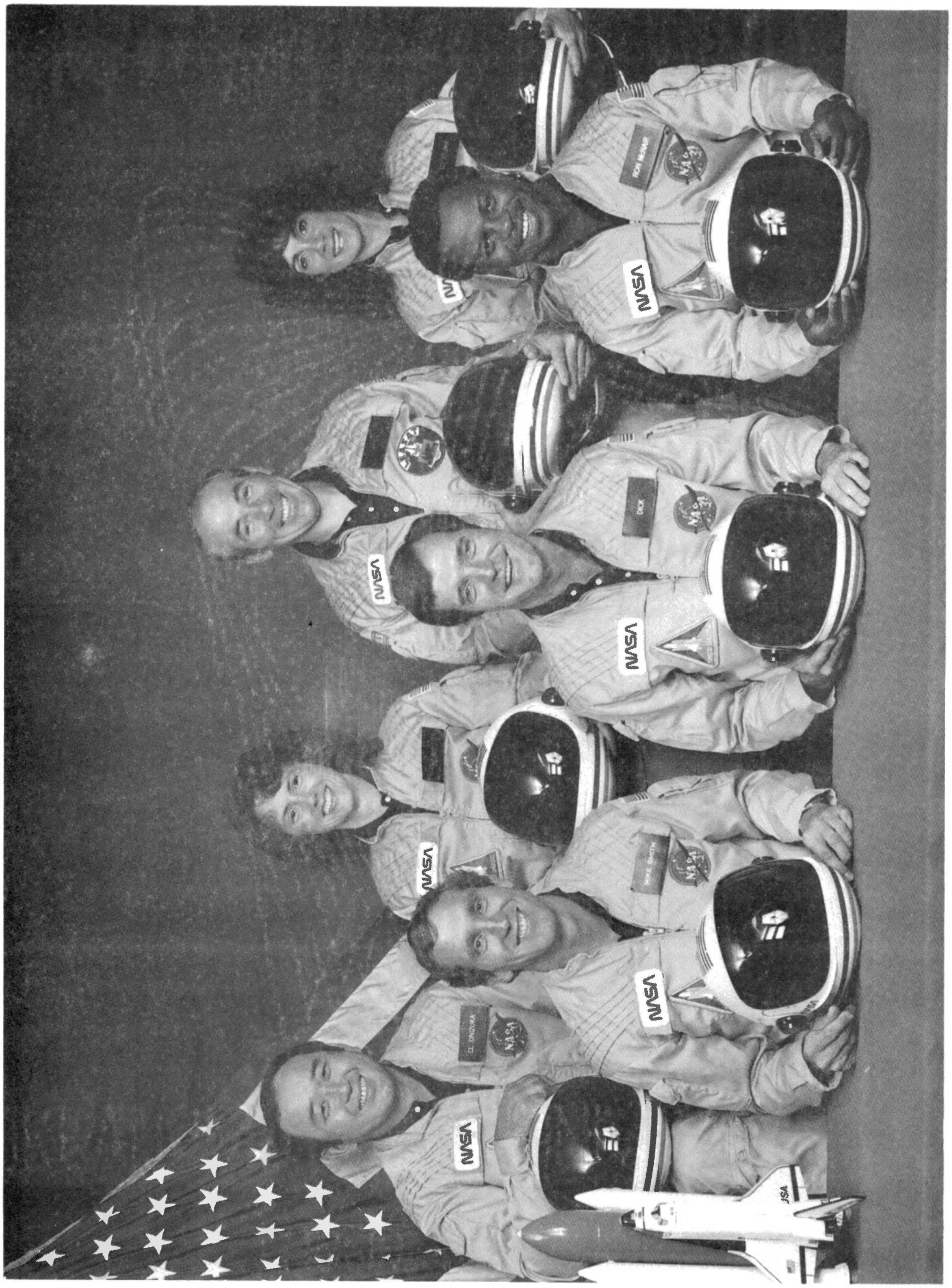
APPENDIX S

TEACHER IN SPACE PATCH


Teacher in Space
NASA

APPENDIX T

SHUTTLE MISSION 51-L CREW



Space Shuttle Orbiter Crew Members

For 51-L

The seven members of the Space Shuttle 51-L flight are: (back row, left to right) Mission Specialist El Onizuka, Teacher in Space Participant, S. Christa McAuliffe, Payload Specialist Greg Jarvis, and Mission Specialist Judy Resnik; (front row, left to right) Pilot Mike Smith, Commander Dick Scobee, and Mission Specialist Ron McNair.

APPENDIX U

MISSION 51-L CREW PATCH


MCNAIR
ONIZUKA
RESNIK
SCOBEE
SMITH
MCAULIFFE
JARVIS

APPENDIX V

TEACHER IN SPACE LESSON PLANS

Teacher in Space Project

CONTENTS

PROJECT BACKGROUND

Plans to make a teacher the first private citizen to fly on the Space Shuttle began with President Ronald Reagan's announcement of the program on August 27, 1984. Christa McAuliffe will fulfill that decision on Shuttle Mission 51-L slated for launch in January 1986. McAuliffe's flight is a part of NASA's Space Flight Participant Program which is designed to expand Shuttle opportunities to a wider segment of private citizens. Among her challenges will be communication of the experience and flight activities to the public through educational and public information programs.

The selection of Christa McAuliffe as primary candidate and Barbara Morgan as backup culminated a search process coordinated for NASA by the Council of Chief State School Officers. Some 11,000 teachers applied for the opportunity to become the Teacher in Space. State, territorial, and agency review panels each selected two nominees for a nomination slate of 104. These nominees are continuing to serve as NASA's educational Space Ambassadors in their areas.

The ten finalists announced on July 1, 1985 traveled to NASA's Johnson Space Center in Houston, Texas and Marshall Space Flight Center in Huntsville, Alabama for briefings and testing. A NASA Evaluation Committee interviewed them in Washington, D.C., and the final selection announcement was made by Vice President George Bush on July 19, 1985. Christa McAuliffe and Barbara Morgan began their training on September 9 at the Johnson Space Center.

The remaining eight finalists are working with NASA on a one-year assignment at Headquarters and NASA research centers. In August, they worked with McAuliffe and Morgan to design the lessons which the Teacher in Space will teach live during the mission. Their continued input will create an abundance of new space-related materials for the classroom.

MISSION BACKGROUND

The Crew:

Commander—Francis R. (Dick) Scobee

Pilot—Michael J. Smith

Mission Specialist—Judith A. Resnick, Ph.D.

Mission Specialist—Ellison S. Onizuka

Mission Specialist—Ronald E. McNair, Ph.D.

Payload Specialist—Gregory Jarvis (Hughes Communications)

Space Flight Participant (Teacher-Observer)—S. Christa McAuliffe

The Flight, Payload, and Experiments:

Shuttle Mission 51-L will be a six-day mission. Launch is scheduled for January 22, 1986 from the Kennedy Space Center, and landing is scheduled for January 28 at the same site. The mission carries two major payloads, the TDRS-B (Tracking and Data Relay Satellite-B) and the Spartan-Halley carrier. On the first flight day, the crew will deploy TDRS-B; on the third flight day, the Spartan-Halley carrier, which will be retrieved on the fifth flight day. In addition, the crew will be conducting and monitoring a series of scientific experiments during the Mission. McAuliffe may describe these activities during her live lessons from space.

Payload:

The TDRS-B will join TDRS-1 in geosynchronous orbit to provide communication and data links with the Space Shuttle and satellites. TDRS-2 (WEST) will be stationed over the Pacific; TDRS-1 (EAST) is stationed over the Atlantic.

The Spartan (Shuttle Pointed Autonomous Research Tool for Astronomy) mission is designed to observe the ultraviolet spectrum of Comet Halley. Two ultraviolet spectrometers will be mounted on the Spartan carrier which will scan the tail of Halley on each of its orbits. The Spartan will be deployed and retrieved with the Remote Manipulator System (RMS) and stowed in the payload bay for the remainder of the Shuttle flight.

The Shuttle Student Involvement Program, a competition managed by the National Science Teachers Association with NASA to encourage student-designed experiments that can qualify to fly on missions, will be flying three experiments on this mission:

A. *Chicken Embryo Development in Space* by John C. Vellinger of Lafayette, Indiana.

B. *The Effects of Weightlessness on Grain Formation and Strength in Metals* by Lloyd C. Bruce of St. Louis, Missouri.

C. *Utilizing a Semi-Permeable Membrane to Direct Crystal Growth* by Richard S. Cavoli of Marlboro, New York.

PREFACE

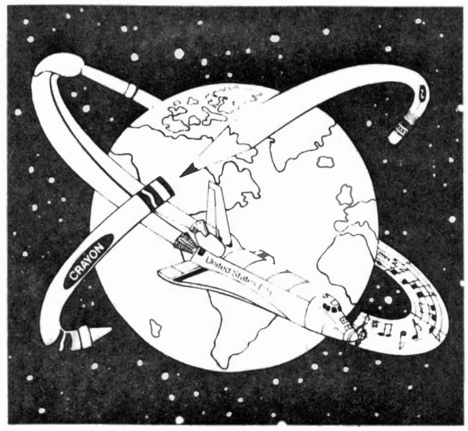
NASA is pleased to provide this Teacher's Guide to extend the learning experiences evolving from the Teacher in Space Project. The publication is the product of a team effort by NASA, the National Science Teachers Association (NSTA), the National Council for the Social Studies (NCSS), and curriculum professionals. It is based upon ideas contributed by the Teacher in Space finalists, the Space Ambassadors, and other practicing teachers.

We have sought to publish practical and mind-stretching teaching ideas, plans, and resources for a variety of curriculum areas and grade levels — all growing from aspects of Mission 51-L. The capsules and detailed activities are concept-based and are designed to strengthen critical thinking and problem-solving skills. We hope this Guide will help all of you, the people who teach live on Earth every day.

NASA wishes to thank the following individual teachers who wrote activities for this Guide: Charles Frederick, Marilyn Kirschner, Beverly Sutton, and Howard White. We wish to acknowledge the contributions of the following: William D. Nixon, Teacher in Space Project Manager; Dr. Doris K. Grigsby and Muriel M. Thorne of NASA Headquarters Educational Affairs; Dr. Helenmarie Hofman, NSTA; Frances Haley, NCSS, and Dr. June Scobee, University of Houston–Clear Lake. We also thank Joan Baraloto Communications, Inc. for coordinating the preparation, development, and publication of this guide.

Thomas P. DeCair

Thomas P. DeCair, Associate Administrator for External Relations, NASA



DESCRIPTION OF THE LIVE LESSONS

The Ultimate Field Trip

This lesson is based on a quotation by Teacher in Space Christa McAuliffe who described her opportunity to go into space as "the ultimate field trip."

Viewer Objectives:

1. To observe the major areas of the Shuttle and describe their functions
2. To list and describe the major kinds of activities crewmembers perform aboard the Shuttle
3. To compare and contrast daily activities in microgravity with those on Earth

Video Lesson Description:

This lesson from space will begin in the flight deck area of the Challenger where Christa McAuliffe will introduce the commander and pilot and will point out the Shuttle controls, computers, and payload bay.

