



AEROSPACE

Frontiers

Volume 8 Issue 4 April 2006

Glenn offers structure for space-based communications

BY S. JENISE VERIS

How quickly can we adapt to unpredictable events or make adjustments to science thousands of miles away? To find out, Glenn is playing a lead role within a multicenter working group that is developing changes to NASA's space radio communications systems. These changes will offer flexibility and adaptability in the digital domain that were previously thought infeasible.

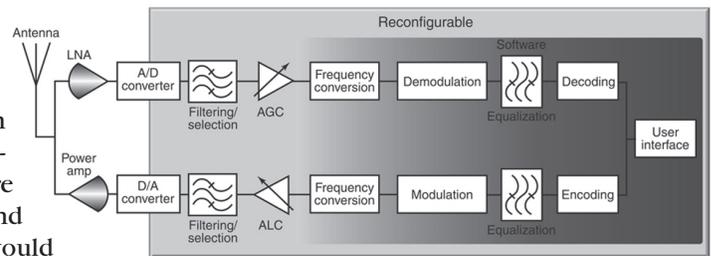
Glenn's team, made up of personnel across the Center, recently released a software-defined radio (SDR) open architecture, known as the Space Telecommunications Radio System (STRS), which provides a framework for a comprehensive set of functions, components and design rules to test and maintain communication and navigation radios used for NASA space missions.

STRS is under consideration as an agency standard for communication transceiver developments among future missions. Mission and radio designers would

apply the architecture to their individual requirements, select required technology and build, qualify and operate the SDRs. The lessons learned provided by the radio developers will help the architecture evolve as mission needs and technology advancements change.

Advancements in computing and digital signal processing components such as field programmable gate arrays (FPGAs) have

Continued on page 4



Software-defined radio technology enables modifications to typical communication radio functions (illustrated) by using software or firmware at a higher definition language for operations through devices such as FPGAs. The STRS Architecture provides guidelines on how the software and firmware interact (interface) with the physical hardware devices of the radio.

NASA celebrates STS-1 anniversary

BY S. JENISE VERIS

April 12, 1981 marked the beginning of greater and more frequent access to space than ever before. On that day, NASA celebrated the maiden flight of the nation's Space Transportation System (STS) and the rebirth of manned space flight in America.

STS-1 was the first of four engineering test flights of a new orbiter designed to deliver passengers and cargo into Earth orbit, dock with satellites and transport supplies and personnel to build the International Space Station. Although there was no payload on the space shuttle's maiden voyage, there was plenty of instrumentation to monitor the system's performance with STS-1 Commander, John Young (captain, USN, ret.), and his pilot Robert Crippen (captain, USN, ret.) at the helm of the 54½-hour flight.



Noteworthy among NASA Lewis (Glenn) contributions to STS-1's successful flight was pioneering work in chemical

Continued on page 6

Inside

DIRECTOR'S CORNER 2

Fun educational activities get kids fired up

RETIREE SPOTLIGHT 4

Ray Holanda shares aviation history with other retirees

EARTH WEEK 2006 5

Here's the lineup of Glenn's Earth Week activities

RECORDS LEAVE TOO 5

Thinking of leaving? Where do your records go?

GLENN EARNS PATENTS..... 8

Patents in 2005 show Glenn innovation

From the Director

Getting kids fired up

Anyone who doubts that America's future generations have the creativity and capacity to carry on the NASA mission should have attended the FIRST (For Inspiration and Recognition of Science and Technology) Buckeye Regional Robotics Competition at Cleveland State University on March 11.

I had the pleasure of co-chairing this year's competition along with Cleveland Mayor Frank Jackson. During this fast-paced event, 42 high-school-age student teams remotely guided their robots—designed and built over 6 weeks with the help of Glenn mentors—in a demonstration of their math and science skills. The FIRST program, which thrives with the assistance of NASA, corporate and community sponsors/volunteers, shows that we can get kids "fired up" about technology, engineering and mathematics. Yet, this is but one vehicle that we use to inspire future generations.

