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Paper Session III-A - Challenger Center Touching the Future

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BACKGROUND

The Challenger Center for Space Science Education is a nonprofit educational organization with a mission to increase the number of elementary and middle school students interested in science, and to reverse the negative feelings many American youngsters have about science and technology. The Challenger Center was established in 1986 by the families of the Challenger shuttle crew as the most appropriate way to continue the Challenger crew's educational mission: to teach, to explore and to inspire.

Challenger Center uses the excitement of space exploration to capture children's interest. Through interesting and hands-on, problem-solving, space-related activities, children experience first-hand the opportunities and satisfactions offered by science and technology. To ensure reaching the broadest possible group of schoolchildren nationwide, Challenger Center operates through a distinctive series of collaborations with local schools, science center and museums, government agencies and community organizations.

Challenger Center currently has four core educational programs:

1) **Challenger Learning Center Sites** form a national network of high-technology space-flight simulators for exciting hands-on learning experiences.

2) **Satellite Learning Network** is a continuing series of teleconference programs for classrooms featuring space-based lessons, "call-in" interviews, activities and materials for the classroom.

3) **Touching the Future: Linking the Classroom with Space** is a series of teacher training workshops led by 100 NASA Teacher-In-Space finalists who are the core of the Challenger's National Faculty. This program uses space-based teaching and curriculum materials designed to be effective tools and strategies for teaching science.

4) **Adventures in Exploration** is a series of educational projects involving students from around the world in year-long space mission simulations designed to address the challenges of problem-solving in multicultural and multilingual situations.

Over the last four years Challenger Center has accomplished the following:

1) established a core of 100 teachers in the National Faculty who meet continually to develop new space science curriculum materials and who provide ongoing teacher workshops;
2) held 60 teacher training workshops in 41 states, Korea and Germany;
3) built six simulated space stations across the country in what is expected to be a 25-site network;
4) reached more than a million students annually through its satellite programs.

The Challenger Center currently has a staff of 15 professional and 8 support staff.

NATIONAL EDUCATION GOALS

In our nation's schools a much publicized decline in mathematics and reading scores has been parallelled by a loss of students entering careers in mathematics, engineering and the sciences. To insure a global lead in technology, it is necessary to reverse this trend now.

During the past 10 years there has been an alarming decline in the international industrial competitiveness of the U.S. and an erosion of our nation's technological leadership.

Numerous papers, including: A Nation at Risk, Academic Preparation for College, Educating Americans for the 21st Century, A Nation Prepared, Transforming American Education: Reducing the Risk to the Nation, and What Works, have conluded that for change to occur:

1. math, science and technology must become important, stimulating and personally rewarding to students beginning with the elementary grades.
2. involving students in applying math, scientific and technological knowledge to the solution of real problems - not just the study of facts - becomes a required curriculum component.
3. the educational program features multiple learning avenues open to students, their parents and teachers.

THE NEED

Multiple applications of advance technology have, to date, satisfactorily answered many of America's needs. However, by the year 2010, we can expect a shortfall of 500,000 scientists and engineers traceable in turn to an under-investment in their education. Concurrently, we can expect 85% of those entering the workforce to be minorities and women, both historically underrepresented in science and engineering. Without addressing these phenomena, it is clear America's needs will not continue to be satisfied by a strong technological workforce, neither can we expect to maintain global leadership in this area.

Concurrently, we know that the alarming trend among American students - even bright students - is to take the minimum required math/science courses in these areas. It is crucial that programs reach out to individuals who might not seek out such materials on their own, such as teachers with little background in mathematics or science; that it reach those who might not otherwise have such an experience, such as minority students in inner city schools, or girls who traditionally perceive mathematics and science as "male" subjects; and that they reach students before they make choices that put many satisfying and productive future careers out of their reach forever. The point at which most students in the United States decide whether or not to pursue mathematics and science tracks occurs predominantly in middle school (grades four through eight).

CHALLENGER CENTER ADDRESSES THE NEED

Challenger Center has worked to address this need with its programs from its inception. The Challenger Center for Space Science Education is working to be the nation's first interactive space science education center where teachers and students of all ages and levels of accomplishment may, by using advanced technology and space-life simulators, learn to explore space and science for themselves.

