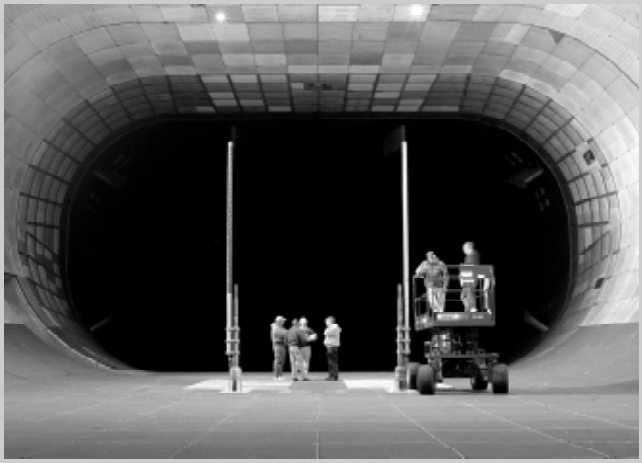
FO OUTLOOK
NASA AMES RESEARCH CENTER

Information for the NASA Ames Wind Tunnel Test Community April 2002

ANTENNA TEST IN THE 40-BY-80-FOOT WIND TUNNEL



Engineers and technicians prepare for a calibration check on strain gauges and accelerometers on antennas in the 40-by-80-foot Wind Tunnel.

By Catalina Ortiz

You can add a new item to the list of earthbound devices tested in NASA Ames' wind tunnels.

Several radio antennas were evaluated at the National Full-Scale Aerodynamics Complex 40-by-80-foot Wind Tunnel in March. The test was to help make sure that the antennas – used by police, fire, and rescue networks – operate properly under extreme wind conditions.

The antennas are made by TX RX Systems, Inc. of Angola, New York. The company provided five different antennas for evaluation – two existing models, two new ones, and one experimental design. Four were 16 feet long, one was 10 feet long, and each was about 3.5 inches in diameter.

TX RX Systems had requested NASA support after experiencing internal electrical and structural problems with some antennas, most likely caused by wind loads. Although the company had carried out load and fatigue testing based on estimated loads, they wanted wind tunnel tests to verify how the antennas would behave in actual high-wind conditions.

"You want to make sure antennas will work when they're needed, particularly during an emergency, which could be during a storm," says test manager Tom Arledge.

Creating the right test conditions meant operating with a narrower safety margin than usual, Arledge says. Wind tunnel tests usually operate with a safety factor of four on structural failure, meaning that the object is subjected to a quarter of the force that would cause it to break. With the antenna test, "we were operating very near a safety factor of one," Arledge says.

Because of the low factor of safety, engineers proceeded cautiously. The major components of the antenna were tethered using metal cables to keep them from going downstream in the event of a failure. Also, plywood was bolted to the floor of the test section in the possible impact area to protect the acoustic lining.

Strain gauges to measure structural loads were placed on each antenna's radome, the composite sheath surrounding its metal core. Accelerometers also were used to measure each antenna's dynamic and static deflection.

"The test was relatively simple compared to what we usually do in the NFAC, but we gave the customer exactly what they wanted," Arledge says. TX RX Systems was pleased with the results, giving the FO Division a nearly perfect performance assessment score.

Although nearly all of Ames' wind tunnel tests involve fixed-wing aircraft or rotorcraft, the center occasionally runs tests of terrestrial objects. These have included yachts, trucks, wind turbines and golf balls. Dish-type antennas also have been tested at the NFAC, but the TX RX Systems test marked the first time pole-type antennas have been tested there.

Serving the Aerospace Industry and Research Community
Wind Tunnel Operations Division
NASA Ames Research Center

IMPROVING SAFETY BY UPDATING FACILITY SIGNS

By Don Nickison

Facility signs are an important part of an overall safety program. The FO Division has started a program to update all signs, including the Danger, Warning, and Caution signs at its facilities.

The division formed a four-member committee last summer to study the signs. We are looking at as many areas as we can in Code FO's facilities to see if the signage is appropriate from a safety, security, and informational standpoint. We've started replacing or removing signs that are outdated or that have incorrect or vague wording. This effort will continue for the foreseeable future.

Here is some information about facility signs that you should be aware of and answers to questions that you may have:

Q:Why the emphasis on signs?
A: Signs are perhaps the last chance to warn individuals about hazards or guide them to safety in an emergency.

