



National Aeronautics and
Space Administration
Goddard Space Flight Center

Goddard News

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SPECIAL EDITION - THE YEAR IN REVIEW

Year In Review

by **Joseph Rothenberg**
Center Director

1996 was a busy and productive year at Goddard.



Mission Success

Goddard's 1996 science and technology spacecraft, payloads, and instruments flew on Shuttles, Deltas, Pegasus, sounding rockets, balloons, campaign aircraft, international launchers, and interplanetary missions. We flew Polar, TOMS-ADEOS, TOMS-Earth Probe, the Fast Auroral Snapshot (FAST) mission, ORFEUS SPAS-II, Spartans, Hitchhikers, GAS Cans, instruments on NEAR and the Mars Global Surveyor, and more. And we continued to operate and collect data from more than a dozen orbiting spacecraft.

We launched 16 sounding rockets with a 100% vehicle success rate. We made 14 balloon flights, and flew airborne science campaigns in the northern and southern hemispheres — from Greenland to Christmas island.

Science Results and Discoveries

We made spectacular discoveries and continued the pace of scientific research — learning more about the atmosphere; monitoring massive forest fires across the globe; “chasing” hurricanes; uncovering radio emissions from Earth's aurora; revealing “hidden plasma fountains” escaping our ionosphere; and, imaging the solar corona, active solar plumes, and the interaction between our planet and the Sun.

We tracked comets; detected high-speed stellar vibrations; found new X-ray sources; discovered Galactic Building Blocks; uncovered new astronomical objects; studied Jupiter's aurora; and saw Pluto's surface clearly for the first time. We put the finishing touches on our preparations for the Second Hubble Servicing mission.

Technology

In 1996, we also made progress as a technology leader and enabler — successfully flying the TEAMS experiments on the shuttle; selecting the advanced land imager to fly on the first New Millennium Earth Science Flight; developing a commercial “off-the-shelf” ground system prototype; and creating a new Systems Technology and Advanced Concepts Directorate.

We have begun to put in place a Mission Design Center with the systems engineering tools needed to support technology and mission development. And we are continuing or important work to develop technology roadmaps.

Team work

We teamed with industry — kicking off our New Millennium earth science missions; advancing our supercomputing applications; working on advance semi-conductor microchip technology; and, developing launch vehicle services called Med-Lite.

We also teamed with other NASA Centers — joining forces with Ames in information systems technology; Langley in structures technology; and Marshall and the Jet Propulsion Laboratory for the Next Generation Telescope.

Students joined us in our work — flying payloads on the last Shuttle mission, launching their own sounding rocket, and making observations from Hubble.

We initiated Regional Data Centers, and took steps to partner through Centers of Excellence with other premier research institutions.

Center Achievements

As an organization, we also made great strides in 1996. We have a Goddard Strategic Implementation Plan, and we are outlining a new organizational structure for achieving our plan, undertaking the first major restructure of Goddard in 30 years. We've made good progress re-engineering some of our internal and external processes — like the spacecraft acquisition process, the manager evaluation and promotion process, and Goddard's New Business process. We are currently working on the travel and employee recognition processes. We filled the East Campus, opening Building 32. We also made good progress in the construction of the new Earth Systems Sciences building on the East Campus. We implemented the Alternative Work Schedule (AWS), and initiated our workforce Refocusing Program to provide our workforce with training opportunities. And, we are finalists this year in the governmentwide President's Quality Award program.

Looking Forward to 1997

In the coming year, we have a lot to look forward to: the Hubble servicing mission and the installation of the NICMOS & STIS instruments; the launch of the Submillimeter Wave Astronomy Satellite (SWAS) to investigate how stars are born; the launch of our next NOAA weather satellite — GOES-K; the SEAWiFs launch; the Tropical Rainfall Measurement Mission; launches of our other explorers and small explorers including SNOE, ACE and TRACE; and, the continuing flights of our payloads and experiments aboard the shuttle.

1997 is already shaping up to be a busy and exciting time. We are moving out on our Strategic Implementation Plan to position Goddard for the 21st century. Many challenges and opportunities lie ahead, and I look forward to working with you in the coming year to seize the future.

