FOCUS ON EDUCATION

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Lewis News

Education Holds The Key To Our Future

NASA Administrator Richard H. Truly recently announced objectives for one of the most important missions that NASA must undertake in the years to come. That mission calls on centers throughout the Agency to promote aerospace educational programs and activities from elementary through undergraduate school.

"NASA's educational strategy, in order to achieve this goal, is comprised of three elements designed to *capture* student interest in science, mathematics, and technology at an early age; *channel* more students into science, engineering, and technology career paths; and to *enhance* the knowledge, skills, and experiences of precollege teachers, college university faculty, and other educators," said Truly.

Responding to that call, Lewis Research Center's Office of Educational Programs has outlined its objectives in meeting that goal:

1. To enhance the knowledge, skills, and experience of educators.

2. To provide programs which inspire general student interest and participation in science, technology, and related careers.

3. To substantially increase the number of minorities, women, and handicapped in Center educational programs.

4. To form additional partnerships with other government agencies, private industry, foundations, and other organizations to coordinate educational efforts.

5. To provide for organizational maintenance and development of the Office.

Dr. R. Lynn Bondurant, Jr., chief of the Office of Educational Programs, is proud of the strides Lewis has made in educational programs and excited about the commitment that NASA has pledged in making education a top priority.

"Lewis has led the way in developing and conducting educational programs for both students and educators," said Dr. Bondurant. "We are educational leaders in the pure sense—in what we do, what we have accomplished, and the people we serve."

But Lewis won't rest on its laurels, says Dr. Bondurant, who heads the Office that was reorganized in February, 1990. Dr. Bondurant and his staff are presently evaluating the Office's current programs and generating ideas that will help make educational programs at Lewis more effective and efficient.

The Office of Educational Programs is made up of two branches: Student Services Branch and Educational Services Branch, which have responsibility in reaching Lewis' six-state service area—Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin. The Office is also involved in private sector initiatives which include accessing educational programs, reviewing state curriculum, and coordinating an advisory board of professionals outside of Lewis.

The Educational Service Branch is responsible for a variety of programs that reach out to educators.

This branch has conducted numerous On-Center Programs that have helped teachers gain a better understanding of our nation's space program, and provided teachers with creative ways of getting students interested in math and science. Off-Center programs, such as conferences, have also proven successful in informing and motivating educators. According to Dr. Bondurant, if Lewis continues to keep "plugged into the right conferences and conventions, then we can expect to touch 30,000 teachers face-to-face in the course of one year."

The Teacher Resource Center at Lewis and Regional Teachers Resource Centers placed throughout Lewis' six states provide teachers access to NASA materials. Future plans call for the resource centers to serve as sites for in-service opportunities as well.

For teachers who do not have access to one of the resource centers, there is NASA's Central Operation of Resources For Education (CORE) located at the Lorain County Vocational School in Lorain, OH. Lewis is NASA's technical monitor for the facility which provides teachers across the country with quality teaching materials.

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"Young people are Lewis' future," said Ross in a conversation with the *Lewis News* when he was named director in July.

To reach and cultivate today's young people is perhaps an even harder goal than reaching educators, said Dr. Bondurant. That is why the Student Services Branch, which works with elementary/secondary programs, student interns, and partnerships plays such as important role in the future of our nation's space program.

"Education, especially in science and math, is in a crisis mode in the United States, and NASA has a very exciting program that can capture the hearts and minds of our youngsters," said Frederick P. Povinelli, director of the Administration and Computer Services Directorate which oversees the Office of Educational Programs. "We need to reach elementary school children at an earlier age and focus our attention on involving all segments of our society."

The Student Services Branch has worked diligently in the past and will continue in the future to provide a variety of student intern programs at Lewis, said Dr. Bondurant. Again, this involves participation by the entire Lab. In addition to opening students' eyes to the abundant opportunities math and science careers can provide, Lewis is building a data base of young people who will eventually grow into informed and enthusiastic adults who can work and succeed at Lewis.

Partnerships between Lewis and the schools are also providing a valuable service. The East Technical High School Partnership Program, for example, develops strong student/mentor relationships. Lewis personnel act as mentors and role models for students who might not normally be exposed to NASA if it were not for this program.

More attention is also being paid to developing NASA materials for visually and hearing impaired students.

"To me, space provides us with a horizon that you can see over," said Dr. Bondurant. "It permits you to vividly use your imagination and in so doing solve many problems that we face here on earth. The future can either just happen or we can prepare for it."