When she arrives at the middeck, McAuliffe will show viewers the kinds of equipment and processes which help human beings live comfortably and safely in the microgravity environment of the Shuttle.

Where We've Been, Where We're Going, Why?

Viewer Objectives:

1. To explain some advantages and disadvantages of manufacturing in a microgravity environment
2. To describe spinoffs and other benefits which have evolved from the space program
3. To list ways in which the modular Space Station would change the lives of human beings

Video Lesson Description:

As this lesson from space begins, Christa McAuliffe will refer to models of the Wright Brothers' plane and of a proposed NASA Space Station to help viewers recall that only 82 years separate that early flight and today's life in space.

McAuliffe will discuss the reasons we are living and working in space, covering astronomy, Earth observations, experiments on-board the Shuttle, satellites on the mission, materials processing, and technological advances.

TEACHING-RELATED EVENTS OF MISSION 51-L

Live Lessons:

As part of the 51-L Mission, the Teacher in Space, Christa McAuliffe, will teach two live lessons from space. These lessons are currently scheduled on the sixth day of the Mission at 11:40 a.m. and 1:40 p.m. Eastern Standard Time.

PBS Broadcast:

The Public Broadcasting Service (PBS) will carry both lessons via Westar IV. PBS will offer the programs to member stations that will be requested to preempt regular classroom programming to carry the lessons live. Specific information about the PBS transmission may be obtained from local PBS stations or by writing to Elementary and Secondary Programs, PBS, 475 L'Enfant Plaza, SW, Washington, D.C. 20024 or calling 202/488-5080.

Mission Watch
(Satellite Broadcast to Schools):

NASA will make available to schools equipped with satellite dish antennas daily activities conducted aboard the 51-L Mission. This effort will be coordinated by Classroom Earth, an organization dedicated to direct satellite transmission to elementary and secondary schools. Participating schools will receive in advance educational materials, television schedule, orbital map, Shuttle Prediction and Recognition Kit (SPARK), and other information that will prepare teachers and students to follow all aspects of the 51-L Mission. Barbara Morgan, backup candidate, will act as moderator for these daily special broadcasts. Specific information related to "Mission Watch" is available by writing to Classroom Earth, Spring Valley, IL 61362 or by calling 815/664-4500. Information can also be accessed on the National Computer Bulletin Board (300 baud) 817/526-8686.

Filmed Activities:

In addition to live lessons, McAuliffe will conduct a number of demonstrations during the flight. These filmed activities will be used as part of several educational packages to be prepared and distributed after the Mission.

KEY MISSION-RELATED TERMS

Comet Halley — comet which reappears near Earth approximately every 76 years

Communication satellite — orbiting spacecraft which sends messages, connects computers, and carries radio and television programs via microwaves

EMU (Extravehicular Mobility Unit) — space suit with its own portable life-support system

51-L — number of the Mission carrying the Teacher in Space project

Flight deck — upper Shuttle deck housing the controls and computers for the commander and pilot

Geosynchronous orbit — path 35,680 km from Earth in which a satellite's speed matches exactly Earth's rotation speed, so that the satellite stays over the same location on the ground at all times

Microgravity — 1/10,000 of the gravity force on Earth

Middeck — living and work area of Shuttle located below flight deck

Mission control — a room at the Johnson Space Center in Houston, Texas from which the crew's activities are directed

Mission specialist — scientist on crew responsible for experiments and deploying satellites

Mission Watch — daily satellite program transmission highlighting Mission events

NASA — National Aeronautics and Space Administration

Orbiter — reusable manned component of Space Shuttle; there are four; Mission 51-L uses Challenger

Payload — cargo; equipment

Payload bay — large section of the Shuttle where the payloads are stored

Payload specialist — scientist named for flight by a company or country sponsoring a payload; specialist is certified for flight by NASA

Principal investigator (PI) — scientist who designs and directs a mission experiment

Simulator — training equipment which gives trainees opportunities to experience flight-like activities and sensation

Space Shuttle — four-part vehicle: a reusable orbiter, an expendable liquid propellant external tank, and two recoverable and reusable solid rocket boosters

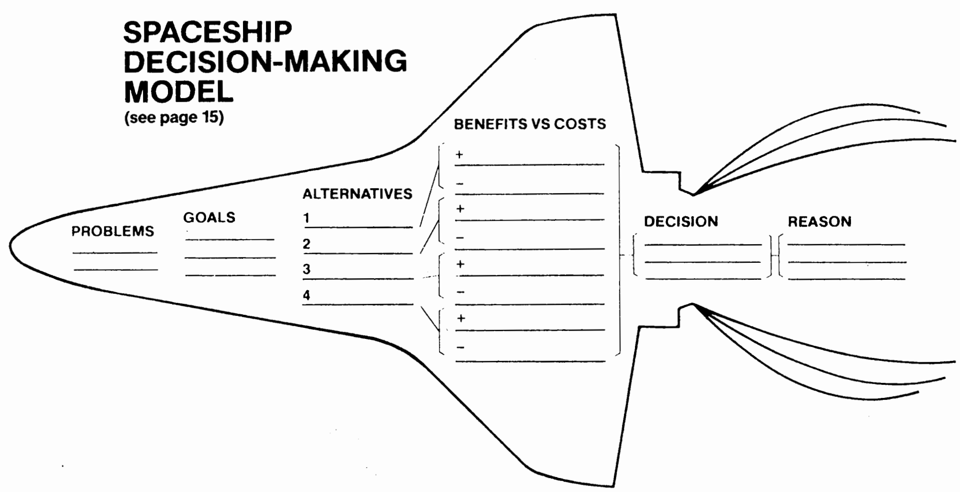
Spartan-Halley — payload designed to make observations of the ultraviolet spectrum of Comet Halley

Spinoffs — useful applications of space technologies different from their original aerospace function

TDRS (Tracking and Data Relay Satellite) — a communication satellite deployed by NASA for its communication system

SPACESHIP DECISION-MAKING MODEL

(see page 15)



PRE-VIEWING ACTIVITIES

● Provide enlargements of the illustration of the Space Shuttle from this Guide or other sources. Explain that the teacher-observer is part of a seven-person crew living in that Shuttle. Ask students to focus on "The Ultimate Field Trip" lesson, to estimate the Shuttle's size, and to describe as many details of the living space as possible.

Use a globe and model or picture of the Shuttle to demonstrate the location of the Shuttle above Earth's surface. Have students relate the distance of the spaceship above Earth to ground distances familiar to them, e.g., the Shuttle is orbiting at least 115–190 statute miles above Earth's surface — a distance between your community and ________. Talk about how Earth looks from that distance.

● Tell students that they will be seeing the teacher-observer as she speaks from the Space Shuttle. Theorize with them about how that will be possible. Introduce the idea of communication satellites and ask them to watch for information about satellites.

Focus students' thinking on the kinds of planning it may take for a mission to be successful. Discuss the roles of the ground and Shuttle crews in performing experiments. Think about applications of the experiments after 51-L.

● The Teacher in Space is the first private citizen in space. When President Reagan announced the NASA Space Flight Participant Program, he emphasized that the private citizen chosen to fly a mission would have the job of communicating the experience and flight activities to the public. Discuss why the first private citizen is a teacher. Discuss the duties and sense of responsibility placed upon her. Have students list some experiments they would like to see her demonstrate in the microgravity environment. Have them provide the rationale for their choices.

Explain that the Teacher in Space is keeping a journal of her experiences. Ask students to describe the kinds of information they think she should include in it.

● The commercial world anticipates many benefits from manufacturing in space. Ask students to think about how microgravity could actually help the manufacturing of certain products.

One of the justifications for the space program has been the many benefits of direct applications of ideas and products to life on Earth. McAuliffe will explore some of the newest experiments. Ask students to be watching for ways these experiments might help human beings on Earth.

● Brainstorm with students the titles and collections of space-related music. Collect the albums or tapes and play them as background music during the week of Mission 51-L. Possible titles: *The Planets* by Gustav Holst; *Pops in Space* and *Out of This World* by John Williams and the Boston Pops; the soundtracks from *E.T.*, *Close Encounters of the Third Kind*, the *Star Wars* trilogy, *2001*, and the PBS television series of *Spaceflight*; Handel's *Royal Fireworks Music*; and *Ionization* by Varèse.

Prepare a list of authors, stories, books, and poetry that deal with space. (See Resources.) Read selections with students each day of the Mission.

● Before reading the following passage to students, explain that it was read aloud from space by Astronaut Jeff Hoffman during his April 1985 mission. The prose was written by French writer, René Daumel, in his book, *Mount Analog: NonEuclidean Adventures in Mountain Climbing*. Discuss with students what the surrealist Daumel may have meant when he first wrote the words in the 1920s. Then discuss possible applications of the words to spaceflight. Why would an astronaut choose to carry these thoughts with him into space? "You cannot stay on the summit forever, you have to come down again. So why bother in the first place? Just this. What is above knows what is below, but what is below does not know what is above. One climbs. One sees. One descends. One sees no longer. But, one has seen. There's an art of conducting oneself in the lower regions by the memory of what one saw higher up. When one can no longer see, one can at least still know."

Obtain a SPARK KIT (Shuttle Prediction and Recognition Kit). See Resources. Step outside with your students to gaze at the first outer space classroom — the Space Shuttle, home to Teacher-Observer Christa McAuliffe. The easy-to-follow booklet will let you and your students learn how to locate the Shuttle on any of its orbits around Earth and to predict when it can be seen from your community.

● Discuss with students the special problems of meeting survival needs in space. Explain that in addition to those described by McAuliffe during the live lessons, the students may want to read about special needs and solutions for space. Assign students to research and report on the areas of needs and how they are met.

Have students prepare a list of items they might like to take on the Shuttle to use in their leisure time. Ask them to explain the importance of each item selected.

● Encourage students to imagine that they are on the crew of a future spaceflight. Have them describe a problem that arises, how the crew might resolve it, and the role of the individual in the solution. Have them write their composition in narrative style.

Set up a tent in the classroom and assign various activities that will help students experience working in a confined space.

● Ask students to think about their home kitchens and meals. Ask them to talk with families about items that were not there before the students were born. Make a class list of these items and processes. Students may like to write a time warp story about a person from the 1960s who shows up in a kitchen of the 1980s or the year 2000.

Display several items such as a digital watch, calculator, microcomputer, plastic meal pouch, or Velcro fastener. Ask students to link the items to the space program. Classify them as benefits or technological spin-offs of space technology. Emphasize that when Congress established NASA in 1958, one of the goals was to have the space agency seek to transfer space technologies to everyday life. Today's benefits are accessible through NASA's Technology Utilization Program.

● Benefits related to aerial photography via satellite are also of interest to students. Some may want to explore detecting oil slicks at sea, charting glaciers, forecasting spring runoffs for irrigation, inventorying standing timbers and grasslands, evaluating flood damage, checking environmental impact of strip mining, analyzing the gypsy moth, detecting potential earthquake zones, and mapping land and water uses.

