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Piers Sellers Picked for Astronaut Corps

By Ernie J. Shannon

Live images of Astronaut Neil Armstrong stepping onto the moon, beamed to the earth, set the course of a young British boy's life. Today, he prepares to enter that same astronaut corps.

"I was mesmerized by the experience of watching Armstrong walk on the moon and I knew then that I wanted to someday travel to space myself," said Piers Sellers, a member of NASA's newest astronaut class and a scientist in the Laboratory for Terrestrial Physics at Goddard. Sellers reports to the Johnson Space Center in Houston in August.

It's common to hear American astronauts credit the historic Apollo missions as the inspiration for their dreams. One forgets, however, that many people around the world were inspired by America's achievements and also dreamed of going into space.

Sellers was born in southern England and raised around the world while his father filled assignments to British army posts in Cyprus, Malta, the Middle East and Europe. During those years, Sellers developed a love for flying while being trained by the Royal Air Force at school. The stark reality of a 16-year commitment to the Royal Air Force to pursue a fast jet flying career prevented him from signing on the dotted line for a commission. During those years, he also earned a degree in ecology and a Ph. D in bio-meteorology. With the de-



Piers Sellers in Northern Canada at -40°C.

grees in hand, pilot experience and one year serving as a software consultant in London, Sellers and his wife left England in 1982 and came to Maryland where he had been recruited by Goddard's Yale Mintz.

"Yale knew of my work in England and he was looking for people to do climate modeling and so we came into contact with each other. My wife and I arrived ar-

rived in the U.S. for the first time with \$60 in our pockets and three suit cases and I started work at Goddard two days later."

Beginning in 1984, Sellers began applying to the astronaut corps. The biggest obstacle was his lack of citizenship. He was finally naturalized in 1991. Still, he persisted in completing the paperwork each year if, for nothing else than to keep his name before the selection board.

By 1995, Sellers had already been down to Houston one year for the astronaut interviews, but this year was different.

"I could sense that things were more serious this time around. I was more apprehensive. What with nearly a week of medical tests combined with an intensive 40-minute interview with a panel that consisted of former astronaut John Young and some current astronauts," Sellers said. One hundred and twenty individuals interviewed for 35 slots, but Sellers knew the corps was seriously interested when a

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Hubble Tool Engineer Gets *The Call*

by Ann Jenkins

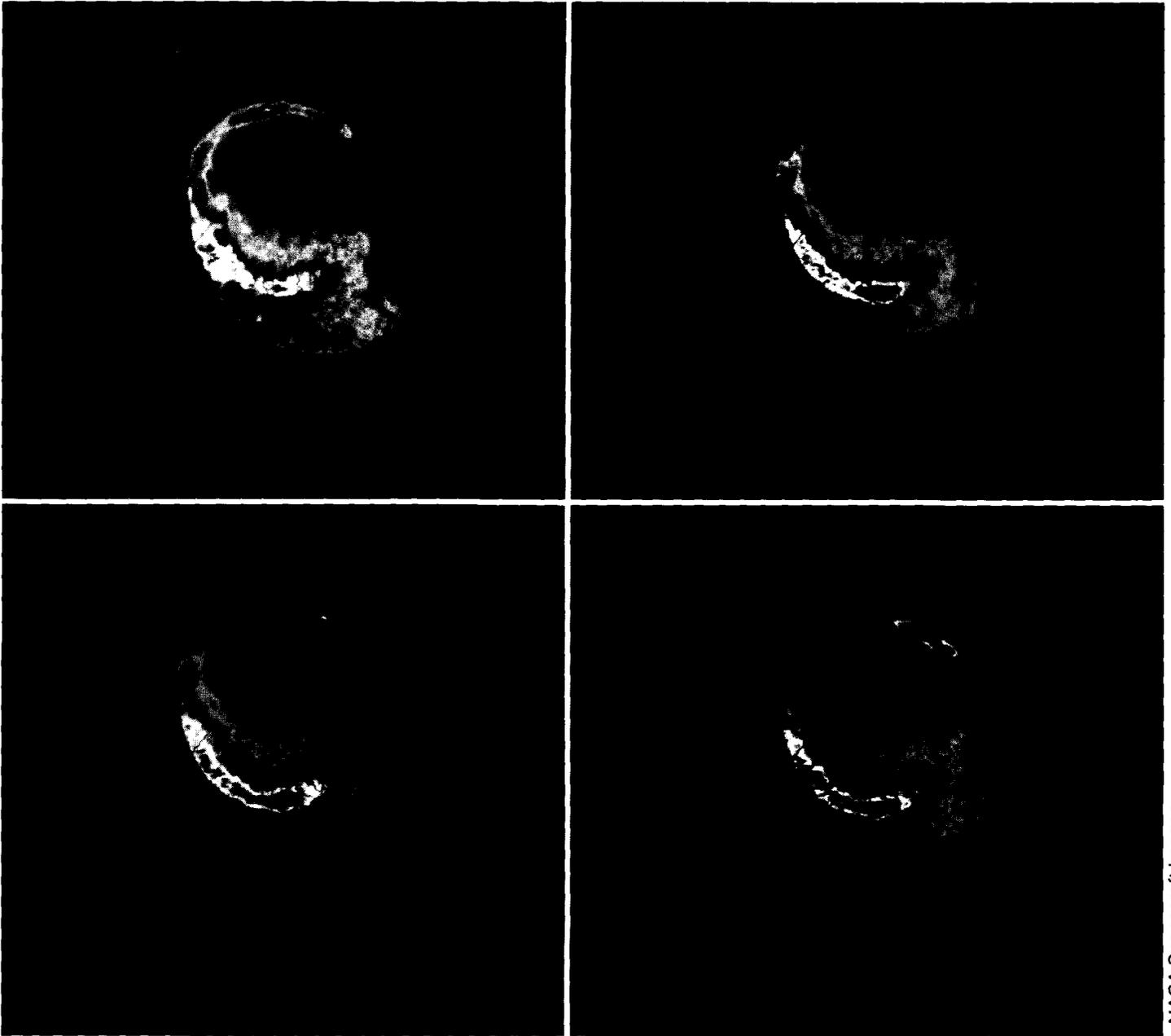
On April 29, Paul Richards of the Hubble Space Telescope Project finally got *The Call* from Houston. After years of applying and months of waiting for word, Hubble's "Tool Guy" was invited to join NASA's elite astronaut corps.

