I am honored and delighted to be here at Iowa State University. Since arriving in July 2003, I’ve learned a great deal about the department’s rich history in aerospace engineering and engineering mechanics. This history includes an impressive list of research accomplishments and an amazing number of distinguished alumni.

It’s been the dedicated work of faculty, staff, and students, both in the classroom and in the labs, that has made these accomplishments possible.

We are building on this history as we strive to reach new levels of achievement. The following pages provide details about our many activities and accomplishments, but first I would like to share some of the highlights.

In research, the department’s well-established strengths in nondestructive evaluation (NDE), computational fluid dynamics (CFD), computational and experimental solid mechanics, guidance and control, and wind engineering will continue to evolve. Wind engineering, for example, has received much public attention due to the completion of two one-of-a-kind tools, the world’s largest research tornado simulator and a wind tunnel. This research area encompasses both wind engineering and experimental aerodynamics. In recent years, four new focus areas—aircraft icing, gas turbine science and technology, rotorcraft and uninhabited/micro aerial vehicles, and micro and nano mechanics—have emerged as we’ve grouped together faculty with related research interests.

We take great pride in the Space Systems Operations Laboratory sponsored by the Iowa Space Grant Consortium because it provides students at all levels, freshmen through seniors, an opportunity to explore their interests and develop their skills working on projects outside the classroom. We are expanding this concept by creating open undergraduate research laboratories in computations and experiments. Students will be able to use these two labs to work on problems that cut across departments and colleges.

Endowed and named professorships provide a tremendous resource for recruiting and retaining top-quality faculty members. This past year, alumnus Roger Hanson established the Martin C. Jischke Professor of Aerospace Engineering to honor the former ISU president and current Purdue University president, Martin Jischke. And Lockheed Martin established the Vance Coffman Endowed Chair of Aerospace Engineering to honor the retirement of their CEO and chairman of the board. Vance Coffman earned his BS at Iowa State in aerospace engineering in 1967.

On faculty news, both of our department’s untenured assistant professors hold NSF Career Awards. These prestigious awards help young faculty get their research careers off to a good start. We are also very proud of Bruce Thompson, distinguished professor and director of our NDE Center, who was inducted into the National Academy of Engineering in 2003.

In addition, three new faculty members have joined us. Hui Hu, an experimental fluid dynamicist and an expert in diagnostics development, arrived in August 2004, and Z. J. Wang, an expert in CFD, came in January 2005. Paul Durbin, a visiting professor this semester and an internationally renowned researcher in mathematical modeling of turbulence, will hold the Martin C. Jischke Professorship in Aerospace Engineering beginning in August 2005.

Lastly, I’d like to give special mention to our alumni. Over the years, we’ve had the privilege of educating many excellent students who’ve gone on to make tremendous contributions to the aerospace industry. On April 18, 2004, we inducted the first five honorees into our Hall of Distinguished Alumni: John Yardley, former senior vice president of McDonnell Douglas and a pioneer of our country’s early space program; T. A. Wilson, former CEO of Boeing; Art Bryson, former professor and chair of aeronautics and astronautics at Stanford University and one of the founders of applied optimal control; Vance Coffman, chairman of the board and CEO of Lockheed Martin; and Kevin Petersen, director of NASA Dryden.

All of these achievements have been possible because of our dedicated faculty and staff, our hard-working students, and our loyal and energetic alumni. I appreciate the many ways each of you have made my transition here very rewarding, and I look forward to continuing our tradition of excellence.

Tom I-P. Shih
Professor and Chair
Welcome to Dean Kushner


Kushner came to Iowa State from the University of Illinois at Urbana-Champaign, where he had served in various engineering roles including assistant dean of academic programs, interim associate dean of administrative affairs, and interim head of electrical and computer engineering and chemical and biomolecular engineering. He is an internationally renowned researcher in the study of plasma, laser physics, and spectroscopy.

In 2003–2004, 7 PhD and 14 MS degrees were awarded and research expenditure was $4,467,231.

Cover Photo

Completed in 1999 at a cost of $31 million, Helen and Stanley Howe Hall is the home of the Department of Aerospace Engineering at Iowa State University. The building is equipped with state-of-the-art teaching and research facilities. A 1946 engineering alumnus, Stanley Howe is chairman emeritus of HNI Corporation (formerly HON Industries).
Aerospace engineering relies heavily on nondestructive evaluation (NDE) technologies to ensure the safety and reliability of materials and structures used in aerospace vehicles and propulsion systems. Using NDE technologies, such as ultrasonics or x-rays, engineers can assess the physical condition of a wing or propeller, for example, without invasive action that could weaken the part.

Iowa State’s NDE research began in 1980 when the U.S. Air Force funded a program to develop more quantitative NDE measurement methods for aircraft inspection. In 1984, the Center for Nondestructive Evaluation (CNDE) was formed as a National Science Foundation Industry/University Cooperative Research Center.

CNDE is a leader in developing a new generation of NDE measurement techniques and computer-based engineering tools. While these techniques and tools are commonly used in aviation and space industries, they’re also being used in the energy industry to determine the integrity of critical structures like nuclear waste storage tanks and pipelines and for manufacturing and agricultural machinery.