LIVING IN SPACE

Concept: The size of the middeck and payload bay areas of the Shuttle helps determine the crew's activities and the payload.

● Ask students to imagine that they have been chosen for a space mission. Have them list items they would take as mementoes. Then inform them that their Personal Preference Kits must be limited to 20 separate items weighing a combined total of 680 grams (1.5 pounds). Ask them to eliminate all overweight articles and list only the items they consider most important.

Have students suggest some familiar large payload objects for the cargo bay to gain an idea of comparative size, i.e., a trailer truck (18-wheeler), a railroad boxcar, a tank car, or a bowling alley.

● Obtain large discarded cardboard boxes used to ship appliances to build a model of the middeck. Let students measure, cut, tape, and build a walk-in model of the middeck. Invite other classes to see these examples of "cardboard carpentry."

Many teachers are using a process approach to writing with their students. In one of its earliest stages students prepare to write by charting words and relationships on paper. Given the topic "Everyday Life on Mission 51-L," build a "word web" or idea chart on the chalkboard. Assign students to choose the best ideas to write a paragraph on the topic.

Objectives:

1. To simulate the amount of space available to the crew on a Shuttle mission by measuring and laying out the dimensions of the middeck and payload bay

2. To physically experience the amount of space available in the middeck and payload bay areas

1. Remind students of the Teacher in Space's tour of the Shuttle. Explain that they will be laying out the size and shape of the Shuttle on a parking lot or blacktop area (chalk), playing field (lime or mowing), snowy field (dye). Middeck dimensions may be laid out in the classroom; payload bay, in the school hallway.
2. Assign groups to make specific measurements of the following interior dimensions of the Shuttle on the surface you have selected:

   a. Overall length of the middeck, 4.00 m (13.1 ft.) plus the payload bay, 19.7 m (60.00 ft.) totals a continuous length of these two working interiors of 23.7 m (73.1 ft.).

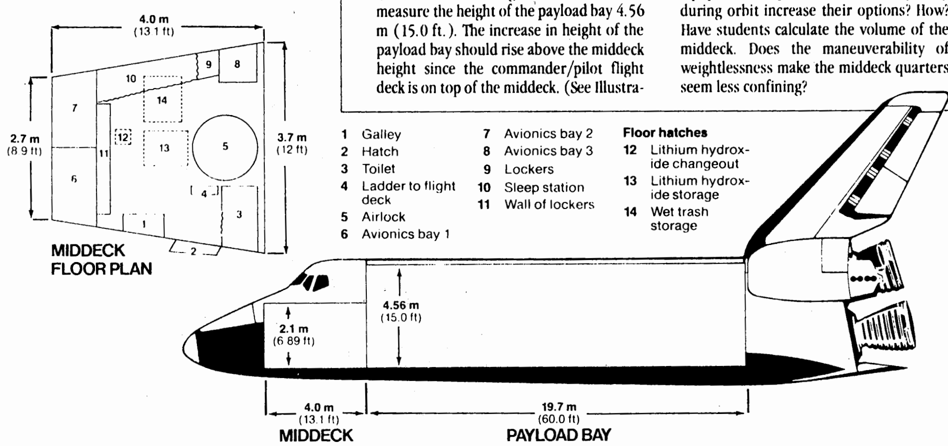
   b. At right angles to the length, beginning at the front end, mark off the height of the middeck, 2.1 m (6.89 ft.).

   c. At the terminal end of the middeck (which has an airtight structural wall), measure the height of the payload bay 4.56 m (15.0 ft.). The increase in height of the payload bay should rise above the middeck height since the commander/pilot flight deck is on top of the middeck. (See Illustration below.) Measure and mark this height, 4.56 m (15.0 ft.), at intervals along the entire length of the payload bay.

   d. Use some technique to outline the length and height of the middeck and payload bay. You now have the crew's working area (middeck) and the payload bay.

   e. To show the trapezoidal-shaped floor space available to the crew when the Shuttle is on the ground, use the same 4.00 m middeck length and mark off these widths for the floor plan: 2.7 m (8.9 ft.) at the front, expanding to 3.7 m (12 ft.) at the rear. This floor plan area is filled with hundreds of items precisely arranged to maximize efficiency and minimize discomfort for the crew. (See Illustration below.)

   f. The payload bay's floor plan is the same as that laid out in 2.c. above because the height of the bay, 4.56 m (15.0 ft.), is also its width.
3. Have seven students stand on the floor plan of the middeck and see how much area each student has. How does this area compare with rooms in a home? Tell students to imagine this middeck floor plan area also holding large equipment. (See Illustration below.) Have students now estimate the available space for crewmembers with equipment in place. Could microgravity during orbit increase their options? How? Have students calculate the volume of the middeck. Does the maneuverability of weightlessness make the middeck quarters seem less confining?



LIVING IN SPACE

Concept: Planning for life on extended Shuttle missions or in Space Stations must consider the effects of Orbital Human Factors (OHF) on people's behavior.

● Have students work individually or in small groups to study the following questions:

a. What are the physiological effects of microgravity?

b. Why is exercise so important in microgravity?

c. What is space sickness? How might it affect the crew's performance? How is it being treated?

Circadian rhythms are another consideration when planning space missions. Circadian rhythm is the cycle of wakefulness and rest that each individual experiences. Most people operate on a 24- to 25-hour cycle with six to eight hours of sleep included in the cycle.

a. *Have students locate general information regarding the crew's schedule in space.*

b. *Direct students to chart their own circadian rhythm for one or two weeks. Each day, they should record their times of sleep, peak activity, and relative inactivity. Compare these charts with those schedules maintained by flight crews.*

c. *Have students compile information about the effects of shift work on humans, the scientific explanation of "Monday morning blues," and how much sleep actually is required by most people. Invite a psychologist or medical doctor to discuss sleep.*

● Ask the class to explain why it is necessary for most people on Earth to recline in order to sleep well. Then compare this sleep behavior on Earth to sleep in microgravity. (See Illustration right.) Emphasize the changes in sleeping arrangements in microgravity where there is no need to recline.

Discuss with students the kind of psychological atmosphere among the crew that would be necessary to function for six to nine days in these small living/working quarters where every waking and sleeping hour is programmed.

a. ***What kinds of preparation might be needed in pre-flight training to ensure a smoothly working team?***

b. ***What other kinds of high performance teamwork might be as demanding on Earth?***

Have students design recreational activities which would be suitable for a microgravity environment.

● Several of the seven crew members on Mission 51-L have a strong interest in the arts. Commander Scobee enjoys oil painting and woodworking; Pilot Smith does woodworking; Mission Specialist Resnick is a classical pianist; Mission Specialist McNair is a performing jazz saxophonist; Space Flight Participant McAuliffe plays the guitar and piano and enjoys singing; and backup candidate Morgan plays the flute and violin. Ask the students how the crew might pursue their interests during flight. Discuss why it is important to have outside interests. Ask them to list some of theirs and to discuss the benefits they receive by being a member of the team, club, or group.

Have students describe their favorite at-home and at-school activities. Could they be able to enjoy them during a spaceflight? Have them consider a substitute leisure activity.

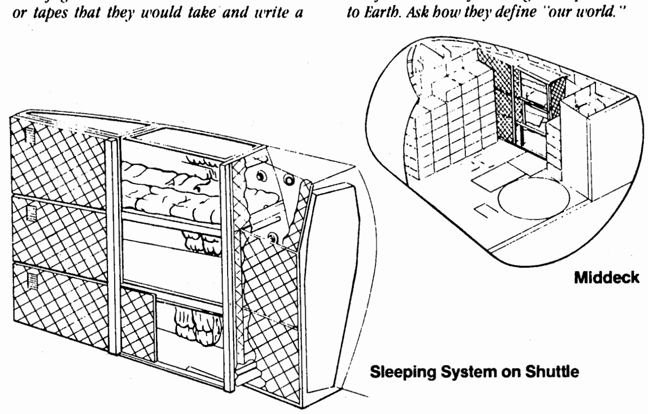
● Make a class mural that includes a self-portrait of each student doing his/her favorite leisure activity on the Shuttle. Allow students to include only those which would work in small spaces and in microgravity.

Each member of a Shuttle crew has a portable stereo cassette with earphones and may take six 60- or 90-minute tapes of music on a flight. Have students select six albums or tapes that they would take and write a paragraph explaining their choices. Ask them to listen to only that music during the 51-L Mission. At the conclusion of the flight have them write their reactions to their selections: Would they make the same choices again? Why or why not?

● Arctic and Antarctic explorers have kept detailed records of the influences of an isolated environment and cold on human behavior. Challenge students to research their writings and report to the class on parallels between their ideas and Orbital Human Factors. Discuss whether similar parallels might be drawn with explorers of other territories.

Ask students to interpret what Isaac Asimov meant when he said, "Throughout the history of humanity, we have been extending our range until it is now planet-wide, covering all parts of Earth's surface and reaching to the bottom of the ocean, to the top of the atmosphere, and beyond it to the Moon. We will flourish only as long as we continue that range, and although the potential range is not infinite, it is incredibly vast even by present standards. We will eventually extend our range to cover the whole of the solar system, and then we will head outward to the stars." —Isaac Asimov in "Our Future in the Cosmos—Space," NASA Conference

Have students write position papers based on this quotaton. Ask them to defend or refute the idea of limiting our exploration to Earth. Ask how they define "our world."



Middeck

Sleeping System on Shuttle

LIVING IN SPACE

Concept: Space crews follow specific routines for meeting health and survival needs in space.

● Describe and demonstrate the small space (4 m × 3.7 m × 2.7 m) of the middeck in which the spaceflight crew lives. Have students list the basic needs they think might have to be met in order to survive a seven-day period in a microgravity environment. Ask them to explain and defend their choice.

Plan a day's menu which meets the daily food requirements. Determine how to prepare the foods for storage, how they will be stored, and how they will be prepared. Plan a five-day menu which can be stored in a child's backpack. Compare the space utilization (volume) and weight of dehydrated foods such as instant soup, orange drink, and dried apples with their rehydrated counterparts. Make a graph showing the results.

● Visit or read about a ship's galley. Compare and contrast it with the galley on the Challenger.

When people colonize space, it will be necessary for them to produce some of their own foods. Discuss the implications of food production in space.

● All clothing for the crew, except underwear, is the same for both sexes and includes cotton pants, shorts, tee shirts, flight jackets, short sleeved shirts, and slipper socks. Crew members frequently move around their Shuttle environment and they need to carry and use pens, flashlights, scissors, fork, kneeboards (for notes), and a checklist. Ask students to design clothing to accommodate movement and accessories. Have them consider both vehicular and extravehicular needs. How will their clothing differ from that which is worn on Earth?

Astronauts have recorded evidence that they grow at least 2.54 to 3.81 cm (1 to 1½ in.) very soon after they are in a microgravity environment. Their space suits are designed to accommodate this temporary growth. Discuss with students why the body grows and how the spaces between the vertebrae expand in space. Research body fluid shifts in microgravity. How does this affect clothing requirements?