Joseph Rothenberg

TECHNOLOGY SHOWCASE—A ROUSING SUCCESS

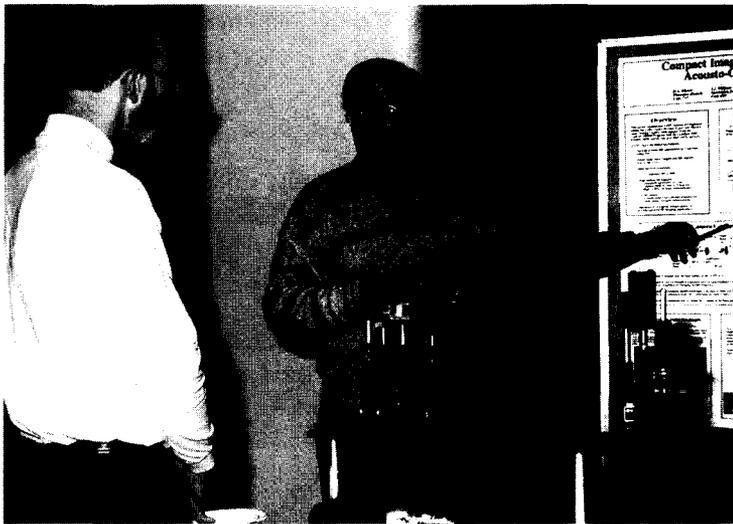
Comments heard round the halls:

“I thought it would be an effort to convince busy scientists to build their exhibits and spend a day staffing them, but they overwhelmed us with their enthusiasm.”

Steve Maran, Code 600

“The success of the showcase was the result of when people unite together to fulfill a common purpose that is meaningful to an entire body.”

Sharland Norris, Jorge Scientific



“I thought the committee had bit off more than it could chew, but the key to its ultimate success was the way all the people involved pitched in and did their part quickly, willingly, and in many cases, creatively.”

Sue Hart, Graphics Branch

“I was very impressed at how well everyone ended up working together in the end to pull it off. It’s nice to be part of an event where you can look back and see how well everyone functioned as a team towards a single goal. It’s imperative to teach engineers in the 90’s how to market themselves. For NASA to be competitive in the world we have no choice but to think about better marketing.”

Melanie Ott, Code 310

“I had no idea we did THIS kind of technology here at Goddard.”

Exhibit visitor



“Wow! What a terrific concept!”

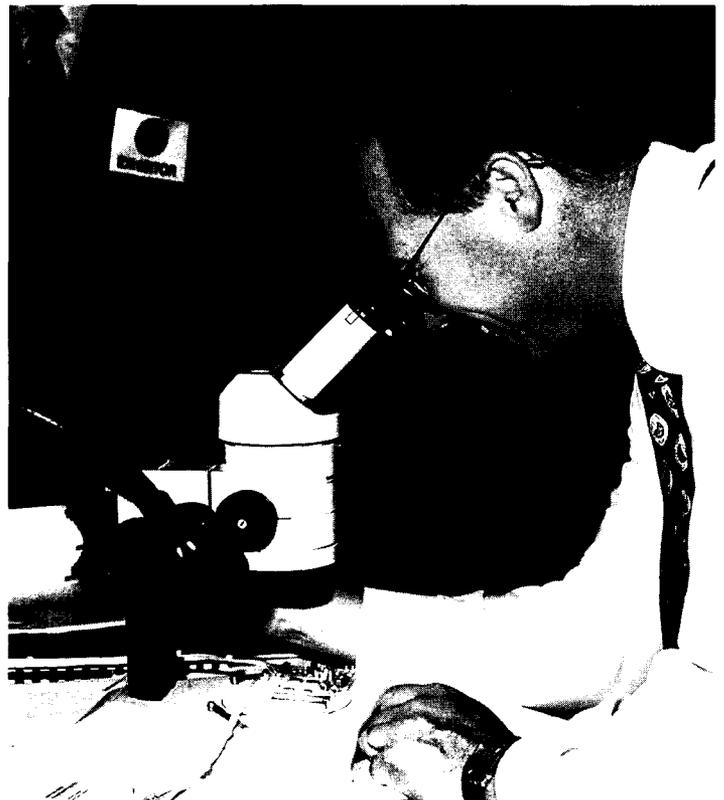
Enthusiastic visitor to the Fritz Hasler exhibit

“This definitely needs to be an annual event. It’s a showcase that really shows Goddard as being at the forefront of technology.”