I recently welcomed three Ohio elementary schools in to the NASA Explorer Schools program, another successful way of introducing math and science in a fun, yet in-depth, way. These schools are elated to partner with NASA and learn about our mission of discovery through educational activities aimed at promoting technology and introducing exciting career options. Every time I attend an Explorer School event, I enjoy the enthusiasm and the sincerity of the schools' staff and administration as they realize how NASA can help their students view education as a journey of endless possibilities. However, nothing is more fulfilling than when I see the pride and enthusiasm in the students' eyes as they are welcomed into the NASA family.

NASA's Education Office has been working diligently over the past several months with input from agency leaders to define NASA's goals and activities. I applaud them

Paving the sky for advancement of women

BY S. JENISE VERIS

On March 14, Gene Nora (Stumbough) Jessen and Myrtle Cagle, two members of the famous Mercury 13, provided an inspirational highlight to Glenn's Women's History Month celebration and Federal Women's Program Awards event held at the Visitor Center (VC).

Glenn's Women's Advisory Group (WAG) invited Jessen and Cagle to relate their

experiences as members of the nation's "first lady astronaut trainees." These women met the same rigorous physical and mental tests exercised as their male counterparts, who became the Mercury 7, our nation's first astronauts. Jessen shared slides of her experiences and expressed no regrets that her dream to fly to the outer limits of space was deferred to a generation of women that followed. To this day, she continues to fly, and like Cagle, finds great satisfaction in mentoring other women.

Cagle spoke briefly about her wedding gown, which she fashioned

Left to right, WAG Chair Gloria Richards, Power and Electric Propulsion Division, assists Cagle and Jessen in unveiling a commemorative poster. Lisa Liuzzo, RSIS/Logistics and Technical Information Division, designed the poster.



Photo by Bob Jadloski

Dr. Whitlow proudly poses with the Delphi ELITE team from Warren G. Harding High School, Warren, Ohio, who earned the Chairman's Award—FIRST's most prestigious award recognizing a team's creativity and effort to inspire people of all ages.

for their noble efforts, as well as all the Glenn employees who support programs such as FIRST and Explorer Schools.

I believe that part of my job as a Center Director is to inspire others—including future generations of explorers. But so often I find that their excitement inspires me. ♦



Meinert



Severt

from a parachute, before joining Jessen to unveil a Glenn-designed commemorative poster on display in the VC. A copy of the poster will become part of a permanent exhibit to honor the Mercury 13 and NASA's female astronauts under construction at Cleveland's International Women in Aviation Museum.

During the event, Karen Meinert, chief of the Applications Branch, and Gwynn Severt, Aviation Environments Test Engineering Branch, received the coveted 2006 Federal Women Awards. The awards recognize a supervisor and nonsupervisor's significant contributions and mentorship to inspire and advance women. ♦

Photo by Marvin Smith

C-2006-537



NASA Ambassador of Exploration award

News and Events



Photo by Donna Faher, OSU

John Glenn, center, accepted NASA's Ambassador of Exploration Award with Apollo 11 commander Neil Armstrong, right, and STS-114 astronaut Steve Robison at his side during a special ceremony at The Ohio State University in Columbus on February 20. The date also marked the 44th anniversary of Glenn's historic mission as the first American to orbit Earth. The award—a lunar rock encased in Lucite—is also being presented to the 38 astronauts (or their surviving families) who participated in Apollo, Gemini and Mercury space programs.



C-2006-460

Photo by Marvin Smith

Welcome Dr. Whitlow

Glenn employees extended a "hearty" welcome back to Dr. Woodrow Whitlow as Glenn's new Center Director during a reception held in the Main Cafeteria on Valentine's Day. Dr. Whitlow, who served as Glenn's Research and Technology director from 1999 to 2003, became reacquainted and met new employees. Dr. Whitlow, far right, extends his hand to Dr. Lennart Hultgren, Engine Systems Branch. Dr. Chi-Ming Lee, Combustion Branch chief, and Dr. Isaiah Blankson, Research and Technology Directorate, look on.