The EVA tool development engineer describes the weeks leading up to that call as maddening. Enthusiastic co-workers constantly asked, "Have you heard yet?" "It was a little frustrating," Richards admits. "I probably got asked at least ten, sometimes twenty times a day!"



Goddard engineer Paul Richards, shown here during a neutral buoyancy test for the Hubble Space Telescope Project at MSPC, has been chosen to become an astronaut.

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NASA Spacecraft Images

Polar Spacecraft Imagery Begins

Independence of Daylight and Nightside Aurora Observed — This four-image sequence taken over a 47-minute period on April 9, 1996, shows the dynamics of the dayside aurora and the onset of an auroral substorm with very intense nightside activity. It illustrates the remarkable capability and the types of auroral activity that have been observed already by the UltraViolet Imager on the Goddard-managed Polar spacecraft.

Upper left: (0 minutes) The dayside portion of the auroral oval over Canada is very active whereas the nightside oval along the Siberian coastline is relatively quiet.

Right top: (40 minutes) Changes in the dayside activity can be seen by comparison of the shape of the active region in this image.

Lower left: (42 minutes) A sudden brightening of the nightside aurora seen at the top of the figure is the first sign of the onset of an auroral substorm.

Bottom right: (47 minutes) The nightside activity has intensified greatly and spread in all directions over a five-minute period.

New Options Available for Retiring Employees

Employees eligible for retirement now have more options to consider when planning their future.

Because retirement is often a difficult decision, the Goddard Center has developed the "New Alternatives" program to provide attractive, voluntary incentives to help employees transition into retirement. The program is designed to give employees new alternatives, more control and greater flexibilities as they make retirement decisions.

What are the "new alternatives" options and how do they work?

Goddard is initially offering two new retirement options: Trial Retirement and Phased Retirement. These options are only available to permanent Goddard employees who volunteer for "early out" or optional retirement. Prior to entering the New Alternatives Retirement Transition Program, the employee signs a written agreement which specifies the conditions of their individual arrangement.

Trial Retirement

(offer expires Sept. 3, 1996)

Trial Retirement lets the employee "try out" retirement for 12 to 18 months. After 12 months, but no later than 18 months, if they decide retirement is not for them, Goddard will hire that person back as a re-employed annuitant at their former grade, unless they retired from a position with a

grade higher than GS-15. These employees will be re-employed at the GS-15 level. Re-employed annuitants will perform duties similar to those performed while previously employed. Employees may decide to work either full-time or part-time. As a re-employed annuitant, they will continue to receive a retirement annuity while also earning a supplemental salary.