Comment heard in Bldg. 8

“Before opening the doors to Technology Showcase '96, Goddard’s excellent support staff prepared the showroom. Chairs, tables, and partitions were moved, floors were marked, network cables were laid, and power was run. This was an incredible ‘behind the scenes’ effort.”

Deanna Trask, Code 222

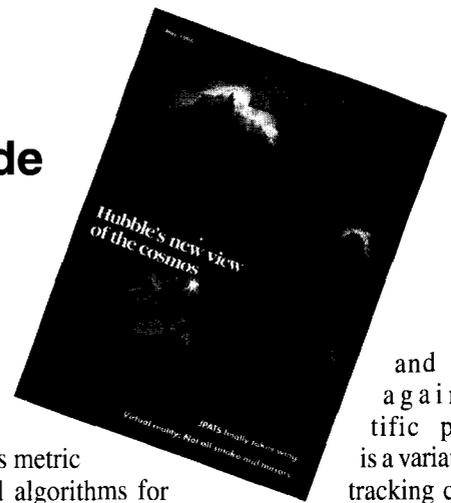


Measure for Measure: NASA and Goddard Science Make the Grade

by Cindy Buck, Senior Communications Specialist,
Office of Public Affairs

Goddard science scored high in 1996, according to the metrics derived from analyzing the "most important stories" featured in the Science News publication. In 1996, there were 166 "most important stories" in Science News, and analysis of the statistics tell an impressive story about NASA and Goddard's performance over the past year. Using this metric, NASA accounted for more than 8 percent of worldwide discoveries. Of this, Space Science was responsible for 7 of the 8 percent with major discoveries reported for Hubble, the Solar Heliospheric Observatory the Gamma Ray Observatory, the International Ultraviolet Explorer, and ROSAT. (Hubble alone tallied 3.5 percent.) The Total Ozone Mapping Spectrometer Earth Probe also figured into Goddard's high score. As an organization, Goddard's missions ac-

diverse activities compare them world-wide scientific productivity. While this metric on more traditional algorithms for tracking citations, it does correlate strongly with numbers of refereed papers and citations, and with statistics on NASA's impact on college textbooks. The Science News metric has been reviewed by and gained the interest of the National Research Council and committees of the National Academy of Science's Space Science Board.



counted for 6.1 percent of world wide discoveries (76 percent of NASA's total 1996 discoveries). Mr. Greg Davidson, the Mission Operations and Data Systems Assistant Director for Plans, has been tracking NASA's contributions to world scientific discovery and technological achievement via the Science news metric for the past five years now. Davidson's interpretation of the results is that , "We fly a heck of a lot of stuff at Goddard that does well. Analyzing the data available for the past the 24 years, Goddard has averaged 48 percent of the Agency's total science impact. 1996 looks like it was a particularly strong year for Goddard science results, given that we accounted for 76 percent of the total NASA score."

Davidson explains that his metric allows you to aggregate many

Using this metric, several NASA missions are continuing their climb up the productivity chart. (Hubble still tops the charts in first place among NASA scientifically productive missions.)

Most Productive Missions (1973-1996)

- Gamma Ray Observatory (6th, up from 9th)
- International Ultraviolet Explorer (19th, up from 23rd)
- Galileo (7th, up from 15th)

SPECIAL EVENTS SPECIAL



Above the hard working team from the Appalachia Drive. (l, r) Frank Martin, John Steckle, Tom Butash, and Roland VanAllen)