Partners in FIRST



Photo by Tim Dedula

Hundreds of high school students converged on Cleveland State University's Wolstein Center for the fifth annual FIRST (For the Inspiration and Recognition of Science and Technology) Buckeye Regional Robotics Competition, March 9 to 11. This year, 35 local sponsors representing business, industry, academia and foundations joined NASA in supporting this event (e.g., financially, publicity, judging, refereeing, mentoring and machining). Glenn Center Director Dr. Woodrow Whitlow (2006 co-chair) and Astronaut Don Thomas joined in on the excitement as well. The winning alliance included Lansdale Catholic High School, Lansdale, Pa.; Liverpool High School, Liverpool, N.Y.; and Goodrich High School, Goodrich, Mich. Agency support continues to grow through NASA's Robotics Alliance Project grants to individual FIRST teams as well as sponsorship of FIRST Regional Competitions across the nation. Thomas is pictured at the event autographing pictures for team members from McKenzie Career Center, Indianapolis, Ind.

Explorer School welcome

NASA's Deputy Associate Administrator for Program Integration, Space Operations Mission Directorate, W. Michael Hawes, far right; and former Astronaut Roger Crouch, left; joined Center Director Dr. Woodrow in celebrating the newly established Explorer School partnership with Alpha School of Excellence in Youngstown on February 15.



Photo by Jan Wittry

Holanda shares aviation and space history

BY DOREEN ZUDELL

Glenn retiree Ray Holanda believes learning does not have to stop when you retire. As an instructor for the Institute for Learning in Retirement (ILR) at Baldwin-Wallace College, Holanda shares his knowledge of aviation and space with other retirees.

Holanda, who retired in 1994 after 36 years in instrumentation research and testing, said that NASA's 2003 Centennial of Flight celebration sparked his desire to teach.

"Seeing the public's excitement about aviation convinced me that a class on aviation history could be a viable topic for an ILR course," said Holanda, who had been attending various ILR classes since 1998.

Upon retiring, aviation history became a serious hobby for Holanda. He used that

knowledge to create a 6-week course that covered America's first 30 years of aviation—from the Wright Brothers to Charles Lindbergh.

The popularity of that course propelled Holanda to design two more courses to complete aviation's history. His own knowledge, coupled with videos and other material from NASA Glenn's Teacher Resource Center and the Johnson Space Center library in Houston, helped him develop another course, "The Moon Walkers: Mankind's First Visit to Another World."

"I've enjoyed sharing my knowledge with a variety of other seniors, including a few NASA Glenn retirees," Holanda said.



Photo by Doreen Zudell

Holanda, standing, conducts his classes at Baldwin-Wallace College. Pictured in the first row, far right, are retirees Stitt and Bob Titran.

Additional classes that have been offered by NASA retirees include Astronomy (Al Armstead), Computers and Digital Camera Use (Lester Nichols), and Technical Communications (Fred Goldberg), according to retiree Leonard Stitt, who co-chairs the ILR curriculum committee with Nichols, chair. Carol Vidoli serves as the ILR newsletter editor.

NASA retiree participation is not limited to the classroom. Some have served on the ILR board and many attend the educational bus tours. For more information on ILR activities, log on to <http://homepages.bw.edu/ilr>, e-mail irl@bw.edu or call 440-826-3188. ♦

Software offers flexibility for space communications

Continued from page 1

enabled NASA to consider software-defined radios for future space missions.

"Software-defined radios enable advanced operations and potentially reduce mission risks and costs over the life-cycle of space platforms and operations," explained STRS Architecture Lead Richard Reinhart, Digital Communications Branch. "In other words, replacing fixed hardware with flexible, reprogrammable software and firmware modules offers the ability to modify or reconfigure radio operation as needed by changing only the radio's software and thus reducing the number of radios required for multiple applications."

NASA has flown radios intended for reconfiguration during two missions—one flight test experiment on the STS-107 and more recently on the Mars

Reconnaissance Orbiter mission. These radios employ architecture proprietary to individual developers, making sharing software and lessons learned more difficult.