Phased Retirement

(offers expires Sept. 3, 1996)

Phased Retirement allows persons to transition into retirement. After the employee voluntarily retires from the civil service, they will be hired (as early as the next business day) as a re-employed annuitant. The employee will continue to receive a retirement annuity while also earning a supplementary salary that is pro-rated according to the number of hours they work. Phased Retirement affords employees three choices. They may submit a proposal to continue working in their current organization performing the same or similar duties, or they may submit a proposal to work in their current or a different organization performing a new line of work. These two choices provide the employee the opportunity to identify and propose a set of duties to perform. The last choice provides persons the opportunity to respond to a listing of work assignments designed especially for

retirees. The Center will make this listing available in the near future. Employees who are considering Phased Retirement are encouraged to take this opportunity to pursue an area of personal interest.

All of the Phased Retirement choices described above permit Goddard people to work up to 1,040 hours a year for up to two years, working either part-time or full-time until they reach the 1,040 hour yearly limit. The organization in which they want to work and the Office of Human Resources must approve their work assignments and work schedule before their Phased Retirement is effected.

For general information on Trial or Phased retirement, call Donna Swann at 6-2172 or Tonya West at 6-5327. If employees have specific questions involving their personal retirement options or would like detailed retirement calculations, call Janet Morgan at 6-4709 to set up an individual retirement counseling appointment.

In addition to the Trial and Phased Retirement options described in this announcement, the Center is exploring additional opportunities to partner with retirees in commercial applications of new technology and in educational outreach endeavors, including in-classroom teaching assignments. Additional information will be publicized in coming weeks as soon as it is fully developed.

Beyond the Bottom Line

Editor's Note: The following article is taken from the September 1995 editor of Government Executive.

One of the great misconceptions about re-engineering is that it applies only to businesses, and large businesses at that. But re-engineering is not primarily about profit and loss, stock price or any other appurtenances of modern capitalism. It is about work. Re-engineering is concerned with the redesign of work so that it can be performed in a far superior way. Therefore, re-engineering is relevant for any organization in which work takes place: large or small, manufacturing or service, profit or non-profit, private or public sector.

It's true that when corporations re-engineer, they do so for financial benefits. But while Protagoras may have been right in say-

ing that man is the measure of all things, money is not the measure of all organizations.

Think of the U.S. Army, Planned Parenthood, the Metropolitan Museum of Art, the American Civil Liberties Union, the John Birch Society. They certainly need money, often plenty of it, to pay their staffs, buy equipment, cover their rent. But to them, money is a means to a non-economic end. Their purposes transcend economics. We call these mission-driven organizations.

There are tens of thousands of them: government agencies, charities, hospitals, universities, schools, think-tanks, benevolent societies, veterans associations, communities of bird watchers. While improving their financial situation may be important, what really motivates them is performing their mission more effectively. Such

institutions often consider finance a necessary evil, not to be confused with their fundamental mission, which usually seeks to improve or even transform lives.

Still, reengineering has much to offer these organizations, and some—the Army and the Social Security Administration, to name just two—have embarked on the adventure and are reaping its benefits. Reengineering is not just a capitalist tool. It enables any organization—those in the service of ideals as well as stockholders—to re-think its processes and find breakthrough ways of improving them. And although there are fewer reengineering tales to tell about the mission-driven world, where it has arrived more recently than in

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NASA's Hubble Space Telescope Probes Crab

By Tammy Jones

Probing the mysterious heart of the Crab Nebula, the tattered remains of a stellar cataclysm witnessed more than 900 years ago, astronomers using NASA's Hubble Space Telescope have found that the Crab is even more dynamic than previously understood, based on a cosmic "movie" assembled from a series of Hubble observations.

The results promise to shed new light on a variety of high energy phenomena in the universe, from nearby neutron stars to remote quasars.

Though changes in most astronomical objects are barely perceptible over a human lifetime, Hubble shows that the interior of the nebula "changes its stripes" every few days, according to Jeff Hester of Arizona State University, Tempe, Ariz., who leads the team of astronomers that took the images, which were separated by only a few weeks.

"We took the images a few weeks apart because we knew that it might be possible to observe slight differences in the Crab over a short time," said Hester. "But, I don't think that any of us were prepared for what we saw."

Though ground-based images of the Crab had shown subtle changes in the nebula over months or years, the Hubble movie shows sharp wisp-like features streaming away from the center of the nebula at half the speed of light.

The powerhouse at the center of the nebula responsible for these changes is a rapidly spinning neutron star — the compact core of the exploded star. Only about six miles (10 kilometers) across, the neutron star would fit inside a small town, "yet its small size belies its significance and the

punch that it packs," Hester said.