Sign warning of noise hazard outside the NFAC

Our facilities tend to have heavy industrial environments – which can be dark, noisy, and dangerous – in close proximity to office-type settings. Almost anyone, including our customers, has access to these industrial environments. And with the recent changes in FO's workforce, we have even more people working in Building 227 – and a greater need to make sure the proper signs are in place.

Q: What hazard signs should I pay the most attention to?
A: You need to be aware of all the signs around you. But keep a special look out for signs saying "Danger," "Warning," or "Caution" – and please follow their instructions.

Danger signs warn of the most serious hazards.

Danger signs warn you about an immediately hazardous situation that, if not avoided, will result in death or serious injury. For instance, some Danger signs warn you about high voltage. Your best bet is to keep out of areas marked with Danger signs unless you need to be there, are authorized to be there, and have appropriate training.

Warning signs indicate a potentially hazardous situation that, if not avoided, could result in death or serious injury. Examples at the wind tunnels warn you about unannounced air discharges and the noise they produce.

Caution signs alert you to potentially hazardous situations. If not avoided, these hazards may result in minor or moderate injury. These signs include warnings of lead and noise exposure. "Caution" signs also are used to warn people against unsafe practices, such as not wearing eye protection.

Q: What else should people watch out for?
A: Try to know your exit routes before you need to leave the area quickly during an emergency. Whenever you go to a new area, it's always good to make a mental note of the exit routes.

In an emergency evacuation, slow down and pay attention to your surroundings. See if anyone around you needs help getting out. Look for either the red or green Exit signs. They usually will be located above exits or at intersections in hallways. Look at them carefully, though; some signs have an arrow pointing to the quickest way out of the building.

In some large spaces, such as the warehouse area of the 9-by-7-foot Supersonic Wind Tunnel, floor striping leads to the exits.

Lastly, watch out for dead ends. Some doors leading to dead ends have signs saying "No Exit" or similar wording, but not all of them are marked.

Q: Who is on the sign committee?
A: Jim Bonagofski, Dan Clasen, Gayle Frank, and myself are the members. Of course, a lot of credit should go to Jim Prunty and the Sverdrup craftsmen who actually are making the changes.

Q: What are the committee's goals?
A: We are trying to keep the right balance of signs to provide the necessary information without overdoing it. If there are too many signs in one area, it's less likely that someone will "see" the ones they really need. We also are trying to add some consistency. Some signs are pretty old. They're often based on outdated safety standards or are remnants from systems long since removed.

Q: What is the committee doing now?
A: The committee is reviewing all Code FO facilities – the Unitary Plan Wind Tunnel, the National Full-Scale Aerodynamic Complex, 12-foot Pressure Wind Tunnel, and the High Pressure Air Distribution facilities (HPADs). We are going building by building, starting with Unitary because it is where most of the division's work occurs. The signs at the 9-by-7 have been redone as a result of this effort. Other parts of Unitary are in progress.

(Continued on page 3)

FO SPONSORS BOOTH AT AIAA AEROSCIENCES MEETING

By Pete Zell

The Wind Tunnel Operations Division sponsored its first booth in the exhibit hall of the Reno Hilton during the AIAA Aerosciences Meeting in January. Several other wind tunnel service providers including NASA Langley, NASA Glenn, AEDC, and Veridian are regular exhibitors at this conference. We shared the 20-by-10-foot booth with the Ames thermal protection facilities (Arcjet) folks.

The objective of having a booth at Reno this year was to show the industry that we have an excellent set of wind tunnels that are available to support their test requirements. We distributed about 1,500 cork drink coasters imprinted with our logo and Web address. There was a lot of interest in our display of wind tunnel test photos, and we made lots of great contacts with the potential to lead to future tests.

The booth was staffed by (left to right) Max Amaya, Mike George, Pete Zell, and Phil Stich. Not pictured: Norbert Ulbrich.

HELICOPTER SOCIETY HONORS THE TRAM SUPPORT TEAM

Members of the TRAM technical support team

Code FOI and FOW technicians and mechanics who supported the full-span Tiltrotor Aeroacoustic Model (TRAM) test in the 40-by-80-foot Wind Tunnel have been honored by the American Helicopter Society. The society's San Francisco Bay Area Chapter presented them with its annual Outstanding Technical Support Award in December.