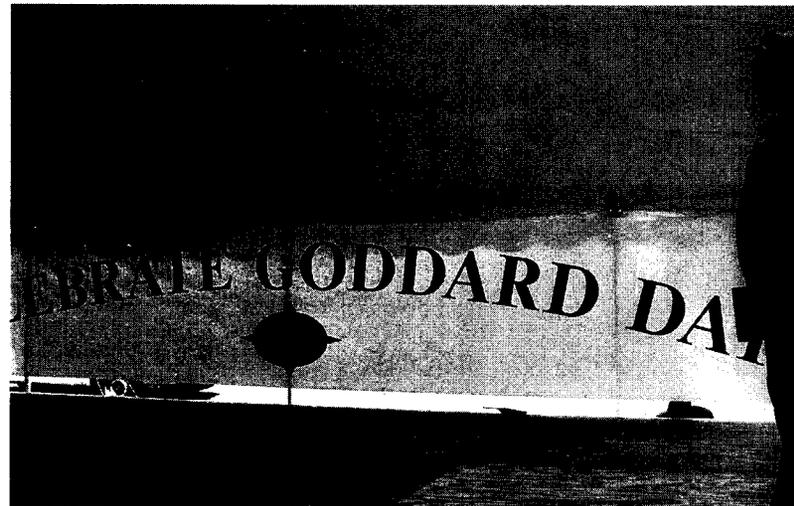
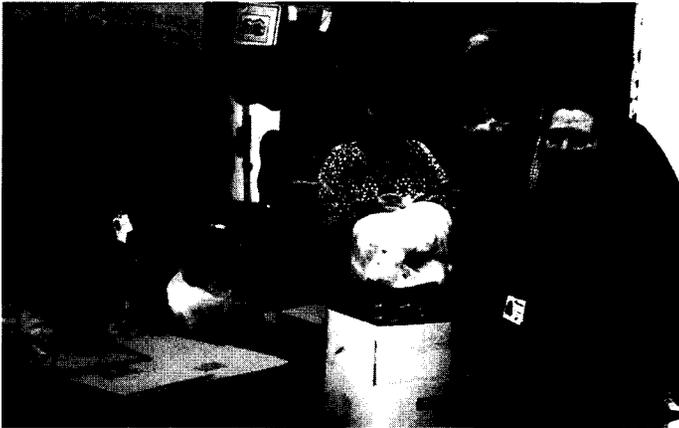


A touch of beauty in preparation for Celebrate Goddard Day



The wonder of it all - future Aerospace Engineer

Below the spirit of Goddard employees at their best. The Pennies from Hubble team - Holiday charity drive. Linda Collins heads this most successful drive. Also shown is Steve Arslanian, Lynn Bassford and Ed Olson. This team collects pennies towards the purchase of new toys for children. Roland Van Allen from the Appalachia Drive states with pride -- This team fills several truck loads each holiday.



The finishing touches for Celebrate Goddard Day are put in place



The winning team - Goddard beats HQ's in the annual softball tournament. HQ's wins the coveted "Toilet Bowl" award

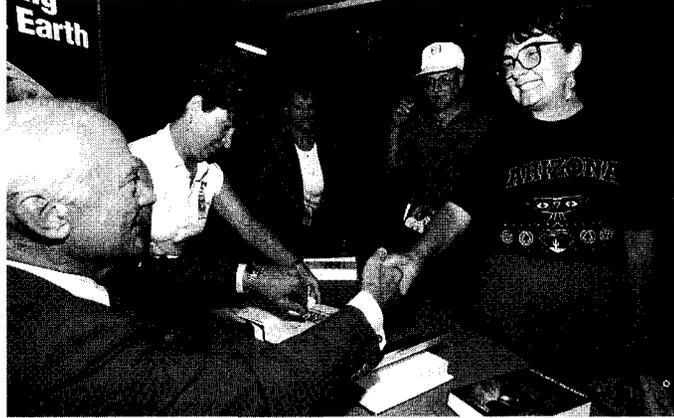


Large turnout for the "Fun-Run"