Dr. R. Lynn Bondurant, chief of the Office of Educational Programs, says all of Lewis has made a difference in educating teachers and students.

NASA's future depends on capturing, channeling, and enhancing the knowledge of our nation's teachers and students.

The most important aspect of the Educational Services Branch, said Dr. Bondurant, is that contact be maintained as effectively as possible with instructors throughout the six-state service area.

Curt Olson, an Aerospace and Electronics Technology instructor at Sauk Rapids High School in Sauk Rapids, MI., is proof that Lewis' careful attention to teachers is working. Over the past two years Olson has worked closely with the Office of Educational Services in developing a simulated space environment program for his high school.

"Dr. Bondurant and the entire Lab at Lewis have donated their talents and time in helping me to develop this important program," said Olson during a recent visit to Lewis.

Dr. Bondurant feels one of the major reasons for Lewis' success in educating teachers and students is that the entire Center "lends a hand and opens its hearts" to the students and teachers both on- and off-site. He attributes much of this philosophy to Center Director Larry Ross who stresses the importance of getting educators and young people involved in programs at Lewis.

TOUCHING Tomorrow Today

Artwork courtesy Lynn Bondurant

There are many ways to introduce space to students but the key to success is collaboration among educators.

by R. Lynn Bondurant, Jr.

One of the words that frustrated me most when growing up was "someday." Teachers and parents would respond to many of my questions with, "someday this . . . someday that." The word is used often to represent the future in some undefined way. My ears still perk up when I hear a future-related question answered with the word "someday."

Ancient cultures studied the stars to help them to define their "somedays." Their star observations enabled them to predict times for planting crops and events such as the flooding of the Nile. The nighttime sky created awe and wonder and served as a catalyst to learn more and dream bigger dreams.

It is a paradox that we now have the technology to explore space, but that the night skies no longer create the motivational wonder and awe that was so special to our ancestors. Unfortunately, light pollution hides the majesty and wonder of the heavens from the views of most of our urban youths. Still, our technology is incorporated into wonderful adventures of human space travelers coping with the many challenges encountered in space far beyond the Solar System.

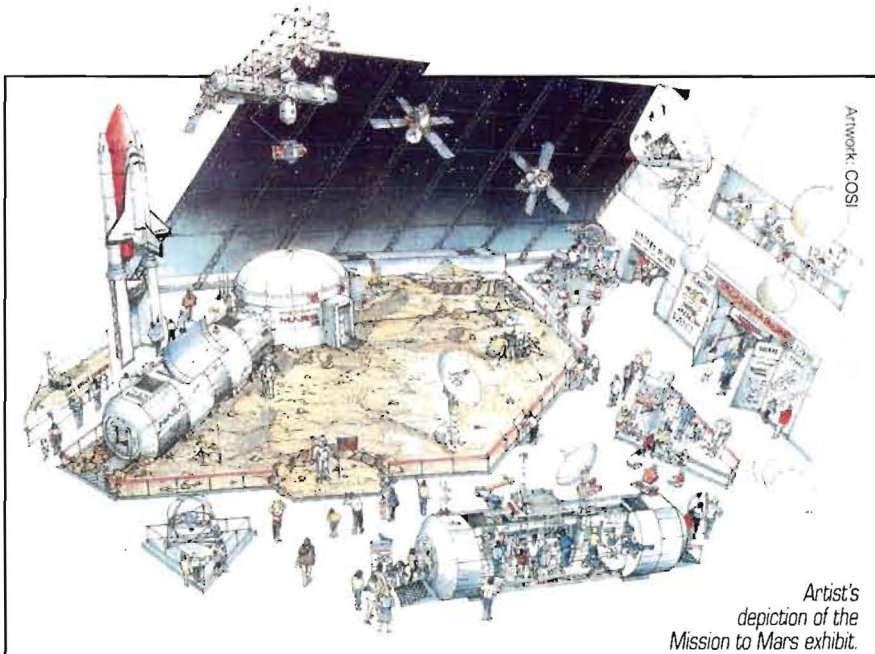
The late 20th century requires a new stimulus for young people to dream possible futures involving humans sailing the oceans of space. The use of space topics and concepts in the classroom can address the need for scientific literacy while motivating students to see far beyond their limited horizons. The subject of space is a great motivator for learning. It permits students to use imagination in searching for the solutions to space-related problems.