Glenn collaborated with NASA's Jet Propulsion Laboratory, Goddard Space Flight Center and Johnson Space Flight Center in defining the correct combination of development and processing functions and guidelines for the architecture. They also benefited from the growing examples of industry and military SDRs, such as the Department of Defense's Joint Tactical Radio System-Software Communications Architecture, a terrestrial ground radio architecture for multiple domains such as soldiers, humvees, helicopters, ships and planes.

"We tried to pick the best architecture and technology and aligned it with what we

need, so that we can come up with the best space-based plan," Reinhart said.

While the STRS team will present the final architecture recommendation to the Space Communications Architecture Working Group by May 2006, they anticipate that activities to refine and validate concepts will continue before it is certified as the Agency standard. Meanwhile, the Glenn team is leading additional efforts to expand software radio technology's use in the agency's vision for exploration.

"Glenn's recognized expertise has positioned us strategically to compete for and encourage partnering opportunities to accommodate further development," said Gene Fujikawa, Digital Communications branch chief. ♦

Glenn celebrates Earth Week: April 17 to 23

Glenn's Earth Day Committee invites everyone to visit a variety of displays and events planned for onsite and as outreach to nearby communities during the 13th annual Earth Week celebration from April 17 to 23. Come for refreshments, handouts and door prizes and learn how to protect the planet.

Earth Week schedule of events:

April 17 to 21: Lewis Little Folks, Inc. The Earth Day Committee will join in activities showing the children how to become good caretakers of the Earth

with a coloring contest, movies and a visit by EVA, the inflatable astronaut.

April 19: 10 a.m. to 3 p.m. Youngstown, State University. The Aerospace Bus will be among the exhibits at the university's Earth Day Awareness event.

April 19 to 20: 11 a.m. to 1:30 p.m. Main Cafeteria. Environmental exhibits will be on display, inside, and hybrid cars will be in the small parking lot. The Ohio EPA will have a Hurricane Katrina display, Cleveland Solar and Wind will demonstrate their flat shingle roofing

Employee records leave too

When you leave NASA Glenn, where do your personnel records go?

"Civil service employees are often surprised to learn that when they retire or leave Glenn for another organization, the official personnel folder that contains a record of their employment leaves the center as well," said Sue Kiley, Office of Human Resources and Workforce Planning (OHRWP).

During an employee's tenure at Glenn, official employment records—including job descriptions, awards, commendations, military and insurance documentation—are secured in a folder at Glenn's OHRWP. When employment status changes, the maintenance of the official record changes and OHRWP sends the record to another federal facility to be maintained or archived.

Work and Military Records

When an employee leaves Glenn to work at another NASA center or federal installation, this record is forwarded to his or her new location where the gaining personnel officer assumes responsibility for the record. Upon retirement or death, an employee's official permanent records, such as job history, awards, commendations and military service, are sent to the National Archives and Records Administration (NARA) in St. Louis, Mo., for safekeeping. Civil servants and their designated beneficiaries may request copies of the information, but the original documents remain indefinitely in the folder at the NARA because the records belong to the federal government. For further information about obtaining copies of the government records not currently maintained by NASA Glenn, call 866-272-6272 or log on to <http://www.nara.gov>.

Health and Life Insurance

When a civil service employee resigns, retires or dies, the portion of his or her employment record pertaining to payroll retirement deductions, health and life insurance and annuity entitlement is forwarded to the Office of Personnel Management (OPM). OPM serves federal employees, retirees and their families by administering retirement health benefits, long-term care and life insurance programs. The OPM is responsible for helping retirees transition to retirement and helping their beneficiaries. Call OPM toll-free at 888-767-6378 or log on to their Web site at <http://www.opm.gov>. The site also offers forms pertaining to retirement and benefits. ♦



panels and the Ohio Prairie Nursery will show you how to "plant native." Learn how to "clean green," save energy, and much more. Two movies will portray the latest amazing footage on the effects of global warming and help us to have "more fun with less stuff."

The popular Earth Week T-shirt featuring another unique logo imprinted on organically grown Texas cotton with organic ink will be on sale, along with compact fluorescent light bulbs, which use 75 to 80 percent less energy than regular bulbs and last for years.