● Logos are symbolic representations of the major goals of a spaceflight mission. Ask students to imagine that the class has been assigned to a spaceflight. Have them design and prepare a logo for use on their clothing to designate that mission.

Exercise is needed on a spacecraft so that bones and muscles will not deteriorate on long missions. In an apparent weightless state, bones and muscles do not experience the same resistance as in gravity. Have students compare their exercise regimens with the recommended 15 minutes per day treadmill workout on the Shuttle. Discuss why doctors have patients up and walking as soon after surgery/illness as possible.

● Have teams of students take blood pressures and pulse rates before and after three minutes of vigorous exercise, determine the time needed to return to normal pulse rate, and record all data. Invite a doctor/school nurse/instructor to help students interpret the results. What variables might effect changes in pulse rate/blood pressure during and after a spaceflight?

Ask students to prepare a list of exercises they could not do in space and the reasons why they could not be done.

● Shuttle crew members are allocated as much as 2800 calories each day of the mission. Challenge students to decide whether they think the crew would need more or fewer calories in space than on Earth. Have them explain and support their decision.

Explore the following thought questions as they relate to similar needs in space.

a. *How does the Shuttle crew's health maintenance routine compare with that of the crew of a submarine on active patrol?*

b. *What kind of balanced diet, exercise, and sleep routine do you need to do your best in your sports/academic life?*

● Show students a picture or model of the Orbiter. Explain that there are systems aboard the spaceship to help keep it functioning and to keep the crew alive. Discuss each of the six systems with the class: food supply, air, water, waste disposal, power, and communications. Assign a group to each of the six systems to begin a chart with the following headings: **a.** Name of System, **b.** Need for the System, **c.** Possible Problems if System Does Not Function, e.g. spoiled food, loss of oxygen, fire, **d.** Alternate Solutions. Have groups report their findings to the class.

Have students investigate problems encountered and resolved in earlier spaceflights. Consider, for example, Solar Max repair (STS 41-C) and the Syncom satellite repair (STS 51-D). Ask students to write expository essays explaining the problem-solving activities in space.

Objective: To compare the Shuttle crew's needs in space with those needs on Earth in terms of caloric intake, exercise, and sleep

1. Talk with students about how they maintain their health by eating, exercising, and sleeping.
   a. Develop an efficient record-keeping chart for each student to record the following data:
      1) name, day, date, and hours of sleep;
      2) each meal's items and approximate number of calories and total calories for the day
      3) type and amount of exercise all day
   b. Provide the following information on daily needs of the Shuttle crew:
      1) food/calories — (approximately 2,800 Calories)
      2) exercise — (15 minutes on treadmill or its equivalent)
      3) sleep — (8 hours)

2. Review the kinds of foods used on a space mission. Describe a typical daily menu. Compare an astronaut's menu with a student's menu. If possible, compare and contrast them as to processed or natural foods. Compare calories.

3. Compare students' records for exercise and sleep with crew's requirements in space.

LIVING IN SPACE

Concept: A Space Station is designed to serve a variety of functions for technological study and development that will benefit all humankind.

● Ask students to recall different kinds of space stations from science fiction stories they have read or movies they have seen (Battlestar Gallactica, the Star Wars Empire, the Star Trek Federation). Emphasize that these are fictional versions of something that has never existed, but that the Space Station will soon be a reality.

The Space Station will fulfill eight major functions: living area, laboratory for science and technology, permanent observatory of Earth, servicing for spacecraft, station for space vehicles and payloads, manufacturing facility, storage depot, and staging base for future space activities. Divide the class into small groups to study each of the Space Station functions. Ask the groups to describe the possible details of their function, to compare it to a place or activity we know on Earth, and to describe how they think it will look with words and illustrations. Have the groups report and combine all illustrations into a giant collage or flow chart entitled "Our Future Home." (See Illustration below.)

● President Reagan's plans include international cooperation in the development and use of the Space Station. Discuss this potential international colony in space.

Reasons for establishing a space station may include adventure, trade, freedom, growth of new technology, commerce, transportation, and manufacturing. Have students suggest other reasons for space colonization.

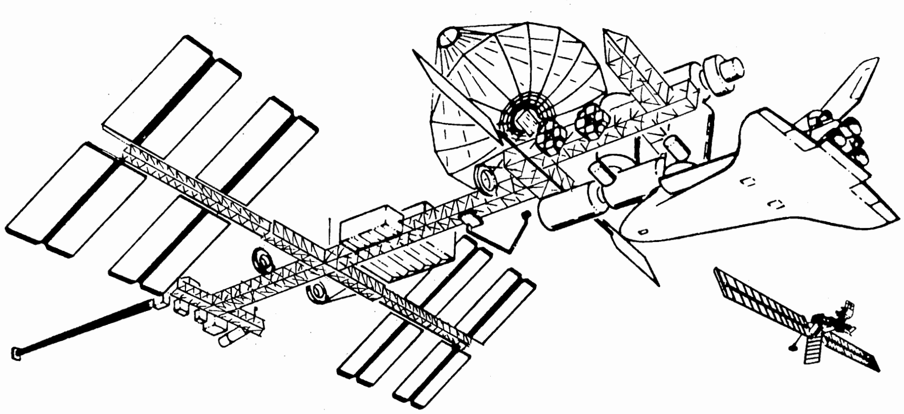
● Challenge students to predict how people from Earth will get to the Space Station, how long they will stay, and how they will return. Ask them to pretend that tickets will go on sale in the year 2000. Have them imagine what they will be doing and whether they or anyone they know will go. Predict whether the Station will admit only workers or whether visitors will be allowed.

Assign each student to write a first-person account of a new inhabitant of the Space Station. Have the students describe their trip, their new living quarters, and their work. Share the compositions.

● The Space Station concept will be reality for your students in their lifetimes. Talk with them about the kinds of activities and responsibilities which will be required on a Space Station. Ask them to pretend that they have an opportunity to apply for a job on the Station. Have them write their letter of application to the space personnel office to apply for the job of their choice.

Challenge students to consider the following question: Will migrations from Earth to Space Stations and other planets be similar to the migrations from Europe at the turn of the century? Ask students to compare our future space settlers and pioneers to the early settlers and pioneers of America. After a brainstorming session, have students organize their ideas for a composition based upon comparison/contrast.

● Hypothesize with students that they have been given the responsibility of planning a Space Station community. They may be like the planners of some of America's famous planned communities or towns. Ask them to list the institutions, services, jobs, activities, recreation, and other details their community would have. Make a large flow chart to show the relationship of the community's components.



A Space Station Concept

WORKING AND STUDYING IN SPACE

Concept: A diversity of jobs is required to plan, build, operate, and maintain a spacecraft.

● Distribute pages of classified advertisements to the class. Divide the class into small groups to write want ads for each of the jobs on the crew of 51-L. Post the ads. Discuss whether they know of individuals who could meet the qualifications they set.

Philip Morrison, Professor of Physics at the Massachusetts Institute of Technology, speaking at a NASA symposium in 1976, said, "... it seems to me the imagination has not yet succeeded in conveying to people in general what kind of role one can have in today's complex exploraton. Very many are the indispensable porters, and only very few are the intrepid mountaineers." Have students apply this to Mission 51-L and the space program.

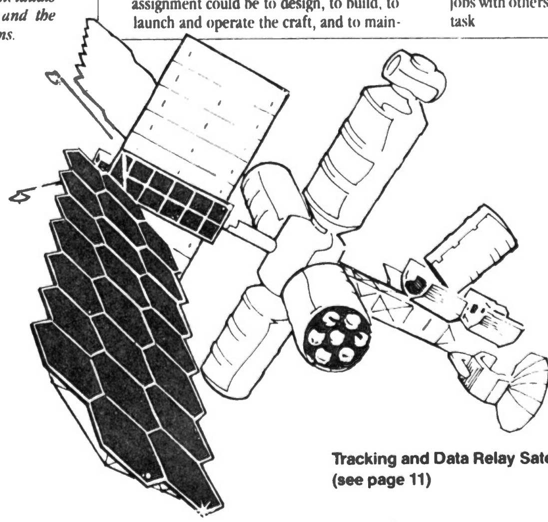
● Ask students to think about their interests and to choose two jobs related to space that they think they would like to do; research the skills and training necessary to fulfill the jobs; draw up job applications; apply for jobs in space; and go through a preliminary screening and interviewing process to select two candidates for each job.

Interpersonal cooperation is a critical element in a successful mission. Discuss the kinds of personal qualities that individuals chosen for a mission must have and the qualities which might cause problems.

Objectives:
1. To identify job opportunities in the space industry
2. To apply decision-making skills in small groups
3. To discuss the interdependence of personnel in completing a project

1. Introduce the concept of jobs by displaying pictures of a Shuttle, Space Station, or satellite. Have students list the kinds of jobs it takes to design, build, operate, and maintain a Shuttle, Space Station, or satellite. Discuss a misconception that the only space-related jobs are for astronauts. Divide the students into small groups to list as many jobs as they can think of under each category. Have each group appoint a recorder.
2. Copy each job onto an index card. On the bottom of the card, identify the job according to one of the four categories and have each student select a card to research.
3. Have students make oral, first-person reports on the jobs, including the job qualifications and training.
4. Divide students into groups according to their job category on the spacecraft. Give each group an assignment that will require cooperation and interdependence. The assignment could be to design, to build, to launch and operate the craft, and to maintain it before and after launch. Note that groups will have to choose leaders and individuals to meet with other groups to keep the groups coordinated. Assign two students to observe the activities of all four groups and to comment on the following:
   - How the students made decisions within their own groups
   - How the groups communicated with other groups
   - Whether the completed plans and work reflected cooperation and organization
   - Whether individuals performed the work required by their assigned jobs

   The groups should keep written records of their ideas and decisions, list assignments on chart paper, and sketch plans and designs to be displayed and shared.
5. Have each group present its work to the entire class. Ask the two student observers to present their comments and to accept explanations and rebuttals from the groups. Have students prepare oral or written statements on the following topics:
   - The importance of any job in completing tasks
   - How decisions are made in completing a task
   - How individual workers perform their jobs with others as they try to complete a task



Tracking and Data Relay Satellite (TDRS)
(see page 11)

WORKING AND STUDYING IN SPACE

Concept: The space program has had both benefits and costs for Earth's inhabitants.

● Give some examples of recent spinoffs of the space program, including microminiaturization of electronics, lightweight materials, solar panels, computerized scanning medical devices, portable x-ray machines, automatic utility meter reading devices, compact water filters, automatic inventory cash registers, high intensity lights, water-cooled headbands, fabrics made of strong chemical bonds, and microcomputer software. Have students research their own list. Have teams of students report on an item, whether the work it does was possible before its space application, and how the work it does changes lifestyles on Earth. Have the students illustrate their reports.