The Challenger Center is striving to design and implement innovative and exciting programs to encourage students traditionally underrepresented in sciences and

mathematics to become interested in the sciences. Space is an excellent medium to attract these students, because youth of all ages have an exciting interest in space.

Challenger Center's programs use space exploration and its applications here on earth to enhance teaching and stimulate learning. Space captures the imagination of young people, evoking visions of adventure, scientific achievement, and the pursuit of excellence. In the classroom, this enormous appeal makes space a valuable tool for motivating students to learn about mathematics, science and technology; this is especially true with minority and female students.

Programs that are effective in stimulating interest and success in science and mathematics share some characteristics. Two characteristics mentioned repeatedly are central to the Challenger Center programs. These are the use of role models and hands-on learning experiences (Malcom 1983; Rendon 1985; Ascher 1985; Task Force on Women, Minorities, and the Handicapped in Science and Technology 1989).

Role models help students identify with potential success in a field. Challenger Center will provide students with the opportunity to hear and speak to men and women that have exciting careers in the sciences. Hands-on learning experiences increase understanding of scientific concepts and confidence in the student's own ability.

MARSVILLE: SCOPE OF THE PROJECT

To extend its impact Challenger Center is planning a 3 phase educational experience for youth as its International Space Year Project. "Marsville -- The Cosmic Village," (formerly called "Destination -- Mars") was endorsed as one of the lead educational projects for International Space Year by the Space Agency Forum meeting in Kyoto, Japan, in May 1990.

Marsville will lead students to an increased appreciation of the fragility of the Earth's environment by using Mars as an analog. Except for a few robotic probes, Mars is a pristine world untouched by human presence. Examining and learning from the historical experience of their home planet's development, students will be asked to create a new human world, a multi-racial settlement on Mars, Students will be asked to become pioneers of the space frontier.

While the primary educational thrust in Marsville focuses on science, math, technology and communications, the project will use a cross-curricular, holistic approach bringing in the humanities (arts, language, music) as well as the social and political sciences when appropriate. In addition, each major project activity will follow the four-part Challenger Center instructional model: (1) content instruction, (2) cooperative learning strategies, (3) critical thinking and problem solving, (4) responsible decision-making.

The purpose of Marsville is to create for young people from around the world a positive vision of the technological society of the twenty-first century, and of their role in making it a reality.

Its objectives are:

- To teach math, science, technology, engineering and communications concepts.
- To demonstrate problem solving using a cooperative model.

- To arouse student's interest in pursuing careers in the sciences, communications, and technology.
- To promote international understanding among youth and increase student's awareness of, and respect for, multi-cultural perspectives.
- To expose students to the complex scientific, technological, environmental, socio-political, and cultural issues related to space exploration.
- To provide students with positive role models from the fields of science and technology.

When the American pioneers went west, they literally left the United States at the Mississippi border and entered truly uncharted territories. Faced with problems they had never imagined, they had to create brand new answers.

How do you build a cabin when you have no logs? You make bricks from soil. Hide from a tornado? Dig a cellar. And if you have no state constitution (because you aren't a state yet), the home rule of each sheriff in each town must resolve many conflicts.

Just like the pioneers who lived years before them, students will be pioneers, too; but their territory will be the planet Mars. Together with fellow pioneering teams they have not yet met, they will create brand new solutions to basic human problems.

DESIGN

Phase 1 - Planning Marsville - (October 1991-April 1992)

Over 125,000 students in 5,000 classrooms around the country will help plan Marsville, the prototype Martian community of the future. "Mission teams" consisting of 5-7 students with a teacher/mentor will solve 4 simulation-based problem sets from October '91 to April '92.

Program #1: Pioneering the Space Frontier (October 1991)

The first Marsville satellite programs will focus on pioneering. Students will be asked to consider questions such as:

- What is a pioneer?
- Why do people become pioneers? What motivates them and sustains them?
- What problems do pioneers generally face? What are their "life support" needs in a new and potentially alien environment?
- How did pioneers historically deal with the wide range of problems facing them?