The TRAM program's objective was to develop a platform to study the noise-generating mechanisms of tiltrotor aircraft. The test, which lasted more than a year, resulted in the acquisition of valuable performance data.

Winners appear in the photograph to the left. Back row, left to right: Scott Torok, Rich Toner, and Tim Gildersleeve. Front row, left to right: Ralph Briones, Gene Devargas, Lannah Hoang, and Lamont Pham. Not pictured: Ken Horn and Lex Alday.

IMPROVING SAFETY BY UPDATING FACILITY SIGNS

(Continued from page 2)

However, the committee also is reviewing any problems at other facilities as they are identified by management safety inspections, other safety-related checks, or requests from personnel.

Q: What should I do if I can't figure out what a sign means – or one that should be changed?

A: Please ask your manager if you have a question about a sign. He or she will know or should be able to find out. If you see a sign that looks to be in error, is damaged, or is illegible, please contact the building's Facility Services Manager (FSM) or me directly. We want to ensure that every sign alerts personnel appropriately.

CORRECTION

In the November 2001 FO Outlook, a caption on Page 5 mistakenly said that a 1970 Space Shuttle test occurred in the 9-by-7-foot Supersonic Wind Tunnel. The test pictured actually occurred in the 6-by-6-foot Wind Tunnel.

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CURRENT ACOUSTIC RESEARCH AT NASA AMES

By Stephen M. Jaeger

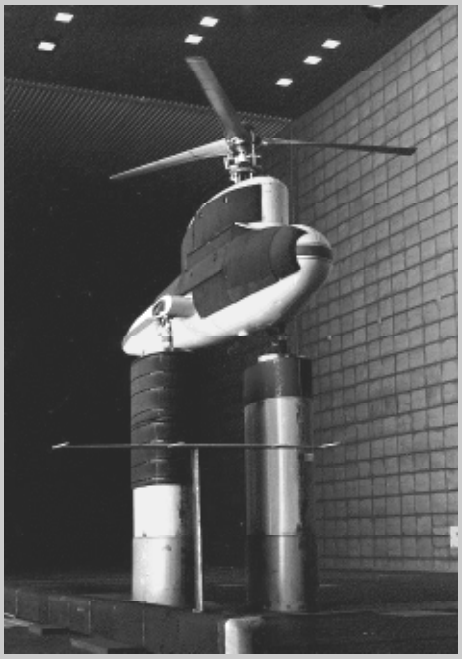
People and governments around the world are unanimous: "We want less noise!" Over the years, NASA has played a significant role in making our backyards, our cities, and even outer space a little bit quieter. Much of the research devoted to making airplanes, helicopters and spacecraft less noisy has been done right here at NASA Ames Research Center.

NASA's role is a direct response to various government mandates intended to protect our health and our quality of life. In the realm of air transport, the International Civil Aviation Organization (ICAO), the governing body for aircraft noise standards, has called for quieter airports in this century. In fact, European governments enforce particularly strict noise regulations, and if American aircraft manufacturers want to remain competitive they will need to build quieter aircraft. NASA has responded to this challenge, establishing the goal of reducing a typical jet airliner's noise signature by 10 dB or more in the next 10 years – a major feat.

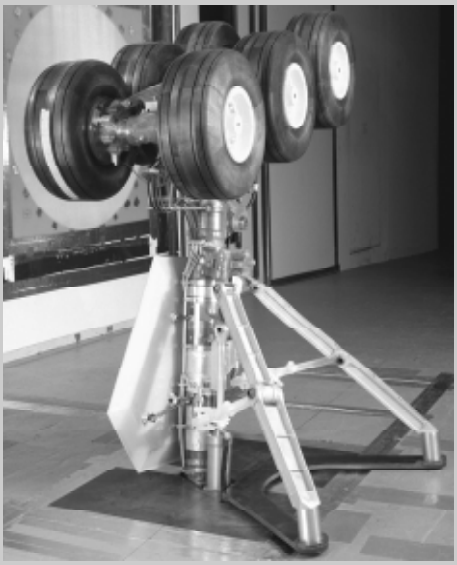
Evaluating Noise-Control Techniques

In support of this goal, the National Full-Scale Aerodynamics Complex (NFAC) has conducted several large wind tunnel tests over the years. The recent Subsonic Transport Aeroacoustic Research (STAR) test in the 40-by-80-foot Wind Tunnel was the culmination of a multiyear effort to quantify noise generated by a typical jet liner airframe. Airframe noise sources such as landing gears and flaps now rival the noise of the engines while the jet is on approach. This is mostly a consequence of the industry's success in reducing engine noise over the last three decades.