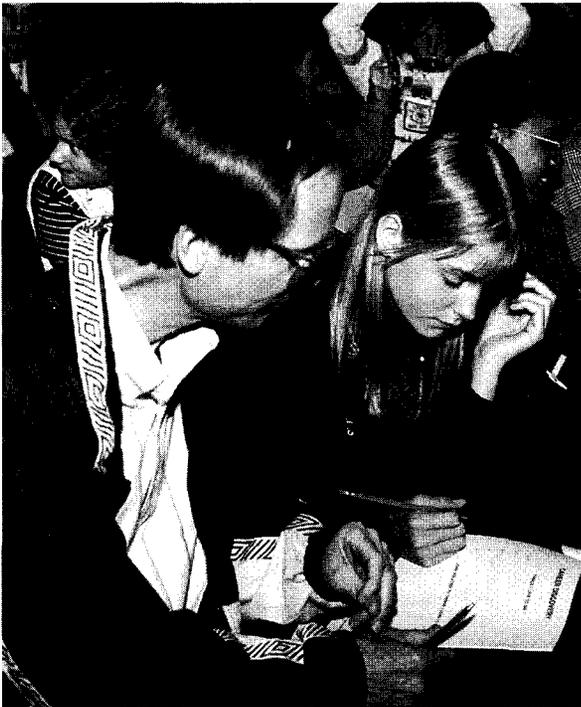
EVENTS SPECIAL EVENTS



Just some of the fun events at Goddard Community Day



Former Astronaut Buzz Aldrin signs copies of his book "Encounter with Tiber" for Goddard employees



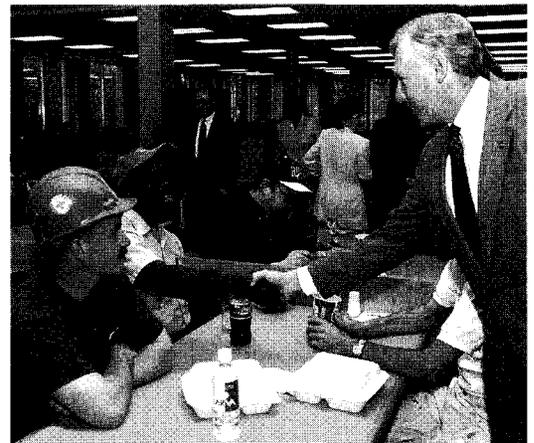
"Take Your Daughters to Work" Day



Rosa Parks visits Goddard on July 30, with nearly 100 students as part of the annual Pathways to Freedom Tour. Al Diaz is there to welcome her.



Administrator Dan Goldin visits Engineering Labs at Goddard



Congressman Steny Hoyer visits Goddard and greets employees in the Cafeteria.

1996 SEEN AS YEAR OF SPECTACULAR DISCOVERIES AND NEW CHALLENGES FOR NASA

by David E. Steitz, NASA Headquarters

A rock, a record, a rover and a new rocket were among the top NASA stories for 1996. Background material, video and still images are available to news media to illustrate these stories, with supporting material also available via the Internet and the World Wide Web.

LIFE ON MARS? TANTALIZING CLUES FROM AN ANCIENT ROCK

In an announcement that caused all humankind to take pause, NASA Administrator Daniel S. Goldin and a team of scientists revealed in August that a meteorite from Mars strongly suggested that primitive life may have existed on that planet more than 3 billion years ago. In a press conference at NASA Headquarters, a research team showed the world pictures of the first organic molecules thought to be of Martian origin; several features characteristic of biological activity, and possible microscopic fossils of primitive, bacteria-like organisms inside the ancient meteorite. In vowing to pursue the investigation of this historic discovery, Goldin said "The evidence is exciting, even compelling, but not conclusive. It is a discovery that demands further scientific investigation. NASA is ready to assist the process of rigorous scientific investigation and lively scientific debate that will follow this discovery." Goldin invited governments from around the globe to participate in the continuing investigation of the meteorite.