April 21: 7 to 9 a.m. Bike-to-Work Day. Get healthy and reduce airborne pollutants at the same time. If you are interested in participating, contact Wai Wan at 3-5599 or e-mail Wai.Wan@grc.nasa.gov. Refreshments will be provided.

April 22: 10 a.m. to 4 p.m. Boardman, Ohio. The Aerospace Bus will be on hand to augment this community's Earth Day festivities.

April 23: 10 a.m. to 5 p.m. Earthfest at the Zoo. The committee will staff a NASA display featuring renewable energy or energy efficiency project models and posters recounting the history of alternative energy work at Glenn, including the world's first photovoltaic-powered village in Arizona, as well as current/future alternative energy projects.

To view updates to the Earth Week festivities, learn more about Glenn's Earth Day Committee, and for other environmental sustainability links, visit <http://earthday.grc.nasa.gov>, and click on "Activities."

People



Employees Invited Virtual Trip to the Moon

Take a virtual trip to the moon via NASA's Vision for Space Exploration 53-foot trailer exhibit. It will be onsite for employees to visit on May 5. Stay tuned to Today@Glenn for details.

In Appreciation

My family and I would like to thank my NASA coworkers and friends for their support and prayers following my mother's death. The calls, cards, flowers and donations meant so much during this difficult time. —Linda Norberg

I wish to thank all of the employees who contributed leave to me while I recovered from ankle surgery. The prayers, good wishes, kind words and donations of leave helped me during this difficult time. Your thoughtfulness will always be remembered. —Terressa Mills

A special thanks to all the Glenn employees for their condolences and support on the recent death of my mother, Julia Romero. They were comforting during a time of great loss.

—Robert Romero and family

AeroSpace Frontiers is an official publication of Glenn Research Center, National Aeronautics and Space Administration. It is published the first Friday of each month by the Community and Media Relations Office in the interest of the Glenn work force, retirees, Government officials, business leaders and the general public. Its circulation is approximately 6700.

Editor.....Doreen B. Zudell
SGT, Inc.
Assistant Editor.....S. Jenise Veris
SGT, Inc.
Managing Editor.....Kelly R. DiFrancesco

DEADLINES: News items and brief announcements for publication in the May issue must be received by noon, April 14. The deadline for the June issue is noon, May 12. Submit contributions to the editor via e-mail, doreen.zudell@grc.nasa.gov, fax 216-433-8143, phone 216-433-5317 or 216-433-2888, or MS 3-11. Ideas for news stories are welcome

but will be published as space allows. View us online at <http://AeroSpaceFrontiers.grc.nasa.gov>.



Appointments

Anita Alexander has been selected an Office of Strategic Management (OSM) specialist. Alexander joins the team responsible for assisting the OSM director in formulating the Center's strategic management process and developing the Center's strategic roadmap. Alexander brings to her new position a wealth of experience in the areas of management and marketing, in addition to outstanding communications skills and team focus.



Alexander



Farkas

Les Farkas, CIO Policy and Planning Office, was appointed Glenn's Enterprise Architect. Farkas will represent the Center in NASA's Enterprise Architecture Program initiated in compliance with Office of Management and Budget and General Administration Office guidelines under the President's Management Agenda. He earned the Federal Enterprise Architecture certificate by completing an accelerated program that certifies him qualified to investigate Information Technology (IT) investments for the agency's portfolio.

Honor

Engineering and Technical Services Directorate Director Olga Gonzalez-Sanabria is one of 12 Latino engineers to be featured in the book "Ay Mija, Why Do You Want To Be An Engineer?" written by Edna Campos. In addition to Gonzalez-Sanabria, two other NASA employees are featured: Laurie Carillo (Johnson) and Debbie Martinez (Langley). The book discusses the engineers' childhoods and shows students how they can serve as role models in pursuing degrees in engineering. The target audience is third- through fifth-graders. The book is endorsed by the Society of Hispanic Engineers (SHPE), with portions of the proceeds going to the SHPE scholarship fund.



