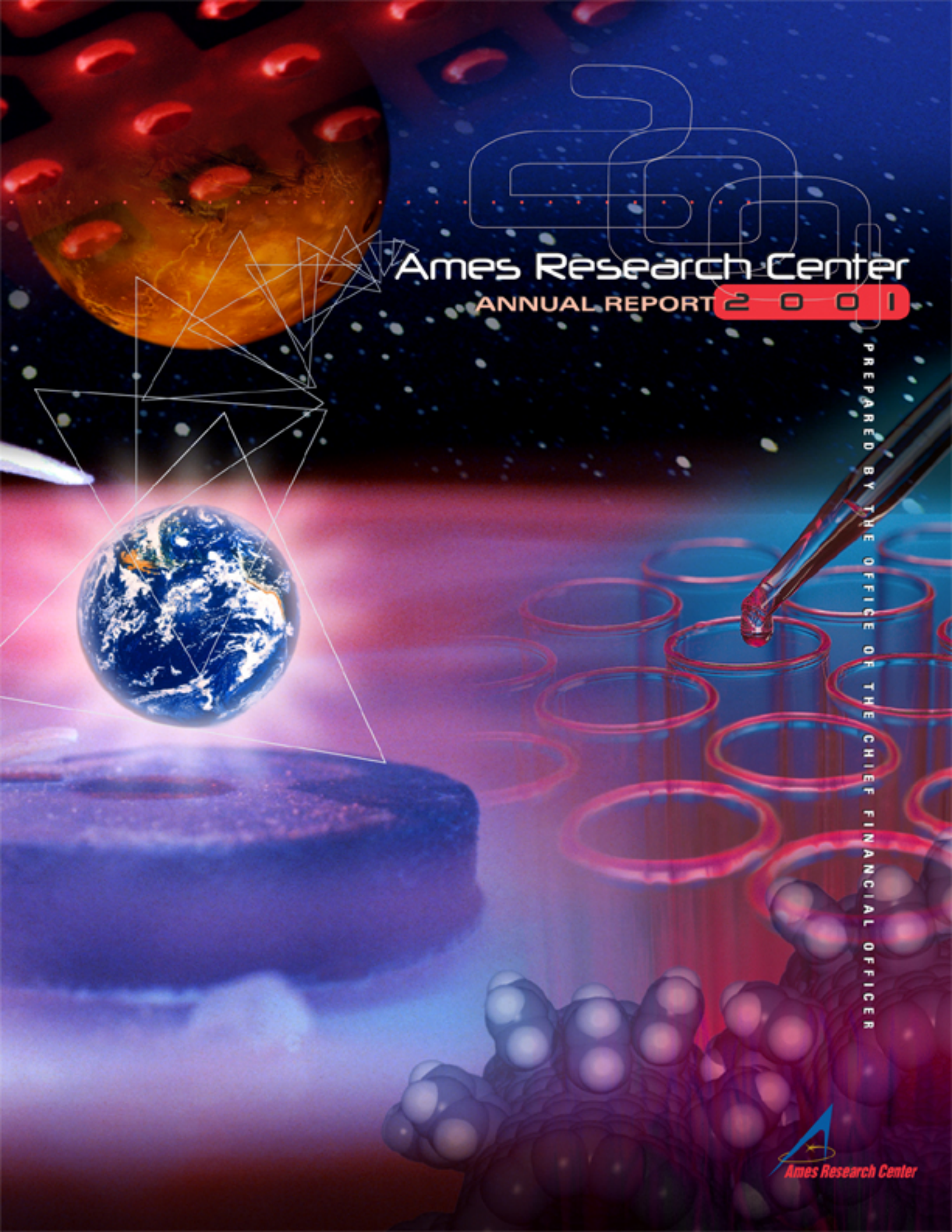
Ames Research Center
ANNUAL REPORT 2001
PREPARED BY THE OFFICE OF THE CHIEF FINANCIAL OFFICER
Ames Research Center

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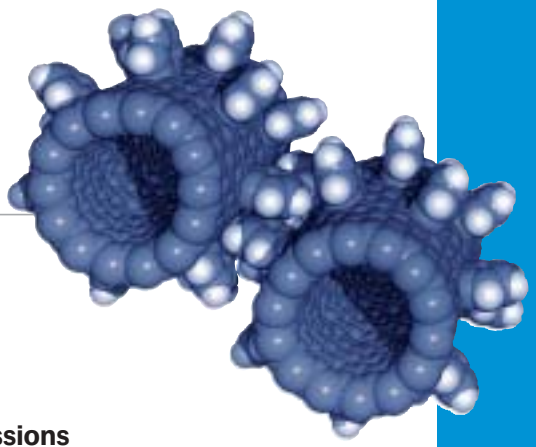
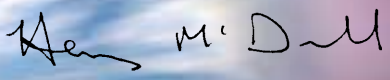


To Our Stakeholders

A Letter from the Ames Center Director, Dr. Henry McDonald



NASA is about DARING to dream, . . . and then going out and making those dreams a reality.

That is as true today as it has ever been in the history of the Agency.

NASA's vision for the future is to improve life here, to extend life to there, and to find life beyond. This vision will be realized through our mission to seek to understand and protect our home planet, explore the universe and search for life, and inspire the next generation of explorers . . . as only NASA can.

Dreams take vision, and the achievement of a vision requires the conceptualization and implementation of a series of missions. And missions, especially bold missions, require a never-ending supply of breakthrough technologies and cutting-edge scientific research.

That is where the people of Ames come in and make their vital contributions to the nation's efforts and accomplishments — in space exploration, in aviation, in advancing human knowledge, and in inspiring all of our nation's citizens and, indeed, the people of the entire world.

This year, Ames and NASA are operating in new ways and with fewer restrictions. We are reaching out to minority and non-traditional audiences like never before. We are working together within the Agency in collaborative ways rarely seen previously, approaches that truly characterize a 'One NASA' belief. We are ensuring that our programs are citizen-centered, results-oriented, cost-effective and responsive to the American people. We are operating in an environment characterized by a new freedom to manage, and a determination to succeed. We are motivated more than ever to reach out, engage and inspire the nation's youth – the next generation of explorers. And we are doing this in unprecedented ways and with unparalleled enthusiasm . . . as only NASA, and NASA people, can.

These are truly exciting times at NASA, and the people of Ames are committed to doing their part – to being a vital and fully contributing party.

I am delighted to present this Annual Report for 2001 for Ames Research Center. This document covers the period from October 1, 2000, through September 30, 2001. It highlights Ames' activities and accomplishments throughout the entire fiscal year.

Once again, I am proud of the commitment to excellence and unrivaled dedication that our incredibly talented workforce has consistently and willingly demonstrated. Our people truly are our most important asset.

Message from the Chief Financial Officer

As the Chief Financial Officer (CFO) on NASA-Ames Research Center, I am proud to present the NASA-Ames fiscal year (FY) 2001 Annual Report. This report highlights Ames' activities, the results of financial operations, and Ames' financial position from October1, 2000 through September 30, 2001.

The Office of the CFO enthusiastically endorses the Presidents Management Agenda (PMA). To this end, my Office actively participates in all activities supporting the Agency financial initiatives. The initiatives include:

– The Full Cost accounting, budgeting, and management initiative is aligned with the "Budget and Performance Integration" initiative outlined in the PMA.

– The Integrated Financial Management Program (IFMP) is aligned with the "Improved Financial Performance" initiative outlined in the PMA. IFMP is an Agency-wide effort to standardize and improve the financial and business management processes and systems within NASA. The IFM System will provide NASA management with accurate and timely financial information.

– Improved Cost Estimation establishes credibility for NASA programs. Cost Estimation supports the "Budget and Performance Integration" initiative in the PMA. Ames is providing Agency management with decision support services by providing independent cost estimation analysis capabilities.

These initiatives will improve NASA's capability to more effectively manage its programs across organizations with an emphasis on value added results. These initiatives, when fully implemented, will facilitate NASA's ability to make informed decisions, enable strategic management and improve the cost effectiveness of mission performance.

The NASA-Ames financial statements (unaudited) have been prepared for FY2001 to report the financial position and results of operations of the Center pursuant to the requirements of the CFO Act of 1990 and the Government Management Reform Act 1994. These statements were prepared using the standards developed by the Federal Accounting Standards Advisory Board (FASAB) and the Office of Management and Budget Bulletin 94-01, as required by NASA Headquarters.

The statements are different from (but reconcilable to) the internal financial reports used to monitor and control budgetary resources, which are prepared from the same books and records. The statements include all of the Center's activities and 100% of its budget authority.

Lewis S. G. Braxton III, Chief Financial Officer

Introduction

This report highlights the activities and accomplishments of NASA Ames Research Center for fiscal year 2001, spanning the period from Oct. 1, 2000, through Sept. 30, 2001.

To fully understand what was happening at NASA and at Ames throughout this period and subsequently, one cannot focus on just the Agency or the Center alone. It is essential to put everything into the context of the changing national and international environment, particularly the political landscape, that was unfolding throughout this time and beyond.

Introduction

The Presidential elections of November 2000 brought a new administration to power, with a new President and new leadership in the Congress, both House and Senate. The inauguration of America's 43rd President, George W. Bush, on Jan. 21, 2001 brought with it 'The President's Management Agenda,' a primer and a way of doing business designed to achieve an efficient, effective and results-oriented federal government.

Subsequently, on Nov. 14, 2001, the President nominated Sean O'Keefe, former deputy director of the Office of Management and Budget responsible for overseeing NASA's fiscal activities, to be the tenth administrator of NASA. The confirmation of O'Keefe on Dec. 21, 2001, and his swearing in as NASA Administrator the next day signaled a whole new round of changes and challenges for the nation's space agency and its ten field centers.

Specifically, the new administrator sought to redefine and refocus NASA's understanding of what it was attempting to achieve in service to the American public. To that end, he met with his entire senior NASA management team, comprising the field center directors and the enterprise associate administrators and functional office assistant administrators at NASA Headquarters, to hammer out a new vision and mission for the Agency. Further, Administrator O'Keefe made the decision to champion two new initiatives – 'One NASA' and 'Freedom to Manage' – initiatives that promise to effect a fundamental transformation in the way NASA and its field centers do business.

It is within this context, and in the aftermath of the worldwide economic, social and security transformation occasioned by the events of Sept. 11, 2001, that the activities and accomplishments of NASA and Ames must be placed. Only from that perspective can they be meaningfully and reasonably viewed, interpreted, evaluated and, as appropriate, judged.

The President's Management Agenda

The President's Management Agenda calls for a government that is "active but limited, that focuses on priorities and does them well." To that end, it emphasizes the need to rethink — and then reform – government, based on the principles that it needs to be citizen-centered, results-oriented and market-based.

The President's Management Agenda identifies five government-wide initiatives designed "to improve federal management and deliver results that matter to the American people."

The five initiatives are:

- strategic management of human capital,
- competitive sourcing,
- improved financial performance,
- expanded electronic government, and
- budget and performance integration.

The Agenda mandates "a coherent and coordinated plan" that "focuses on remedies to problems generally agreed to be serious, and commits to implement them fully." It calls for "a shared responsibility" between the President and the Congress to create "a manageable government" that will "achieve immediate, concrete, and measurable results in the near term." It also stresses the need to create an environment that identifies both the "statutory impediments" and "structural barriers" to good management, and a Congress that will "quickly and decisively consider and act to remove those obstacles." In other words, it calls for an environment wherein federal managers are given the 'freedom to manage.'

Freedom to Manage

NASA Administrator O'Keefe declared in a recent speech that the President's Freedom to Manage initiative has given NASA the capability to "accomplish our mission objectives as part of our primary everyday focus, not [merely] after all the other things are done." We now have "the opportunity to challenge and contest the way we do business," he said. We must ask ourselves why we do business at NASA the way we currently do. We must decide "what is the purpose, outcome, objective and how do we accomplish it best."

At the Administrator's direction, NASA has "put in motion . . . a process for looking at this," for "breaking down boundaries" through the Freedom to Manage initiative. Some early results are streamlining NASA 'time and attendance' practices, standardizing NASA badge and entry procedures, and addressing hiring impediments and delegating authority as close as possible to the entity ultimately responsible for program performance.

The Administrator says that NASA will continue to operate in the spirit of the Freedom to Manage initiative and, in addition, in accordance with three fundamental principles, namely:

- assuming everyone at NASA is a professional and treating them accordingly;
- providing the resources required so that NASA employees can do their jobs; and
- holding everyone accountable for his or her performance.

The Administrator and his senior management team are continuing to pursue a whole range of additional avenues that will enhance 'freedom to manage' imperatives within the Agency.

One NASA

Administrator O'Keefe believes that it is important for NASA to undertake "collaborative efforts" – to be "specific about our focus" across enterprises, across centers and across boundaries. He emphasizes that he is "looking specifically at how we emphasize agency objectives and 'One NASA' kinds of objectives." He said that NASA must identify "what we bring to bear that uniquely identifies our contribution" and that which, "if we didn't do it, it might not get done at all."

This 'One NASA' approach requires collaboration, rather than competition, among NASA field centers. For these reasons, the Administrator is pulling back from use of the terms 'lead center' and 'centers of excellence.' We must consider carefully "what 'lead center' means," he says. To that end and in the pursuit of effective and efficient management, the Administrator has declared that NASA will employ "a variety of centralized, decentralized and hybrid approaches" to decision-making under his leadership.

Vision and Missions

NASA's Vision and Mission(s)

One key to NASA's future success, according to the Administrator, is developing a compelling vision that speaks to all Americans. For that reason, he has made it a priority to engage his senior management team in developing a new vision and mission for the Agency.

The new NASA vision that has emerged is:

- to improve life here,
- to extend life to there,
- to find life beyond.

This will be accomplished through three primary NASA mission objectives wherein, as the nation's space agency, we seek to understand and protect our home planet, to explore the universe and search for life, and to inspire the next generation of explorers . . . as only NASA can.

In the area of learning about — and protecting — our home planet, the new NASA mission focuses on three important sub-topics:

- understanding the Earth's system and its response to natural and anthropomorphic (human-induced) changes;
- enabling a safe, efficient, and environmentally friendly national and international air transportation system; and
- investing in technologies and collaborating with others to improve the quality of life and to create a more secure world.

There is a clear emphasis on Earth science and security, on research and technology development, and on results-oriented programs that have a near-term and real-world effect on the everyday lives of Americans.

In efforts to explore the Universe and search for life, technology is a key component, first through the creation and deployment of robotic trailblazers and, subsequently, through enabling human exploration of distant planets, asteroids and other bodies in our solar system and beyond. In every case, the bottom-line issue is one of an 'astrobiology' nature, being driven by the compelling scientific questions, 'How did we get here?' 'Where are we going?' and 'Are we alone?' These are the fundamental unknowns that have driven human desire to explore the Universe around us from the beginning of time.

The Administrator's strategy for inspiring the next generation of explorers has four key thrusts and objectives:

- motivating students to pursue careers in science, mathematics and engineering;
- providing educators with unique teaching tools and compelling teaching experiences;
- improving our nation's scientific literacy; and
- engaging the public in shaping and sharing the experience of exploration and discovery.

The NASA Administrator has placed particular attention on the Agency's responsibility to engage young people. He notes that "people, especially kids, identify with us;" they find us "exciting beyond measure." Yet, the number of students pursuing careers in math, science and engineering has continued to decline over the past decade, even as opportunities in these fields are growing, he said. At NASA, he says, we must continually ask ourselves "how can we use what we do everyday to inspire the next generation?" . . . particularly since "the requirement for doing so was never more present than now."

The three mission objectives that the Administrator is championing are "not specific to any one center, to any one aspect of headquarters, or to any one enterprise," he says. We must use "our rich diversity of backgrounds" as "one of our greatest assets," he says, working in "collaborative and cooperative" ways, "not unique to any one center or any one enterprise."

What are the payoffs to America if we at NASA pursue these missions effectively and do our jobs right? In short, what does the nation stand to gain from NASA's fulfillment of its mandate? First, we will develop a new generation of leaders and explorers ready to expand the frontiers of air and space. Second, we will develop and provide pioneering technological and scientific research that enables new industries and drives our economy. Third, we will become a nation that reaches across borders and boundaries to unite people. Finally, we will all develop and share a deeper understanding of life, of ourselves, and of the Universe. The possibilities are both without limits and within reach. And it is the mission of NASA and Agency personnel to make this happen for the benefit of all.

What is the Ames Research Center's Role and Mission within NASA?

Within the context of NASA's newly defined vision and mission, the role of NASA Ames may perhaps best be described as that of a research engine and an important technology provider for the entire Agency. To that end, NASA Ames conducts critical NASA missions in both aeronautics and space research. However, Ames also plays an even more fundamental role central to the conduct of all NASA missions. Specifically, all Agency missions, in both aeronautics and the exploration of space, require order-of-magnitude forward leaps in many areas of scientific research and technology development. It is in this arena that NASA and its ten field centers look to Ames to play a key and enabling role.

Ames Research Center at a Glance

Exploring space and the potential for life beyond Earth's boundaries may be NASA's ultimate challenge. However, every NASA mission requires major technological breakthroughs and consequent cost reductions if the Agency is to take its contribution to the next level that the American people need.