As the neutron star spins on its axis 30 times a second its twin searchlight beams sweep past the Earth, causing the neutron star to blink on and off. Because of this flickering, the neutron star also is called a "pulsar." In addition to the pulses, the neutron star's rapid rotation and intense magnetic field act as an immense slingshot, accelerating subatomic particles to close to the speed of light and flinging them off into space.

In a dramatic series of images assembled over several months of observation, Hubble shows what happens as this magnetic pulsar "wind" runs into the body of the Crab Nebula. The glowing, eerie shifting patterns of light in the center of the Crab are created by electrons and positrons (anti-matter electrons) as they spiral around magnetic field lines and radiate away energy. This lights up the interior volume of the nebula, which is more than ten light years across.

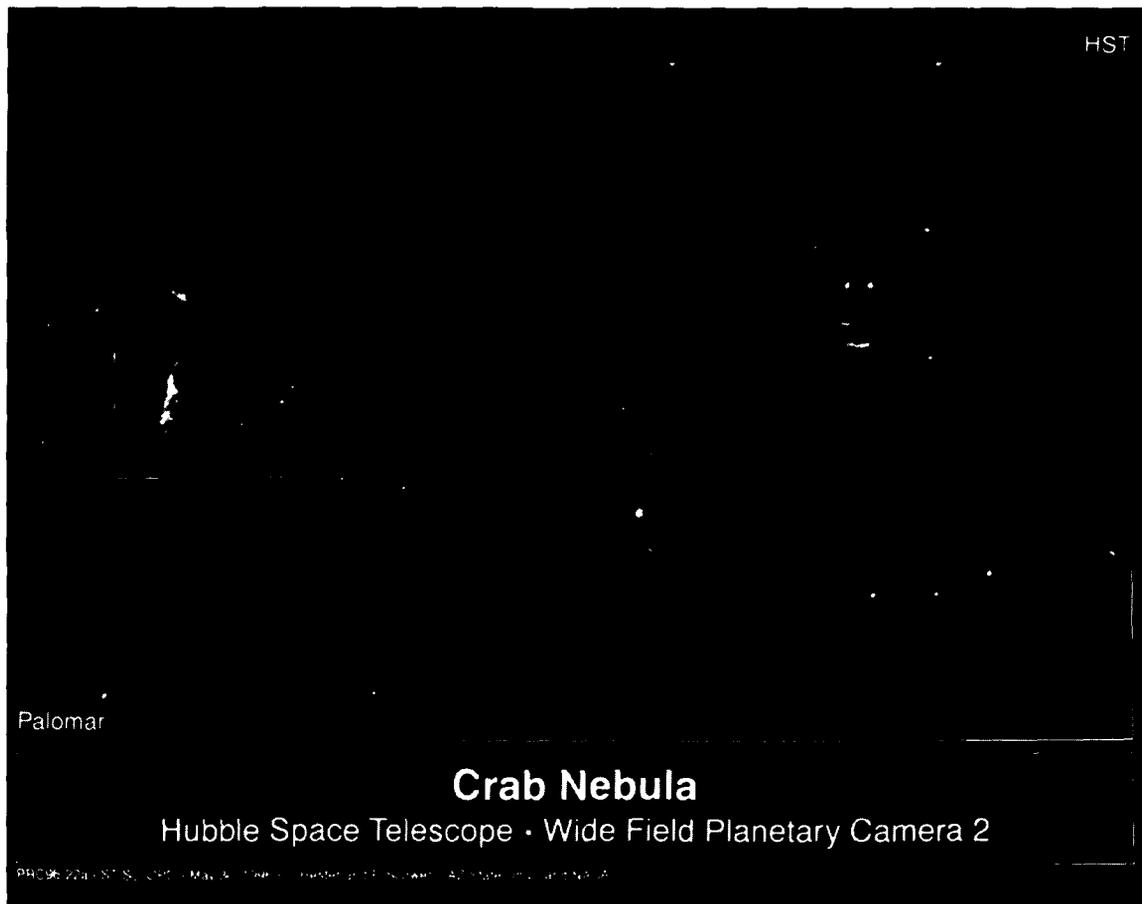
The Hubble team finds that material doesn't move away from the pulsar in all

directions, but instead is concentrated into two polar "jets" and a wind moving out from the star's equator.

The most dynamic feature in the inner part of the Crab is the point where one of the polar jets runs into the surrounding material forming a shock front. The shape and position of this feature shifts about so rapidly that the astronomers describe it as a "dancing sprite," or "a cat on a hot plate." The equatorial wind appears as a series of wisp-like features that steepen, brighten, then fade as they move away from the pulsar to well out into the main body of the nebula.