Have students pursue spinoff technologies in more detail. Teachers can locate materials through NASA Teacher Resource Centers.

a. Assign a group of students to develop a catalog of spinoff products.

b. Have students locate information on specific products and report how they are linked to the space program, e.g., fabric used for the Pontiac (Detroit) Silverdome, heat absorbing clothes for athletes, NASTRAN computer structural analysis program, and plastic welding.

c. Challenge students to create a "Technological/Economic Impact" statement highlighting and analyzing the impact of spinoffs. This could be reported in traditional oral or written formats or as a video news report format. Challenge a second group of students to create the opposite scenario, "What If We Had Not Pursued the Space Program" and to report it in a "Point-Counterpoint" format.

Although the spinoffs seem to have improved life on Earth, some individuals and groups believe that the technology has also brought increased costs. Do a cost-benefit analysis and debate the issue.

● Weather satellites are another benefit of space technology. Students may wish to research and report the following areas: forecasting, television reporting, the meteorological satellite system, economic impacts of weather satellites, and the potential issue of controlling the weather. Students could prepare video news reports or "white papers" on controversial aspects of the topic.

Present a hypothetical situation in which you are NASA and want to hire a contractor—four students—to manufacture certain parts for the Space Shuttle. Give the four students a sum of play money and a period of time to "manufacture" some meal packs for the Shuttle. Then have them dispose of their money in the economic community—the rest of the class. Use this activity to lead into the concept of circular flow of goods and services. Have students generalize about the impact of NASA spending.

● Many of the economic impacts of NASA are first felt on a local level. The areas surrounding the Johnson Space Center in Texas and the Kennedy Space Center in Florida are obvious examples. Students may want to generalize about the potential impact of a NASA facility on a community, discussing increased retail sales, employment, increased per capita income, and accelerated road and building construction.

Have students speculate about the future economic impact of space travel and colonization. They may want to use a decision-making model to decide a hypothetical issue, such as whether a space colony should be established. The key concept would be the economic impact of the colony.

● Offer the following research opportunity: In past decades, "urban renewal" has been a highly controversial topic. The current trend of "revitalization," a mix of refurbished and new construction, is a parallel. Direct students to locate information on the impacts of this trend and to compare it with renewal. Discuss the implications for life in space.

Challenge students to investigate the regulation of communications satellites (orbits and relay frequencies). They may approach it in an international economic or legal context at the present time or at some future age.

● Although the Shuttle itself is reusable, the equipment and items for crew life aboard the Shuttle may be disposable. Have students list items used aboard the Shuttle and indicate whether they are reusable or disposable. Discuss the difference between the terms "reusable" and "recyclable." Have students determine whether any disposable items could be recycled and discuss the feasibility of such an idea.

Discuss advantages and disadvantages of robotics in space and on Earth.

● The TDRSS (Tracking and Data Relay Satellite System) is an example of the potential benefits of the current flight. Mission 51-L will deploy TDRS-B, the second of three communication satellites that will allow almost full-time coverage of the Shuttle and up to 26 other satellites. Present several scenarios that involve communications satellites such as an important news story breaking in Europe, a long-lost relative calling from Latvia, or worldwide viewing of the Olympic games. Discuss how communications satellites are involved in each example and how the quality, speed, and reliability of the communications would be affected without the use of satellites.

Have students address the questions that follow in small groups, debates, written essays, or discussions.

a. Why were previous spacecraft not designed to be reusable? (technological limitations, changes in budgetary policies, and cost increases)

b. What advantages are provided by this Space Shuttle design? (more economical in terms of dollars per payload, resource conservation, ability to repair inoperable satellites, two-way transportation)

c. What considerations in terms of reuse are involved with the Space Station or other "permanent" space facilities? (similar economic considerations)

d. Consider products and packaging involved in your everyday life that could and should be recycled.

● Have a group of students prepare a collage of magazine pictures or a mural showing space technology at work in their community. Communities may allow these murals to be painted on or displayed in shop windows.

WORKING AND STUDYING IN SPACE

Concept: The space program generates experimentation in a variety of scientific fields.

● Provide students some background on the use of crystals in communications. Explain that the space program has extended the opportunities for scientists to study and grow useful crystals. Discuss the potential benefits of growing a crystal in a microgravity environment.

Ask students to defend or refute Isaac Asimov's idea: "Another kind of structure in outer space is factories. There is no reason why a good proportion of our industrial factories couldn't be placed in orbit. Pollution that it produces can be discharged into space."

Explore the following thought questions:

a. How does the process of growing a crystal of germanium or silicon differ from growing crystals of sugar or salt?

b. How would microgravity make purifying metals easier?

c. What is the advantage of containerless processing of materials over heating them in ceramic containers on Earth?

d. Why do some materials form crystals and others do not?

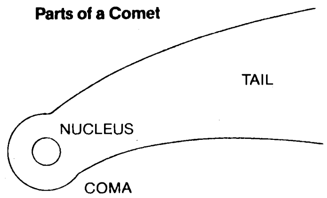
● Ask students to prepare two advertisements that would convince manufacturers to conduct experiments aboard the Shuttle. One group could do a magazine advertisement; the second, a radio or television advertisement. Generate ideas in a brainstorming session.

Objectives:

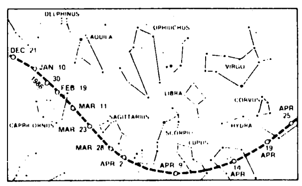
1. To describe the structure and behavior of the Comet Halley
2. To draw a comet and label its parts
3. To explain that light radiation exerts pressure
4. To place ultraviolet radiation in the electromagnetic spectrum correctly and compare its wave lengths to that of light

1. Explain to students that on Flight Day 3, the Spartan astronomical instrument was deployed from the payload bay to examine the tail of Comet Halley. At this time, radiation pressure from the Sun will make the sublimation of materials from the head of the Comet the greatest. The ultraviolet spectrometers on the Spartan will tape record Comet radiation invisible to the human eye. The Spartan unit was retrieved by the Shuttle on Flight Day 5. When returned to Earth, the data will be analyzed and compared to other ultraviolet data gathered by Spacelabs and satellites to help us understand the Universe.
2. Ask students who have recently observed Comet Halley to describe their sightings to class members. List pertinent facts on the chalkboard. Show a chart or diagram of the Comet's structure and orbit. Have students use the chart to locate the Comet's position in reference to the Sun–Earth orbit on the day of sighting.
3. Have students draw and label the parts of the Comet.
4. Have students discuss why the tail is visible only when the Comet is close to the Sun. Use dry ice to represent the Comet, a flashlight to represent the Sun's light, and a vacuum cleaner's blower-end attached to the flashlight to represent the solar pressure of light. Darken the room. Have a student circle close to the "Sun" carrying the tray of dry ice while the blower directs the sublimating gas away from the coma. Observe that the gaseous tail is always streaming away from the Sun. Question students as to which parts of the demonstration are similar to Comet Halley's trip close to the Sun. Explain that the pressure of light is due to tiny particles called photons. Light can exist in fact as both wave and particles. The pressure of our Sun's light is called the solar wind in space.
5. Exhibit a "dirty snowball" with a rock core. Explain that in the vacuum of space, ice changes to gas without melting (sublimation). The dirt becomes the dust of the tail, and the particles in the rocky core eventually disintegrate to dust. We see them as meteors in our upper atmosphere.
6. Darken the room and demonstrate one property of ultraviolet light by shining an ultraviolet (UV) light source on "glow in the dark" materials. Clap erasers near the beam of the UV source to see if eraser dust appears different under UV than in normal light. WARNING: *Do not allow students to look directly at the bulb. The light could burn the eye's retina.*
7. Show where UV radiation is located on the electromagnetic spectrum chart. It has shorter wavelengths than visible light, but not as short as x-rays. Explain that astronomers have used space-orbiting spectrometers sensitive to UV to study dust clouds, our Milky Way, and other galaxies. They want to compare the effect of our Sun's UV on Halley's dust.

Parts of a Comet



MOVEMENT OF COMET HALLEY



Late Jan. to Feb., '86	Comet at its brightest but cannot be seen from Earth as it circles the Sun.
Feb. 24, '86	Comet reappears in early morning sky, just before sunrise, a few degrees above the eastern horizon.
Mar. 6, '86	Comet visible, perhaps with a small tail, 5 degrees above the eastern horizon during dawn twilight.
Mar. 26, '86	Comet 10 degrees above southeast horizon in pre-dawn morning. Its tail may reach up to 20 degrees or more.
April 10, '86	Comet 10 degrees above southern horizon at the crack of dawn. Comet should be at its brightest.
April 11, '86	Comet begins its journey outbound.
April 12, '86	Comet visible before dawn in the southwest and after sunset in the southeast.
April 17, '86	Comet 7 degrees above the horizon after sunset in the southern sky.
Late April, '86	Comet fades from unaided vision.

RECORDING THE SPACE EXPERIENCE

Concept: The space environment is a catalyst for creative expression in art, music, and literature.

● Review with students the music that throughout history has resulted from exploration, migration, and conquest: the sea chanty, Appalachian folk songs, Negro spirituals, Western ballads. Trace the development of each from their sources to 20th-century interpretations. Then challenge students to create a comparable musical form and expression for space. Have them write a paragraph about their reasons for choosing the style, instrumentation, and lyrics.

Challenge music students to imagine that they have been named to compose the theme music for a space mission. Ask them to identify their musical style. Then ask them to identify the moment their composition would begin — launch, orbit, sleep, space walk. Next, ask them to identify the mood or feeling of a piece that best shows the kind of work they would compose. Ask them to compose a given number of measures.

● To commemorate the 50th anniversary of the National Society of Professional Engineers, Richard Bales composed *The Spirit of Engineering* for orchestra. Have students consider what kind of music would capture the Spirit of Exploration, of Science, of Learning, or of Mission 51-L (chamber music, a march, a chorale).

Have students research and report on "What effect has space exploration had on music?" including a discussion of improved recording techniques as a function of advanced electronic technology and the use of electronics in music composition and performance.

● Read the story of Gian Carlo Menotti's opera, *Help, Help, The Globolinks!*, to students and discuss with them the qualities that make it a space-age opera. High school students might consult with a local opera association about producing it.

Challenge students to agree or disagree with novelist James Michener's comments at a NASA symposium on "Why Man Explores." "I have always believed that an event has not happened until it has passed through the mind of a creative artist able to explain its significance." Have them put their ideas into a piece of persuasive composition.

● After discussing the modules of a space station, have students draw their own concepts and develop their ideas from preliminary sketches to detailed drawings to finished paintings or prints.

Have students depict a Space Station in different pictorial styles (e.g., realism, expressionism, abstract). Have them paint two views: (1) the Space Station seen from the Shuttle and (2) the view from the Space Station. Then have them select one of the compositions to explore a variety of techniques — water color, oil, tempera, and collage.

● Have teams of five to eight (the numbers of the Shuttle crew) students draw cross sections of the interior of the middeck area of the Space Shuttle. Challenge each team to choose a color and decorating motif to use in their drawing. The interior of the Shuttle orbiter is white. Discuss color likes/dislikes of individuals, and how various colors affect moods and sense of space. Have the students compare the colors of their classroom, the cafeteria, gymnasium, and a room at home and discuss the reasons why specific colors are selected. Have each student describe his/her personal preference for the interior design of the orbiter and then, what modifications might have to be made to accommodate the tastes of other crew members.