While the identification of these noise sources was an important aspect of the STAR test, the evaluation of various passive noise control techniques such as flap fences and slat cove fillers was critical since such technology provides the tools for aircraft designers to build quieter airplanes. Results of the test suggest that with a few design changes, considerable reductions in some noise sources can be achieved. Specifically, a recent test in the NASA Ames' 7-by-10-foot Wind Tunnel revealed that landing gear noise can be reduced substantially with even modest design changes.



XV-15 rotor test in the 80-by-120-foot Wind Tunnel



Model landing gear being tested in the 7-by-10-foot Wind Tunnel

Testing Rotorcraft

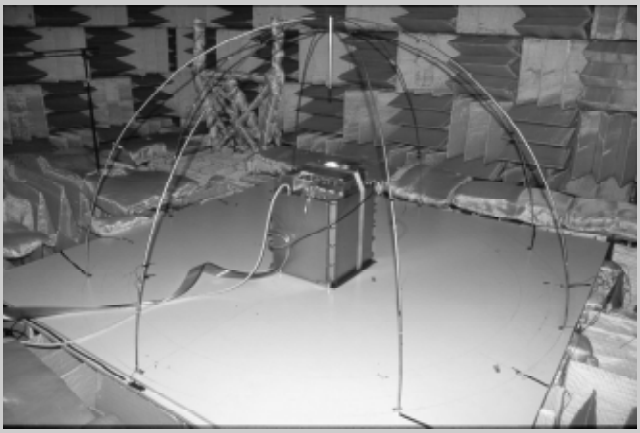
The NFAC has also been the site of an ambitious schedule of rotor noise tests. In an effort to reduce noise, helicopter acousticians have been turning to active techniques such as Higher Harmonic Control (HHC) of the swashplate and Individual Blade Control (IBC). A particularly vexing problem is the Blade Vortex Interaction (BVI) noise that occurs when a helicopter or tiltrotor is in hover or descent. The blades sweep through their own wakes, producing considerable noise.

A recent test of an XV-15 rotor in the 80-by-120-foot Wind Tunnel demonstrated that HHC can reduce BVI noise by up to 6 dB. HHC changes the pitch of all the blades at a higher rate than once per revolution, effectively helping the blades avoid the wakes. Individual Blade Control also was evaluated as a noise control technique during a recent 80-by-120 test of a UH 60 helicopter. With IBC, the standard blade pitch links of the rotor are replaced by servo-actuators so that the pitch of each blade can be controlled independently. According to preliminary test results, IBC also shows great promise in reducing BVI noise and vibration.

CURRENT ACOUSTIC RESEARCH AT NASA AMES

Investigating Microphone Arrays

NASA's contributions to aircraft and engine noise research are well-known in the industry. What is not as well recognized, however, is the work done in other areas of acoustics research. For example, microphone arrays used for wind tunnel studies can also be applied to other research areas. The technique uses the combined signals of dozens of microphones not only to detect important sources in an otherwise loud environment but also to determine source locations. The focus of one current study is to determine whether jet-engine combustion can be detected and controlled using microphone arrays. By using a special array of transducers within the hot combustion chamber, a sophisticated control system would monitor the noise of dozens of burner flames, alleviate acoustic instabilities, and assure smooth operation of the combustion chamber. This work is just beginning, but the technique may lead to more efficient jet engines in the future.



Sound power testing of a bio-habitat payload

Although noise usually is a problem, sometimes it may help solve other problems. A microphone array one day could locate potentially life-threatening leaks onboard the International Space Station (ISS). The device, called the Handheld Acoustic Source Isolation Tool (HASIT), is a small unit that can focus on and quickly detect pinhole-size air leaks based solely on their acoustic signature. Small leaks produce inaudible noise, making them difficult to find and repair. In studies at NASA Ames Research Center, HASIT has proven successful in detecting leaks as low as -10 dB at 60 kHz.