The triad of technologies – nanotechnology, biotechnology and information technology – are widely recognized as holding the key to mission success for NASA as they are the most likely source of breakthrough technologies in the coming decades. NASA Ames has the integrated research environment capable of exploiting these disciplines and technologies. That is why Ames' role is so important and so compelling.

Perhaps the most critical among the enabling technologies required is that group known collectively as Information Technologies (IT). To ensure that NASA fully exploits this vital and enabling set of tools, Ames' location in the heart of California's Silicon Valley is a major benefit from both a technology perspective and from the academic and private industry collaborations that it makes possible.

NASA has a long history of leadership in high-performance computing for both scientific and engineering applications. Today, the field of high-performance computing is changing rapidly. On the high end, new architectures are being developed to combine the performance gains of massively parallel machines with the flexibility of shared-memory multiprocessor approaches. On the low end, powerful microprocessor-based systems are now performing computations

that would have required a specialized supercomputer until very recently. Ames researchers are also playing an important role in developing tomorrow's networking capabilities, up to 1000 times faster than today's.

The emerging concept of 'human-centered computer' represents a significant shift in thinking about information technology in general and about intelligent machines in particular. It embodies a 'systems view,' in which the interplay between human thought and action and technological systems is understood to be inextricably linked and an equally important aspect of analysis, design and evaluation. Within this framework, Ames researchers are inventing and deploying sophisticated computational aids designed to amplify human cognitive and perceptual abilities.

The next generation of robotic explorers must exhibit an unprecedented level of autonomy. They will need to be smart, adaptable, curious, and self-reliant in harsh and unpredictable environments. Ames research on automated reasoning for autonomous systems will enable a new generation of spacecraft to do more exploration at a much lower cost than traditional approaches. An impressive example developed by Ames, the Remote Agent Autonomy Architecture, has already demonstrated its utility during the Deep Space 1 mission.

The projected growth in air traffic over the coming decade will strain already-congested management systems, even in the aftermath of the events of Sept. 11, 2001. In collaboration with the Federal Aviation Administration (FAA), Ames is developing advanced information technology systems that will play a major role in expanding the capacity of the national (and world's) aviation systems. These tools will enable NASA to realize the twin national goals of safer aircraft operation and higher throughput of the airport and ground-control infrastructure.

NASA is responsible for launching and gathering data from progressively more sophisticated orbital and deep-space instruments. For example, the Earth Observing System (EOS) is being deployed to monitor global climate change. When fully operational, the sensor-rich satellites will generate about one terabyte of data per day. Equally important is the development of tools aimed at facilitating human understanding of these immense databases. Emerging results from Ames' IT research is the key to enabling scientists to better understand our world, as well as distant ones.

Future NASA space-exploration missions, such as probe and human missions to Mars, pose extremely difficult design and engineering challenges. Early in the design cycle, complex trade-offs between spacecraft characteristics and mission concepts must be performed. Ames IT researchers are making it possible for geographically distributed teams of experts to perform these trade-offs working together—in a virtual environment or so-called 'collaboratory.'

In the area of space research, Ames is an important NASA leader with core competence in the arena of astrobiology, the study of the origin, evolution, distribution, and destiny of life in the universe. In this capacity, Ames develops science and technology requirements for current and future flight missions relevant to research in astrobiology. Ames also leads NASA in information-technology applications and education and outreach programs of an astrobiology nature that inform and inspire the American public.

Ames scientists conduct basic research, participate in flight missions, and facilitate the participation of the national science community in astrobiology-related areas and disciplines. Ames led in the development of a NASA astrobiology 'road map' and continues to bring the science and technology communities together to identify research priorities and translate them into appropriate NASA programs, technology challenges, and flight missions. Through its Center for Mars Exploration, Ames continues to support planning for future Mars missions.

In the area of aeronautics, Ames has demonstrated core competency within NASA in the area of Aviation Operations Systems (AOS). In this capacity, Ames champions NASA research efforts in air traffic control and human factors; leads Agency research in rotorcraft technology; creates design and development process tools; and operates wind tunnel and simulation facilities. AOS encompasses those ground, satellite and aircraft systems, and human operators who control the operational safety, efficiency, and the capacity of aircraft operation in the airspace and airports.

In December 1999, Ames opened Future Flight Central, the world's first virtual airport control tower. Constructed at a cost of $10 million, the two-story facility was jointly funded by NASA and the Federal Aviation Administration (FAA). Future Flight Central will permit integration of tomorrow's technologies in a risk-free simulation of any airport, airfield, and tower-cab environment. The facility provides an opportunity for airlines and airports to mitigate passenger delays by fine-tuning airport hub operations, gate management, ramp-movement procedures, and various other airport improvements.

The tower cab of the facility provides a three-dimensional visual model of an airport, which can be viewed out of the 360-degree windows of the tower cab in stunningly realistic detail. It is anticipated that airport and airline management and researchers will want to look primarily at the feasibility, safety and reliability, and cost benefits of technologies prior to incorporating them into airports.

Through its leadership in the fields of aviation operations systems and astrobiology, and through the leadership responsibility recognized to reside at Ames in Information Technology, the Center is playing a fundamental and crucial role with NASA, central to Agency programs and success throughout the foreseeable future.

Ames Research Center — Core Competencies and Physical Assets

Broadly speaking, Ames Research Center's assigned roles and responsibilities are based on its core competencies. Founded in the Center's workforce capabilities and physical assets, these competencies are enhanced by a broad range of collaborations with other Government agencies, industry, and academia.

Ames Research Center has the following core competencies and physical assets that support and enable them:

- Information Technology and Science
- Computer Science

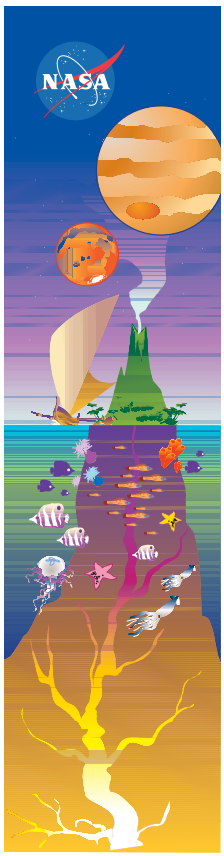
- Nanotechnology and Science
- Astrobiology
- Fundamental Space Biology
- Biotechnology and Science
- Aerospace Operations
- Runway-Independent Aircraft/Rotorcraft/Helicopters
- Thermal Protection Systems
- Simulation, Wind Tunnel and Arc Jet facilities
- Stratospheric Observatory for Infrared Astronomy (SOFIA) program

The Values of NASA and Ames Research Center

At Ames and throughout NASA, people are our first and foremost asset. For that reason, we seek to actively create a work environment that adheres to the following core values:

- ***Safety*** — we ensure a safe and secure working environment.
- ***Respect*** — we respect individual and diversity in culture, background, and experience. We maintain the highest principles of fairness and equitable treatment of all employees.
- ***Communication*** — we recognize that only through open and honest communication will our goals be achieved.
- ***Teamwork*** — we believe in cooperation interaction among others and ourselves. By working together with respect, trust, and mutual support, we achieve common goals.
- ***Creativity*** — we foster creativity, ingenuity, and innovation in our endeavors.
- ***Integrity*** — we maintain the highest principles of integrity, honesty, and accountability.
- ***Excellence*** — we continually strive to improve. We demand professionalism in our con duct and excellence in our products.
- ***Customer Focus*** — we are responsive to our customers and satisfy their requirements.
- ***Responsibility*** — we are responsible and accountable stewards of the public interest, public resources, and the public trust.
- ***Relevance*** — we ensure that all of our endeavors are aligned with national needs and the Agency vision and purpose.
- ***Discovery*** — we are bold, but prudent, as we expand the boundaries of scientific under standing and technical knowledge in air and space.

The Year In Review



Inspiring the Next Generation...Ames Hosts 10,000-plus California Students During JASON Project

Hawaiian volcanoes and life forms were the highlights of 50 interactive satellite telecasts that more than 10,000 California students attended Jan. 29 through Feb. 9, 2001 at Ames.

Students talked live by satellite with scientists and students who are studying volcanoes and the kinds of life that live in lava tubes in Hawaii. These investigations are part of a big educational effort, " JASON Project XII: A Living Laboratory." The two broadcast sites were the Hawaii Volcanoes National Park and the Little House on the Lava, both on the big island of Hawaii. A third broadcast site was the Kilauea Point National Wildlife Refuge on the island of Kauai.

"Students on location and viewers around the world saw lava flowing out of a Kilauea volcano vent, through a lava tube and into the ocean," said science teacher John Colombero, Ames' JASON project coordinator. "This particular lava flow has been active since January 1983 and travels about 7 miles through a lava tube with very low temperature loss."

"The JASON broadcast gives students the opportunity to see their peers participate in real research as it actually happens," said Thomas Clausen, education officer at Ames. "The teachers and students participating in JASON have been preparing for their visit to Ames since last fall, learning about Hawaii and its unique geology and ecosystems."

During the broadcasts, students in grades 3 through 9 were able to chat with scientists, researchers and "Argonauts." Argonauts are students and teachers selected by the JASON Project to travel to JASON expedition sites. Ames is one of 38 JASON "primary interactive network" sites located across the nation and in Bermuda, Mexico and the United Kingdom as well as other countries.

Worldwide, JASON officials expected about 750,000 students and teachers to take part in the program. Many other youths also participated via the Internet at: http://www.jasonproject.org. The JASON Internet site included "chat sessions" with scientists, a digital lab that provided experiments students can do on-line, and other information. In addition, teachers managed their students' class work with the JASON website.

NASA Ames is sponsoring an Argonaut, ninth grader Sarah Beth Walker of Nevada Union High School, Grass Valley, CA. She took part in the broadcasts from Hawaii.

In Bldg. 583C at NASA Ames, students also received hands-on experience in solving problems and participated in a scavenger hunt. In addition, the Monterey Bay National Marine Sanctuary and the Marine Advanced Technology Education Center, both of Monterey, CA, provided an interactive watershed exhibit that illustrated the water cycle. United States Geological Survey (USGS), Menlo Park, CA, scientists conducted hands-on seismographic demonstrations and offered a Kilauea volcano exhibit. USGS gave each teacher a rock sample of Hawaii's Loihi, an island still forming beneath the ocean's surface. These programs were repeat daily during JASON from 9:45 a.m. to 1:45 p.m.

Founded by international explorer and RMS Titanic discoverer Dr. Robert Ballard, the JASON Project incorporated cutting-edge technologies, a multi-disciplinary curriculum, professional training for teachers and Internet communications within a comprehensive learning program.

By John Bluck

Scientists and students interacting live from Ames auditorium via satellite to remote locations.

Ames Developing "Snakebot" to Explore and Build in Space.

Engineers at Ames Research Center are developing an intelligent robot snake that may help explore other worlds and perform construction tasks in space.

The robot serpent, able to independently dig in loose extraterrestrial soil, smart enough to slither into cracks in a planet's surface and capable of planning routes over or around obstacles, could be ready for space travel in five years, NASA engineers predict.

"The snake will provide us with flexibility and robustness in space," said Gary Haith, lead "snakebot" engineer at Ames . "A snakebot could navigate over rough, steep terrain where a wheeled robotic rover would likely get stuck or topple."

"One of our first steps was to make a simple mechanical test snake, and we constructed it in less than a day thanks to previous work at other labs," said Haith. "It is a direct model of a 'polybot' developed by Mark Yim of Xerox Palo Alto Research Center, Palo Alto, CA, with whom we are cooperating. We have slightly different electronics in our version."

"The test snake has a wire that carries communications and power to and from the computer brain," Haith explained. "All of the identical hinge-like modules are easy to make, and we attached the snake segments together in a chain. It has off-the-shelf hobby motors in its hinged segments that cause it to move. Each of the many motors takes a signal from the snake's main computer brain," he said.

Gary Haith, lead engineer for the Ames program, holding part of the snakebot.

"Our first test robot does what we tell it to do, no matter what the results are. If it comes to an obstacle, the robot will continue to try to go over it, even if the task is impossible," he said. "We made the first, simple robot because we wanted a working snakebot in a day or two, a robot that would help us to think about how a snakebot could and should move."

Robotic serpents can "inchworm" ahead, can flip themselves backward over low obstacles, can coil and can side-wind, Haith said. "Future work will enable the snake to become a mast or a grasping arm. A rover would need to have a dedicated mast and arm that would cost extra weight, money and time."

"A snakebot is not as good at some jobs as other robots, but you get a lot more robot for the weight and the money," he said. "The problem is it's hard to tell the snakebot what to do. It is a complex robot that must operate independently, possibly far from Earth. Work on our second snakebot is aimed at making it capable of independent behavior."

"The key part of what we are striving for in the second snakebot version and beyond is sensor-based control in which the robot uses its sensors to decide what to do,'" Haith said. "We made two little microcontrollers, tiny computers, that we put in each hinged section that also includes a motor, electronics and gears to get the hinge to move to certain positions," he explained.

The snakebot will have a main computer that will tell its little computers in each segment what to do in a higher, planning sense. The tiny computers in the segments could provide "reflexes" that take care of simple, but important jobs.

"In the next couple of months, we hope to simulate the snakebot in a computer program so we can automatically develop computer routines that can control the robot," Haith said.

The Snakebot in action, moving over rocks on a simulated planetary surface.

Engineers have added strain sensors to the robot on metal ribs inside the snake. "They will tell the snake whether or not it is contacting anything, and where and how hard it is touching," Haith explained.

"We hope to write software that allows the snake to learn on its own by experience," he said. "Some lessons we hope it will learn are how to crawl from soft to hard surfaces, and how to go over rough surfaces that have rocks. We even hope to show that it can climb scaffolds and go into cracks. These abilities would help the robot look for fossils or water on another planet," he added.

The snakebot can save spacecraft weight because the snake-like design enables the robot to do many tasks without much extra equipment, according to engineers.

"One of the many advantages of the snake-based design is that the robot is field-repairable. We can include a bunch of identical spare modules with the snake on a space mission, and then we can fix the snakebot much easier than a regular robot that needs specific parts," said Haith. "Other benefits are: the snakebot can crawl off a spacecraft lander and doesn't need a ramp, the snake's moving parts can be sealed inside artificial skin to avoid exposure to the outside environment and the robot can still function, even if one joint freezes."

"In coming years, we hope to make snakebot muscles out of artificial plastic or rubber materials that will bend when electricity is applied to them," he added. "This design change will reduce the snake's weight considerably, and the robot would be very robust, like an automobile tire." For more technical robotic snake information, visit the NASA snakebot Internet site at: http://ic-www.arc.nasa.gov/ic/snakebot/

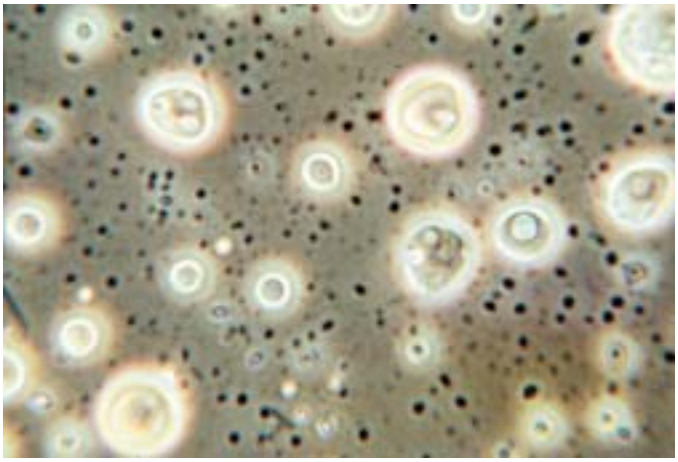
by John Bluck

Ames Scientists Find Clues to the Possible Origin of Life

Duplicating the harsh conditions of cold interstellar space, a team of scientists led by Ames' Dr. Lou Allamandola created primitive cells in a laboratory that mimic the membranous structures found in all living things. These chemical compounds may have played a part in the origin of life.

This breakthrough by NASA researchers is important since some scientists believe that the delivery—by comets, meteorites and interplanetary dust—of similar organic compounds born in interstellar space may have "kick-started" life on Earth.

"Scientists believe the molecules needed to make a cell's membrane, and thus for the origin of life, are all over space. This discovery implies that life could be everywhere in the universe," said Allamandola.



The droplets pictured above (~ 10 μm across) show structures reminiscent of cells. They were obtained from a chemically separated fraction of the bulk residue created in the Ames astrochemistry laboratory.

Using common, everyday chemicals, researchers from Ames' astrochemistry lab and the Department of Chemistry and Biochemistry at the University of California, Santa Cruz, created, for the first time, "proto"-cells. These are primitive cells that mimic the membranous structures found in all life forms. "This process happens all the time in the dense molecular clouds of space," Allamandola said.

This discovery has important implications for NASA's astrobiology mission. "The formation of these biologically interesting compounds by irradiating simple interstellar ices shows that some of the organics falling to Earth in meteorites and interplanetary dust might have been born in the coldest regions of interstellar space," Allamandola said. "The delivery of these compounds could well have been critical to the origin of life on Earth."

The team's results were published in the special Jan. 30 astrobiology issue of the "Proceedings of the National Academy of Sciences, USA."