Gonzalez-Sanabria

Glenn contributed to STS-1 success

Continued from page 1

propulsion, turbomachinery and heat transfer analysis applied in development of the Space Shuttle Main Engines. Fuel cell research led to increased efficiency in powering the orbiter, while a series of tests in the 10 by 10-Foot Supersonic Wind Tunnel helped validate the shuttle design and performance.

Glenn-developed liquid hydrogen propulsion technology that substantially contributed to Apollo missions' success also paved the way to develop a compact engine powerful enough to carry the desired payloads of the space shuttle. Adapting the turbopump designs and elements of the main injector assembly for the combustion chamber dating back to the 1950s and 1960s became critical to containing and delivering propellants

in an internal environment more severe than any rocket engine previously built. The data accumulated from heat transfer analysis and cyclic testing also aided predictions for engine life expectancy.

As NASA celebrates the space shuttle's 25th anniversary, the nation approaches the close of another chapter in human exploration and the beginning of a new one as NASA transitions to the Crew Exploration Vehicle.

The public is invited to learn more about the shuttle program and celebrate "The Space Shuttle's Silver Anniversary" during a special Third Saturday presentation at Glenn's Visitor Center on April 15. See "News Notes" on page 7 of this issue for more information on the program. ♦

News Notes

LESA MEETING: LESA/IFPTE, Local 28, will hold its next monthly membership meeting on April 12, at noon in the Employee Center, room 101.

THIRD SATURDAY AT THE VC: On Saturday, April 15, Glenn's Visitor Center (VC) will present "Space Shuttle Silver Anniversary" from 10 a.m. to 3 p.m. During the 11 a.m. and 1 p.m. presentations, visitors will learn more about the space shuttle and celebrate with NASA as it observes the 25th anniversary of the shuttle's first flight. Other highlights include free photos available in the Picture Yourself in Space photo booth, kids make & take crafts, and plenty of handouts. For reservations and more information, call 216-433-9653. For details on this and other Glenn events, log on to glennevents.grc.nasa.gov.

DEMOLITION PROJECT MEETING: Glenn will host a community awareness meeting for employees and the public to learn about the Altitude Wind Tunnel and Propulsion Systems Laboratory 1 & 2 Demolition Project. The meeting will be held on Thursday, April 27, in the DEB Auditorium from 7:00 to 8:30 p.m. For more information, contact Les Main, 216-433-6345.

AFGE MEETING: AFGE Local 2182 will hold its next monthly membership meeting on May 3, at 5 p.m., at Denny's Restaurant, 25912 Lorain Road, North Olmsted. All members are encouraged to attend. There are no regular monthly meetings in June, July or August.

STAR GAZING AND MORE AT THE VC: On Saturday, May 6, Glenn's Visitor Center (VC) will celebrate National Astronomy Day with its third annual Star Gazing event. Bigger and better than ever, the day will include solar and night telescope viewing, tours, presentations and Starlab Dome programs, and the Ohio debut of NASA's Vision for Space Exploration trailer. The event runs from 10 a.m. to 11 p.m. Be sure to bring your family and friends. For an up-to-date schedule of events, log on to glennevents.

Retirements

March 31, 2006, retirements:

Richard Blech, Engine Systems Branch, retired with 28 ½ years of NASA service.

John Logan, Jr., Engineering Development Division, retired with 26 years of NASA service.

Therese Ross, Office of Human Resources and Workforce Planning, retired with 28 years of NASA service.

Thomas Fuller, Space Power and Propulsion Technology Branch, retired with 33 years of federal service, including 26 years with NASA.



Fuller

Bruce Viergutz, Research Testing Division, retired with 35 ½ years of federal experience, including 31 ½ years with NASA.

In Memory

Dr. Lawrence "Larry" Bober, 62, who retired in 2003 after 35 years of service, recently died. Bober served as deputy director of the Research and Technology Directorate.

Virginia Doran, 82, who retired in 1980 after 35 ½ years of NASA service, recently died. Doran served as secretary to the director of Technical Services prior to her retirement.