As the major problem-solving challenge that is part of Program #1, student teams will plan the essential life support needs for their six-month voyage to Mars.

Program # 2: Building the Habitat: Home Away from Home (December 1991)

The second program in the series will focus on the construction of a habitat for the first Martian settlement. This program with its accompanying materials will provide necessary background on Martian atmosphere, terrain, "weather" and geology. Students will be asked to consider questions such as:

- What constitutes a human habitat?
- How did pioneers historically use available materials to fashion their habitats?
- What materials, shapes and structures would provide the most efficient and hospitable habitat for a human settlement?

The major problem-solving challenge for student teams as part of Program #2 will be the design of a Martian habitat for 5 to 7 humans.

Program # 3: Now, There Is Life on Mars (February 1992)

The third program will focus on meeting the various life support needs for the Martian habitat (air, energy, waste, food). Students will address questions in this program such as:

- How will the settlement feed itself?
- What will provide the most efficient energy needs?
- How will waste products be treated so as not to pollute the Martian environment?

The major problem-solving challenge for student teams as part of Program #3 will be design of three major life support systems for the settlement.

Program # 4: At Work on Mars (February 1992)

The fourth program will concentrate on the work of the Martian settlement in conducting scientific experiments and developing engineering prototypes. Students will be asked to develop and conduct science and engineering experiments on Mars and to apply the knowledge gained to Earth's problems. They will be asked to deal with such questions as:

- How can life in the artificial biosphere on Mars be maintained pollution free?
- How can Mars be "farmed"? Mined?
- What can we learn about the earth by experimentation on Mars?

The major problem-solving challenge for student teams as part of Program #4 will be the design and construction of the most effective vehicle for transportation of people and materials on Mars.

Phase 2 - Building Marsville - (May 1992)

Mission teams will convene at sites around the country for a one-day "televenture." (Host sites will be Challenger Learning Centers, NASA field centers, science centers and museums, and Space Grant Consortia Colleges and Universities.) At each site via interactive videoconferencing, teams will share their

solutions with other Martian "outposts" and solve an additional problem requiring cooperation and communication among "outposts."

All problem sets will focus on the environmental needs of humans living on Mars for an extended period of time: food production, waste management, energy utilization, use of resources, advanced technologies and their applications, and other issues such as communications, transportation, and governance. The educational strategy is to use the establishment of this imaginary Martian biosphere as a dramatic tool for increasing students' awareness of Earth's environmental problems.

For purposes of definition, Phases 2 and 3 are described relative to implementation in the USA. Sample materials will be made available to coordinating agencies in any country that wishes to participate and is willing to reproduce the materials in the appropriate language. It is hoped that the full project will be implemented in many countries around the world.

Phase 3 - Marsville--the Cosmic Village - (July 1992)

Select Mission Teams (250 students) representing each of the 26 nations of SAFISY will convene in cooperation with Kennedy Space Center for a four-day conference. During the week students will share the work they have done on the development of their prototype Martian communities. The participants will have "flight" briefings by top space scientists, explore the real world of space launches, and work on the final ISY project: the creation of Marsville, the Cosmic Village.

In essence, the students will be holding the First Constitutional Convention of Mars. Topics to be discussed might include:

Allocation of resources
Preservation of the environment.
Governance
Growth

This first Global Town Meeting will encourage world-wide participation through linkage with local sites via interactive teleconferencing. It is anticipated that this concept will be so unique in its use of Mars as an analogue to discuss Earth's problems that it will be carried by major networks in many countries.

The final product of Phase 3 will be a design for the ideal Mars village — the first planned community in outer space.

CONCLUSION

The United States today faces a broad array of technological challenges. Our ability to meet these challenges hinges on our ability to recapture America's traditional excellence in science, math, and technology. America needs to develop a scientifically literate, mathematically competent citizenry and a technologically skilled workforce to lead us into the 21st century. Through "Marsville," the Challenger Learning Center network, and a wide range of educational programs, Challenger Center is doing its part to touch the future.