"Watching the wisps move outward through the nebula is a lot like watching waves crashing on the beach — except that in the Crab the waves are a light year long and are moving through space at half the speed of light," said Hester. "You don't learn about ocean waves by staring at a snapshot. By their nature waves on the ocean are ever-

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TOMS Satellite Scheduled to Launch End of June

The Goddard-managed Total Ozone Mapping Spectrometer is projected for launch the end of June onboard an Earth Probe Satellite (TOMS/EP). The spacecraft is scheduled to be placed into orbit after deployment from a Pegasus rocket. A L-1011 will depart It will continue NASA's long term daily mapping of the global distribution of the Earth's atmospheric ozone.

TOMS/EP will take high-resolution measurements of the total column amount of ozone from space that began with NASA's Nimbus-7 satellite in 1978 and continued with the TOMS aboard a Rus-

sian Meteor-3 satellite until the instrument stopped working in December 1994. This NASA-developed instrument, measures ozone indirectly by mapping ultraviolet light emitted by the Sun to that scattered from the Earth's atmosphere back to the satellite. The TOMS instrument has mapped in detail the global ozone distribution as well as the Antarctic "ozone hole," which forms September through November of each year.

In addition to ozone, TOMS measures sulfur-dioxide released in volcanic eruptions. The U.S. Federal Aviation Adminis-

tration (FAA) is studying ways to use these measurements to detect volcanic ash clouds that are hazardous to commercial aviation.

Ozone, a molecule made up of three oxygen atoms, shields life on Earth from the harmful effects of the ultraviolet radiation of the Sun. The increased amounts of ultraviolet radiation that would reach the Earth's surface because of ozone depletion could increase the incidence of skin cancer and cataracts in humans, harm crops and interfere with marine life.

Goddard Hosts First Community Outreach Fair

By Nina Desmond

"Join Together to Lend a Hand" was the theme of Goddard's first Community Outreach Fair, held on May 21. Over 100 Goddard employees came out to talk to several dozen volunteer coordinators from a variety of public and private community service organizations.

The purpose of the fair was to promote volunteerism and provide employees an opportunity to discuss various community service options available in their communities. Many employees came to look for volunteer opportunities for their school age children. The school systems now are requiring students to participate in community service.

Some Goddard employees not only were attendees at the Outreach Fair, but also representatives of volunteer organizations. Ron Zaleski, offers computer assistance to the Frances R. Fuchs Special Center for

physically and mentally challenged youngsters. The Fuchs Center is located just four miles from Goddard; Zaleski helps out by repairing personal computers and

organization. This group trains and places dogs with mobility, deaf or hearing impaired individuals in the Washington- Baltimore metropolitan area. Fidos for Freedom also provide therapy dog visits to local health care facilities.

Some of the other service organizations participating in the fair included: Doctor's Community Hospital, Food & Friends, Jewish Council for the Aging, PG Memorial Library, Greenbelt Cares, Goddard's Visitor Center, Bowie SPCA, Whitman-Walker Clinic of Suburban Maryland, and the Red Cross.

In case you were unable to attend the fair, a summary of all the participating volunteer organiza-

tions is available by calling 6-8141 in the Office of Public Affairs. The summary also can be accessed on Goddard's Homepage under the Public Services section. The URL address is <http://pao.gsfc.nasa.gov/>



installing software. If you'd like to 'lend him a hand', please call 6-8449.

Three Goddard employees, Candice Carlisle, Dave Campbell, and Theresa Held are actively involved with Fidos for Freedom, an assistance dog training

Hyakutake Measurements Suggest New Class of Comets

Astronomers observing the close approach of Comet Hyakutake to the Earth in March discovered large quantities of the gases ethane and methane in the comet. This is the first time these or other molecules classified as "saturated hydrocarbons" have been found in a comet, strongly suggesting that at least two basic types of comets inhabit the Solar System. This conclusion also has potentially profound implications for scientific theories that describe the primordial conditions that led to the formation of the Sun and the planets.

The discovery was by a team of NASA and university researchers using the NASA Infrared Telescope Facility at Mauna Kea, Hawaii.

Ethane has never before been detected in comets or in interstellar matter, the ultimate source material from which the Solar System was formed. Yet, comet investigators found levels of ethane in Comet Hyakutake that are about 1,000 times greater than can be explained if the molecules were formed by normal physical processes within the gases of the primordial solar nebula, the birth cloud of the Solar System.