I have been involved in aerospace education for the majority of my professional career. I have come to realize its impact on and versatility in the instructional program. Aerospace education can be used to enhance many different areas of the curriculum.

Over the years I have involved students in art projects with a space theme. On one occasion I played space sounds: satellite telemetry signals, lift-off sounds, etc. I then gave each student a white piece of paper, a cotton swab and black tempera paint and asked them to draw what they saw in their minds. On another occasion I asked students to create tissue paper collages of life forms living elsewhere in the universe after I played for them Orson Welles' classic *War of the Worlds* radio broadcast.

Left: *The concept of space exploration can have enormous impact on even the youngest minds.*

Right: *Shuttle pilots of the future learned the intricacies of completing a rendezvous in space as these Ohio children "flew" their own mission.*



Artwork: COSI

Artist's depiction of the Mission to Mars exhibit.

Visiting Mars on Earth

Mars will be the destination for several robotic missions planned for the 1990s. The United States is launching Mars Observer in 1992. The Soviet Union will be following two years later with the Mars '94 mission, and there are plans in the works for another Soviet mission to Phobos in 1996. A U.S. Mars Network Mission (which will feature 10-20 small experimental stations) is being planned for 1998, and U.S. and Soviet Mars Rover/Sample Return missions are in the works for after that.

But the first Mars launch will occur in the United States, when the *Mission to Mars* exhibit begins a nationwide tour of 13 major science centers in 1991.

The 5,000-square-foot (450-square-meter) exhibit will examine some of the basic issues of space exploration, specifically oriented toward Mars. The goal of *Mission to Mars* is to provide hands-on learning experiences in science and math aimed at people ages eight and up. The science and math content incorporates curriculum guidelines developed by professional organizations such as the National Science Teachers Association.

A major component is the Mars habitat simulator, which will bring Mars to life with computer animation, video images and digitized sound effects to create a realistic Martian environment.

The habitat simulates what human life in a module on the Martian surface would be like, with 16 workstations emphasizing such areas as meteorology, geology and biology. Visitors will work as astronauts and scientists to decide if it's feasible to place a permanent colony on Mars.

Participants will be presented with problems to solve, such as calculating the track of a dust storm or searching for possible evidence of past life. The mission's success depends on data gathered by each workstation, and each person's contribution is important.

While the simulation activities stress both creative problem-solving and teamwork, they also allow time for individual learning. Each workstation activity includes an on-line glossary to learn more about the concepts introduced in the activity.

Whether examining the lack of ozone in the Martian atmosphere or addressing the issue of terraforming, participants will gain an awareness of the environmental problems on Mars. This may lead to greater awareness and understanding of the environmental problems on Earth and the need for creative scientific solutions.

The $1.6 million exhibit is funded by grants from the National Science Foundation, Apple Computer Inc. and Battelle Memorial Institute in Columbus, Ohio. Additional funding is provided by the Center of Science and Industry (COSI) in Columbus, the Pacific Science Center in Seattle, and by science centers taking part in the national tour. COSI is designing and constructing *Mission to Mars*, and the Pacific Science Center is creating educational materials.

For the next four years Mars will be available for close viewing and exploration. During that time, *Mission to Mars* is expected to reach an audience of four million.

Mission to Mars will be at COSI in Columbus, Ohio, from December 28, 1990, to May 11, 1991, although the habitat simulator will open on October 1. After Columbus the exhibit will travel to the Franklin Institute in Philadelphia, Pa. For more information contact Bill Buckingham, Developer of *Mission to Mars*, at COSI, 280 E. Broad St., Columbus, OH 43215-3773, (614) 228-2674. —*Roger Klare*

The Office of Educational Programs at NASA's Lewis Research Center has collaborated with the Cleveland Orchestra to produce two educational programs and concerts, the most recent a musical tribute to Comet Halley featuring selections composed during previous apparitions of the comet. Severance Hall, home of the Cleveland Orchestra, was alive with activities before the concert. Students visited a set in the decor of the 1910 comet visit and then one in the decor of 2061. Some students wrote messages to the comet and sent them up in balloons.

The NASA Lewis Office of Educational Programs also worked with Cleveland's Great Lakes Shakespeare Festival Theatre Company to stage *A Midsummer Night's Dream* set in outer space, with characters whisked away to another planet.