The U.S. Air Force, Federal Aviation Administration, and NASA have had on-going collaboration with CNDE as they’ve worked to address major challenges faced by the aerospace industry.

In June 2004, CNDE won a $6.5-million contract to research NDE techniques for assessing the dependability and safety of the military aircraft fleet as it ages. The research involves improving NDE techniques and using computer simulations to determine how much of the life of critical components, such as the jet engines, remains.

Another program is focused on inspection technology directed at advanced materials and sensors that could be used to continuously monitor the condition of future space vehicles and take corrective action when a problem occurs.

R. Bruce Thompson is CNDE director and Lisa J. H. Brasche is associate director. Brasche is also program manager for the FAA Center for Aviation Systems Reliability and the Engine Titanium Consortium, which provide leadership in the inspection of aircraft and propulsion systems for military and commercial aircraft.

Visit www.cnde.iastate.edu for more information.

Thompson is member of elite group

R. Bruce Thompson, distinguished professor of engineering in two disciplines—aerospace engineering and materials science and engineering—was elected to the National Academy of Engineering (NAE) in 2003.

Election to NAE is considered one of the highest professional distinctions accorded an engineer. Thompson, who is also director of Iowa State’s Center for Nondestructive Evaluation and a senior scientist with the U.S. Department of Energy’s Ames Laboratory, has made outstanding contributions to nondestructive evaluation, materials processing, life-cycle management, and the development of novel ultrasonic technology. He’s also developed improved computer tools for simulating the results of the inspections so the information can be considered in managing the service life of structures.

Thompson emphasizes the interdisciplinary nature of NDE with contributions and support coming from many fields including physics, materials, mechanics, electrical engineering, and statistics.

Thompson is the second AerE faculty member to receive this NAE recognition. He joins Distinguished Professor Emeritus Donald Thompson, who was elected in 1991.
Tannehill receives top college research award

**John C. Tannehill**, professor of aerospace engineering and manager of the Computational Fluid Dynamics Center, received the College of Engineering 2004 Boylan Eminent Faculty Award.

With expertise in algorithm development, Tannehill has developed highly efficient and accurate numerical methods and codes for computing fluid flows in subsonic, supersonic, and hypersonic regimes. Recognized as the world’s foremost expert on parabolized Navier-Stokes methods and their application in developing and evaluating high-speed aircraft and space-launch vehicles, Tannehill has been actively involved with NASA in developing CFD computer codes for many projects including the Space Shuttle, National Aerospace Plane, and the High-Speed Civil Transport.

Tannehill has played a key role in building Iowa State’s international reputation as a leader in CFD research and teaching. He helped design and implement the first CFD courses in 1972 and co-authored the first comprehensive CFD textbook, which is used by over 100 institutions around the world. When NASA sought proposals for development of national CFD centers in 1980, Tannehill was co-principal investigator of the proposal that won the center for Iowa State, and he has served as manager since its formal establishment.

Iowa State’s CFD research program began in the mid-60s with an initial focus on the development of new algorithms to solve the governing equations of fluid dynamics. In 1980, the National Aeronautics and Space Administration (NASA) selected Iowa State University and the College of Engineering as the site for one of seven U.S. centers of excellence in CFD. Aerospace Engineering Professor **John C. Tannehill** has managed the CFD Center since its formal establishment in 1984.

In the last 25 years, the development of high-speed computers and new algorithms for analysis has led to remarkable gains in CFD. Computations that would have taken computers of the 1970s years to perform take today’s machines just seconds. CFD has greatly reduced the need for expensive and time-consuming experimental analyses and model tests.

As the science of CFD has matured, research at Iowa State has become more applied and is currently being conducted for a variety of agencies including NASA, the National Science Foundation, the Department of Defense, and the Department of Energy, as well as for private industry.

Visit [www.me.iastate.edu/cfcdc](http://www.me.iastate.edu/cfcdc) for more information.
A Wind Engineering and Experimental Aerodynamics

Aerospace Engineering: Partha P. Sarkar, Fred L. Haan, Hui Hu; Geological and Atmospheric Sciences: William A. Gallus

Wind is a devastating force. Each year in the United States, an average of $6.3 billion in financial losses is caused by tornados, thunderstorm outflows, frontal winds, and hurricanes.

The Wind Engineering and Experimental Aerodynamics (WEEA) Program at Iowa State, with sponsored funding from the National Science Foundation, focuses on the study of wind and its impact on structures and the environment. Researchers are attempting to understand the damaging effects of extreme winds with the purpose of determining ways to reduce or prevent damage. While high winds are recognized for the severe damage they cause, even low-to-moderate winds below 30 mph can cause problems. These include such things as large-scale vibrations of bridge stay-cables, large oscillations of traffic signals and light poles, unwanted air pollution dispersion patterns, or decreases in building ventilation efficiency.

To aid in the study of wind and how to mitigate its detrimental effects, WEEA has built a world-class Wind Simulation and Testing Laboratory. The lab, equipped with the latest instrumentation for conducting research, education, and outreach, houses two one-of-a-kind facilities.