Scientists do not yet know whether life began as naked RNA or as genetic material encapsulated in membranes. But at some point, membranes became important.

"All life as we know it on Earth uses membrane structures to separate and protect the chemistry involved in the life process from the outside," said Dr. Jason Dworkin of the SETI Institute, the paper's lead author and a team member. "All known biology uses membranes to capture and generate cellular energy."

"Membranes are like a house," Dworkin added. "Maybe these molecules were just the raw lumber lying around that allowed origin-of-life chemicals to move in and set up housekeeping or construct their own houses."

In the lab, the scientists recreated the conditions found in space — which is a cold vacuum — zapping a series of simple ices with the ultraviolet radiation found everywhere. They created solid materials which, when immersed in water, spontaneously created soap bubble-like membranous structures that contained both an "inside" and an "outside" layer.

In contrast to current thinking, this new work shows that the early chemical steps believed to be important for the origin of life do not require an already-formed planet. Instead, they seem to take place in deep space long before planet formation occurs. This implies that the vastness of space is filled with chemical compounds which, if they land in a hospitable environment like our Earth, can readily jump-start life.

Interstellar ices are made of familiar everyday chemicals such as water, methanol (wood alcohol), ammonia and carbon monoxide that are frozen together.

The astrobiology research team also included Dr. Scott Sandford of Ames and David Deamer of the Chemistry and Biochemistry Department of UC Santa Cruz.

Further information about this research is available at: http://web99.arc.nasa.gov/~astrochm/vesicle.html

The research was supported by the Space Science Division at Ames and the Offices of Exobiology and Astrobiology at NASA Headquarters, Washington, D.C. Ames is the agency's lead center for astrobiology and the location of the central office of the NASA Astrobiology Institute, an international research consortium. Astrobiology is the study of the origin, evolution, dispersion and future of life in the universe.

By Kathleen Burton

Scientists Find Strong Evidence of Microbial Life on Mars

An international team of researchers has discovered compelling evidence that the magnetite crystals in the martian meteorite ALH84001 are of biological origin.

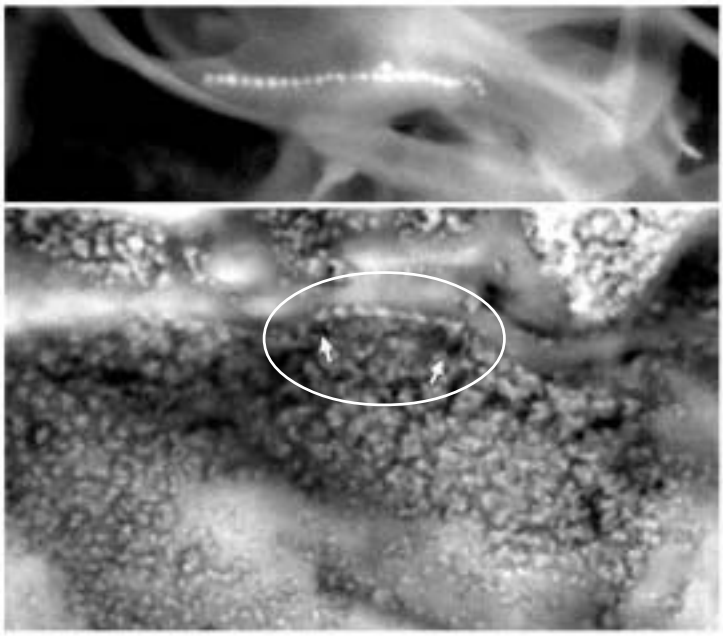
The researchers found that the magnetite crystals embedded in the meteorite are arranged in long chains, which they say could have been formed only by once-living organisms. Their results were reported in the latest issue of the Proceedings of the National Academy of Sciences (PNAS).

"The chains we discovered are of biological origin," said Dr. Imre Friedmann, an NRC senior research fellow at Ames and leader of the research team. "Such a chain of magnets outside an organism would immediately collapse into a clump due to magnetic forces," he said.

The chains were formed inside organic material whose structure held the crystals together. "The end result looks somewhat like a string of pearls," Friedmann noted. Each magnetite crystal in the chain is a tiny magnet, approximately one-millionth of an inch in diameter. Magnetite is an iron oxide, similar to iron rust.

The chains may have served as 'compasses' for the host magnetotactic bacteria, so named because they navigate with the help of the magnetic crystal chains inside their bodies. The chains were preserved in the meteorite long after the bacteria themselves decayed.

The researchers say the magnetite chains probably were flushed into microscopic cracks inside the martian rock after it was shattered by an asteroid impact approximately 3.9 billion years ago. This cataclysmic event on Mars' surface also may have killed the bacteria. The same, or a later, asteroid impact ejected the rock, now a meteorite, into space.



Upper figure: modern magnetotactic bacteria, one showing a chain of magnetic crystals, as seen in the backscattered scanning electron microscope. Lower figure: magnetic crystals and chains of magnetite crystals in the martian meteorite ALH84001 in the backscattered scanning electron microscope. One conspicuous chain is indicated by the circle. The diameter of a single crystal is approximately one-millionth of an inch.

Another NASA research group, led by Kathie Thomas-Keprta of NASA's Johnson Space Center, reported in the same issue of PNAS that the magnetite crystals inside the meteorite are similar to those formed by 'modern' magnetotactic bacteria now living on Earth. The team studied only single crystals, however, not the elusive chain-like structures.

Friedmann's team discovered the crystal chains using a technique that enabled them to 'see' the tiny chains inside the meteorite without destroying them. Besides the chain-like formation, the team discovered that individual crystals are of similar size and shape, do not touch each other and that the chains themselves are flexible, further evidence of biological origin.

"Until now, studying life has been like trying to draw a curve using only one data point —life on Earth," said Friedmann. "Now we have two data points to draw life's curve. The next step is to find the remains of the bacteria themselves," he said.

The fact that a small (about 4-pound) meteorite from a planet contains large numbers of bacteria suggests that such bacteria were widespread on the surface of Mars, according to the researchers. A stone of similar size from Earth would contain many bacteria.

In addition, since magnetotactic bacteria require low levels of oxygen, this finding indicates that photosynthetic organisms, the source of oxygen in the atmosphere, must have been present and active on Mars 3.9 billion years ago.

"Finding evidence of life on Mars is one of the central problems in astrobiology research today," said Dr. Michael Meyer, head of NASA's astrobiology program, which funded the research.

In addition to his fellowship at Ames, Friedmann, who is best known for discovering microorganisms living inside desert rocks, is professor emeritus of biological science at Florida State University. Members of the research team included Dr. Jacek Wierzchos (University of Lleida, Spain), Dr. Carmen Ascaso (CSIC, Madrid, Spain) and Dr. Michael Winkelhofer (University of Munich, Germany).

The meteorite ALH84001 was found in the Allan Hills region of Antarctica in 1984 by researchers supported by the National Science Foundation's Antarctic Search for Meteorites Program, a joint effort by the NSF, the Smithsonian Institution and NASA. The Case Western Reserve University in Cleveland manages the program.

Full text of the research paper is available at: http://www.pnas.org

Ames is NASA's lead center for astrobiology, the study of the origin, evolution, distribution and future of life in the universe. Ames is the location of the central offices of the NASA Astrobiology Institute, an international research consortium.

by Kathleen Burton

Ames Team Evaluates South Pole Research Base

The South Pole is a long way from just about anywhere, but that isn't stopping an Ames team from trying to determine if it's a good place to conduct a search for Jupiter-sized planets orbiting around other stars. Using a small photometer specially modified to operate in the harsh Antarctic environment, the team, Douglas Caldwell, Robert Showen and Kevin Martin, deployed and tested a prototype photometer this past February at the Amundsen-Scott South Pole Station.

The Vulcan South project is a sister project to Ames' Bill Borucki's Vulcan (North) planet search being conducted at the Lick Observatory east of San José. This project searches for the slight dimming of a star's light when a giant planet orbiting very near that star passes between it and the Earth. Because these "transits" are somewhat rare, thousands of stars must be observed simultaneously for long periods using a small telescope and a large-format CCD camera to yield results.

Vulcan South is taking the experience and technology gained from Vulcan (North) and is investigating the possibility of placing an autonomous version of the telescope at the South Pole for several winters. Placement

Doug Caldwell (right) and Kevin Martin (left). The profile of the Vulcan South Camera, A small telescope that will look for exosolar planets, is in the front. It's so cold in this picture that the camera's shutter did not operate properly and caused the dark shading on the right.

at the pole is important because it takes advantage of some of the unique environmental characteristics found there. The most important of these characteristics is Antarctica's long winter night, which provides for uninterrupted observations of planetary transits. The second major advantage relates to the fact that stars don't rise and set at the South Pole; instead they seem to circle overhead. Since the Vulcan South telescope will follow one field of stars for the entire winter, the telescope sized planets) are part of an effort at Ames to discover and understand the frequency and distribution of planets around other stars.

The snowbound old dome at the South Pole.

The Vulcan South project is an excellent example of what can be achieved at Ames with a limited Directors Discretionary Fund budget and the enthusiastic support and cooperation of an eclectic group of participants and volunteers. With science, design, construction and management from codes SST, ASF and IC; machining and rapid prototyping from Codes FM, FMX and SSA; extreme environmental testing and thermal design from Code FEE and thermal quilting and insulation from some nice folks in the general public, we were able to put together a viable instrument in less than nine months. Additionally, equipment and logistical support for Vulcan South's deployment to Antarctica was graciously donated by the Rochester Institute of Technology and the Center for Astrophysics Research in Antarctica.

The results of the Vulcan South expedition to the South Pole indicate that the site would be an excellent place to set up a planet-search telescope. Despite the cold, the site offers good observing conditions and sufficient logistical support to run a small automated telescope. With proper funding, an over-winter deployment in 2003 of an autonomous telescope is very feasible.

By Kevin Martin

Ames Uses Aerial Remote Sensing to Help Grape Growers

Ames researchers are helping growers improve wine quality by employing remote-sensing techniques to scan vineyards from high above California.

Scientists are using images taken from airplanes and satellites to map vineyard leaf area to assist vintners in measuring ripening rate, disease incidence, soil drainage and fruit quality.

"For hundreds of years, wine growers have known that grapes harvested from different areas in their vineyards can produce wines with unique flavors and tastes," said Tim Mondavi, winegrower and vice-chairman of Robert Mondavi winery, Oakville, Calif. "We are now using NASA's advanced remote-sensing technologies to understand the subtle nuances of our vineyards—and with astounding results."

Researchers divided groups of vines in the study area into high-, moderate- and low-vigor areas, which have unique flavors and levels of grape maturity, allowing for different styles of wine. Results of the study confirm that the low- and moderate-vigor areas produced higher quality wines, while the high-vigor area produced medium quality wine. The winery has engaged a commercial remote-sensing vendor for 'decision support' across its Napa properties, researchers said. Scientists also measured light levels, water status, chlorophyll and other factors on the ground.

"In certain regions of France, grapes have been grown for more than 1,700 years. Vintners in these regions have had abundant time to understand how vintage varies throughout the vineyard," explained principal investigator Lee Johnson, a research scientist at Ames. "By contrast, the majority of vineyard development in California's Napa Valley has occurred since the mid-1960s." Until now, Napa vintners generally have treated large 'blocks' of vines as single units for cultivation and harvest.

Remote-sensing imagery allows Robert Mondavi winegrowers to better understand micro-regions within their vineyards. "We now identify vine vigor to see weak and strong areas of growth in the vineyard, then we break up how we harvest," said Daniel Bosch, vineyard technical manager at Robert Mondavi Winery. "We can taste those differences in the grapes at harvest."

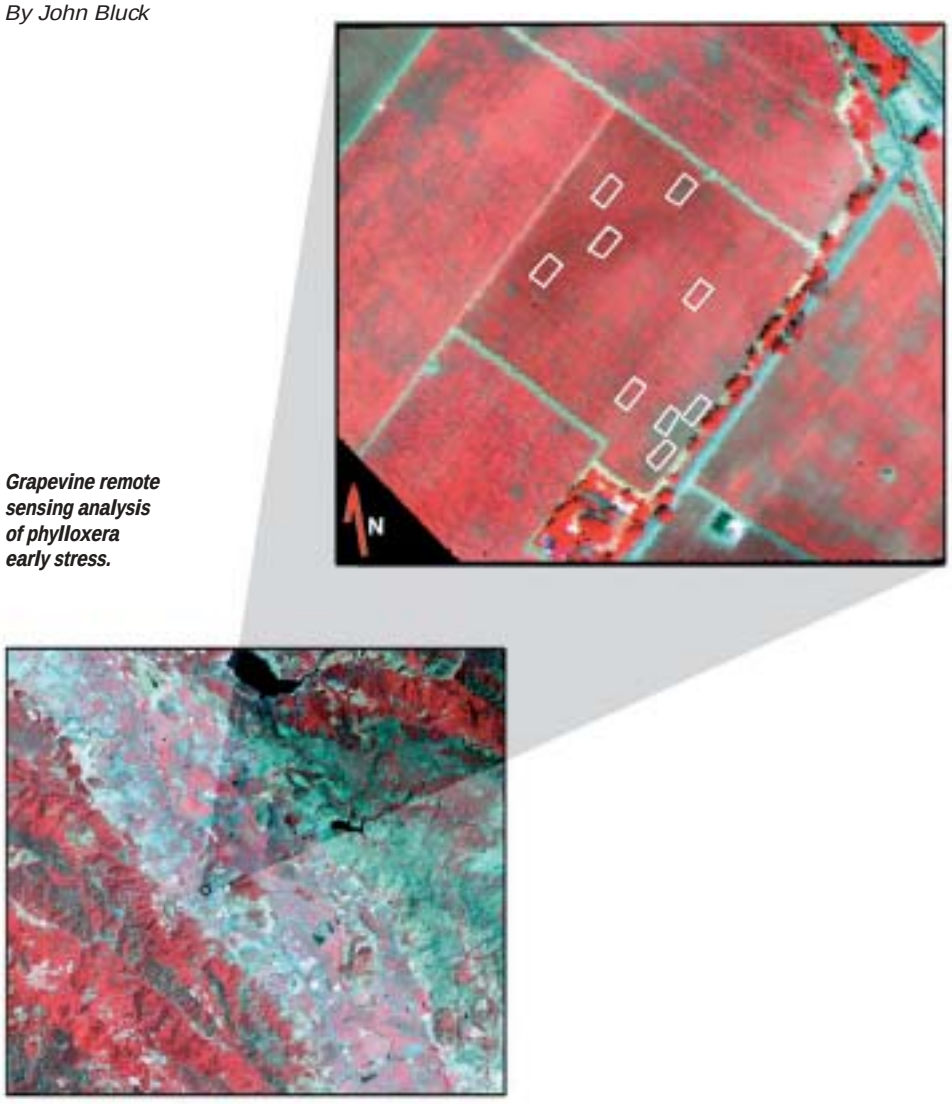
"Winemakers blend wines from different lots to create a desired flavor profile in the final wine," Johnson said. "A greater number of distinct wine lots will provide the winemaker with increased latitude in blending, and serve to increase quality."

Ames researchers are helping winemakers enhance crop value and quality using images from aircraft and satellites combined with on-the-ground sampling.

Scientists on the ground measured leaf area in selected sample sites at the winery. The researchers then combined the ground-gathered leaf area data with aerial and satellite information to make an accurate map of the vineyard under study. Researchers used red and near-infrared images to monitor plant density, comparing various vine areas. Study results are scheduled for later publication in the journal Applied Engineering in Agriculture, and for presentation at the Third International Conference on Geospatial Technologies in Agriculture and Forestry.

NASA remote sensing of vineyards by airplane and satellite first began at the Robert Mondavi winery in 1993 to track the phylloxera infestation that was affecting northern California. From the late 1980s, California winegrowers faced destruction of their vines by infestation of the pest that kills vines by feeding on their roots. Infested areas must eventually be replanted on a phylloxera-resistant or tolerant rootstock. Additional information about Ames' grapevine studies is on the Internet at: http://geo.arc.nasa.gov/sge/vintage/vintage.html

By John Bluck



Grapevine remote sensing analysis of phylloxera early stress.

Ames Steps Boldly Forward with NASA Research Park

Ames Research Center and Lockheed Martin officials signed an historic agreement on March 22, one that promises to change the face of the Center as we know it. The Space Act Agreement between the two parties commits both sides to initiating the development of a collaborative research and office complex at Moffett Field in the NASA Research Park (NRP) currently being planned.

In its simplest terms, the agreement provides for mutual collaboration in "astrobiology, aerospace, information technology, science education, and space commercialization." Discussions of potential areas for research and technical collaboration have been ongoing for about 15 months, since Jan. 2000, when Ames and Lockheed Martin officials inked a planning memorandum of understanding that culminated in the recent signing.

"This is the first step to the new Ames," said Ames Center Director Dr. Henry McDonald as he signed the historic Space Act Agreement with Lockheed Martin Space Operations President Jay F. Honeycutt during the recent ceremony. "I think we can all be very proud of what has been, and will be, accomplished. I believe that, in retrospect, we will come to view this day as one of the most significant in the evolution and growth of Ames Research Center, one that set the tone for the next 20 to 30 years and beyond."