A prototype of the HASIT array

Making Space Quieter

Is noise really a problem in outer space? It is if you're within the confines of the Space Shuttle or the International Space Station. Although the Space Shuttle and ISS are among the most sought-after workplaces in the solar system, they are particularly poor environments when it comes to noise. Each self-contained experiment payload within the ISS generally requires its own cooling system consisting of various fans and ductwork. Continuously operating machinery and cooling fans can make it hard for astronauts to think clearly, let alone get a good night's sleep.

Regulations regarding noise aboard the ISS are mandated by the Multilateral Medical Operations Panel (MMOP), an international body that reviews crew health and safety issues. The regulations are more stringent than typical OSHA standards since astronauts, unlike most workers, have to be there 24 hours a day. Also, communication and speech intelligibility are main drivers since they impact safety and are compromised at lower acoustic levels than where hearing loss would occur.

Unfortunately, traditional noise-reduction techniques are not always appropriate in an orbital environment. Materials such as foam and fiberglass make excellent acoustic absorbers on Earth, but in a microgravity environment, food particles and dust drift to every corner of the vehicle. Acoustic absorbers become ideal environments for mold, and keeping such materials clean would be a nightmare. Weight limitations on each experiment also make it difficult to include absorbers.

In response to these problems, Ames researchers have been testing various cooling fan designs on scientific payload bays to assure that the noise emitted by each device is as low as possible. Results suggest that by utilizing well-designed fans and ducts in the early stages of construction, each payload bay can be built to meet the strict standards set forth by MMOP. Recently, two new test rigs were built to test fan designs under varying pressure loads. With these new tools, NASA Ames Research Center will remain an essential part of the effort to make outer space a quieter place.

MIKE LIU WINS AMES HONOR AWARD FOR EEO

Every summer Mike Liu, deputy chief of the Wind Tunnel Systems Branch, gladly takes on a few more roles: host, tour guide, mentor, and role model.

Mike Liu holds a talking feather, used by various Native American groups to show who has the floor.

Mike spends much of his personal time working with teachers of Native American students during educational workshops at Ames. For that work, Mike has received an Ames Honor Award in the category of Equal Employment Opportunity.

Mike, who is half Navajo, takes charge of the visiting teachers in his role of chairman of Ames' Native American Advisory Committee. He also is Ames' representative to NASA Headquarters' Native American programs and is active in the American Indian Science and Engineering Society, helping to organize conferences and advising college students.

But it is his "selfless and tireless personal commitment" to working with educators that deserves special recognition, says Bonnie Samuelson, who runs the summer educational workshop.

The program exposes teachers of Native American students in kindergarten to 12th grade to NASA technology and research. Mike discusses his experiences with instructors and gives tours of the wind tunnels. He also arranges astronomy lectures and visits to Lick Observatory and leads other field trips.

Mike, who was raised away from Native American culture, became active in Native American activities in 1993, when he reestablished a relationship with his father, who is Navajo.

He thinks it's important to increase diversity at NASA and in the fields of science and engineering. By serving as a role model, he hopes to encourage students to believe in themselves.

"I feel there are a lot of students out there who don't know what they could become. A lot of them could be involved in a science or technical career – perhaps at NASA. If they see people like me involved, they can think, 'I can do that, too,' " Mike says.

In addition to his duties as FOI deputy chief, Mike recently helped organize Ames' celebration of Sun-Earth Day in March. This year's event – which celebrated the sun and space around the Earth with a variety of educational activities – featured Native American perspectives on Sun-Earth science. Mike also arranged visits to Ames by students of a Native American school in Oakland and local teachers of Native American students.

WIND TUNNEL OPERATIONS DIVISION EMPLOYEES OF THE MONTH

George Hopf-Lovette and George Swaiss

George Hopf-Lovette and George Swaiss were recognized for successfully planning and conducting the test of the new block house pressure-relief valve at the 9-by-7-foot Supersonic Wind Tunnel.