Walter Herrlich, 81, who retired in 1970 after 26-plus years of NACA/NASA service, recently died. Herrlich served as head of the Materials and Rocket Services Section-B of the Test Installations Division.

Donald Noga, 63, who retired in 2000 after 35 years of NASA service, recently died. Noga served as an electrical engineer in the Engineering Design Division and supported the Cassini and Centaur missions.

Peter Toth, Jr., 78, who retired in 1994 after 33 years of federal service, including 3 years in the Army, recently died. Toth served as an architect technician and contract inspector in the Carpenter Shop.

James "Cody" Williams, 79, who retired in 1996 after 37 years of NASA service, recently died. Williams was an engineer in the Office of Mission Safety and Assurance.

Nine Glenn-sponsored innovations featured in "Spinoff 2005"

"Spinoff 2005," NASA's premiere publication, featuring the agency's latest technological innovations transferred to the commercial market, is available in both print and online editions. "Spinoff 2005" highlights nine Glenn-sponsored innovations including an intelligent oven that allows people to start cooking dinner before they get home, via a cell phone, personal digital assistant or Web connection. The oven is based on NASA-developed computer technology. For a free copy of "Spinoff 2005," contact the National Technology Transfer Center (NTTC) at 800-678-6882. The free version is available from the NTTC as an interactive compact disc, complete with streaming video and Web links. For the "Spinoff" series from 1996 through 2005 Web versions, visit <http://www.sti.nasa.gov/tto/spinoff.html>. ♦



Patents demonstrate research quality and innovation

BY DOREEN ZUDELL

Are Glenn researchers leading the way in breakthrough technology? The U.S. Patent and Trademark Office (USPTO) believes so. In 2005, it awarded 14 patents to Glenn for "unprecedented" research.

Achieving this honor is no easy task, said Kent Stone, patent attorney in Glenn's Office of the Chief Counsel. He explained that researchers who submit new technology through the Technology Transfer and Partnership Office undergo a rigorous review process.

"Technology is evaluated for a patent based on technical, commercial and legal merit, and these three factors carry equal weight," Stone said.

About 250 Glenn researchers and/or research teams submit their technology through the process each year, and although much of the technology is considered of high-caliber, only a small number of inventions are recommended

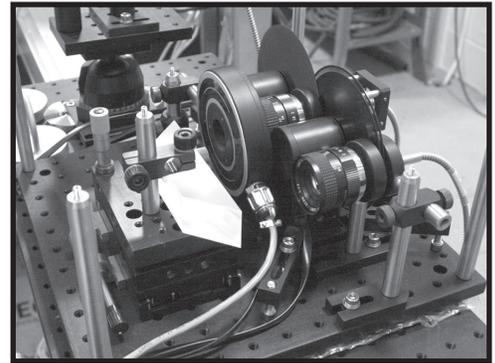
for patenting. "The number of patent applications processed also depended on the resources made available each year," Stone said.

Glenn technologies evaluated to have patenting potential are packaged by the legal office and submitted to the USPTO. It takes about three years for the invention to navigate through USPTO's demanding evaluation process.

Recent patents focused on advanced microelectromechanical systems (MEMS) technology for universal antenna communications, as well as packaging of electronics for protection from damage in high-temperature and harsh environments; hollow cathode tube technology used to improve performance and life expectancy for a variety of applications such as propulsion engines, commercial



Patent #6,845,664 B1 17,256-1



Patent #6,937,331 B1 17,175-1

Above, left: This technology can be employed in a variety of high-temperature electric applications. Above: This technology has applications in electro-optical, spectroscopy, and high-speed digital imaging systems.

satellites and waste handling; and vapor deposition aluminide coatings that provide thermal and chemical protection in combustion environments up to 900 degree Celsius.

Deputy Director of Research and Technology Dr. Jih-Fen Lei, who oversees the patent process, says patents are a testimonial of Glenn's technical merit. "These patents and their research authors are internationally recognized," she said. "They demonstrate that we are innovative and on the cutting edge." ♦

National Aeronautics and Space Administration
John H. Glenn Research Center
Lewis Field
21000 Brookpark Road
Cleveland, Ohio 44135