The focus of the new collaboration centers on Lockheed Martin's plan to construct a laboratory for advanced science research, make supporting infrastructure improvements, and develop an office complex in the NRP. The company will also contribute to an independently established non-profit research fund in support of science and technology research throughout the NRP.

Artist's conceptual drawing shows the view from the Lockheed Martin lab project looking towards the NASA Research Park.

It is anticipated that research will encompass the disciplines of astrobiology, life sciences and microgravity, biotechnology, nanotechnology, aeronautics and space technology development, educational outreach, information sciences and technology, communications support, and commercial use and development of NASA research.

"Our goal is to develop a world-class shared-use research and development campus in association with academia, industry and non profits," said McDonald. "We can achieve this goal by creating a unique community of researchers, students, and educators who have a shared mission, in addition to pursuing their own organization's mission," he explained.

Dr. Henry McDonald signs the recent agreement with Lockheed Martin space operations president Jay Honeycutt to develop a research and office complex in NASA Research Park.

NRP partners must be committed to supporting NASA's mission by enhancing the agency's research leadership, by facilitating science and technology education, and by assisting NASA's outreach efforts, according to Michael Marlaire, Ames' newly named Assistant Director for Development.

"Our objectives are to establish technical collaborations in key research areas, to create unique facilities for collaborations, to develop workforce enhancement programs, including joint appointments and internships, and to provide increased access to graduate students, post docs and future employees," Marlaire said. "Our partnerships with the University of California, Carnegie Mellon University, San José State University, and Foothill-DeAnza Community College will facilitate the pursuit of our research and education objectives within the NASA Research Park," he added.

"Through the NASA Research Park, we can benefit the agency by optimizing the use of NASA property for mission purposes, by creating new opportunities for NASA education programs, and by leveraging resources to spread infrastructure costs," Marlaire pointed out. "Foremost, we will enhance NASA scientific research, increase technology advancement, and facilitate the commercialization of NASA technologies," he concluded.

Under the provisions of the new collaboration, negotiations for a land use agreement must be completed within 180 days. This agreement will establish all of the contractual relationships needed to construct new buildings for the research collaborations. Cliff Imprescia, Ames' Director of the Office of Research, and Development Services and Ames' Deputy Chief Counsel, Tom Berndt, along with representatives and consultants from Marlaire's staff, will continue to lead the negotiation process.

The Lockheed Martin project is permitted under the Environmental Assessment conducted in accordance with Ames' 1994 Comprehensive Use Plan (CUP). As proposed, the project could include approximately 700,000 square feet of new construction in the NRP. Other NRP partners are participating in an environmental entitlement process called an Environmental Impact Statement (EIS) that NASA is currently conducting. The EIS would permit new construction, in addition to that allowed by the 1994 CUP.

EIS partners will be entitled to build in the NRP after completion of the EIS process. These partners include the University of California, Carnegie Mellon University, San José State University, Foothill-DeAnza Community College District, the National Association for Equal Opportunity in Higher Education and two non-profit organizations—the California Air and Space Center and the Computer History Museum Center. All of these organizations are interested in research collaborations and educational programs involving NASA. They are actively working with Ames to develop a "master plan" for the EIS-enabled portions of the NRP.

Several other high-tech industry companies are also considering research partnerships with Ames. In fact, Ames has established an NRP research collaboration working group to interact with industry and universities to determine potential research collaborations. Recently, the group held discussions with Intel Corp. concerning its potential participation in the NRP.

Ames' chief scientist Dr. Stephanie Langhoff chairs the group. Other members include Office of Aerospace deputy director Dr. Vic LeBacqz, Office of Information Systems deputy director Dr. Eugene Tu (Acting), Office of Astrobiology and Space Research deputy director Ken Souza, Commercial Technology Office chief Carolina Blake and Office of Information Systems manager of strategic partnerships Maylene Duenas.

Binding agreements with EIS partners cannot be executed until the record of decision completing the EIS process is signed, permitting construction and new development. Ames is currently working on the NASA Ames Development Plan, a comprehensive plan for the development of the entire 2,000-acre site at Moffett Field. As part of the EIS process, Ames held public scoping meetings last summer to inform local communities about the development plan and to solicit comments.

During the next few months, project consultants will analyze the plan for environmental impacts. Upon completion of the review process, the plan will be presented to the public during a series of hearings currently scheduled for this fall. After reviewing public comments, the NASA Ames Development Plan will be finalized. Following the expected signing of the "Record of Decision" in the spring of 2002, phasing of construction by EIS partners can begin.

NASA Research Park will benefit all partners by leveraging research resources through collaborative activities, by providing a unique location for transfer of scientific and engineering ideas, and by establishing closer linkages between industry and academia, according to Marlaire.

"The American people will benefit from the research and formal education aspects," Marlaire said. "In addition, they will receive increased opportunities for public involvement and understanding of science, technology and exploration through the universities and the non-profit organizations, including the California Air and Space Center and the Computer History Museum Center, proposed at NASA Research Park."

By Michael Mewhinney and David Morse

Carnegie Mellon and NASA Ames Join Forces

Carnegie Mellon University and NASA Ames Research Center have agreed to a unique partnership that promises to significantly strengthen both organizations. It will also provide tremendous benefits to the Silicon Valley region and the nation.

At a mid-December news conference held at Ames, senior management representatives of the two organizations announced the formation of the new High Dependability Computing Consortium (HDCC). The mission of the new collaborative is to eliminate failures in computing systems critical to the welfare of society. The consortium will also be a key element in the emerging landscape of Ames' new NASA Research Park.

To add to the importance of the recent announcement, it was revealed that twelve information technology companies have agreed to work with Carnegie Mellon and NASA on the consortium. They will be full partners in the agenda to promote and conduct research that enables the development of highly dependable, affordable software systems.

Ames Director Dr. Henry McDonald (far left) participates in a news conference to announce the High Dependability Computing Consortium with (left to right) Dr. Jared Cohon, President of Carnegie Mellon University, Raymond Lane, general partner, Kleiner Perkins Caulfield & Byers, and Dr. James Morris, dean of Carnegie Mellon University school of computer science.

Ames Center Director Dr. Henry McDonald could barely contain his delight at the announcement of the new partnership. "Carnegie Mellon's expertise in robotics has played a major role in the success of numerous NASA research projects," he said. "We look forward to working with the university and our industry partners to advance NASA's computing capabilities for future research projects."

To that end, NASA awarded a $500,000 grant to Carnegie Mellon earlier this year to initiate development of the HDCC.

Carnegie Mellon President, Dr. Jared Cohon, spoke of his institution's long history of building practical computing systems. As a result, they are recognized for their software engineering expertise, both nationally and internationally, he acknowledged.

"We have an innovative faculty that excels in cross-disciplinary research. The university has played a guiding role in forming this consortium. Once established, we will help lead it and contribute to its technical agenda. All of Carnegie Mellon's capabilities will contribute to the success of the HDCC," Cohon added.

Why is the HDCC viewed by all parties as such an important new development? Because dependable computer systems are at the heart of virtually all operations given today's technology. Improved computing capability is critical to the nation's air traffic control system, Internet

communication, power generation and transmission, space exploration, health care and highway safety. Dependable computer systems are also essential for space missions, defense, health care, electronic commerce, and any and all operations that affect human safety and well being.

In addition to its direct benefits, the HDCC also represents the first concrete step in Carnegie Mellon's plan to develop a presence in the Silicon Valley. Last January, the university signed a memorandum of understanding with NASA Ames establishing a partnership to explore the creation of a branch campus in the new NASA Research Park being developed at Moffett.

Since that time, university officials have signed a letter of intent with NASA Ames that outlines the university's proposed programs, including the High Dependability Computing Consortium, for the research park site. Carnegie Mellon proposes to build 500,000 square feet of space on 15 acres in the university reserve section of NASA Research Park.

One Carnegie Mellon University objective is to showcase its research and educational offerings in Silicon Valley, the information technology capital of the world, according to James H. Morris, dean of CMU's school of computer science. Nationally known research and educational programs from the school's college of engineering and software engineering institute may play key roles in the Silicon Valley campus.

Private industry partners in the new consortium already include Adobe Systems, Inc., Compaq Computer Corp., Hewlett-Packard Corp., IBM Corp., ILOG, Inc., Marimba, Inc., Microsoft Corp., Novell, Inc., SGI, Inc., Siebel Systems, Inc., Sybase, Inc., and Sun Microsystems, Inc. It is anticipated that others will join in as the collaborative evolves.

Currently, Carnegie Mellon and NASA are working together to develop an environmental impact statement relating to proposed development. The university has hired San Francisco-based BMS Design Group, EHDD architects and consultant Barnes and Co., to assist in planning.

"We want to undertake basic, empirical and engineering research aimed at making the creation and maintenance of computer systems a true professional discipline comparable to civil engineering and medicine," said Morris. "As shapers of the future, universities should address the software quality problem now, before the world at large sees a crisis. Carnegie Mellon has more than 2,500 alumni in Silicon Valley. They want to see us take a more active role in this environment."

Morris and other Carnegie Mellon principals believe that a presence in Silicon Valley will enhance the educational experience of students at the Pittsburgh campus by giving them opportunities for internships or research with NASA or Silicon Valley companies. Morris said the goal is to create a suitable platform, including classrooms, laboratory space and housing that will allow any department of the university to run a program here at reasonable cost. Initial plans call for the new CMU facility to be used for research with NASA, executive education programs, electronic commerce courses, computer science, robotics and software engineering.

Carnegie Mellon has a long-standing relationship with NASA Ames. In addition to developing high-profile robots such as Dante, which explored the interior of a volcano, and Nomad, which trekked across Chile's Atacama Desert and found meteorites in Antarctica, CMU researchers have worked with NASA Ames on a variety of science projects. For instance, members of CMU departments as diverse as philosophy, computer science and mechanical engineering have worked with Ames scientists on projects involving formal methods for verifying digital circuitry, vision and navigation, machine learning and data mining.

By David Morse and Michael Mewhinney

Ames 2001 Spinoffs

A Cool Tool for Deicing Planes

When airplanes reach cruising altitude, the high speeds and low temperatures of the air cause thin layers of ice to begin forming on the wings. Ice can present an increased safety risk to the aircraft and its passengers. Thanks to an innovation from NASA Ames Research Center, this danger could one day be eliminated. Ames patented the Electro Expulsive Separation System (EESS), which is now licensed to Ice Management Systems, Inc. (IMS), of Temecula, California.

EESS is an aircraft ice removal system, appropriately nicknamed the "ice zapper." According to the Principle Inventor, Leonard Haslim, "It pulverizes ice and removes layers of ice as thin as frost or as thick as an inch of glaze." The EESS consists of layers of conductors encased in materials that are bonded directly to the airframe structure. When ice accumulates on the aircraft, an electric current is sent through the conductors, causing them to pulse. Even though the conductors move less than a twenty-thousandth of an inch in just a millisecond, the movement is sufficient to pulverize the ice. It is this highly accelerated motion that shatters the ice into particles the size of table salt; too small to be harmful to the aircraft.

"The NASA-developed Electro Expulsive Separation System (EESS) is shown in a testing chamber where it proved it could rid aircraft from ice layers ranging from thin frosts to thick glazes."

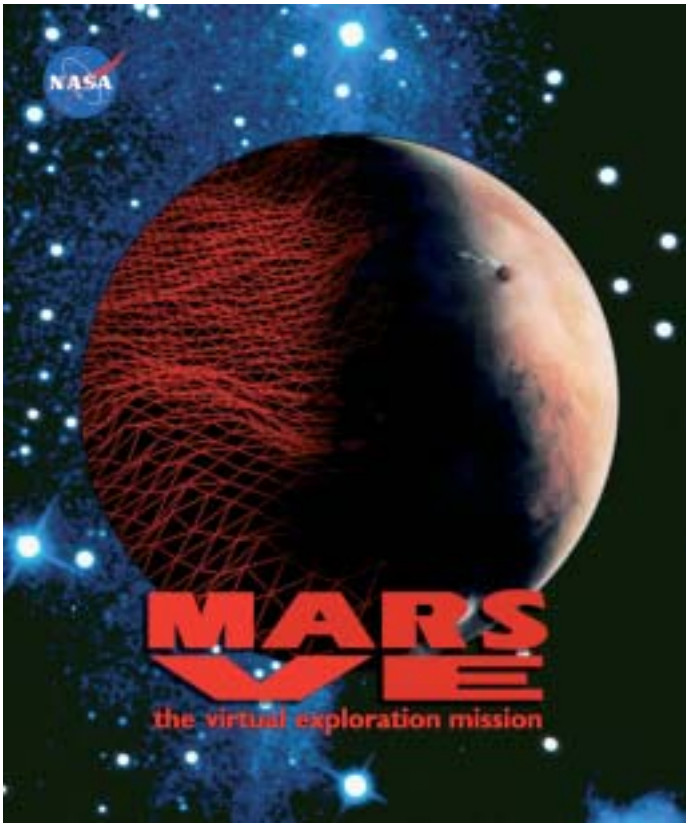
In 1995, Richard Olson, CEO of Ice Management Systems, Inc. (IMS) first introduced the ice zapper into the private sector. He has since made improvements that have paid off with recent sales to TRW (Thompson Ramo Woolridge), who purchased the technology for use on a new line of planes. IMS envisions a variety of uses for the EESS technology in the aerospace and automotive industries.

The EESS also offers additional benefits besides the unique ability to deice planes while in flight. According to Haslim, "The ice zapper uses one-thousandth of the power and is one-tenth of the weight of electro-thermal ice removal systems used today." Using less power means that operating costs are lower, while lighter weight translates into needing less energy to propel the aircraft, resulting in even further cost reductions.

When compared with other systems in use, such as thermal deicers and pneumatic boots, the ice zapper does very well. Thermal deicers are fairly common, although they use an enormous amount of energy and present the possibility of ice refreezing. Pneumatic boots are not always effective because they require an inflation device that is unable to work until a quarter inch of ice has accumulated. With both systems, the ice that is loosened may still be large enough to cause problems for the plane once dislodged. For instance, in just one winter, 26 F/A-18 airplanes were seriously damaged when sizable chunks of ice entered the engines after having been removed by pneumatic boots. Because the EESS will reduce ice to such tiny particles, the chances for this type of occurrence on a plane using the technology would be very unlikely.

Even though EESS has a clear market in the aerospace industry, another potential use for the EESS is in the automotive sector. Specifically, a modified version of the ice zapper could be fitted to the windshields in cars, making the need for ice scrapers and other cumbersome methods obsolete. The automotive applications may be further explored in the future, but for now, IMS is aggressively working to demonstrate value to aircraft manufacturers.

Learning That's Out of This World



NASA's Ames Research Center developed new curriculum to educate the space explorers of tomorrow. The *Mars Virtual Exploration* CD-ROM results from the efforts of the Educational Multimedia Group in the Office of External Affairs. The CD-ROM is exclusively licensed to Modern School Supplies, Inc., of Bloomfield, Connecticut.

For decades, humans have been fascinated by the mysteries surrounding Mars. What is it like? Was there ever life? Will we live there someday? These questions and others inevitably arise whenever the planet is discussed. This new learning resource presents some potential answers to these questions and will undoubtedly help to cultivate an eagerness to learn more about Mars and our universe.

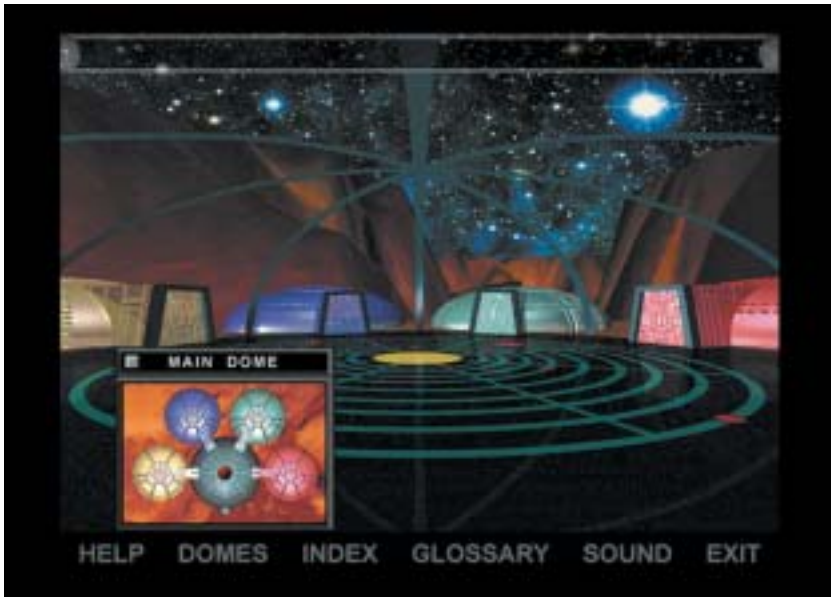
The CD-ROM allows students to imagine they are residents of a research team at an advanced facility divided into four different domes. Students experience how scientists approach planetary exploration through interactive exercises in Exopaleontology, Meteorology, Exobiology and Volcanology. Once the students have learned the facts and consulted with the experts, they select a potential landing site. Using QuickTimeVR™ software, the students get a 360-degree view of the potential landing terrain. They are then able to virtually explore the four available sites and then select the one they feel is best for conducting research.