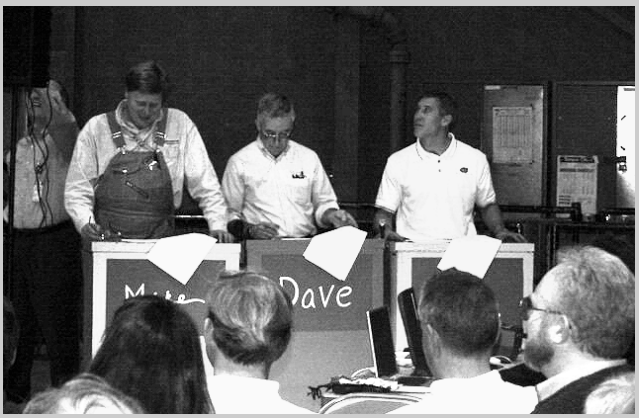
The test, which demonstrated passive over-pressure protection for the block house under worst-case conditions, was an important milestone in the extensive renovation of the wind tunnel. George Swaiss, of Sverdrup Technology Inc., and George Hopf-Lovette, a NASA employee, jointly supervised the block house pressure-relief test.

Jim McGinnis

Jim McGinnis received unsolicited recognition from Code FO Deputy Division Chief, FOF Branch Chief, and the Unitary Plan Wind Tunnel Chief Engineer for his work designing and implementing remote breaker racking capability at the UPWT.

Although the possibility of remote racking had been studied at Ames' wind tunnels, no cost-effective concepts had been proposed. But Jim, understanding the safety benefits of remote racking, independently thought of using a remote racking pendant. He produced a fully developed design, including wiring diagrams, even working out some physical details in his shop on his own time. Jim in this case exceeded his normal high level of performance. His initiative and creativity led to a substantial and very cost-effective facility safety improvement.

FO HOLIDAY PARTY FUN



Mike George, Dave Banducci, and Phil Stich take part in a Jeopardy! skit during the FO holiday party in December. The party also featured a buffet and a raffle.

DAN PETROFF EARNS POLLUTION PREVENTION AWARD

Dan Petroff, Code FO's chief engineer, has won the Ames Pollution Prevention Award for 2001. Petroff was recognized for leading the redesign of a wastewater plant essential to wind tunnel operations.

Dan Petroff

The renovation of the Industrial Wastewater Treatment Plant, which serves Code FO and Code ASF, corrected serious deficiencies in the plant, allowing NASA Ames to save tens of thousands of dollars a year.

"His leadership really made the difference in getting things moving and organizing all the parties involved," says Diane Shelander, environmental compliance manager at NASA Ames' Environmental Services Division.

Dan, who marks his 40th anniversary at Ames in February, headed the group overseeing the redesign of the wastewater plant, located in Building 271. Most of the water it treats comes from the Unitary Plan Wind Tunnel's cooling tower and Code ASF's steam-vacuum system.

Although the plant was only a few years old, serious deficiencies prevented the plant from meeting requirements. That compelled the center to install additional collecting tanks. It also forced Code FO to change the cycles of concentration of the cooling water from ten cycles to six, requiring the use of more treatment chemicals. This was because the water had higher-than-acceptable levels of copper, nickel and zinc. In addition, the treated water had pH levels too high for the steam vacuum system boiler to reuse.

Ames had to make the plant work. If the wastewater failed to meet discharge requirements, the center might have had to stop tests at the UPWT – or pay the hefty cost of shipping the wastewater elsewhere for treatment.

Dan was the natural choice to head the group figuring out how to solve the problem, Diane says.

"We needed somebody who had the engineering background and level of seniority to deal with folks here at the center and outside," she says.

The project, which replaced most of the plant's processing equipment, took more than a year and cost $1.8 million. But Code FO and Code ASF now have a plant that works.

For example, in November 2001, the plant processed 660,000 gallons of wastewater from the arc jet boiler and UPWT. Before the redesign, the plant could process only 60,000 gallons a month.

" I think we have nailed the last problem," Dan says.

Dan came to work at Ames in February 1962, initially at the 14-foot Wind Tunnel and later at the Unitary Plan Wind Tunnel. He switched from testing to facility engineering in 1976. Over the years, Dan has been involved in many memorable wind-tunnel tests, including the SR-71 and the Space Shuttle.

MARIANNE SHELLEY WINS AMES STUDENT HONOR AWARD

Marianne Shelley had no experience in acquisitions when she began her internship as a purchasing agent at NASA Ames. But she impressed her co-workers by swiftly mastering the complexities of her job.

Since then, Marianne, a student at West Valley and De Anza colleges, has met challenge after challenge with aplomb, routinely handling large purchase contracts and earning a 2001 Ames Honor Award.