LUCID SETS U.S. RECORD FOR STAY IN SPACE

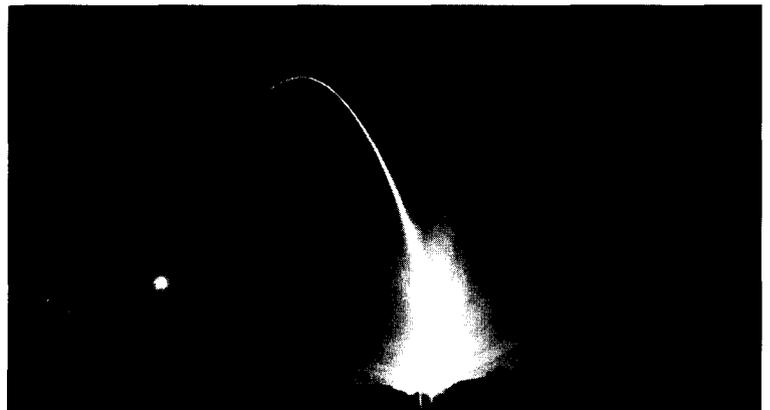
Astronaut Dr. Shannon Lucid set a new record for an American living in space and broke the world's record for a woman living in space by spending 181 days aboard the Russian Mir Space Station. Lucid, who conducted microgravity and life sciences experiments aboard the Mir with two Russian cosmonauts, returned to Earth aboard Space Shuttle Atlantis in November. President Clinton presented Lucid with the Congressional Space Medal of Honor in an early December ceremony, citing Lucid "for her contributions to international cooperation in space ... Shannon Lucid is an explorer in the best tradition of those who dare to challenge the unknown." Lucid's stay on Mir was part of continuing U.S. - Russian space cooperation, which is setting the foundation for the International Space Station.

TWO PROBES LAUNCHED TO STUDY THE RED PLANET

In a continuing effort to learn more about Mars, the United States launched two new spacecraft to the Red Planet in 1996. The Mars Global Surveyor and the Mars Pathfinder missions were both successfully launched from NASA's Kennedy Space Center, FL. Mars Global Surveyor, due to rendezvous with Mars in September of 1997, will spend four months dipping into Mars' atmosphere using a technique called "aerobraking." Starting in 1998, the Surveyor will begin compiling a systematic database as it surveys the Martian landscape and photographs unique features, such as polar caps and Mars' network of sinuous, intertwining river channels. Mars Pathfinder, set to land on Mars July 4, 1997, is designed to test the feasibility of a new low-cost method of delivering a spacecraft, science payload and free-ranging rover to the surface of the Red Planet. Once deployed, the lander will transmit back to Earth science data collected during descent through Mars' atmosphere. The rover, named Sojourner, will then activate an onboard camera and send back images to Earth, signifying the start of its exploration.

GALILEO UNRAVELS MYSTERIES OF JUPITER AND ITS MOONS

Mars was not the only planet to reveal startling new secrets in 1996. NASA's Galileo spacecraft, in its flyby and probe deploy at Jupiter, revealed many previously unknown facts about our Solar System's largest planet. Galileo's Probe, which was successfully sent into Jupiter's violent atmosphere in December 1995, provided new discoveries for NASA scientists. New information on the extent of water, clouds, and



the chemical composition of Jupiter's atmosphere was revealed. As Galileo sped by Jupiter's moons, new details of the satellites began to emerge. On Ganymede, Jupiter's largest moon, scientists were intrigued by three-dimensional pictures of giant, icy fissures and evidence of a

magnetic field. Galileo also reported that "warm ice" or even liquid water may have existed, and perhaps still exists, beneath the cracked icy crust of the moon Europa. Galileo found that the volcanically-active moon Io had noticeably changed since it was last observed 17 years ago by the Voyager spacecraft. In November, Galileo flew by Jupiter's moon Callisto, investigating the strange, pockmarked fourth moon, so different from its other active siblings.