Today, students have an opportunity to touch the future through space flight simulations. In 1985, students, teachers and parents in two Ohio school districts "converted" two school buses into Space Shuttles. The students planned and "flew" missions that included a rendezvous and the completion of several space experiments. Every student in each school was involved in the project in some way.

Space education can motivate and inspire many students to appreciate the need for a viable space program—a thought they will carry with them into adulthood. Images of the future must be more clearly defined than can be done through the use of the word "someday." There is no doubt that incorporating space in instruction is a great way to motivate students to dream of the myriad possibilities of all tomorrows. As we address the future, three major themes need to be stressed in space education.

First, students need to know that exploration of space benefits humanity. Second, through the exploration of space many new jobs are created, and many individuals, including themselves, are and will be employed to assist in this endeavor. And third, students must understand that any nation interested in being a world leader in the years ahead will have to have a vigorous space program. We must stress the gains from the exploration of space—things such as new knowledge, technologies, and greater understanding of the universe.

Certainly no other subject studied in school can apply the word "future"

The Corporate Classroom

"It gives me claustrophobia to think I will always be on this planet. I want to travel to outer space," said Rigo G. He has wanted to be an astronaut all his life, all 11 years of it. He does not mirror the image that is projected on today's American students: unmotivated, undereducated and uninspired. At this tender age he is already seeing his future. Rigo is the kind of child Ball Corporation is looking for in its educational outreach programs.

Photo: Ball Aerospace

The New Frontiers workshop gave 100 teachers a close-up view of the Hubble Space Telescope last March.

Ball's Aerospace Systems Group, based in Boulder, Colorado, opened a new era in company support to education with its "New Frontiers" program. Working in conjunction with the Colorado Alliance for Science, the local school district and the state department of education, the company handpicked 100 exceptional Colorado teachers to participate in the symposium. This year's topic was the Hubble Space Telescope.

Symposium topics included a class called "Alien Eyes," which was designed to show students how the world would look if humans were to see infrared light or X-rays. Other symposium workshops about the size of space and one in which students build their own home planetariums are now part of a list of workshops that are getting high marks from teachers that have used them in their classes.

Each teacher received videotapes, slide sets, lesson plans, trade journals, wall posters and model kits at the symposium. All materials were donated by NASA and Hubble Space Telescope contractors. Next year's symposium will focus on the Solar System.

This fall Ball will also begin a membership program in cooperation with a local junior high school. Every two weeks, eight selected seventh graders will take time off from their school day to study aerospace and space exploration topics unavailable at their public school. The students will spend 14 hours during the semester in the program, which will be held at Ball. If it is successful, the company hopes to expand the program to cover other topics.

In 1985 the company began one of its most successful educational programs, the "Space Challenge," to provide a once-in-a-lifetime learning experience for fourth, fifth and sixth grade student and teacher teams from local school districts.

The Space Challenge is a three-day trip to Florida packed with visits to the Kennedy Space Center's Spaceport USA and Exploration Station, Disney's EPCOT Center and Space Camp. Included are talks with NASA experts and the grand finale—an actual Space Shuttle launch.

To be selected for the program teachers are asked to submit a space-related project that can be included in their curriculum. Projects have included exercises in microgravity, music for the stars, history of space, space poetry and space station environments. Selected projects are published in a curriculum guide that is made available to all teachers.

Once selected, teachers choose a student to be their team partner. These students are interviewed by a panel of educators, engineers and scientists who are looking for bright, motivated, curious students who are good communicators.

"It's the beginning of an astronaut's dream. I expect to be an astronaut on a new Shuttle, or on one of the old 1980s models," said 11-year-old Kris H., one of the participants.

Ball's goal with the Space Challenge program is to raise interest in science and math and build community interest in the U.S. space program. The company hopes to lead promising students into science-related careers and give students and their teachers a spirit of adventure that they can bring back with them to the classroom.

"When two people experience a dramatic event together such as a Shuttle launch, you get different levels of meaning that add interesting dimensions to be shared in the classroom," said David Aguilar, a former teacher who is now Ball's manager of marketing communications.

These education programs have given students opportunities they might not have had. They also give teachers a new lease on their own teaching abilities.

"The challenge of keeping current as a teacher is to bring enthusiasm into the classroom and stimulate students to use their creativity," said Charles Garcia, a third grade teacher. "Witnessing the launch of *Discovery* gave me quite a souvenir to bring home inspiration."— *Bernadette Stechman, Ball Aerospace*

The Space Challenge program gave this Colorado student a front-row seat for the Atlantis launch of Galileo last October.