Marianne, who started at Ames a year ago, handles purchases for four divisions: Wind Tunnel Operations, Systems Engineering, Aeronautics and Spaceflight Hardware Development, and Space Technology. She processes purchase requests, from researching vendors to generating purchase orders to making sure products are delivered.

Procurements she's worked on include the intercom system for the 9-by-7-foot Supersonic Wind Tunnel, a forklift maintenance contract, laboratory test equipment, and thermal-protection materials.

Marianne's colleagues, in nominating for an Honor Award, cited her aptitude for learning the many rules governing procurements. "Her knowledge and ability were displayed by her command performance of analyzing, negotiating and preparing all the necessary documentation for the award of a ... contract valued at $600,000 within a month of her arrival," they said.

Marianne enjoys working in a scientific and engineering environment and is interested in what she buys – particularly materials supporting cutting-edge work in nanotechnology.

Marianne had been a full-time mother for 20 years when she decided to go back to school and re-enter the workforce. She decided the NASA internship program would offer a good opportunity to gain professional experience.

She began her internship in January 2001. Interns usually work for one year, but Marianne is extending her stay at Ames. She will complete her A.A. degree in computer applications from West Valley in May and plans to start working on a business degree from San Jose State University this fall.

FO DIVISION PEER AWARDS

GILBERT K. KOJIMA

Gilbert Kojima has worked as a principal engineer on the development of tunnel conditions control systems for the Unitary Wind Tunnel Modernization Project. His dedication and teamwork skills ensured that the facility control and safety systems were well designed, properly constructed, and carefully tested. Especially during the construction phase, Gil tackled and solved many difficult problems. He was very concerned with safety, and his attention to detail led to the identification and correction of many potentially unsafe conditions. He expended considerable effort to train others so they can continue to maintain and operate these facilities productively. Gil's devotion, diligence, and exceptional performance have made the Unitary Plan Wind Tunnels safer and more productive, which will help Ames provide world-class service to the aerospace community in the future.

JAMES M. STRONG

Jim Strong was the Integrated Systems Test (IST) manager for the 9-by-7-foot Supersonic Wind Tunnel modernization program. The IST was an important milestone for the division but had to share resources with other tests. The IST required a clever and determined test manager, and Jim's dedication and attention to detail led to the successful completion of the project under difficult schedule and budgetary constraints. Without Jim's technical and managerial leadership, many problems would not have been resolved and many tasks would not have been completed on time. He oversaw the IST activities on a daily basis and spent many additional hours making sure that steady progress was being made. Jim's contributions played a critical role in bringing the 9-by-7 back to full operational status. As a result, the division is once again in a position to offer our supersonic test capabilities to government and industry customers.

SANDRA M. RUIZ

Sandee Ruiz provided critical software operation and development support during the Tilt Rotor Acoustic Model (TRAM) and Large Rotor Test Apparatus (LRTA) tests at the National Full-Scale Aerodynamic Complex (NFAC). Her versatility and troubleshooting skills contributed significantly to the productivity of both programs. Sandee assisted the Parametric Realtime Information Management Enterprise (NPRIME) support team in maintaining the database for TRAM development in Building N246 and tests in the 40-by-80-foot Wind Tunnel. She also developed solutions that enabled NPRIME to acquire data and perform data reduction on long-duration data points for the LRTA test in the 80-by-120-foot Wind Tunnel. She quickly responded to trouble calls and was always willing to substitute for computer system technicians during emergency or training situations. Sandee did whatever was necessary to maintain test support levels that satisfied or exceeded our customers' needs and expectations.

MAX A. AMAJA JR.

Max Amaya has worked as a data quality engineer for the Subsonic Transport Aeroacoustic Research (STAR) test in the 40-by-80-foot Wind Tunnel and for nearly every test in the Unitary Plan Wind Tunnels (UPWT) for the last 18 months. During those tests, he meticulously checked parameters and computations to assure their validity. He continually monitored critical test results to quickly identify failing instrumentation. His knowledge of the UPWT model support knuckle-sleeve positions and the Angle Measurement System allowed him to guide test engineers through the often-confusing process of obtaining model attitude. On the STAR test, he developed a mathematical method for approximating strut loads when a checkload was applied on the model but not on the load pans. On a previous test, the process of applying checkloads on the model alone had been tried but without success. His role in assuring data quality has been an integral part of our quality process.