"The discovery of ethane was a blinding surprise," according to research team leader Dr. Michael J. Mumma of the Laboratory for Extraterrestrial Physics at Goddard. The spectral lines, or identifying signature of ethane gas, "were so bright they seemed to leap off the computer screen when we got the first observation," Mumma said.

The discoveries were made on March 24, 1996, with the three-meter diameter telescope of the NASA Infrared Telescope Facility atop Mauna Kea. The investigators used a state-of-the-art instrument known as a high-resolution infrared spectrometer. The device was cooled to about minus 400 degrees Fahrenheit to achieve the needed sensitivity to infrared light, which has a longer wavelength than red light and cannot be seen with the human eye.

The unexpected ethane discovery came as the observers searched for evidence of molecules of methyl alcohol, a known constituent of other comets. However, "the emissions of methyl alcohol that we first looked at were much weaker than expected, so we decided to search for other signatures of the alcohol," said research team mem-

ber Dr. Michael A. DiSanti of the Catholic University of America, Washington, D.C. "But after reprogramming the spectrometer, instead of detecting methyl alcohol, we discovered ethane."

Further observations and analysis showed that ethane and methane each constitute about one percent of the frozen gases in Comet Hyakutake. (The astronomers measured radiation from gases released from their frozen state as the solid nucleus—or "dirty iceball"—of the comet was warmed by the Sun.)

"Comets that are rich in ethane must have experienced very different conditions during their birth than comets that do not contain it," Mumma said. One theory is that ethane-rich comets formed in the warmer region near the primitive Saturn and Jupiter, while those without it formed farther away from the young Sun, near the primitive Uranus and Neptune.

Another possibility is that cometary ices formed even earlier, in different layers of the original interstellar gas and dust cloud that led to the solar nebula. An even more challenging concept is that the vast sphere of comets that are believed to surround the Solar System, called the Oort Cloud, may contain comets that formed from different solar nebula—that is, stars other than the Sun. Chemical and physical processes may have been at work in any scenario, altering the properties of the material that now makes up the comet's ice.

The discovery of ethane in Comet Hyakutake will spur scientists to go back and review measurements of other comets to see if unusual blips in their data contain hints of ethane. "For example, we're going to go back and look at Comet Halley data again," Mumma said. Similar measurements of Comet Hale-Bopp, which will pass closely by Earth in March and April 1997, are scheduled for June, he added.

As a comparison to comets, there are three major categories of asteroids. Some of the rocky bodies now considered to be asteroids may in fact be dead nuclei of short-period comets.

Both ethane and methane occur naturally on Earth and some other planets, and in certain meteorites, including the Murchison meteorite that fell on Australia in 1969.

Bottom Line

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the private sector, these tales are still worth examining. They demonstrate many similarities with profit-driven re engineering—and certain meaningful differences.

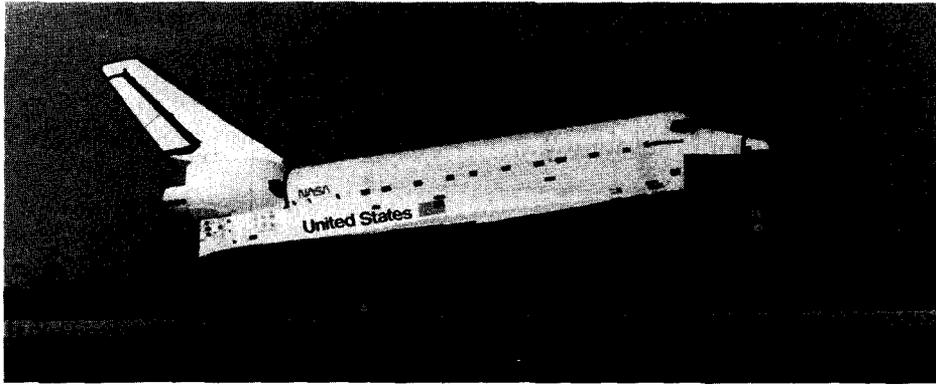
Defining Customers

There are two dilemmas inherent in virtually every mission-driven re engineering. The first is how to determine success. One of the great virtues of business is its relatively unambiguous way of judging results: the bottom line. It provides a clarity and precision that is almost always missing in a mission-driven environment.

A second problem facing mission-driven organizations contemplating re engineering involves identifying their customers. Before long, such organizations will almost inevitably find themselves involved in an agonizing debate about who, in fact, their customers are. Once again, most companies find this question relatively easy to answer: follow the money trail, as they say. But who is a college professor's customer? The student attending the class? The student's parents who are footing the bill? The employer who will eventually hire the student? The worldwide community of scholars, or mankind as a whole? An argument can be made in support of any of these alternatives. This ambiguity exists in virtually all mission-driven environments.