The *Mars Virtual Exploration* CD-ROM comes complete with a printable teacher's guide and student logbook. These bonus tools provide additional content and activities for as many as 15 lessons and serve as enhancements to the rest of the material presented.

The CD-ROM is designed to target the interest of fourth through eighth grade students. Modern School Supplies, Inc. now provides students with this opportunity to learn about Mars in an interactive hands-on experience that requires the use of their critical thinking and problem-solving skills—all very valuable assets when exploring the Red Planet. After all, with a manned mission to Mars anticipated for as early as 2018, today's students are tomorrow's astronauts, explorers, and scientists.

QuickTimeVR™ is a trademark of Apple Computer, Inc.

"The Mars Virtual Exploration CD-ROM allows students to virtually explore potential landing sites on the Red Planet."



"By visiting four different research domes, students learn about Mars and use their newly gained knowledge to conduct a virtual exploration of the planet."

New Fluid Prevents Railway Ice

Through a licensing agreement between NASA's Ames Research Center and Midwest Industrial Supply, Inc. (MIS), comes a new development to make railroads safer and more reliable during wintry conditions. MIS has been the leading provider of deicing and anti-icing fluids used on railway systems for more than 20 years. Through the licensing agreement, two MIS products have been enhanced with NASA's anti-icing fluid technology.

This NASA technology was designed specifically for use as an anti-icing and deicing agent. It is an effective and environmentally friendly, biodegradable fluid that has proven its capabilities over a broad range of low temperatures. The fluid is also non-corrosive, and will not damage the railways to which it is applied. Because it is not conductive, it is safe to use with the electrical wiring associated with railways.

The Ice-Free Switch"® enhanced with Zero Gravity"™ helps keep railways free of ice and snow.

MIS offers the new fluid in two commercial products, the Zero Gravity, Third Rail Anti-Icer/Deicer and the Ice Free Switch. Using NASA's fluid technology, these products form a protective-coating barrier that prevents the buildup of ice and snow. Applying the fluid to the railway components prior to ice or snowstorms it works as an anti-icing fluid, remaining in place to melt precipitation as it hits the surface.

It also functions as a deicing fluid. If applied to an already frozen switch or rail, it will quickly melt the ice, free the frozen parts, and then remain in place to prevent refreezing. Additional benefits include the ability to cling to vertical rail surfaces and resist the effects of rain and wind.

Manually freeing frozen switches can take an entire crew several hours. With the Ice Free Switch, it takes only five minutes to treat the switch by spraying, brushing, or pouring on the product. Ice Free Switch requires as little as one gallon per switch whereas other deicing fluids require five to ten gallons of liquid to effectively melt ice.

Zero Gravity serves the same anti-icing/deicing purposes, but it applies fluid to the third rail through a system that is easily installed onto mass transit cars. A tank of fluid and a dispensing system are placed underneath the train car and the fluid is applied as the train runs its route.

The fluid leaves no build-up, does not become tacky, and will not leave excessive residue on the application site. It also works as a lubricant to keep rails and switches operating smoothly. Due to these beneficial features, the fluid can be left unattended for an extended length of time once it has been applied. This is a significant benefit to consider when treating rail components located in remote areas.

The fluid is effective in temperatures as low as -70°F, which is an improvement over the use of heaters. Heaters have trouble functioning if temperatures are sub-zero and they have high rates of energy-consumption. Use of the new products has resulted in fewer instances of lost power and stalled trains. Most importantly, passengers can travel safely and with fewer weather-related delays.

MIS is impressed with the results of their enhanced products for railroad operations. The company looks forward to expanding it's products to solve similar problems in other industries. Many new applications will likely be found for this remarkable fluid from the space program. If recent successes are an indicator, a smooth ride moving the anti-icing technology forward is assured.

Zero Gravity, and Ice Free Switch, are registered trademarks of Midwest Industrial Supply, Inc.

Ice-Free Switch"® enhanced with Zero Gravity"™ and manufactured by Midwest Industrial Supply, Inc., uses NASA-developed technology to make railways safer.

Paper Thin Coating Offers Maximum Protection

Can you imagine a coating that with a paper-thin layer protects your property from structural fire damage from the ground up? Wessex Incorporated has recently taken a technology that was originally developed for NASA as a protective coating for ceramic materials used in heat shields for space vehicles, and modified it for use in applications such as building materials, machinery, and transportation. The technology was developed at NASA Ames Research Center as a protective coating for ceramic composites (PCC). Wessex, of Blacksburg, VA, obtained a license for the PCC and is proceeding to further develop it for numerous applications. Wessex describes this innovative technology as, "A significant advancement in thermal protection for the aerospace industry."

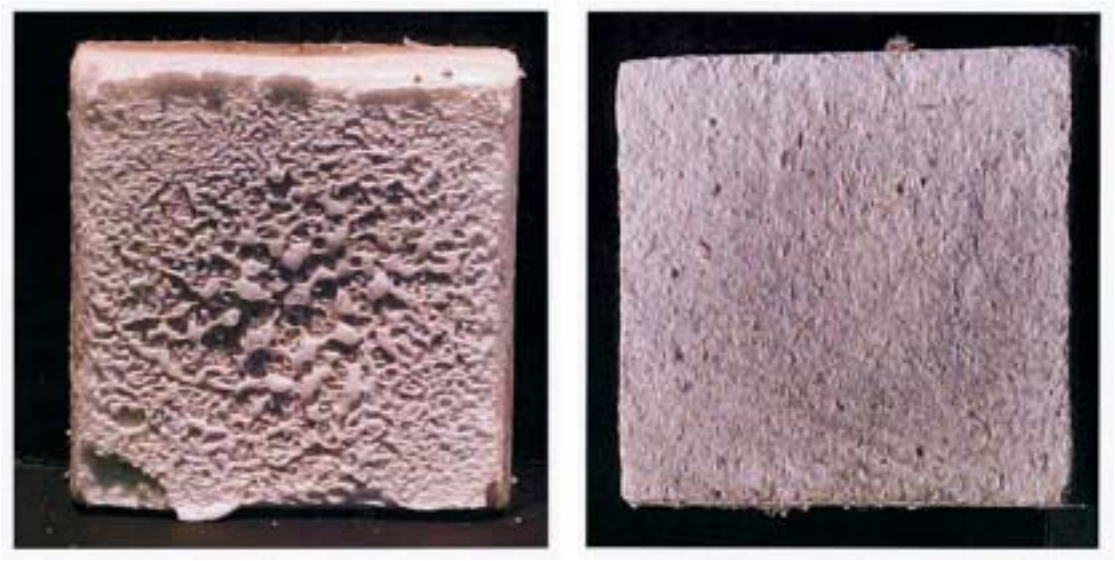
The NASA-developed material is environmentally safe, water-based, and contains no solvents. Many other flame-retardant materials contain petroleum-based components, which can produce toxic smoke under flame. The ceramic components of PCC do not produce any type of toxic fumes during exposure to elevated temperatures.

An emissivity agent is attributed to PCC's remarkable thermal properties. Emissivity is the relative power of a surface to emit heat by radiation. This principle, along with PCC's non-combustible material makeup, is what increases the temperature capability of underlying insulation from high temperatures. Because the emissivity of the PCC helps radiate thermal energy at the surface, it reduces heat to the underlying material. The coating essentially reduces the likelihood of the underlying material becoming so hot that it combusts and thus inhibits the "flashover" phenomenon from occurring.

Wessex version of PCC can be used to shield ceramics, wood, plasterboard, steel, plastics, fiberglass, and other materials from catastrophic fires. They are extraordinarily tough and exhibit excellent resistance to thermal shock, vibration, abrasion, and mechanical damage. One thin layer of coating provides necessary protection and allows for flexibility while avoiding excessive weight disadvantages.

Wessex sold the PCC product to Danser, Inc., of Parkersburg, West Virginia, a producer of ceramic lined commercial ductwork. Sales have also been made to Encapsulation Technologies, a manufacturer who is applying PCC to venetian blinds to make them more fire-resistant. Potentially, the PCC material can be used in the home, in the garage area, where many volatile chemicals are often stored, in the kitchen to prevent cooking and appliance fires, as a lining to prevent chimney fires, and also as a firewall between the garage and the house. PCC applications could be beneficial in automobiles, trucks, boats, aircraft, storage facilities, and high-rise facilities, as well.

Wessex has developed several other coatings for substrates such as woods and metals, and is currently working with a plastic manufacturer to use PCC on fiberglass doors. Currently, fiberglass doors are extremely flammable and produce noxious smoke in the event of a fire. Fiberglass doors treated with PCC could be a low-cost, lightweight alternative to the expensive, heavy steel fire doors currently available in today's market.



Two silicon-dioxide-based ceramic tiles were tested using a oxy-acetylene torch (hot enough to cut metals). The untreated tile on the left melted and turned to glass beads within 30 seconds. Under the same conditions, the tile on the right with Wessex's PCC coating, was tested for 2 minutes and showed little damage.

Giving Back to the Community

Community Outreach

COMMUNITY SERVICES AGENCY OF MOUNTAIN VIEW

For the past several years, Code C has participated in the Holiday tradition of sharing our good fortune with others in our community who are less fortunate. We have contributed new toys and pajamas to The Community Services Agency (CSA) of Mountain View for the past few years in lieu of having a gift exchange at our Code C Holiday Party.

CSA sets up a "Toy Store" in their facility on Steirlin Road in Mountain View where the clients they serve can come in and "shop" for free toys for their children. These are clients who cannot afford to "shop" in a regular store and whose children would probably not receive any Holiday presents if it were not for this "special" store.

AMES AEROSPACE ENCOUNTER

Created for fourth-, fifth-, and sixth-grade students, NASA's Ames Aerospace Encounter is a unique, interactive program designed to stir young people's imaginations and fuel their enthusiasm for science, mathematics, and technology. Located in a renovated supersonic wind tunnel, this classroom facility makes math and science curricula come alive through cooperative discovery.

DISASTER ASSISTANCE RESCUE TEAM (DART)

DART was formed in 1986 at the request of the Director of Ames Research Center. The intent was to train and equip a team capable of responding to the type of disasters that the Center would likely encounter. It began as a small group of volunteers with few skills and very little equipment. Today, it is a fully functioning emergency response team that is not only capable of dealing with potential Center disasters, but is also capable and prepared to respond off Center to support the community as a fully functional Urban Search and Rescue Team. DART is one of this country's most qualified and best-equipped emergency response teams.

EDUCATOR RESOURCE CENTER

At the Educator Resource Center (ERC), educators can access a wide variety of NASA resources to develop their own educational programs. The facilities and staff at the center will assist teachers in gathering ideas, doing research, and duplicating selections from an outstanding collection of audiovisual and printed materials.

ERC materials reflect NASA research and technology development in such curriculum areas as life science, physical science, astronomy, energy, Earth resources, the environment, mathematics, geography, and careers in aerospace. Teachers in disciplines other than science and mathematics are also encouraged to visit the ERC and explore ways in which aerospace materials may be incorporated into their lessons.

JASON

The JASON Project, named after the Greek mythological character who reclaimed the Golden Fleece, embodies Robert Ballard's goal of showing kids that science and technology can be exciting and accessible. Ballard found the wreckage of the sunken Titanic in 1985 and started the project after receiving 15,000 letters from kids who wanted to know every detail of his discovery. The rest is history—and a valuable learning and educational experience for thousands of students and their teachers.

"QUEST" — THE K–12 INTERNET INITIATIVE

Located on the Ames Home Page, QUEST provides support and services for schools, teachers, and students, to fully utilize the Internet and its underlying information technologies as a basic tool for learning. At this Web site, students can interact with the people of NASA, join in select NASA events, and access a wealth of information.

SPEAKERS' BUREAU

The Speakers' Bureau provides speakers for educational institutions, business organizations, service clubs, and professional and technical societies. Employees volunteer their time and speak to these groups on a wide range of topics, including space, astrobiology, aeronautics, and information technology.

Recognizing Exceptional People

2001 Presidential Rank and NASA Honor Awards

The Presidential Rank and NASA Honor Awards are presented to the 26 employees who have been selected for individual awards and to the managers of the 7 groups which have been selected for the NASA Group Achievement Award.

PRESIDENTIAL RANK OF DISTINGUISHED EXECUTIVE

William E. Berry

PRESIDENTIAL RANK OF MERITORIOUS EXECUTIVE

Steve Zornetzer

OUTSTANDING LEADERSHIP MEDAL

Joseph T. Bielitzki

Clifford C. Imprescia

Earl B. LeMar

Sandra M. Olliges

Gregory K. Schmidt

Charles E. Wade

EXCEPTIONAL ACHIEVEMENT MEDAL

Nancy G. Daunton

Robert E. Gisler

Robert W. Mah

Theresa Nogales-Liang

Peter Norvig

Joan S. Salute

EXCEPTIONAL ENGINEERING ACHIEVEMENT MEDAL

Mark D. Betzina

EXCEPTIONAL SCIENTIFIC ACHIEVEMENT MEDAL

Linda L. Jahnke

Azadeh Tabazadeh

EXCEPTIONAL SERVICE MEDAL

James P. Connolly

Teresa M. Del Vecchio

Thomas A. Edwards

Philip R. Fluegemann

Glen A. Knaust

John E. Humbert

Chuck C. Jorgensen

Robert J. Navarro

Harry Partridge III

Solita R. Que

PUBLIC SERVICE MEDAL

Mary Williams

Alexis A. Flippen

GROUP ACHIEVEMENT AWARD

NASA Astrobiology Institute (NAI) Central Team

Dash 8 Wind Tunnel Test Team

Information Power Grid Group

Intelligent Neural Flight and Propulsion Control System Group

SAGE III Ozone Loss and Validation Experiment (SOLVE) Science Team

SHARP-B2 Flight Experiment Team

Ames X-33 Integrated Product Team

2001 Ames Honor Awards

ADMINISTRATIVE PROFESSIONAL

Lisa L. Lockyer

Maria-Elena Lopez

ADMINISTRATIVE TECHNICIAN

Femy D. McGrath

BEST FIRST PAPER AT AMES

Tori M. Hoehler

COMMERCIALIZATION/TECH TRANSFER AWARD

Robert W. Mah

COMMUNITY SERVICE/VOLUNTEER

Doris Chow

CONTRACTOR EMPLOYEE

Mary P. Conway – *Foothill-DeAnza College District Internship Program*

Paula M. Dumars – *Lockheed Martin Engineering & Sciences Co.*

Sonja Jones-Shin – *Quantum Services, Inc.*

Julie M. Nottage – *Quantum Services, Inc.*

Claire Smith – *Quantum Services, Inc.*

2001 Ames Honor Awards continued

CRAFTSMAN/TECHNICIAN

Gary H. Palmer

EQUAL EMPLOYMENT OPPORTUNITY

Michel Liu

ENGINEER

Daniel L. Dittman

Shawn A. Engelland

George W. Sutton

GROUP/TEAM

Aviation Safety Reporting System (ASRS) Team

Aerospace Education Development Team

International Space Station (ISS) Testbed Centrifuge Upgrade Project Team

HEADQUARTERS EMPLOYEE

Paula M. Cleggett

Neal R. Newman

MENTOR

Emily M. Holton

Jonathan D. Trent

SAFETY AND ENVIRONMENT

Thomas A. Spalding

SCIENTIST/RESEARCHER

Andrew S. Ackerman

Douglas M. Hudgins

SECRETARY/ADMINISTRATIVE SUPPORT

Merle D. Simbe

Jennifer M. Whalen

STUDENT

Marianne Shelley

Nguyen Trang

SUPERVISOR/MANAGER

Edwin W. Aiken

TECHNICAL SUPPORT

Robin M. Orans

TECHNOLOGY DEVELOPMENT

John E. Finn

2001 Acquistion Improvement Awards

ACQUISITION STRATEGY PLANNING GROUP

Astrobiology and Space Research Services Procurement

NASA REGIONAL TECHNOLOGY TRANSFER CENTER (RTTC) PROCUREMENT TEAM

ANIMAL CARE FACILITY PROCUREMENT TEAM

IFMP CORE FINANCIAL SOFTWARE PROCUREMENT

Undrell Palmer

Robert Brummett

2001 Chief Financial Officer Awards

Charlotte diCenzo

Greg Josselyn

Derrick Thomas

2001 Turning Goals into Reality (TGIR) Awards

Future ATM Concepts Evaluation Tool (FACET) Team (Ames led)
– Increase Capacity Objective

Highly Maneuverable Crew Transfer Vehicle Development Team (Ames led)
– Mission Safety Objective

X-33 Thermal Protection System Development Team (Ames led)
– Mission Affordability Objective

Control Designer's Unified Interface Development Team (Ames led)
– Engineering Innovation Objective

Aircraft Icing Project Team
– Revolutionize Aviation Goal

Airframe Noise Reduction Team
– Noise Reduction Objective

Numerical Propulsion System Simulation Team
– Pioneering Technology Innovation Goal

Broadband SatCom/Ring Buffer Network Team
– Commercialize Technology Goal

Aircraft VOrtex Spacing System (AVOSS) Team
– Administrator's Award

External Awards

VICE PRESIDENT'S HAMMER AWARD—FOR REINVENTING GOVERNMENT

Ames National Rotorcraft Technology Center

AMERICAN GEOPHYSICAL UNION JAMES B. MACELWANE MEDAL

Azadeh Tabazadeh

ARTHUS S. FLEMMING AWARD (FOR DESIGN AND APPLICATION OF COMPUTATIONAL FLUID DYNAMICS TOOLS)

Dr. Stuart Rogers

CHRISTOPHER COLUMBUS FELLOWSHIP FOUNDATION PRIZE - CATEGORY WINNER (DISCOVER MAGAZINE) FOR NEUROELECTRIC INTERFACES.