HUBBLE SPACE TELESCOPE CONTINUES TO AMAZE ASTRONOMERS

Living up to its role as one of the "Great Observatories," the Hubble Space Telescope showed images of galaxies colliding, the surface of Pluto, and the birth of stars during 1996. In April, Hubble sent back dramatic images of gigantic tadpole-shaped objects surrounding a dying star. The "cometary knots" are probably the result of a dying star's final outbursts, seen in the Helix nebula. The Space Telescope continues on track for measuring the expansion of the universe, sending back information that fine-tunes the Hubble Constant. Scientists are using the telescope to try and place the Hubble Constant to within a ten percent accuracy. Compiling a "cosmic movie" of the Crab Nebula, Hubble found the Nebula even more dynamic than previously understood. Hubble measured the diameters of a special class of pulsating star called Mira variables, which rhythmically change size. At 11 billion light-years away, they existed during the epoch when it is commonly believed galaxies started to form. Hubble concluded the gigantic, old stars are not round but rather egg-shaped. That discovery may preview the fate of our Sun five billion years from now. Hubble also surveyed the "homes" of quasars, showing that they live in a remarkable variety of galaxies, many of which are violently colliding. The complicated image Hubble sent back suggests there may be a variety of mechanisms for "turning on" quasars, the universe's most energetic objects. Hubble introduced us to images of what may be galaxies under construction in the early universe, being made out of a long sought ancient population of "galactic building blocks." Those images show a grouping of 18 gigantic star clusters that appear to be the same distance from Earth, and close enough to each other that they will eventually merge into a few galaxy-sized objects. In October, Hubble followed the spectacular dance of Jupiter's aurora, allowing astronomers to map Jupiter's immense magnetic field and better understand how it generates such phenomena.

NEXT GENERATION LAUNCH VEHICLE CHOSEN FOR DEVELOPMENT

In a quest for a faster, better, cheaper access to space in the 21st Century, Vice President Al Gore and Administrator Goldin announced that Lockheed Martin was selected to build the X-33 technology demonstration vehicle, a one-half scale prototype of the Reusable Launch Vehicle which will be used to demonstrate advanced technologies that will dramatically increase reliability and lower the costs of putting payloads into space. Lockheed Martin will design, build and conduct the first test flight of the X-33 test vehicle by March 1999, and conduct up to fifteen flights by December 1999. NASA has budgeted \$941 million for the project through 1999, with Lockheed Martin contributing over \$200 million. Called "VentureStar," the unpiloted vehicle will launch vertically like a rocket and land horizontally like an airplane.

NOTE FROM EDITOR

More detailed information about this year's top NASA stories is available:

STORY INTERNET WORLD WIDE WEB URL

Life on Mars: <http://www.jsc.nasa.gov/pao/flash/>

Shannon Lucid: <http://shuttle.mir.nasa.gov/science/brochure/toc.html>

New Mars Probes: <http://mpfwww.jpl.nasa.gov>
and <http://www.jpl.nasa.gov/mgs>

Galileo: http://ccf.arc.nasa.gov/galileo_probe/

Hubble: <http://www.stsci.edu/pubinfo/>

Latest.html X-33: <http://rlv.msfc.nasa.gov/x33/index.html>

PHOTOGRAPHS / IMAGES

Life on Mars: 96-H-514, Electron scanning microscope image of Mars meteorite

Shannon Lucid: 96-HC-666,

Imax image of Lucid: 96-HC-711,

Lucid with Russian Space Suit; 96-HC-659, Imax image of
Lucid reading a book in space

New Mars Probes: 96-HC-725,

Mars Global Surveyor; 96-HC-686,

Mars Pathfinder Galileo: 96-HC-682,

Io; 96-HC-728,

Europa; 96-H-432,

Ganymede Hubble: 96-HC-25,

Egg Nebula; 96-HC-216,

Cometary Knots; 96-HC-729,

Quasars X-33: 96-HC-735, X-33

For the latest news and information about NASA, please visit TODAY@NASA at URL: <http://www.hq.nasa.gov/office/pao/NewsRoom/today.html>

Year-End Message from Administrator Goldin

You, the employees of NASA, made it happen.

You made 1996 a red-letter year for NASA...one that will be remembered for years, decades, perhaps even centuries. You wrote a chapter in our Nation's history that will not soon be forgotten.

...please take a moment to reflect on NASA's outstanding accomplishments of the last 12 months. Just for starters, consider the following:

The discovery of possible fossilized life in an asteroid from Mars, providing the most compelling evidence ever of life on another planet.

The successful launches of two low-cost spacecraft, Mars Global Surveyor and Mars Pathfinder, holding great promise for more scientific discoveries about the Red Planet.