Since re-engineering must begin by identifying one's customers, determining their needs and deciding the best way to satisfy them, this is no academic question. It must be resolved and it isn't easy.

Given these considerations, it's not surprising that the first mission-driven organizations to reengineer have been most businesslike in the sense of having well-defined customers and performance measures expressible in financial terms. Across North America, the first governmental organizations to reengineer have mostly been the tax collectors, from the Ontario Ministry of Revenue to the IRS. Having defined the taxpayers as their customers—never mind that they are active ones—they are trying to make their process customer- and service-oriented. A belief that making it easier to pay the right amount of tax will increase tax compliance and tax revenues underlies this effort. Since revenue departments have an "income" line—the amount of tax collected—as well as the cost line, it is possible to compute their "profit" and the financial improvements wrought by reengineering.



NASA Scholarship

By Tammy Jones

The NASA College Scholarship Fund has selected a Goddard employee's son to receive one of five college scholarship grants. Eric H. C. Liu of Ellicott City, Md., is the son of Anthony An-kou Liu.

Liu will pursue a career in engineering at Stanford University this fall. He is a graduate of Centennial High School in Ellicott City. He graduated as the top student in his class of 324 and received a score of 1510 on the SAT. Liu received straight A's throughout high school, including nine advanced placement gifted and talented courses in math and science.

More than 100 students applied for the five available \$2,000 scholarships. The scholarships were awarded for the student's high level of academic achievements and personal accomplishments. Each scholarship will be renewable annually for a maximum of \$8,000 over six calendar years.

The fund was established to award scholarships agency-wide to qualified dependents of NASA and former NASA employees. The fund was a direct result of a substantial unsolicited gift by the noted Pulitzer Prize winning author, James A. Michener.

Many NASA employees have contributed to the fund directly or through the Combined Federal Campaign. Other major contributors include the Freedom Forum (to honor the Hubble Space Telescope crew members) and the Johnson Space Center chapter of the NASA Alumni League.

The Orbiter Endeavour (OV-15) returns to Florida following a ten-day stay in space. Main gear touchdown on Runway 33 of KSC's Shuttle Landing Facility occurred at 7:09:18 a.m. EDT, May 29. On board Endeavour for Mission STS-77 are Commander John H. Casper; Pilot Curtis L. Brown Jr.; and Mission Specialists Andrew S. W. Thomas, Daniel W. Bursch, Mario Runco Jr. and Marc Garneau, who represents the Canadian Space Agency. Among the payloads the crew worked with were the SPACEHAB-4 module, filled with a variety of microgravity research experiments; the Goddard-managed Spartan-207 deployable carrier which held the Inflatable Antenna Experiment (IAE) that was deployed during the flight Get Away Special Experiments; and the Technology Experiments for Advancing Missions in Space (TEAMS), a suite of four experiments. The highly successful mission marks Endeavour's last flight in space for some time to come.

Celebrate Goddard Day - A Multi-Cultural Festival

The Center's Multi-Cultural Advisory Team, in cooperation with Goddard diversity groups, organizations, GEWA clubs and other interested individuals is hosting the center's first "Celebrate Goddard Day - A Multicultural Festival," for Goddard employees and their families. This event will be held July 12, on the mall in front of Bldg. 3.

The purpose of this festival is to celebrate and appreciate the diversity, talents

and unique abilities of the Goddard community. The celebration will include the sharing and experiencing of the many cultures. Goddard employees and their families, near-site contractors, officials from NASA Headquarters and local dignitaries have been invited.

For more information, contact the event co-chairs, Sandra Irish at 6-8944 or Sheri Thorton at 6-1104.

Sellers

Continued from Page 1

representative of the Office of Personnel Management interviewed him here. "They checked out friends, neighbors and relatives."

An announcement had been expected in March, April rolled around with no news. In late April, Sellers departed for a trip to Canada to perform studies in the Boreas experiment flying an instrumented aircraft among other things. During his return trip, he was transferring planes in the Minneapolis airport when the public address an-

nouncer broadcast a phone call waiting for Sellers. He had been told previously that if the call came from anyone other than the chief of astronauts, Bob Cabana, he would know he had failed to make the selection. Thus, when the call came, it was from another individual at Johnson, not Cabana.

"My heart sank and as I walked to the phone I began thinking what I would say, preparing myself for the disappointment." However, upon taking the phone, the caller asked Sellers to hold for Bob Cabana...and the rest is history.