Dr. Charles Jorgensen

Kevin R. Wheeler

QUALITY ASSURANCE SPECIAL ACHIEVEMENT RECOGNITION (QUASAR) AWARD

George Sarver

Management Discussion and Analysis

Management Initiatives

Safety

In FY01, the Center will pursue the Occupational Safety and Health Authority Voluntary Protection Program (VPP) certification. This effort will be accomplished in addition to implementing the Ames Safety Accountability Program (ASAP). The integrated effort of these objectives will reduce the number of hazards on the job and significantly improve safety at Ames.The VPP and the Ames Safety Accountability Programs are based on programs that have proved effective throughout industry. The new initiative includes the following key elements:

- Management Leadership and Employee Involvement
- Work-Site Analysis
- Hazard Prevention and Control
- Safety and Health Training

All elements are integrated into a single management plan that is designed to change behavior and improve accessibility to management. The complete integration includes a new management culture shift to accountability, combined with metrics, pay for performance, and real-time feedback to management by means of automation.

Human Resources Initiative

ARC will continue the development and implementation of a Human Resources Initiative to place greater emphasis on the fact that our people are our greatest asset. This initiative requires formal, continuing management education for all supervisors; the creation of Individual Development Plans for all staff members; and an examination and improvement in the workplace environment. It also creates a process for management accountability to carry out these requirements.

Program and Project Management Development

The ARC Program and Project Management (P/PM) Development Program will expand the scope of the Academy West program. Currently serving NASA's Academy of Program/ Project Leadership (APPL) and NASA Engineering Training (NET), the Academy West Program will provide services to NASA's Leadership and Management Development Program and Agency-wide Risk Management training initiatives. In addition, The ARC P/PM Development Program will incorporate new initiatives into its existing offerings. New development projects, based on benchmarking of best practices, will include the Lead Center Program Managers Mentoring Project, a Project Management Knowledge Management Team and Open PM Forums facilitated by guest presenters from Silicon Valley industries.

Full-Cost Practices

ARC is moving forward with the implementation of full-cost practices and will continue to improve the cost-effectiveness of mission performance through complete implementation of the Agency's Full-Cost Initiative. This initiative will drive policy and practice improvements in the managing, budgeting, and accounting areas that will support "full disclosure"

on activities for more fully informed decision making and better performance measurement. The planned improvements include categorizing costs as direct, service, and general and administrative (G&A).

The Full-Cost Initiative also ensures compliance with recent legal and administrative guidance, including the 1990 Chief Financial Officers Act, 1993 Government Performance and Results Act, 1993 National Performance Review, and the Federal Financial Management Improvement Act of 1996.

Integrated Financial Management System

In addition to operating the Center's legacy systems, ARC is deeply involved with the Agency-wide effort to standardize and improve the financial and business management processes and systems within the Agency. The ARC Integrated Financial Management Program (IFMP) team is actively participating in all aspects of the Agency-wide program, including reengineering business processes, configuring and testing the system, and preparing employees to work in the new environment. The initial system to be replaced is the core accounting system followed by time and attendance, procurement and logistics, budget formulation, human resources, travel, environmental, aircraft management, facilities, and payroll. The IFM System will replace the Agency's existing business management environment, which comprises decentralized, nonintegrated systems that were originally developed to satisfy unique Center requirements. The IFM System will provide the NASA Strategic Enterprises, Lead Centers, Lead Program managers, and Center directors with accurate and timely financial information to support decision making and to enable strategic management. In addition, the system will be designed to satisfy the needs of external customers who require financial information from NASA.

Education

As stated in the NASA Strategic Plan, one of NASA's primary goals is to inspire achievement and innovation. In order to accomplish this, NASA uses its unique resources to support educational excellence for all. Ames delivers the NASA Education Program within the framework of the NASA Implementation Plan for Education, 1999-2003. The education function at ARC is strategically dispersed throughout the Directorates, and all major technical endeavors at ARC contain educational outreach components. This scenario has increased the magnitude, diversity, and technical excellence of ARC's education programs. The wide ranges of ARC's education programs are constantly being refined, and new programs are being introduced to better serve the needs of the educational community within the Bay Area, the state of California, and 10 other western states. The following is a brief list of the wide range of educational activities at ARC:

- The California Air and Space Center (CASC)
- The JASON Project
- The ARC Aerospace Encounter
- National Engineers' week
- Science and engineering fairs, and an active speakers' bureau
- The NASA Quest program

Education continued

New education technology products are produced in conjunction with the significant aeronautics and space programs at the Center. The products usually consist of CD-ROMs and are web based; they fully integrate curriculum based on National Science Standards.

Equal Opportunity/Diversity

ARC strongly supports the principles of equal opportunity and endorses achieving diversity in the workplace. Employees who work at ARC are valued and no one is excluded on the basis of race, color, religion, sex, age, national origin, disability, sexual orientation or any other nonmerit-based factor. The Center fosters and maintains a work environment that respects and values individual differences and is reflective of the entire range of communities that the Center serves. The Center's efforts are focused on workforce representation, recruiting, hiring, retention, training, employee development, promotions, Alternative Dispute Resolution, multicultural employee groups, Diversity Dialogue Groups, and partnerships with historically black colleges and other minority universities.

NASA Research Park Development

ARC is embarking on a bold new vision to create NASA Research Park (NRP), a collaborative research park which will bring together premiere talent in the areas of astrobiology, information technology, and aerospace technology. The transformation of ARC's unused capacity into a unique environment for enhancement of NASA's programmatic initiatives, as well as the Agency's commercialization, education, and outreach goals, will integrate three key components.

ARC will develop a world-class campus for research and learning that will utilize ARC's unique stock of buildings and partnerships with local government, academia, industry, and nonprofit organizations. With its notable military history, prominent architecture, and availability of land, ARC will be an ideal place where NASA, its collaborative partners, and the public can promote advances in aerospace and aviation technology, understand advances in information technology, and explore the outer limits of the Universe. Public displays, interactive exhibits, school programs for students and teachers, and lecture programs will be featured on the campus.

In partnership with academia and industry, NASA will promote entrepreneurship and innovation at ARC. By taking advantage of its proximity to leading entrepreneurs and heads of innovative organizations, NASA and its partners can support the development of business incubators focused on high technology and biotechnology industries. Linkages can be formed with business education programs to provide forums, seminars, executive lecture series, and other venues to facilitate the exchange of information and experience to solve real-world business problems related to technology innovation, technology commercialization, and technology management.

ARC will create a unique community of research scientists, students, and educators with a shared mission to advance human knowledge of space, Earth, and society. A lively and vibrant community will attract industry. NASA will provide critical public safety services and other services typically furnished by municipal government.

An Integrated Development Plan was issued in the first quarter of FY00. That plan described how portions of ARC will evolve into a shared-use campus with government, academia, industry, and nonprofit organizations. The plan also outlines the steps required to optimally develop federal property and to balance NASA's programmatic goals against the financial requirements and infrastructure constraints. This plan was developed in cooperation with local governments to ensure its sensitivity to the needs of the surrounding communities and the environment. It is also a sensible and prudent undertaking for the nation.

Support Functions

A full array of institutional systems support the ARC Center of Excellence, missions, Lead Center programs, and other research and technology development activities. These systems encompass a wide range of areas, including the following.

ACQUISITION/PROCUREMENT

Contract and grant specialists award procurements that support research and operations for all NASA Enterprises. Specialists are integrally involved in the planning and implementation of business-related program/project goals. Annually, the Division awards $500 million in new work and concurrently performs over $3 billion in contract management. NASA Ames' program and project success is directly linked to acquisition excellence.

DOCUMENTATION DEVELOPMENT

Professional specialists who work under the Scientific and Technical Information (STI) Program acquire, produce, distribute, and archive scientific, technical, and nontechnical information using traditional and advanced technologies. Services provided include printing and reproduction, photo and imaging, audiovisual and video production, graphics and exhibit design, publications, and library support.

HUMAN RESOURCES

Human resource specialists work to attract, enhance, and retain a highly effective workforce, properly balanced and trained to accomplish the Center's various missions. They work closely with ARC supervisors and managers, providing advice and assistance in planning and implementing proactive human resources programs within each organization. They also provide management and staff development programs to fully utilize the capabilities and potential of the Center's workforce.

FACILITIES MAINTENANCE AND OPERATIONS, LOGISTICS, AND SUPPLIES

Support is provided through two primary functions: (1) institutional facilities, base operations, and maintenance; and (2) supply and logistics services. In addition, as host for the ARC Moffett Complex, the necessary maintenance of infrastructure and buildings is provided to support office space and military housing utilized by resident agencies.

INFORMATION TECHNOLOGY SERVICES

Services include the development and maintenance of a secure, state-of-the-art computing infrastructure that can support Ames researchers and partners throughout NASA and the world. This infrastructure consists of networking, desktop computing, and other Information Technology services such as telephones, business data processing, World Wide Web, e-mail, software development, and IT systems engineering.

PROTECTIVE SERVICES

A wide range of emergency and nonemergency services are provided, including security, law enforcement, fire/crash rescue, export control, special projects, and emergency preparedness, response, and recovery. Support includes coordination of Center access for all employees and visitors, security clearance processing, foreign travel briefings and debriefings for personnel traveling overseas, and physical, technical, and information security throughout the Center.

RESEARCH AND DEVELOPMENT SERVICES

Cost-effective and highly qualified support is provided to the Agency's R&D programs by providing wind-tunnel testing operations, hardware development, systems engineering, and project and facility construction management. Utilizing concurrent engineering, rapid prototyping, advanced analysis tools, and experienced project management expertise, systems engineering serves the Center's programs, as well as external customers in integrated product design and development. The hardware development capability is centered on unique skills made possible by the advanced tools and expertise of its crafts people. Products range from sophisticated spacecraft hardware and biological sensors to highly accurate and detailed wind-tunnel models. Wind-tunnel testing utilizes modernized national-class facilities, leading-edge instrumentation, and expert technical support for high-speed, high-fidelity data acquisition and understanding. Ames is a leader in wind-tunnel testing productivity, capability, and knowledge.

COMMERCIALIZATION AND TECHNOLOGY TRANSFER

ARC actively supports NASA's Strategic Plan mandate to "transfer advanced aeronautics, space, and related technologies". At Ames, the Commercial Technology Office (CTO) is the focal point for these activities. CTO is focusing on new initiatives for accelerating NASA technology commercialization and dissemination while gaining opportunities to leverage in-house NASA capabilities and resources to accomplish NASA missions. CTO works to facilitate the transfer and commercialization of NASA technologies, the creation of technology partnerships, and the infusion of external technologies and expertise to enhance NASA programs, U.S. economic competitiveness, and quality of life. In order to make the most of opportunities for fruitful interdisciplinary collaborations between NASA researchers and the entrepreneurial community, ARC's CTO provides a range of services as well as new initiatives that will take advantage of the NASA Research Park (NRP). For FY2003, the President's budget emphasizes initiatives involving NASA technology partnerships and strategic alliances with industry to leverage costs and accelerate new technology development that benefits NASA mission goals as well as industry's bottom line. CTO's new initiatives at ARC and NRP such as Entrepreneurial Centers will facilitate such mutually beneficial public-private partnerships. Other CTO activities that promote technology transfer and commercialization at ARC include: facilitation and drafting of partnership agreements; mining Ames R&D programs, contracts, grants and cooperative agreements for new technologies and innovations with assessments of commercial potential; working with the ARC legal office on protection, patenting, and licensing of NASA-developed intellectual property; and management of the Small Business Innovative Research (SBIR) and Small Business Technology Transfer programs. In addition, CTO targets NASA technologies for business creation and accelerated commercial development through its management of the Ames Technology Commercialization Center (ATCC) dedicated to launching small businesses based on NASA mission-related technologies.

EQUAL EMPLOYMENT OPPORTUNITY

Equal employment opportunity, affirmative employment, and diversity in the workplace are promoted through a variety of mechanisms. Enforcement procedures ensure compliance with existing rules, regulations, statutes, policies, and mandates.

PUBLIC AFFAIRS, OUTREACH, COMMUNICATION AND EDUCATION

An extensive array of media services, public affairs activities, and informational, outreach, and educational programs support Center and Agency goals. Many are explained within the foregoing sections.

FINANCIAL SYSTEMS

Effective, efficient, and economic financial and budgetary systems are developed and maintained to support the Center and Agency customers in line with established goals. High-quality, proactive business services help customers to operate effectively, efficiently, and economically, with varying budgets and program requirements.

LEGAL SERVICES

Legal Services provides advice and assistance to all ARC management and to all ARC organizations. Legal Services also furnishes timely and accurate legal advice on a wide range of topics; acts as legal representative for and on behalf of ARC in administrative and judicial proceedings; and participates in various management working groups.

SAFETY, ENVIRONMENTAL, AND MISSION ASSURANCE

A safe workplace, responsible stewardship of the environment, and reliable and quality systems are promoted. Support includes effective advocacy, technical consultation, policy guidance, oversight, training, regulatory interface, and the application of risk-assessment tools.

SYSTEMS MANAGEMENT

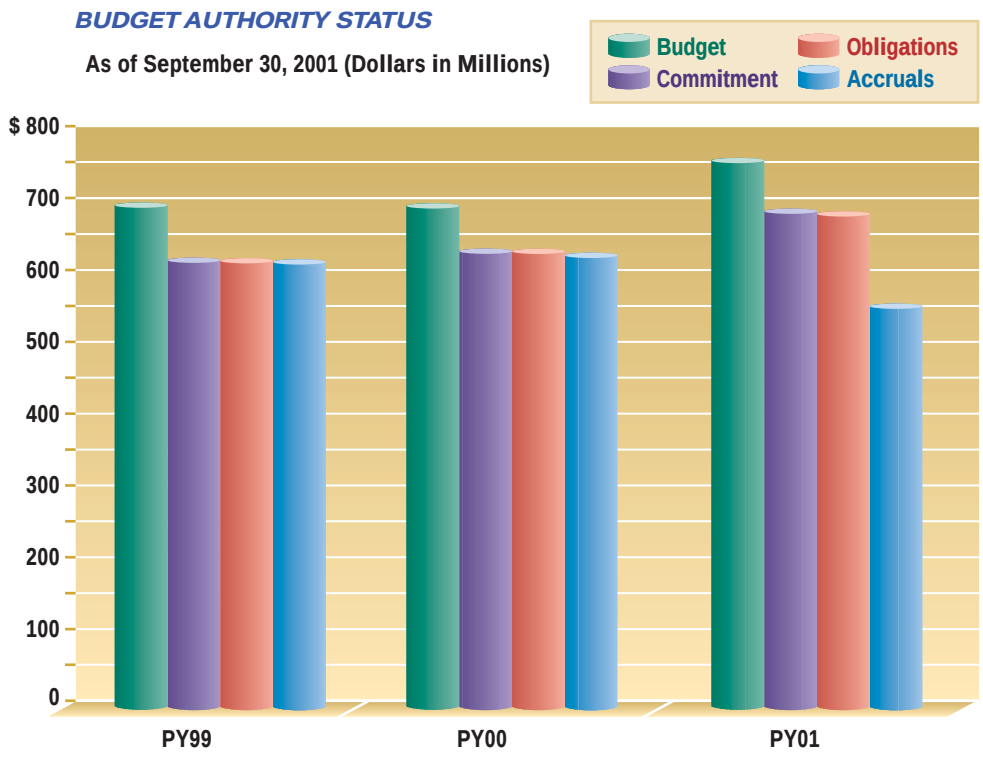
ARC is committed to improving the quality and consistency of the Center's approach toward systems management, which is the integration of systems engineering, system safety and risk assessment, product development, and cost estimation and analysis. The Systems Management Office evaluates and reports to the Center Director on whether the processes, infrastructure and oversight mechanisms are in place to implement systems management in a disciplined and thorough manner, and to ensure that its effectiveness can be verified independently. The initiatives to be conducted by the Systems Management Office for FY01 include:

- Independent assessments of the Center's major programs and initiatives
- Training and skill development
- Tools development and deployment

Operations

Budget Information

Ames' budget authority for fiscal year 2001 was $756.3 million, reflecting a 9-percent increase from the Center's 2000 budget authority. Ames has aggressively implemented financial metrics for all its programs. The Center is attempting to achieve 100-percent commitments and obligations and 83-percent accruals on its current year funding. Ames has made substantial progress in achieving these goals. In accomplishing the financial metrics, Ames substantiates its budgetary requirements through timely utilization of its financial resources. Ames is succeeding in implementing a variety of new initiatives at the Center. This is evidenced by a 9-percent growth in the Ames budget from fiscal year 2000 to fiscal year 2001. The FY 2002 budget is $743.1, which is a reduction of 1.7% from FY 2001. This is due to the 9/11 situation, which contributed to larger budgets for the Department of Defense and lower budgets for everything else. In this era of limited personnel resources, Ames is striving to improve its business processes to ensure accomplishment of its mission in the most efficient manner. Significant emphasis is placed on workforce reporting, because this will be the foundation for accurate full-cost budgeting and accounting.