Solid progress on the International Space Station, paving the way for on-orbit assembly to begin in the coming year.

A series of near-flawless Space Shuttle docking missions with the Mir space station, demonstrating the success and prom-

ise of U.S.-Russian space cooperation.

Shannon Lucid's incredible 181-day stay in space, breaking records for an American in space and capturing the attention and imagination of people around the world.

Selection of a builder for the X-33 technology demonstration vehicle, marking a major step in the quest for cheaper and more reliable access to space.

Successful propulsion-controlled aircraft landing, demonstrating software that enables a pilot to land a plane safely with only engine power.

I could go on and on. The roll-out of the X-36 ... a series of truly amazing discoveries by the Hubble Space Telescope that will rewrite science textbooks ... a plethora of revelations by Galileo as it explored Jupiter and its moons, including the exciting finding of ice on Europa.

And when you weren't capturing headlines around the world with the astounding accomplishments, you were professionally going about NASA's more "routine" business: conducting valuable research about our home planet and its fragile environment; safely launching and carrying out seven Space Shuttle missions; and working on technological breakthroughs that will strengthen the efficiency, safety, and competitiveness of the American aviation industry.

You did all of this, and more, during a very challenging period. You did it as we continued to reinvent the Agency, making it more relevant to our society and more responsive to the concerns of your fellow citizens and taxpayers.

You have my sincere thanks and congratulations for an unbelievable year.

YOU made it happen.

Daniel S. Goldin, *Administrator*

1996 RETIREES

(Deaths - underlined)

CODE	NAME
110.0	<u>Roger Jenkin</u>
151.4	<u>Ronda Bishop</u>
200.0	<u>John Scully</u>
200.0	<u>William Landymore</u>
<u>202.0</u>	<u>Benjamin Fisher</u>
204.0	<u>Robert Marchant</u>
205.3	<u>Linda Mears</u>
217.0	<u>Ellen Ollendorf</u>
227.0	<u>Russell Hansen</u>
228.0	<u>Reed McDowell</u>
<u>233.0</u>	<u>Charles Simms</u>
302.0	<u>Ronald Broadhurst</u>
303.0	<u>Clayton Paynter</u>
406.0	<u>James Shannon</u>
421.0	<u>John Buernschub</u>
440.0	<u>Virginia Beard</u>
442.0	<u>Peter Krump</u>
480.0	<u>George Robinson</u>
<u>501.0</u>	<u>Jeffrey McKenzie</u>
501.0	<u>Gay Carls</u>
501.0	<u>James Joyce</u>
510.0	<u>Jean Gande</u>
513.0	<u>Robert Martin</u>
514.2	<u>William Withgott</u>
515.2	<u>William Schoene</u>
530.0	<u>Raymond Davis</u>
540.0	<u>Irving Salzberg</u>
542.0	<u>Calvin Curien</u>
681.0	<u>Edith Dean</u>
681.0	<u>Daniel Klinglesmith</u>
683.0	<u>Larry Brown</u>
684.0	<u>Allan Silver</u>
701.1	<u>Ewald Schmidt</u>
704.0	<u>Charles Katz</u>
710.0	<u>Henry Hoffman</u>
712.0	<u>Bowden Ward</u>
722.0	<u>Benjamin Swann</u>
<u>722.0</u>	<u>George Ryskewich</u>
724.0	<u>Roy McIntosh</u>
733.4	<u>John Balla</u>
734.3	<u>John Paulkovich</u>
735.2	<u>Henry Miller</u>
<u>754.2</u>	<u>Mary Kitterman</u>
754.2	<u>Gerald Taylor</u>
801.0	<u>Kathryn Taylor</u>
821.0	<u>John Parks</u>
831.3	<u>John Kenney</u>
900.0	<u>Phillip Davis</u>
913.0	<u>Robert Fraser</u>
920.2	<u>Barbara Putney</u>
924.0	<u>Bertrand Johnson</u>
<u>925.0</u>	<u>Hongsuk Kim</u>
932.0	<u>James Strong</u>
972.0	<u>Donald Hines</u>
972.0	<u>Thomas Clem</u>
972.0	<u>John Oberholtzer</u>

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