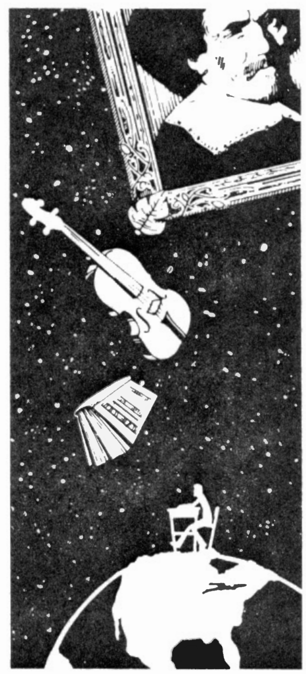
Discuss how artists interpret their awareness of the world: some paint directly from nature, some from experience and memory, some from sketches of nature, and some from imagination. Have students think about how an artist would work during a spaceflight.

● Read poems that mention heavenly bodies, aerospace personalities, and space objects — from nursery rhymes to modern poets — and compare fanciful literature with fact.

Read Gore Vidal's Visit to a Small Planet *and discuss how the alien visitor is like/unlike Earthlings. Read Edmond Rostand's* Cyrano de Bergerac *— are any of the means of spaceflight devised by Cyrano plausible?*

● Talk with students about science fiction authors — Isaac Asimov, C.S. Lewis, Jules Verne, H.G. Wells, Arthur C. Clarke. Read passages from some of their works and assign their books for reports. Discuss with students whether any of the ideas predicted by the authors already may have come to pass.

Astronaut Jeff Hoffman is an astronomer. Ask students to listen to his description of space and to discuss his word choice and sequence of details which enrich his narration. "The sight of the ice particles in front of the Shuttle is like . . . fireflies . . . They're different colors. Some of those sparkles out there are red . . . most of them are white . . . some really bright ones out there . . . . And as the Sun sets on the orbiter, the ice crystals go out. The last few of them turn red. Then they're red. Then they're gone." Later he says, "When you look outside and see the black of space and the ice crystals following us around and the sunrise and sunset every hour and a half, look out and see the lightning storms flashing, the cities making their light patterns beneath the clouds, the patterns in the ocean, flying over the Himalayas as we do the last two orbits tonight, then I know I'm really in space."



RECORDING THE SPACE EXPERIENCE

Concept: The space program engenders diverse reports, stories, and other forms of communication.

● Have students role-play a news correspondent assigned to cover the flight of the Teacher in Space. Ask them to write the news story and a feature story based upon one phase of the event.

Astronaut Jeff Hoffman kept an audio diary of his April 1985 mission. Discuss how this is an example of oral history. Talk with students about the function of oral history. Order a copy of his tape from the National Public Radio Catalog. (See Resources.) After listening to it, discuss if it is more moving to hear rather than to read his words.

● Oral communication is a vital function of the space effort. Have your students help you make a flow chart of the kinds of roles and functions of oral communications during the launch, orbiting, and reentry of the Shuttle. Help them to understand that for each speaking role, there is also a listening role.

Brainstorm the ways in which communication skills of reading, writing, listening, and speaking are used in training for and during a mission.

● McAuliffe is keeping a journal of her experiences. List individuals in history who have kept diaries. Discuss why diaries have been important to later generations.

The second Space Flight Participant will be a journalist. Have students consider the reasons why one of the writing professions was selected and what other writers might like to make a Shuttle flight (poets, science fiction authors). Ask students what other communications professions will probably be represented in the Space Flight Participant Program and list them in order of importance.

● The Mission launch and its ongoing coverage expose students to the jargon of space. With your students, begin to make a list of all terms which have been "coined" by the space program. Place each term or acronym with its definition on a file card. Begin to post them around the room, adding new ones in alphabetical order.

As Mission 51-L progresses, have students collect all news articles, pictures, and any other graphic details which they find. At the conclusion of the Mission, make a class collage, emphasizing the details which the class votes most significant.

● Ask each student to choose a favorite part of the mission which was shown on the live lesson. Allow the student to choose his/her best way of communicating information about that part: oral report, written paragraph, news report, dramatization, role playing, etc.

Identify key events in the history of spaceflight and express them in a workable chronology. Speculate about future events in space.

● Use Comet Halley as a springboard for historical investigation. The reference dates for its returns are 1652, 1758, 1835–1836, 1910, 1986, and 2062. Key question: What has life been like during past returns of Comet Halley? What do you think life might be like during the next appearance in 2062?

Possible projects:

a. *Time capsule approach. Have students create a time capsule that depicts life in the United States in 1986. Have them compare the contents of their capsule with the expected contents of other reference years using inventory lists of facsimile artifacts.*

b. *Time frame approach. Have students imagine that a video is being made entitled "History of the World, Part I." It will include everything from the beginning until now. Their task is to prepare—either visually, orally, in writing, in skits, or in video-vignettes—the frames or scenes from those reference years in which Comet Halley was present. Themes in their time frames can include styles, housing, technology, food and agriculture, currency, manufacturing, important people and events, types of governments, medical science, social and economic conditions, music, dance, and entertainment.*

● Discuss the relationship of the following events to historical themes:

a. Do you think there is a space race? Why and how did it develop?

b. What other themes and events paralleled the space race?

c. What social themes are linked to space history?

d. What evidence is there that international competition was replaced by cooperation?

e. How have economic themes affected the space activities?

Objectives:

1. To write articles that can be submitted to a student newspaper

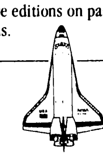
2. To publish a student newspaper about space and the Teacher in Space

1. Technological improvements in satellite communication have enabled publishers to print newspapers with national appeal. Television and radio news receive and send their messages via satellite and microwaves, enabling us to follow news-making events. The Teacher in Space project will be no exception. While the commercial media carry the event, students can track the mission from their own perspective, in their own newspaper.
2. Distribute current newspapers to groups of students. Discuss the functions of different kinds of stories and help the students identify the parts of the newspaper: news articles, features, editorials, comics, and advertisements, etc. How might newspapers be similar or different in the future?

   a. Identify information about Mission 51-L which would make a good news or feature story. Divide the class into small groups to write news stories.

   b. Discuss Mission 51-L. List the kinds of products which could be the subject of advertisements. Ask students to divide into groups. Have each group select a product to advertise in the newspaper, e.g., a space suit, a space meal, or a trip. Challenge each group to design an advertisement for the newspaper, complete with illustration, prices, and details likely to attract sales.

   c. Divide the class into three groups to express their opinions on the Teacher in Space project. One group will write editorials, one the letters to the editor, and the third the cartoon.
3. Using the students' articles, publish a class or school newspaper which records events about Mission 51-L and space in general.
4. To complement the student-produced newspaper on the present mission, challenge students to prepare editions on past and future space missions.



RECORDING THE SPACE EXPERIENCE

Concept: As humanity's presence in space grows, so does the future need for laws and decision making.

● List potential problems of law and governance in space: rights of space travelers, repatriation of downed astronauts, liability problems, ownership or control of heavenly bodies or areas. Investigate the current status of law in space. To introduce the topic, present the following problem:

> Geosynchronous satellites orbit above Earth. Who determines right of way for these orbits and who assigns transmission frequencies? (The United Nations. The International Telegraph Union, ITU, has a special arm, the World Administrative Radio Conference, WARC, to make such allocations.)

Assign students to research the network of U.N. and intergovernmental space agencies which establish and enforce space laws.

Have students research existing guidelines and principles for space government. Provide copies of the provisions of the Treaty on Principles Governing the Activities of States in the Exploration of Outer Space, Including the Moon and Other Celestial Bodies *opened for signature by the U.N. General Assembly in 1967. Discuss with students why it is called the Magna Charta for space. (See Illustration below.)*

● Give specific examples of circumstances that the students could classify by the appropriate treaty provision. For example, "A country cannot claim territory in space." "A country should regulate the space activities of its citizens." (See Illustration below.)

Encourage students to create editorial cartoons or vignettes involving the special problems of space law.

● Have students design an outer space regime as they believe it should function. The Star Trek Federation is a good hypothetical example. Some issues surrounding the creation of the regime may be one nation-one vote versus votes based on contribution, enforcement, jurisdiction, and courts.

> *"Tonight I am directing NASA to develop a permanently manned space station — and to do it within a decade."*
> *— Ronald Reagan, State of the Union Address, January 25, 1984*

Ask students why the President made that decision, committing vast amounts of national resources at a time when budget deficits were rising.

Introduce the concept of a decision-making model or process. Use examples of other pivotal space decisions, such as the lunar landing, or ask students for their ideas of other historical decisions. Reinforce the concepts of goals, alternatives, and expected outcomes.

● Use the Spaceship Decision-Making Model (See Illustration p. 4.) to "walk through" the Space Station decision with the class. Apply the Model to a variety of space-oriented problems. Historical decisions may be researched and evaluated in terms of "accuracy." Present decisions may be followed closely, while future decisions may be considered. These may be done individually, in small groups, or as a whole class.

a. Historical Decisions
1) Creation of NASA
2) Kennedy's goal of reaching the Moon before 1970
3) Participation of other countries in early space efforts
4) Continuation of Apollo after 1967 deaths
5) Inclusion of women as astronauts
6) Apollo/Soyuz joint mission

b. Current Decisions
1) Sharing scientific data with other nations
2) Use of Earth observation satellite data by governments
3) Cost factors
4) Manned vs unmanned space missions

c. Future Decisions
1) Space colonization
2) Space manufacturing or mining facilities
3) International space ventures
4) Landing on other planets

A Treaty of Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies. The Treaty was opened for signature on January 27, 1967. This "Outer Space Treaty" or "Space Charter" has been characterized by some as a Magna Charta for space. Treaty provisions declare that:

(1) International law and the Charter of the United Nations shall apply to space activities.

(2) Outer space and celestial bodies are the province of mankind and shall be used only for peaceful purposes and for the benefit of all mankind.

(3) Nuclear weapons, weapons of mass destruction, military bases, and military maneuvers are banned from space.

(4) Outer space shall be free for exploration, use, and scientific investigation.

(5) There can be no claims of sovereignty or territory by nations over locations in space, "by means of use or occupation or by any other means."

(6) Jurisdiction over space objects launched from Earth shall be retained by the launching state.

(7) Private interests are recognized as having freedom of action in space, so long as a government or group of governments on Earth authorize and exercise continuing supervision over their activities. Signatory nations (seventy-eight at last count, including the United States and the Soviet Union) are therefore under a duty to oversee the activities of their citizens and commercial ventures in space.

(8) Governments are liable for damage caused on Earth by their space objects.

(9) Astronauts are "Envoys of Mankind" and are entitled to noninterference and all necessary assistance in distress.

(10) The natural environments of celestial bodies should not be seriously disrupted, and Earth must not be contaminated by extraterrestrial organisms.