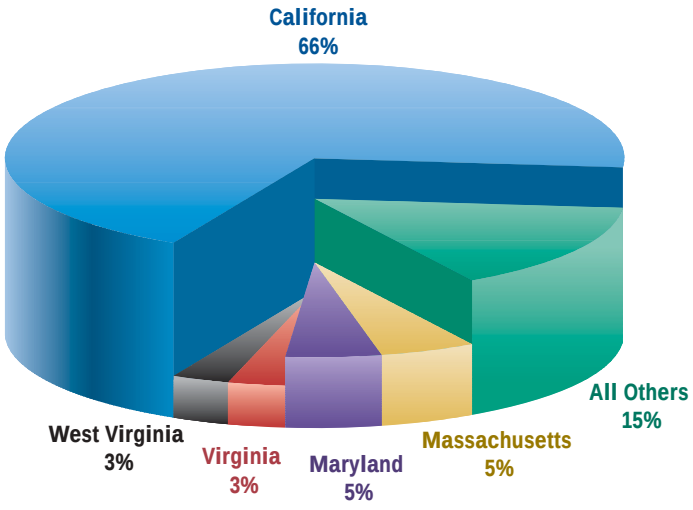
AMES AWARDS BY STATE FISCAL YEAR 2001

STATE	POP COUNT	CURRENT OBLIGS (THOUSANDS)
AL	9	1,430
AZ	13	6,761
CA	690	409,869
CO	20	2,275
CT	17	14,720
DC	17	2,958
DE	1	67
FL	13	1,313
GA	23	2,974
HI	3	3,051
IA	3	428
ID	2	133
IL	14	1,120
IN	7	9,071
KS	2	449
KY	4	285
LA	8	490
MA	66	31,304
MD	58	31,344
MI	7	294
MN	8	964
MO	13	14,283
MS	2	251
MT	1	1,750
NC	11	1,920
NE	1	195
NH	3	1,374
NJ	13	2,197
NM	8	1,425
NV	1	416
NY	12	1,757
OH	7	646
OK	5	509
OR	7	555
PA	25	4,730
RI	4	601
SC	1	176
TN	10	928
TX	27	3,675
UT	2	360
VA	73	15,975
WA	10	1,797
WI	7	5,470
WV	6	15,666
TOTAL	**1,234**	**597,956**

Economic Impact

Ames Research Center significantly impacts the local and national economy. In accomplishing its mission, Ames spends a significant portion of its resources on contracts to acquire goods and services. As of September 30, 2001, Ames awarded approximately $598 million for prime contracts. Of that figure, approximately $410 million, or 69 percent, remained in California.

TOP FIVE STATES BY PRIME CONTRACT AWARDS DURING FY01

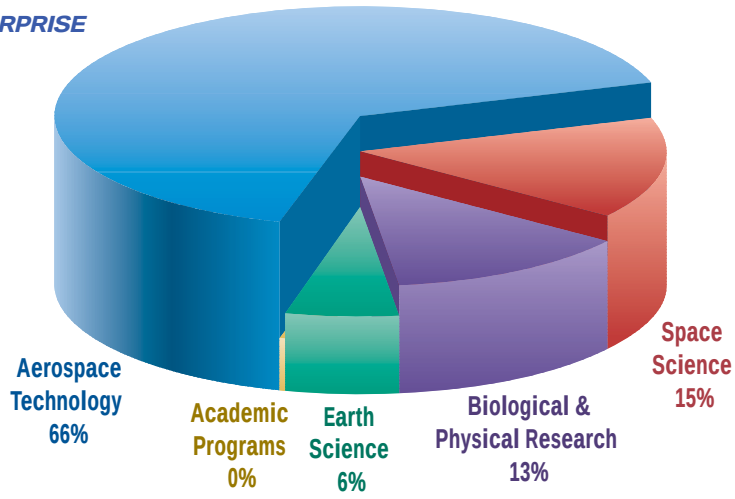


Workforce

NASA has made significant progress in its movement toward a smaller, but more focused civil service workforce. In fact more than three-quarters of the 7500 full-time equivalent (FTE) reductions needed in its civil service workforce have already been accomplished through voluntary measures such as separation incentives, hiring freezes, attrition, and aggressive outplacement. NASA began its restructuring efforts in 1993 when it had approximately 25,000 civil servants at its headquarters and Centers. By the year 2001, NASA plans to have fewer than 18,000 civil servants. This workforce size was determined following a comprehensive Zero Based Review that redefined roles and missions and program management structures consistent with outyear funding levels. The staff reduction represents a 28-percent cut from 1993 levels and will result in the smallest civil service workforce since the 1960s.

AMES WORKFORCE BY ENTERPRISE

Based on a full-cost distribution. Enterprise workforce components include employees who support Center operations.



In 2001, Ames Research Center continued to work toward achieving its targeted FTE complement level.

Some of the Center's initiatives include:

- Use of buyouts in 1994, 1995, 1997, and 1998 to achieve nearly 300 separations and to reach the target employment levels early;
- Reorganization to reduce the number of organizations and supervisory ratio;
- Delegation of selected management authorities to nonsupervisory working managers, group leaders, and team leaders as the span of control increases for supervisors;
- Expanded use of teams to manage complex or cross-organizational projects;
- Streamlining of its reorganization procedures, empowering division and directorate managers with more authority to make organizational changes;
- Increasing utilization of term employees;
- Increasing management's awareness of FTE tracking and full-cost accounting methods.

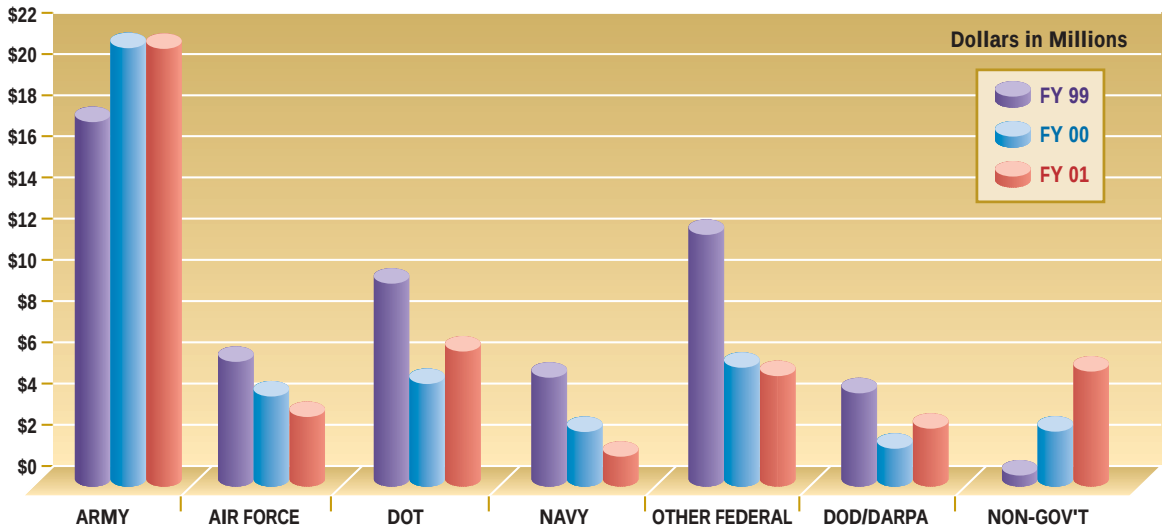
Normal buyouts and attrition have brought ARC to its FY01 and outyear FTE target. Replacement continues to be critical to establishing and/or maintaining expertise in key areas. Although skill mix remains an issue, increased mentoring, reassignment of personnel to critical program areas, career development, and reeducation will enable the staff to carry out the assigned missions. Mechanisms to facilitate the transition of employees include the establishment of a competency-based learning system, the expansion of onsite university classes, and increased focus on technical training, and emphasis on developmental feedback. Additionally, career assessment and a career transition curriculum will continue to be encouraged for all employees.

Reimbursable Agreements

Reimbursable agreements are binding agreements with customers for NASA to sell or rent materials, equipment, or services. In 2001, Ames had reimbursable agreements totaling $44 million. Reimbursable agreements totaled $42 million for 2000, and $46 million in 1999. Ames' largest reimbursable customer continues to be the Army, representing 48 percent of the reimbursable dollars received in 2001. Other federal agencies represented Ames' second largest reimbursable customers with 40 percent, followed by the department of Transportation with 14 percent.

Approximately 74 percent of all reimbursable dollars received are for Science, Aeronautics, and Technology (SAT), 18 percent for Research Operation Support (ROS), 5 percent for Construction of Facilities (C of F), 2 percent for Travel and less than 1 percent for Training.

REIMBURSABLE CUSTOMERS



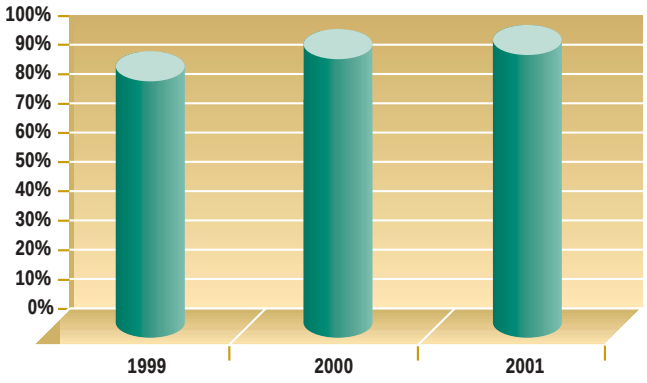
Prompt Payment Act

The Prompt Payment Act requires Federal agencies to pay their bills on time. Interest penalties are imposed on any payment not made in accordance with the Act.

Ames is working toward processing and paying all of its bills electronically in order to minimize costs and increase efficiency. Approximately 97 percent of all bills were paid electronically in 2001, compared to 95 percent in 2000, 88 percent in 1999 and 84 percent in 1998. In dollar terms, 99 percent of all dollars were paid electronically in 2001, as compared to 98 percent in 2000, 95 percent in 1999 and 93 percent in 1998.

In 2001, 98.7 percent of all discounts offered and determined to be cost-effective were taken. The percentage of discounts taken in 2000 were 98.0 percent, in 1999 were 97.1 percent and 99.3 percent in 1998.

ELECTRONIC PAYMENTS MADE AS A PERCENT OF TOTAL PAYMENTS



Purchase Card Program

The United States Government purchase card program, started in 1989, achieves Government-wide savings by reducing, by as much as 14 percent, the administrative costs associated with official small purchases of commercially available goods and services.

Use of the purchase card expedites the acquisition of essential supplies and services, streamlines payment procedures, and reduces the administrative costs associated with traditional paper-based payment methods.

Ames began participating in the purchase card program in 1990. The Center had fewer than 20 cardholders at the time. Since then, it has enjoyed widespread acceptance because of its efficiency and ease of use. In 2001, there were about 400 cardholders with an annual purchase total of $11 million. Ames will continue to use the purchase card to increase financial and procurement efficiency and reduce administrative costs. The total number of transactions in 2001 was 23255, as compared with 20741 in 2000, 16820 in 1999 and only 6816 in 1995.

Financial Statements

Statement of Financial Position (unaudited)

FOR THE FISCAL YEAR ENDED September 30 (IN THOUSANDS)

	2001	2000
ASSETS:		
Intragovernmental Assets:		
Fund Balances with U.S. Treasury (Note 2)	$ 329,259	$ 260,564
Accounts Receivable, Net (Note 3)	12,901	14,964
Governmental Assets:		
Accounts Receivable, Net (Note 3)	227	81
Operating Materials and Supplies, Net (Note 4)	710	866
Property, Plant, and Equipment, Net (Note 5)	1,056,601	896,089
Other Assets (Note 6)	8,696	10,227
Total Assets	**$ 1,408,394**	**$ 1,182,791**
LIABILITIES:		
Liabilities Covered by Budgetary Resources:		
Intragovernmental Liabilities:		
Accounts Payable	$ 12,273	$ 12,682
Other Liabilities (Note 7)	(305)	527
Governmental Liabilities:		
Accounts Payable	148,857	119,968
Other Liabilities (Note 7)	7,678	7,479
Total	$ 168,503	$ 140,656
Liabilities Not Covered by Budgetary Resources:		
Governmental Liabilities:		
Lease Liabilities	0	9,346
Other Liabilities (Note 7)	12,536	11,536
Total	12,536	20,882
Total Liabilities	**$ 181,039**	**$ 161,538**
NET POSITION:		
Balances:		
Unexpended Appropriations	173,790	134,944
Invested Capital	1,066,007	897,835
Cumulative Results of Operations	0	10
Future Funding Requirements	(12,442)	(11,536)
Total Net Position (Note 8)	**1,227,355**	**1,021,253**
Total Liabilities and Net Position	**$ 1,408,394**	**$ 1,182,791**

The accompanying notes are an integral part of these statements.

Statement of Operations & Changes in Net Position (unaudited)

FOR THE FISCAL YEAR ENDED September 30 (IN THOUSANDS)

	2001	2000
REVENUE AND FINANCING SOURCES:		
Appropriated Capital Used	$ 660,995	$ 621,747
Revenue from Sales of Goods and Services:		
To the Public	5,108	1,455
Intragovernmental	35,688	33,635
Total Revenue and Financing Sources	**$ 701,791**	**$ 656,837**
EXPENSES:		
Program or Operating Expenses		
Science, Aeronautics, and Technology	$ 389,861	$ 363,811
Human Spaceflight	64,711	58,278
Mission Support	204,639	196,982
Research and Development	0	383
Construction of Facilities	1,784	2,287
Reimbursable Expenses	40,796	35,090
Total Expenses	**$ 701,791**	**$ 656,831**
Excess (Shortage) of Revenue and Financing Sources over Total Expenses	$ –	$ 6
Nonoperating Changes:		
Unexpended Appropriations	38,846	18,616
Invested Capital	4,595	(93,061)
Future Funding Requirements	(906)	(357)
Total Nonoperating Changes	**$ 42,535**	**$ (74,802)**
Excess (Shortage) of Revenue and Financing Sources over Total Expenses and Nonoperating Changes	42,535	(74,796)
Net Position, Beginning Balance	**1,021,253**	**1,096,049**
Net Position, Ending Balance	**$ 1,063,788**	**$ 1,021,253**

Statement of Net Cost (unaudited)

FOR THE FISCAL YEAR ENDED September 30 (IN THOUSANDS)

PROGRAM/OPERATING EXPENSES BY ENTERPRISE:		
Aerospace Technology:		
Aeronautics Research and Technology	$	224,409
Space Access, Research, and Technology		3,586
Commercial Programs		15,007
Research and Development		121,617
Total Aeronautics and Space Technology		364,619
Human Exploration and Development of Space:		
Space Shuttle		2,584
Space Station		71,921
Life and Microgravity		57,144
U.S./Russian Cooperative		–
Payload Utilization and Operations		483
Investments and Support		88
Total Human Exploration and Development of Space		132,222
Space Science:		
Space Science		103,151
Planetary Exploration		5,394
Total Space Science		108,546
Earth Science:		
Mission to Planet Earth		34,256
Total Earth Science		34,256
Total Enterprise Program Costs	**$**	**639,641**
COSTS NOT ASSIGNED TO ENTERPRISES:		
Mission Communication Services	$	0
Space Communication Services		0
Academic Programs		0
Other Programs		21,354
Trust Funds		0
Reimbursable Expenses		40,796
Total Costs Not Assigned to Enterprises		**62,150**
Total Program Expenses	**$**	**701,791**
COSTS NOT ASSIGNED TO PROGRAMS:		
Change in Unfunded Expenses	$	0
Depreciation Expense		0
Funded Increases in Capitalized Property & Inventory, Net		0
Total Costs Not Assigned to Programs		**0**
Less: Earned Revenue Not Attributable to Programs		0
Deferred Maintenance		0
Net Cost of Operations	**$**	**701,791**

The accompanying notes are an integral part of these statements.

Notes to the Financial Statements

Note 1. Summary of Significant Accounting Policies

BASIS OF PRESENTATION

These financial statements have been prepared for FY01 to report the financial position and results of operations for Ames Research Center, pursuant to the requirements of the Chief Financial Officers Act of 1990 and the Government Management Reform Act of 1994. These include the Statement of Financial Position and Statement of Operations and Changes in Net Position. Although the statements have been prepared from the books and records of Ames, in accordance with formats prescribed by the Office of Management and Budget (OMB) Bulletin 94-01, the statements are different from the financial reports used to monitor and control budgetary resources that are prepared from the same books and records. The statements should be read with the realization that they are for a component of a sovereign entity, that liabilities not covered by budgetary resources cannot be liquidated without the enactment of an appropriation, and that the payment of all liabilities other than for contracts can be abrogated by the sovereign entity.