"I went from great disappointment to exhilaration in an instant," Sellers explained.

After reporting in August, Sellers will spend his first year in Houston in training. Toward the end of that period, Sellers will be assigned to a specialty area in which he will undergo at least another year of technical training in preparation for an assignment to a Space Shuttle mission.

Sellers enters astronaut training in a particularly exciting time when the corps is preparing for the momentous international space station construction as well as service aboard the Russian space station Mir. NASA will be as busy as it has ever been in space during this period and Sellers figures to be in the middle of it.

Hubble

Continued from Page 1

Even when the call came, Houston played a little joke.

Richards explains, "I was called by Bob Cabana [Chief of the Astronaut Office]. I was paged, actually. I came into my office, returned the page and was put on hold for about twenty seconds. Then Bob Cabana answered, and initially I thought: *Great news! He's the head of the Astronaut Office, he should be one of the guys calling.* He said that I'd probably heard through the grapevine that they are notifying candidates today. Unfortunately, he said, 'Dave Leestma usually calls the people who made it.' Because he is speaking to me, the news isn't as good. I just got very silent. Then he said: 'No, just pulling your leg! How would you like to come down and build Space Station for us?'"

Although co-workers never doubted he'd make it, Richards says he is pleasantly surprised. "The average age is 37; I'm 31. And seeing that a lot of the astronauts I work with went through two, three, some even four interviews before being selected, I thought that this was going to be the beginning of a longer process."

The first call Paul made was to his mother. "She said she was proud, and that my father would be proud—that he had probably been looking down on me for the last ten years.

Richards' selection is the fulfillment of a promise as well as a dream. As a boy growing up in Dunmore, Pa., he often spoke to his father about his desire to become an astronaut. His dream continued beyond grade school and high school and into college. In his senior year at Drexel, his father became terminally ill and Richards left school to take care of him.

"I promised him that within two years I'd be working with NASA, within five years I'd have my master's degree, and within ten years I'd be an astronaut." Though his dad didn't live to see him graduate from college, Richards held true to that schedule.

"So, now I'm wrapping up the work here," Richards says of his current job with Hubble Space Telescope. "I've had a really good team, and they're taking up the slack of me leaving. But, I have to wrap things up and make sure they're on their way and get good closure."

On Aug. 12, Richards will report to Johnson Space Center in Houston to begin an intense period of astronaut training. "We'll start off with orientation, and throughout the year we'll learn about all the NASA centers," explains Richards. "We'll get fitted for our flight suits, helmets, boots and we'll do survival training. We'll start learning about the Shuttle and its capabilities and systems, from the software to the hydraulics, to the Remote Manipulator System. We'll also get introduced

to EVA [extravehicular activity] in a space suit and we'll get all the general training and the general knowledge base that one needs to fly in space." After that training, he will transition from astronaut candidate to astronaut and await a flight assignment.

This year's astronaut candidate class is the 16th since the first class of Mercury test pilots was selected in 1959. From last year's original pool of 2,432 applicants, Richards was one of only 35 astronaut candidates selected.

Richards' astronaut adventures will likely include using the tools he helped develop. If all works out, he may even be considered for the Hubble Space Telescope Third Servicing Mission, scheduled for 1999.

"It's going to be sad for me to leave Goddard," Richards confides. "I've come to admire and respect all the people here. I feel that without having been a Goddard employee—given the opportunities that I've had all the way up from testing to mechanisms design to robotics to the Hubble program—I wouldn't have been selected. Having the opportunity at Goddard to be a hands-on engineer—and to actually BE an engineer instead of a manager—that's what got me the job!—I'd like to thank everybody that I've worked with and for along the way."

Crab Nebula

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changing. You learn about ocean waves by sitting on the beach and watching as they roll ashore. This Hubble 'movie' of the Crab is so significant because for the first time we are watching as these 'waves' from the Crab come rolling in."

The Crab Nebula, the result of a supernova explosion witnessed by Chinese astronomers in 1054 AD, also is widely studied because it offers a unique opportunity to study high energy astrophysical phenomena. The physical processes that are at work in the centers of distant active galaxies and quasars are thought to be much like the processes at work in the center of the Crab, only on a vastly larger scale. "The difference is that while astronomers may never truly 'see' into the very heart of an active galaxy, the Crab allows the properties and behavior of high energy winds and jets to be studied up close and personal," Hester said.

"The Hubble results aren't the end of the story," Hester emphasized. "Rather, they are a piece of a larger puzzle.



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