NASA Teacher Resource Centers

Teacher Resource Centers at major NASA installations provide easy access to NASA-related materials that can be incorporated into the classroom at all levels. The materials reflect NASA research, technology and development in a variety of curriculum and subject areas. Resources available include NASA videotapes, 16mm films, 35mm slides, NASA publications, audio cassettes, computer software, laser discs, teacher's guides, and classroom activities. Educators can review the material and request copies for use in their classrooms. The only charge is the cost of reproduction and mailing. Visit or contact the Teacher Resource Center nearest you for information about services and materials:

ALABAMA SPACE AND ROCKET CENTER
Attn: NASA Teacher Resource Room
Tranquility Base
Huntsville, AL 35807
(205) 837-3400, Ext. 36

NASA AMES RESEARCH CENTER
Attn: Teacher Resource Center
Mail Stop 204-7
Moffett Field, CA 94035
(415) 694-6077

NASA GODDARD SPACE FLIGHT CENTER
Attn: Teacher Resource Laboratory
Mail Stop 130-3
Greenbelt, MD 20771
(301) 344-8981

NASA JET PROPULSION LABORATORY
Attn: Gil Yanow
Science and Mathematics Teaching Resource Center
Mail Stop 180-205
Pasadena, CA 91109
(818) 354-6916

NASA LYNDON B. JOHNSON SPACE CENTER
Attn: Teacher Resource Room
Mail Stop AP4
Houston, TX 77058
(713) 483-3455 or 4433

NASA JOHN F. KENNEDY SPACE CENTER
Attn: Educators Resource Library
Mail Stop ERL
Kennedy Space Center, FL 32899
(305) 867-4090 or 9383

NASA LANGLEY RESEARCH CENTER
Attn: Langley Teacher Resource Center
Mail Stop 146
Hampton, VA 23665-5225
(804) 865-4468

NASA LEWIS RESEARCH CENTER
Attn: Teacher Resource Room
Mail Stop 8-1
Cleveland, OH 44135
(216) 267-1187

NASA NATIONAL SPACE TECHNOLOGY LABORATORIES
Attn: Teacher Resource Center
Building 1200
National Space Technology Laboratories, MS 39529
(601) 688-3338

NASA Regional Teacher Resource Rooms have been established at the following institutions:

Mr. Richard P. MacLeod
Executive Director
U.S. Space Foundation
P.O. Box 1838
Colorado Springs, CO 80901
(303) 550-1000

Mr. Barry Van Deman
Museum of Science & Industry
57th Street and Lakeshore Drive
Chicago, IL 60637
(312) 684-1414, Ext. 432

Dr. Kenneth Pool
School of Education
University of Evansville
1800 Lincoln Avenue
Evansville, IN 47714
(812) 479-2766

Mr. Scott Seaman
Director, Learning Resources Division
Northern Michigan University
Marquette, MI 49855
(906) 227-1300

Ms. Carolyn Cooper
Olson Library Media Center
Northern Michigan University
Marquette, MI 49855
(for materials only)
(906) 227-2117

Professor David Housel
O'Dowd Hall, Room 115
Oakland University
Rochester, MI 48063
(313) 370-3079

Dr. Richard Mitchell
Curriculum and Instruction
Box 52
Mankato State University
Mankato, MN 56001
(507) 389-1516

Professor Doreen Keable
Center for Information Media
St. Cloud State University
St. Cloud, MN 56301
(612) 255-2062

Dr. Martin Marin
The City College
NAC 5/208
Convent Avenue at 138th Street
New York, NY 10031
(212) 690-6678

Dr. Paul A. McWilliams
Executive Director
NASA Industrial Applications Center
23 William Pitt Union
University of Pittsburgh
Pittsburgh, PA 15260
(412) 624-5211

Mr. Gregory L. Vogt
Executive Director
Science, Economics & Technology Center
818 West Wisconsin Avenue
Milwaukee, WI 53233
(414) 765-9966

Dr. Ruby Koch
College of Education
213 Morris Hall
University of Wisconsin at LaCrosse
LaCrosse, WI 54601
(608) 785-8128

RESOURCES

An Astronaut's Journal by Jeff Hoffman. National Public Radio, 1985. (Orders to National Public Radio, P.O. Box 55417, Madison, WI 53705. 1-800-253-0808 except Wisconsin and Alaska. $12.95 including postage. Free Catalog.)

Bales, Richard. *The Spirit of Engineering.* Alexandria, VA: National Society of Professional Engineers. (1420 King Street, Alexandria 22314; 703/684-2852)

Branley, Franklyn M. *Space Colony: Frontier of the 21st Century.* New York: Lodestar Books, 1983.

Chapman, P.D. and Bondurant, R.L. *Comet Halley Returns: A Teacher's Guide,* 1985–1986. Washington, D.C.: U.S. Government Printing Office, EP-197.

Dean, Leigh. *Gian Carlo Manotti's Help, Help, The Globolinks!* New York: McGraw-Hill Book Company, 1970.

Jacobs, Leland B. *Poetry for Space Enthusiasts.* Champaign, IL: Garrard Publishing Company, 1971.

National Aeronautics and Space Administration. *Food for Space Flight.* Washington, D.C.: U.S. Government Printing Office, NF-133/6-82.

__________. *Microgravity... A New Tool for Basic and Applied Research in Space.* Washington, D.C.: U.S. Government Printing Office, EP-212.

__________. NASA Facts. Washington, D.C.: U.S. Government Printing Office. (assorted educational publications)

__________. Shuttle Prediction and Recognition Kit (SPARK) and 51-L Mission Chart. (Lyndon B. Johnson Space Center, SPARK AP4, Houston, TX 77058.) Kit can be reused with new mission charts.

__________. *Social Sciences and Space Exploration.* Washington, D.C.: U.S. Government Printing Office, 1984.

__________. *Spinoff 1985.* Washington, D.C.: U.S. Government Printing Office, 1985.

National Space Institute. *Dial-a-Shuttle.* Washington, D.C.: National Space Institute, 1-800-410-6272.

OMNI's Screen Flights/Screen Fantasies. Garden City, NY: Doubleday and Company, Inc., 1984.

Pogue, William R. *How Do You Go To The Bathroom in Space?* New York: Tom Doherty Associates, 1985.

Radlauer, Ruth and Ed; and Mather, Jean and Bob. *Satellite Tech Talk.* Chicago: Children's Press, 1984.

Student Shuttle Involvement Program (SSIP). National Science Teachers Association, 1742 Connecticut Avenue, Washington, D.C. 20009.

Weiss, Malcolm E. *Far Out Factories: Manufacturing in Space.* NY: Lodestar Books, 1983.

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APPENDIX W

TEACHER IN SPACE FINALISTS' PROJECT ASSIGNMENTS

TEACHER IN SPACE FINALISTS' PROJECT ASSIGNMENTS

Kathleen Beres Space Flight Center, Huntsville, AL.	o Develop Educational materials for Space Marshall Telesccope/technology utilization o NASA liaison to MD State Dept. of Ed. o Assist NASA Teacher, Student Minority Programs
Judith Garcia Headquarters, Washington, D.C. Langley Research Center, Hampton, VA.	o Produce video tapes careers in Aerospac (LaRC) o "Space Classroom"- using existing technology to bridge traditional educational educational methods o VP - TISEF
Peggy Lathlaen Johnson Space Center Houston, TX.	o Interface with education leaders, trainers, & writers, gifted Ed., planning group math and science ed., task forces on teaching o Assist Houston public TV (KUHT) with "Space Watch" o TISEF
David Marquart Ames Research Center Moffett Field, California	o NASA liaison with Idaho State Dept. of Educ o Develop curriculum with state-of-the-art material - Idaho State Dept. of Educ. & Mt. Bell Foundation o Maintain contact with NASA/Ames o Develop Business Ed materials for TRR

<u>Richard Methia</u> NASA Headquarters Washington, D.C.	o NASA liaison with TISEF o Strengthen TISEF and activate on-going educational programs & events o VP-TISEF
<u>Mike Metcalf</u> Goddard Space Flight Center, Greenbelt, MD.	o Write historical monograph on the entire Teacher in Space Project in coordination with history office. o Explore and design methodologies to expand NASA's educational programs on an international basis to U.S. dependent schools worldwide.
<u>Robert Foerster</u> Lewis Research Center, Cleveland, OH.	o Explore and develop model dissemination network for NASA materials in cooperation with National Diffusion Network. o NASA Liaison with all Midwest regional TRR o Develop elementary software for TRR o Conduct workshops on implementing Liftoff curriculum material. o Develop elementary math/CS curriculum materials for TRR.
<u>Nikki Wenger</u> Langley Research Center, Hampton, VA.	o Halley's Comet Education Packet o Space Ambassador's conference o Kroger video tapes o Teacher Workshops o Scholars program o NASA data base & bulletin board o "Lessons from Space" o TISEF

APPENDIX X

TEACHER IN SPACE EDUCATIONAL FOUNDATION

TEACHER IN SPACE EDUCATIONAL FOUNDATION

Teacher in Space Educational Foundation (TISEF): 1110 Vermont Avenue NW., Suite 710, Washington, D. C., 20005; contact Teri Adams, 202/833-9250. This is a non-profit educational organization, created in March 1986 by the Space Ambassadors in the Teacher in Space Program (TISP). Conceptualized prior to the Challenger accident, the main goal is to use space as a catalyst to help creative teachers transform their classrooms into schools of the future. Through electronic training, aerospace conferences, teacher recognition awards, and information publications, the Foundation aims to help innovative teachers prepare their students for the 21st Century.

APPENDIX Y

TEACHER IN SPACE AUDIENCE REPORTS

TEACHER IN SPACE AUDIENCE REPORT

Educational Activities of the Space Ambassadors

June 1985 through July 1986

Type Activity

Lectures	1616*	(71%)
workshops	233	(10%)
Publications	45	(2%)
Others	373	(17%)
	2267	

Level of Instruction

Elementary	797*	(39%)
Middle	414	(20%)
Secondary	442	(21%)
Undergraduate	177	(9%)
Graduate	223	(11%)
	2053	

Type Audience

Teachers	1156*	(30%)
Students	1172	(30%)
Administration	532	(14%)
Business	281	(7%)
Community	560	(15%)
Other	173	(4%)
	3874	

* Number of events

****

Audience Size

Pre-Accident	Post-Accident	Total
1.4 million	2.7 million	4.1 million

APPENDIX Z

CHALLENGER FOUNDATIONS AND MEMORIALS

CHALLENGER FUNDS AND MEMORIALS

Space Shuttle Children's Fund: American Security Bank, 1501 Pennsylvania Avenue N.W., Washington, D.C. 20005; Contact, Roger W. Conner, 202/624-4695.

National Air and Space Museum (NASM) building at Dulles Airport, which will house the space shuttle Enterprise. The building is to be called Challenger Hall. The NASA Credit Union initiated the drive. They have delayed formal fund raising efforts until the new building is approved by Congress. Contact Don Bell, 301/699-1000.