Photo: Ball Aerospace

more than the study of space. Another very important factor to stress is that space exploration provides the world with hope, especially in these times, when the students' perception of the future may be dimmed by uncertainty and problems never dealt with before. Through space studies students can begin to discuss and prepare for the realities of tomorrow. What will humanity do when we finally make contact with intelligent beings located far beyond Earth? What happens in, say, 100 years when residents of the Moon want to declare independence from Earth?

The study of space is a powerful tool to make students realize that at present humans all live on a planet named Earth, yet do not live as "one world."

The NASA Lewis Research Center holds teacher workshops to help educators learn how to bring aerospace education into their classrooms.

Space Ballet: *Out of This World*

Who says the sciences and the arts don't mix? At Butler University in Indianapolis you can take a trip through space without ever leaving Earth through the Butler Ballet Production entitled "The Planets: A Child's Space Fantasy." First presented last spring, the ballet received rave reviews from audiences and will be performed again this fall.

"The Planets: A Child's Space Fantasy" is a multi-media ballet portraying a boy's fantasy of travels through space and his encounters on each planet. The production integrates video and computer imagery with the art of dance through the use of an Amiga computer and a General Electric Talaria video projector.

The ballet is set to Gustav Holst's suite "The Planets," combining the original classical version by Holst and a synthesized version by Isao Tomita. The intensity of the sound emanating from 18 speakers mounted in the hall, combined with the projected video images used as scenery, gives audiences the sensation of flying through space.

"Gustav Holst's magnificent symphonic poem 'The Planets,' first performed in 1918 at which time the planet Pluto had not yet been discovered, was not intended as a scientific, educational or mythological description," Stephen Laurent, chairman of the department of dance and artistic director, said. "Rather, it was the composer's evocation of the wonders of our universe, inspired by the astrological implications of each planet of the Solar System."

The ballet begins in the boy's bedroom, where he sleepily toys with a music box playing the tune from the planet Jupiter. Two toy robots come to life and beckon him to embark on a journey into space. The bed transforms into a spaceship, and the boy's galactic adventures begin.

During his fantasy, the boy encounters a variety of characters, including malicious armies, a winged messenger, a magician, a giant puppet-king and fabulous space creatures.

Butler videographer Edward Boilini used NASA space footage and simulations as well as computer animation and electronic effects to create the video transitions which take the boy from planet to planet.

"From the storyline of the production we created a list of desired visual elements that would serve as transitions from planet to planet and as scenic elements within the production," Boilini said. "The intention was for the transitions to flow from literal or real imagery at the start of the ballet through an abstract montage to simulate a time warp, or travel through another dimension. The production not only communicates excitement for both dance and the exploration of space, but also serves as an example of the potential for the blending of art and technology," Boilini added.

The ballet premiered on April 28 (Astronomy Day), when Butler University's Holcomb Observatory and Planetarium, in cooperation with the Indiana Astronomical Society (IAS), opened its doors for free telescope observations and planetarium shows on the evening of the premiere. The public was invited to view Jupiter, the Moon, the Porion Nebula and other objects through several IAS telescopes and through the observatory's own 38-inch Cassegrain reflector telescope, the largest telescope in Indiana.

This fall the Butler Ballet will re-stage "The Planets: A Child's Fantasy" for six performances. They are scheduled for Wednesday, October 17 at 10 a.m. and 12:30 p.m., Thursday, October 18 at 1:30 and 7 p.m., and Saturday, October 20 at 2 and 8 p.m.—*Butler University News*

Photo: Bob Stalcup/Butler University

A child and his imagination dance through the Solar System in this space ballet at Butler University.

Congress Tackles the Education Crisis

For several years now there has been evidence that the United States is losing (or has already lost) its leading edge in science and mathematics education. International achievement exams have shown U.S. students to be at the very bottom when measured against students from other industrialized nations.

The National Science Foundation (NSF) has found that interest levels in math and science decline as early as the third grade. Projections by the NSF estimate a shortage of 675,000 scientists and engineers and 20,000 math and science teachers by the year 2000.

The U.S. Congress has recognized the situation as a crisis that will erode the United States' competitive position in the global economy because the workforce is ill-trained for the technologically advanced modern workplace. Congress argues that funding for preschool, primary and secondary education—which is lower in the United States than virtually all industrialized nations—must be substantially increased if the country is to stimulate student interest in science and mathematics and maintain a technological edge on international competitors.