REPORTING ENTITY

Ames is one of nine NASA field centers established to aid NASA in its mission to provide for aeronautical and space activities. The Ames Research Center's accounting system, Commitment, Obligation, Accrual, Disbursement (COAD), is a mechanized system that utilizes the single-source data-entry concept to reduce redundancy of data entry. Multiple transactions are entered into the system simultaneously by utilizing a coding structure that allows the system to generate files to be downloaded to the appropriate general ledger accounts. The system provides payroll accounting for approximately 1500 civilian employees and processes approximately 40,000 nonpayroll-related accounting transactions monthly. These are used to update the Financial and Contractual Status (FACS) report and the General Ledger. These data provide the basic information necessary to meet internal and external financial reporting requirements and provide both funds control and accountability. Ames utilizes fund accounting for control purposes in accordance with Generally Accepted Accounting Principles and Standards established by the General Accounting Office (GAO) and the OMB. A fund is a fiscal and accounting entity with a self-balancing set of accounts recording financial resources together with all related liabilities and fund balances for the purpose of attaining established objectives. Funds are made available for withdrawal from the U.S. Treasury through Congressional appropriation acts.

BASIS OF ACCOUNTING

Transactions are recorded on an accrual accounting basis and a budgetary basis. Under the accrual method, revenue is recognized when earned and expenses are recognized when a liability is incurred, without regard to receipt or payment of cash. Budgetary accounting facilitates compliance with legal constraints and controls over the use of Federal funds.

REVENUE AND OTHER FINANCING SOURCES

Ames receives most of its funding through multiyear appropriations. For Program Year (PY) 1994 and prior, these include three-year and no-year appropriations for Construction of Facilities (C of F), two-year appropriations for Research and Development (R & D) and Spaceflight Control and Data Communications (SFCDC), and a single-year appropriation for Research and Program Management (R & PM). Because of the appropriation restructure, three new appropriations were established in

PY 1995: Science, Aeronautics, and Technology (SAT); Human Spaceflight (HSF); and Mission Support (MS). In addition to appropriated funds, the Center performs services for other Federal agencies and the public and receives reimbursable funding. Appropriations are recognized as revenue at the time the related program or administrative expenses are incurred. Other revenue is recognized when earned (i.e., goods have been delivered or services rendered).

FUNDS WITH THE U.S. TREASURY AND CASH

Ames does not have disbursing authority and does not maintain cash in commercial bank accounts. Cash receipts and disbursements are processed by the U.S. Treasury. Funds with the U.S. Treasury include appropriated funds and deposit funds received from the public as advance payments for reimbursable services.

ADVANCES

Advances include travel advances, cash grants, and letters of credit. Ames funds most of its University Contracts and Grants programs through the use of a letter-of-credit system and the automated clearinghouse. Quarterly financial reporting of cash transactions is provided by recipients, showing both cash requirements and cash transactions on Standard Form (SF) 272s. Detailed monitoring and accountability records are maintained. Monitoring includes audits by the Defense Contract Audit Agency (DCAA) and NASA's Office of Inspector General (OIG).

ACCOUNTS RECEIVABLE

Ames provides accounting for substantial amounts of receivables for services provided to the public and other Government agencies. The largest portion of these is performed for other Federal agencies and includes aeronautical research and technology as well as research operation support. Non-Government customers are required to provide advance payments, which are placed on deposit with the U.S. Treasury until services are performed.

OPERATING MATERIALS AND SUPPLIES

Ames' inventory of Operating Materials and Supplies is composed of the following categories: (a) stores stock, which is material that is repetitively procured, stored, and issued on the basis of recurring demand; and (b) standby stock, which is material held for emergencies. Operating Materials and Supplies are stated at cost and charged, as used, on a moving average basis.

EQUIPMENT

Equipment with a unit cost of $100,000 or more, that has a useful life of two years or more, is capitalized. Equipment with a cost of less than $100,000, that has a useful life of less than two years, is expensed as current-year costs. The value of Property, Plant, and Equipment (PP&E) on the financial statements includes unit cost, transportation charges, installation charges, handling costs, storage costs and all other costs incurred to bring PP&E to a form and location suitable for its intended use. NASA depreciates PP&E on a straight-line basis. Depreciation is done at the Agency level; our statements do not reflect depreciation. The use of NASA facilities and equipment is included in charges to non-Government reimbursable customers.

CONTRACTOR-HELD PROPERTY

Government-owned, contractor-held property includes real property such as land, building and structures, inventories, plant equipment, Agency-peculiar property, special tooling, and special test

equipment. Contractors, in accordance with Federal Acquisition Regulations, maintain control and accountability of such property, and Ames is precluded from maintaining duplicate records of these assets. Contractors are directed to report, annually, plant equipment that costs $100,000 or more, and that has a useful life of two years or more. NASA depreciates PP&E on a straight-line basis. Depreciation is done at the Agency level; our statements do not reflect depreciation. Contractors are also required to submit depreciation and inactive asset data in supplemental forms that accompany NASA Form 1018.

REAL PROPERTY

Real Property includes land, buildings, other structures and facilities, and leasehold improvements when the cost of acquiring and improving the asset is $100,000 or more. Land is valued at acquisition cost, which, for the most part, may not reflect actual value. Buildings are also valued at cost, including the cost of capital improvements and fixed equipment required for functional use of the facility. NASA depreciates buildings, other structures and facilities, and leasehold improvements on a straight-line basis. Depreciation is done at the Agency level, and our statements do not reflect depreciation. Ames' real property in the hands of contractors is also reported and combined for reporting purposes with Ames-held real property, based on contractor reporting on NASA Form 1018.

During fiscal year (FY) 2001, we performed a thorough review of real property records and transactions to ensure that the NASA Real Property Inventory (NRPI) was correct. We had adjusted the balances as of the end of FY 2000, based on a limited review of real property, after learning at that time that a number of transactions that occurred in FY 2000 and prior, had not been recorded in the NRPI. The FY 2001 real property balance is approximately $158 million higher than that reported in FY 2000. This was primarily because the reported FY 2000 balances had been reduced as a result of our decision to exclude certain real property assets, some of whose records, because of time limitations, we were unable to review thoroughly. Now that we have performed a thorough review of real property records and transactions, we are able to report the full amount of Real Property as shown in the NRPI.

We have also improved Ames' internal controls over reporting of real property to ensure that it is reported in accordance with NASA and Federal accounting requirements. As part of this effort, we have enhanced existing procedures to validate amounts being capitalized, and to detect omissions in the property reporting process.

LIABILITIES

Accounts payable includes amounts recorded for receipt of goods or services furnished to the Agency, based on receiving reports, billings rendered, cost reports (i.e., NASA Form 533, Contractor Financial Management Report; Standard Form 272, Federal Cash Transactions Report) that provide the estimated contractor and grantee unbilled and unreported cost, and estimated amounts for utilities and payroll.

ANNUAL, SICK, AND OTHER LEAVE

Annual leave is accrued at the beginning of each calendar year and the accrual is reduced as leave is taken. At least once per year, the balance in the accrued annual leave account is adjusted to reflect current pay rates of cumulative annual leave earned but not taken. Sick and other types of leave are expensed as taken.

Note 2. Fund Balances with Treasury (In Thousands)

Fund Balances:	Obligated	Unobligated Available	Unobligated Restricted	Fund Balance
Appropriated Funds	$ 298,305	$ 29,888	$ 2,145	$ 330,338
Suspense/Clearing Accounts				(1,079)
Total Fund Balance with Treasury				$ 329,259

Note 3. Accounts Receivable (In Thousands)

	Entity Accounts Receivable	Nonentity Accounts Receivable	Allowance for Uncollectible Receivables	Net Amount Due
Intragovernmental	$ 12,901	$ 0	$ 0	$ 12,901
Governmental	$ 158	$ 69	$ 0	$ 227
Total Accounts Receivable	$ 13,059	$ 69	$ 0	$ 13,128

Note 4. Operating Materials and Supplies, Net (In Thousands)

	2001	2000	Valuation Method
Stores Stock	$ 710	$ 866	Weighted Avg.
Total	$ 710	$ 866	

Note 5. Property, Plant, and Equipment, NeT (In Thousands)

Government Owned/Government Held:	2001	2000
Land	$ 6,863	$ 6,863
Structures, Facilities, & Leasehold Improvements	$ 754,780	$ 584,877
Equipment	$ 251,668	$ 256,585
Assets Under Capital Lease	$ 0	$ 12,508
Construction in Progress	$ 0	$ 0
Total	$ 1,013,311	$ 860,833
Government Owned/Contractor Held:		
Equipment	$ 899	$ 2,257
Special Tooling	$ 0	$ 0
Special Test Equipment	$ 0	$ 0
Space Hardware	$ 12,660	$ 13,518
Construction in Progress	$ 29,731	$ 19,481
Total	$ 43,290	$ 35,256
Total Property, Plant, and Equipment	$ 1,056,601	$ 896,089

Note 6. Other Assets (In Thousands)

	2001	2000
Contractor-Held Materials	$ 8,696	$ 10,227
Total	$ 8,696	$ 10,227

Note 7. Other Liabilities (In Thousands)

Liabilities Covered by Budgetary Resources:

	Current	Non-Current	Total
Intragovernmental Liabilities:			
*Liability for Deposit and Suspense Funds	$ (305)	$ 0	$ (305)
Total	$ (305)	$ 0	$ (305)
Governmental Liabilities:			
Accrued Funded Payroll and Benefits	$ 7,678	$ 0	$ 7,678
*Liability for Deposit and Suspense Funds	$ 0	$ 0	$ 0
Total	$ 7,678	$ 0	$ 7,678

Liabilities Not Covered by Budgetary Resources:

	Current	Non-Current	Total
Governmental Liabilities:			
Accounts Payable for Closed Appropriations	$ 0	$ 2,081	$ 2,081
Unfunded Annual Leave	–	10,455	10,455
Contingent Liabilities	–	–	–
Total	$ 0	$ 12,536	$ 12,536

**Liabilities include cash advances received from other Government agencies and public reimbursable customers. Also included are funds on deposit with the U.S. Treasury for employees' savings bonds and state tax withholdings.*

Note 8. Net Position (In Thousands)

	Appropriated Funds
Unexpended Appropriations	
Undelivered	$ 141,757
Unobligated:	
Available	$ 4,377
Restricted	$ 27,656
Total	$ 173,790
Invested Capital	$ 1,064,678
Cumulative Results	$ 0
Future Funding Requirements	$ (12,442)
Total	$ 1,226,026

Ames Points of Contact

Name	Phone*	Mail Stop	E-mail address
INFORMATION TECHNOLOGY			
Steven F. Zornetzer	4-2800	200-6	szornetzer@mail.arc.nasa.gov
AVIATION OPERATIONS SYSTEMS			
Robert A. Jacobsen	4-3743	262-5	rjacobsen@mail.arc.nasa.gov
ASTROBIOLOGY			
David Morrison	4-5094	200-7	dmorrison@mail.arc.nasa.gov
ASTROBIOLOGY INSTITUTE			
Baruch Blumberg	4-6224	240-1	bblumberg@mail.arc.nasa.gov
ASSOCIATE CENTER DIRECTOR FOR AEROSPACE PROGRAMS			
Victor Lebacqz	4-5792	200-5	vlebacqz@mail.arc.nasa.gov
AEROSPACE OPERATIONS SYSTEMS R&T BASE			
Robert A. Jacobsen	4-3743	262-5	rjacobsen@mail.arc.nasa.gov
AVIATION SYSTEM CAPACITY			
Robert A. Jacobsen	4-3743	262-5	rjacobsen@mail.arc.nasa.gov
INFORMATION TECHNOLOGY R&T BASE			
Eugene L. Tu	4-4486	258-2	eltu@mail.arc.nasa.gov
ROTORCRAFT R&T BASE			
John J. Coy	4-3122	207-1	jcoy@mail.arc.nasa.gov
FUNDAMENTAL BIOLOGY			
Maurice M. Averner	4-2451	19-20	maverner@mail.arc.nasa.gov
HIGH-PERFORMANCE COMPUTING AND COMMUNICATIONS			
Eugene L. Tu	4-4486	258-2	eltu@mail.arc.nasa.gov
CONSOLIDATED SUPERCOMPUTING MANAGEMENT OFFICE (COSMO)			
Robert Shiner	4-0257	243-1	rshiner@arc.nasa.gov
INFORMATION TECHNOLOGY SECURITY (ITS)			
Scott S. Santiago	5-5015	233-17	ssantiago@mail.arc.nasa.govSOFIA
SOFIA			
Clifford C. Imprescia	4-5195	200-10	cimprescia@mail.arc.nasa.gov
SIMULATION FACILITY GROUP			
Robert J. Shiner	4-0257	243-1	rshiner@mail.arc.nasa.gov

**If calling from outside ARC, each phone number is preceded by area code and prefix. (for example, (650) 604-1234).*

Name	Phone*	Mail Stop	E-mail address
Ames Institutional Systems			
ACQUISITION/PROCUREMENT			
Charles W. Duff II	4-5820	241-1	cduff@mail.arc.nasa.gov
CHIEF INFORMATION OFFICER (CIO)			
Scott S. Santiago	4-5015	233-17	ssantiago@mail.arc.nasa.gov
COMMERCIALIZATION & TECHNOLOGY TRANSFER			
Carolina M. Blake	4-0893	202A-3	cblake@mail.arc.nasa.gov
DOCUMENTATION DEVELOPMENT			
Karen D. Thompson	4-5979	241-12	dkthompson@mail.arc.nasa.gov
EQUAL EMPLOYMENT OPPORTUNITY			
Adriana Cardenas	4-6510	241-7	acardenas@mail.arc.nasa.gov
EXTERNAL AFFAIRS/EDUCATION			
David R. Morse	4-4724	204-2	dmorse@mail.arc.nasa.gov
FACILITIES & LOGISTICS MANAGEMENT			
George J. Sabolish	4-2312	19-14	gsabolish@mail.arc.nasa.gov
FINANCIAL MANAGEMENT			
Philip R. Fluegemann	4-5302	203-10	pfluegemann@mail.arc.nasa.gov
HUMAN RESOURCES			
Dennis Cunningham	4-5613	241-9	dcunningham@mail.arc.nasa.gov
OFFICE OF CHIEF LEGAL COUNSEL			
Sally O. Mauldin	4-2181	19-40	smauldin@mail.arc.nasa.gov
AERONAUTICS AND SPACEFLIGHT HARDWARE DEVELOPMENT			
Gerald M. Mulenburg	4-5366	213-14	gmulenburg@mail.arc.nasa.gov
PROTECTIVE SERVICES			
Robert J. Dolci	4-5214	15-1	bdolci@mail.arc.nasa.gov
SAFETY, ENVIRONMENTAL, AND MISSION ASSURANCE			
Laura W. Doty	4-3340	218-6	ldoty@mail.arc.nasa.gov
SYSTEMS ENGINEERING			
Ron Mancini	4-6319	213-1	rmancini@mail.arc.nasa.gov
Other			
ARC EXCHANGE COUNCIL			
Lynda L. Haines	4-5151	262-1	lhaines@mail.arc.nasa.gov
MULTICULTURAL LEADERSHIP COUNCIL			
David R. Morse	4-4724	204-12	dmorse@mail.arc.nasa.gov
Sheila A. Johnson	4-5054	204-12	sajohnson@mail.arc.nasa.gov

Key Personnel

Henry McDonald
Director

Nancy F. Bingham
Deputy Director (Acting)

G.Scott Hubbard
Associate Director for Astrobiology and Space Programs

Victor Lebacqz
Associate Director for Aerospace Programs

Lewis S. G. Braxton III
Chief Financial Officer

Lynda Haines
Associate Director for Systems Management and Planning (Acting)

Adriana Cardenas
Chief Equal Opportunities Program Office

Alexander W. Dunlap
Chief Veterinary Officer

Stephanie Langhoff
Chief Scientist

Tina Panontin
Chief Engineer

Carolina M. Blake
Chief, Commercial Technology Office

Sally O. Mauldin
Chief Counsel, Office of the Chief Counsel

Michael L. Marlaire
Assistant Director for Development

Steve F. Zornetzer
Director of Information Sciences and Technology

L. S. Fletcher
Director of Aerospace

Estelle Condon
Director of Astrobiology and Space

Thomas J. Moyles
Director of Center Operations

George Kidwell
Director of Research and Development Services (Acting)

Laura W. Doty
Director of Safety, Environmental, and Mission Assurance

INQUIRIES

FINANCIAL MANAGEMENT DIVISION
Mail-Stop 203-10
Moffett Field, CA 94035-1000
(650) 604-0638 FAX

RESOURCES MANAGEMENT OFFICE
Mail-Stop 237-9
Moffett Field, CA 94035-1000
(650) 604-1004 FAX

DEVELOPMENT AND COMMUNICATION OFFICE
Mail-Stop 204-2
Moffett Field, CA 94035-1000
(650) 604-3953 FAX

COMMERCIAL TECHNOLOGY OFFICE
Mail-Stop 202A-3
Moffett Field, CA 94035-1000
(650) 604-1592 FAX

WEB SITES

NASA
http://www.nasa.gov

AMES RESEARCH CENTER
http://www.arc.nasa.gov

OFFICE OF THE CHIEF FINANCIAL OFFICER
http://cfo.arc.nasa.gov

Notes

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