Challenger Fund: c/o The Space Foundation, P.O. Box 58501, 711 Bay Area, Suite 300, Houston, TX 77058; contacts, Dr. William Urban or Mrs. Nancy Wood, 713/332-0779: The funds that are raised eventually will be turned over to the Challenger Center for Space Science Education. They also were co-sponsors with the Houston Chamber of Commerce, the Clear Lake Economic Development Foundation and Space Industries, Inc., for the benefit concert, funds of which were turned over to the Challenger Benefit Fund.

Challenger Fund: P.O. Box 51-L, Colorado Springs, sponsored by the U.S. Space Foundation P.O. Box 1838, Colorado Springs, CO 80901, Richard MacLeod, President, 303/550-1000. The Funds received will go toward building a new orbiter.

Space Camp/Challenger Memorial Fund: Scholarships for under- privileged children to the Space Camp in Huntsville, AL; contact is Linda Burroughs, 205/837-3400, Ext. 23. About twenty children were given scholarships last summer.

The Christa McAuliffe American Education Fund: c/o American Security Bank, P.O. Box 0149, Washington, D.C. 20055. This fund was established by the National Foundation for the Improvement of Education, an affiliate of the National Education Association (NEA). The objective is to commemorate Christa McAuliffe's pioneering spirit through scholarships and grants for teachers to explore new and innovative ways to teach and to encourage the high school and college students to enter the teaching profession.

Christa's Challenge: Box 1930, Washington, D.C. 20013-1930, 202/879-4400. This scholarship fund was established by the American Federation of Teachers (AFT) to provide tuition assistance to high achievers who make a commitment to a career in teaching. AFT sponsored television spots to promote contributions to the fund. A permanent memorial of Christa McAuliffe will be placed in the AFT Headquarters building in Washington, D.C.

The State of New Hampshire Christa McAuliffe Sabbatical Trust Fund: 116 North Main Street, Concord, NH 03301. This sabbatical program recognizes outstanding New Hampshire teachers and provides them the opportunity to complete educational projects which will benefit the state's students and teachers.

National Talented Teacher Fellowship Program: Renamed in honor of Christa McAuliffe by the Education and Labor Committee of the House of Representatives and passed by the Congress. The program was organized in 1981 to offer fellowships to encourage and reward outstanding teachers.

U.S. Department of Education: Providing up to $1 million from the Secretary's discretionary fund to provide Christa McAuliffe Scholarships for teachers to study and improve their knowledge in science and mathematics under the tutelage of distinguished scholars and scientists.

NASA Teacher Resource Institute at the University of Pittsburg: has dedicated the Institute to the memory of Sharon Christa McAuliffe. Renamed to :

> Sharon Christa McAuliffe Teacher Resource Institute at the NASA Industrial Applications Center, University of Pittsburg.

Pride in Space Week: a fund-raising activity in Evanston, Wyoming, from February 10-14, 1986. The activity collected monies as contributions to NASA for construction of a new shuttle. Julie Guess, one of the Wyoming Teacher in Space finalists coordinated the effort. Unconditional monetary contributions to NASA by check mailed to: Director of Financial Management, Code BF, NASA Headquarters, Washington, D.C. 20546.

USA Challenger Scholarship Foundation: L.I. Hanson, P.O. Box 681053, San Antonio, TX 78269; 512/522-0469. Planning a fund-raising tribute to the Challenger crew in January 1987. The aim to break the world's record for release of small helium balloons. Their goal is to send 1,281,986 (a play on the date of the Challenger tragedy) balloons aloft. Each of the balloons, they hope, will be sponsored by an individual or corporation. They plan to use funds raised for scholarships for college students, to send younger students to Space Camp, and to develop a space career center.

Resnik Scholarship Fund: Akron Public Schools, 704 North Broadway, Akron, OH 44308; contact, Robert Lewis, treasurer, 216/434-7229. They awarded a $2,000 scholarship last June.

Resnik Scholarship Fund: Carnegie-Mellon University, 603 Warner Hall, Pittsbutg, PA 15213; contact, Dr. Richard Cyert, 412/268-2200; for women in engineering and science.

Judith Resnik Endowment: American Association of University Women, AAUW, 2410 Virginia Avenue, NW, Washington, D.C. 20037; contact Swe (pronounced sway) Thant, 202/728-7615. Funds will be used for predoctoral awards to individual women.

Children of the Challenger: Ms. Betty St. John, 3958 Carnett Court, Ft. Worth, TX 76133. Day phone, 817/292-5388; night phone, 817/924-4982; for donations to build a new orbiter from school children. This group does not collect funds but refers donors to the Challenger Fund in Colorado Springs.

Challenger Scholarship Memorial Fund: P.O. Box 2420, Petersburg, VA 23804; contact is Skip Gieseking, 804/861-8020 or 734-2140/2268. Supported by Radio KHK an TV Channel 8.

Challenger Benefit Fund: c/o Texas American Bank, Trust Division, P.O. Box 2529, Houston, TX 77252, 713/759-2500; Former Astronaut Dr. Joseph P. Allen, 713/338-2676, has been asked by the families of the seven astronauts to represent them in coordinating the proper distribution of contributions made in their memory.

Onizuka Memorial Committee: P.O. Box 1927, Kailua-Kona, Hawaii 96745; 808/329-1634. Purpose is to place a statue of Onizuka at the airport in Kona, rename the airport and build a pavilion to the memory of Onizuka at the airport; contact, Fred J. Fujimoto, Chairman.

The Challenger Center Foundation: The Challenger Center, P.O. 90077, Washington, D.C 20090, 713/488-6481. This Foundation was established by the family members of the Challenger crew. Its purpose is to establish and support a national Challenger Center for Space Science Education as a living tribute to the seven-member Challenger crew.

Ron McNair Committee: P.O. Box 663, Lake City, SC 29560; Harry Wright, Chairman, 803/394-3728. Scholarships for graduating seniors from Lake City High School, who plan to pursue work in some field of science.

Ronald E. McNair Scholarship Fund: Established at North Carolina A&T State University, Greensboro, NC. Contact, Shirley Frye, 919/334-7600 or 765f4. An endowed chair in computer science has just been completed; a donor has given funds for a bust of McNair to go outside the new $8.5 million engineering building which has been named for

McNair; the State Legislature has appropriated money for scholarships for disadvantaged students.

Ron McNair Scholarship Foundation: P.O. Box 54281, Atlanta, GA 30308, 404/872-2333; contact, Carl McNair, Cheryl McNair is chairperson. They are working with the Southern Education Foundation. Purpose is to provide scholarships, nationwide, to graduating high school seniors, who will be continuing on to college.

CHALLENGER MEMORIALS

Astronauts Memorial Foundation, Inc.: P.O. Box 628003, Orlando, FL 32862-8003; 305/740-7373. Sen. Jake Garn and Rep. Bill Nelson are co-chairing this effort to raise funds for the design, construction and perpetual care of a memorial at Kennedy Space Center (KSC), FL, for all astronauts who have lost their lives. Once the memorial is completed, education will become the focus with the scholarship fund to be established to support students pursuing careers in the fields of teaching, engineering and science. Plans are to have the drive underway by January 28, 1987; have the memorial dedicated on January 28, 1989; and to have educational facilities in palce at KSC by January 28, 1991. Rep. Nelson will take part in the kick-off of the fund raising effort on August 21 at 5:30 P.M. at the Visitors Information Center at KSC. A statewide, 7-km., non-competitive walk/run-a-thon is planned for November 22 and the state has been asked to issue commemorative shuttle license plates with the fees going to the Foundation. The month of November is to be designated Challenger month in Florida and a number of educational programs are planned aimed at promoting a positive view of the space program. Contact: Alan Helman, AIA, Helman, Hurley, Charvat and Peacock Architects, Maitland, FL, 305/644-2656.

Space Flight Memorial Foundation, Johnson Space Center: P.O. Box 58009, Houston, TX 77258-8009. Contact, John Francis, 713/333-5986. Center Rotary Club originally launched an effort to build an interfaith memorial on or near the Johnson Space Center, Houston, TX. They have been asked by Johnson Space Center to defer any further fund raising efforts and will probably join in the Challenger Center for Space Science Education effort.

Judith Resnik Memorial, Jerusalem: An $8 million gymnasium for disabled Israeli war veterans is to be built in Jerusalem as a memorial to Judith Resnik and her fellow astronauts who died aboard the space shuttle Challenger. Contact: Mitch Chupak, 136 East 39th Street, New York, NY 10016, 212/725-1211. Dr. Erika Freeman-Padan and Marvin

Hamlisch are co-chairmen of the Ad Hoc Committee for the Memorial.

L-5 Challenger Memorial: A resolution, introduced by Congressman Badham (Republican-California) to authorize the L-5 Society, a private exploration advocacy group to erect a memorial in Washington, D.C. to the Challenger crew is still pending in the House.

In addition to the L-5 bill there at least a dozen other bills in House committees covering such Challenger-related actions as establishing a permanent Teacher Recognition Day on each January 28, authorizing the President to award gold medals to the families of the Challenger crew; renaming seven of the moons of Uranus after the Challenger crew, etc.

Funds received by NASA, specifically for a new orbiter are going to the general NASA trust fund. S2054 (Congressman Nickles, Republican-Oklahoma), which would permit NASA to accept gifts and donations for a space shuttle, which may be named Challenger II, passed the Senate on April 11, 1986, and has gone to the House.

VITA

Lillian Diane Young

Candidate for the Degree of

Doctor of Education

Thesis: A DESCRIPTIVE ANALYSIS OF THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION'S TEACHER IN SPACE PROGRAM

Biographical:

Personal Data: Born in Honolulu, Hawaii, June 11, 1951, the daughter of Revere Alus and Mary Bresser Young.

Education: Graduated from Putnam City High School, Oklahoma City, Oklahoma, in 1969; received Bachelor of Science degree with a major in Special Education from Oklahoma State University in May, 1973; received Master of Education degree with a major in Special Education from Central State University in July, 1979; completed requirements for the Doctor of Education degree at Oklahoma State University in May, 1987.

Professional Experience: Elementary Special Education Teacher at Garden Oaks Fifth Year Center and Rockwood Elementary School, Oklahoma City, Oklahoma, 1973-75; Special Education Teacher, Cerebral Palsy Center, Crooked Oak School District, Oklahoma City, Oklahoma, 1975-76; Special Education Teacher, Shiprock Boarding School, Bureau of Indian Affairs, Shiprock, New Mexico, 1976-77; Special Education Teacher, Riverside Boarding School, Bureau of Indian Affairs, Anadarko, Oklahoma, 1977-78; Special Education Teacher, East Elementary School, Anadarko, Oklahoma, 1978-82; Child Find Coordinator, County Co-op Coordinator, 1980-82; Teacher, Title VI-B Summer Program, 1981; Teacher/Coordinator for Title VI-B Summer Program, 1982; Special Education Teacher, Burleson High School, Burleson, Texas, 1982-84; Graduate Research Assistant, NASA Aerospace Education Contract, Oklahoma State University, 1985 to present.