In response to the perceived crisis there is suddenly a host of new legislation before Congress aimed at improving science and math education—eight bills proposed in the last year alone. The bills attack the same issues, but differ somewhat in their proposed solutions.

The National Academy of Science, Space, and Technology Act, H.R. 2957, introduced by Representative James Traficant (D-Ohio), takes the approach of proposing a new scholastic institution—a call for the establishment of a national academy that would instruct and prepare select students for federal service. The U.S. government would subsidize education and living expenses, demanding in return that the students reimburse the government with four years of service in either a government agency or the armed forces.

H.R. 3685, submitted by Representative Austin Murphy (D-Pa.), proposes the formation of a National Council on Education and Space to foster enhanced education in technological fields. The council would achieve this primarily through the awarding of prizes and scholarships. This directive focuses on elementary as well as secondary students in the belief that if children develop basic interests at young ages, they will persist throughout their years in school.

A bill introduced by Senator John Glenn (D-Ohio), S. 1950, calls for the formation of regional consortia for science, mathematics and technology education and a national clearinghouse to maintain a permanent collection of educational materials for use by teachers. The bill also argues for increased accessibility and support for informal educational programs, such as space camps or summer enrichment programs. The senator believes that an early, positive experience in science can inspire youths to continue studies toward science careers.

Two science education bills, S. 1951 and H.R. 3853, are seeking legislation that would provide better coordination among federal programs already in existence. The sponsors, Senator Mark Hatfield (R-Ore.) and Representative Albert Bustamante (D-Texas) respectively, note that uncoordinated efforts are responsible for some of the current educational problems.

Perhaps the three most comprehensive bills are H.R. 3122 (David Price, D-N.C.), S. 2567 (John Kerrey, D-Neb.) and S. 2114 (Edward Kennedy, D-Mass.). All emphasize heavy increases in informal education activities and programs and include an extensive scholarship program for both teacher and student incentives. H.R. 3122 calls on the NSF to carry out this legislation, and includes the "National Advanced Technician Training Program," designating those institutions with proven success in high-quality technical training as national training centers.

Both S. 2567 and S. 2114 include programs to assess and coordinate current informal and formal education facilities. S. 2114 also includes legislation for the establishment of a national training center similar to that of H.R. 3122, for a national clearinghouse and regional consortia programs—similar to those proposed in Senator John Glenn's bill—and for a concept referred to as "Roving Masters," which would place a highly skilled science and technology professional at the disposal of every school and school system to assess current programs and materials and make recommendations for reform.

All eight bills will be examined by the congressional committees dealing with education and science. Several will surely die due to inaction, but others hopefully will be merged into a conglomerate bill. With adequate support from the space education community, a science and math education package could become law.—*Craig Keller*

Space-related topics can introduce students to the fragility of Earth or to the ethical standards related to mining of the Moon or other celestial bodies for the wealth of one nation. What ethical and philosophical questions are raised when the citizens of Earth prepare to send the first crew of humans to travel one-way beyond the Solar System? What are some of the crucial issues to be dealt with? What values are to travel with these voyagers?

The time seems right for those of us involved in aerospace education to unite our efforts to take fuller advantage of each organization's expertise. As a group we can "fly" farther using the same amount of energy and resources than if we were to go it alone.

An aerospace education summit should be held so that unification efforts can begin. During this summit a clear definition of aerospace education should be constructed to answer such questions as to why we should offer aerospace education and what the impact of such education could be. The definition will provide the framework out of which educational outcomes can be identified. These outcomes will demonstrate how aerospace education can make a difference in overall education.

Roles and responsibilities for the various groups, organizations, and institutions would hopefully be agreed upon. Some will work with students while others focus their efforts on teachers. For example, one group might focus on the development of aerospace curriculum, and another on training teachers.

Within the United States there should be a site devoted to the teaching of aerospace education in each state, where teachers can be trained and get instructional materials, and where students can participate in special educational programs. Different organizations involved in aerospace education throughout the state could work with each state's department of education, and could make great strides in improving science and math education in the United States.

All of us in aerospace education must realize we cannot be all things to everyone. But if we work together today, we can help achieve more for tomorrow. Aerospace education is a great catalyst for our future. ☆

R. Lynn Bondurant, Jr. is chief of the Office of Educational Programs at NASA's Lewis Research Center in Cleveland, Ohio.