The tornado and microburst simulator, which was completed in March 2004, has a translating microburst-like jet that's six feet in diameter and a tornado-like vortex that's four feet in diameter. The tornado can move in a path similar to real tornados, passing over models of structures on a 20-by-45-foot ground plane. This facility enables researchers to more accurately simulate what happens when a twister hits a building.

An eight-by-six-foot wind tunnel capable of generating wind gusts up to 110 mph was recently completed for aerodynamic and atmospheric boundary layer simulation and testing. A smooth flow of wind at high speed can be generated at one end while special devices are used to create very turbulent wind at the other end. Researchers will be able to measure what happens when wind hits a house or goes through trees or when an unmanned aerial vehicle flies through turbulent wind.

With these facilities, WEEA is able to investigate basic aerodynamic problems as they relate to aerospace, agriculture, environment, sports, transportation, and wind energy. Investigating the complexities of these issues is a multidisciplinary endeavor. As part of the aerospace engineering, WEEA has a wealth of resources to draw from in aerodynamics, vibrations, aeroelasticity, computational fluid dynamics, nondestructive testing, composite structures, and solid, fluid, experimental, and computational mechanics. In addition, researchers work with scientists from environmental and atmospheric sciences, statistics, and architecture.

Another unique aspect of WEEA is the development of a design and testing environment (DTE) that will facilitate interaction among researchers, students, and industry representatives leading to novel concepts in wind-resistant aerodynamic design. The versatility of the DTE concept allows each person—from elementary school student to college honors student to professional engineer—to participate at a level appropriate to their education and experience.

Participants will be able to develop and test their design concepts experimentally with both the simulator and computer simulation. The scope of the testing process will facilitate validation and improvement of the computation tools being used. Eventually the information will become part of a Web-based aerodynamic loads database that can be accessed and used on projects in a variety of locations.

Visit www.aere.iastate.edu/wind/facilities.htm for more information.
Guidance and Control (G&C) has become a significant integral part of aerospace systems today and continues to gain prominence. More than 50% of the costs of today’s aerospace vehicles are in avionics, much of it G&C related. Whether dealing with unmanned aerial vehicles or robotic or human exploration of space, intelligent and autonomous operations are the name of the game. In this context, the guidance system is the “brain” of the vehicle that decides what to do, and the control system is the “muscle” that executes the commands.

G&C encompasses advanced control theory, flight mechanics/dynamics, numerical algorithms, optimization, real-time computation, and avionics. With an established reputation in guidance, control, and trajectory optimization of aerospace vehicles, Iowa State faculty have been actively involved in research on G&C of the X-33 Advanced Technology Demonstrator, 2nd-generation Reusable Launch Vehicles (RLVs), Orbital Space Plane, and Common Aero Vehicle. These projects have been funded by NASA, the Air Force, and the aerospace industry.

Entry guidance of spacecraft and RLVs is a current G&C focus area. Stringent constraints in thermal protection, vehicle loads, system integrity, and landing requirements define a narrow corridor that the vehicle must stay within to accurately guide itself to the landing site. The extreme environment during atmospheric entry was demonstrated all too well by the Space Shuttle Columbia tragedy. The critical issue in entry guidance is to have a well-designed reference trajectory that is flyable and satisfies all the constraints. Due to the complexity of the process and the capabilities of the technology, this trajectory has traditionally been planned on the ground prior to the mission. The result is a very limited ability to adapt to changes in conditions or systems failure.

In 2001, under what was NASA’s Space Launch Initiative Program, Iowa State researchers made a concentrated effort to develop an on-board entry trajectory planning capability for design in real time of entry trajectories based on the current flight condition, landing site coordinates, and trajectory constraints. An innovative approach utilizing the quasi-equilibrium glide condition emerged. In 2004, the NASA Marshall Space Flight Center declared this algorithm the leader among five competing advanced entry guidance algorithms and certified it Technology Readiness Level 4.

Another G&C focus area is ascent guidance of launch vehicles. Current technology uses open-loop guidance during the atmospheric portion of the ascent flight. This is a time-consuming and labor-intensive process. National defense and security needs have generated strong interests in the ability to send payloads into space on very short notice. Researchers here are developing closed-loop endo-atmospheric ascent guidance technology. The idea is to repeatedly compute the optimal ascent trajectory as the launch vehicle climbs, using the current condition as the initial condition. In this fashion, the guidance commands are dependent on the flight condition, thus are closed loop in essence. Such a capability could eliminate the need for extensive pre-mission planning and therefore dramatically shorten pre-launch guidance preparation. In addition, it would significantly reduce the recurring costs associated with ascent guidance and offer a much desired fault-tolerance ability for both civil and military launches.

The technical challenges are formidable. The central issues boil down to how to reliably solve a highly sensitive multivariate nonlinear two-point-boundary-value problem in real time. Iowa State researchers have developed an algorithm based on the classical finite-difference method with modifications specially tailored to the ascent guidance problem and have demonstrated that it is well within the capability of today’s flight computers. Currently faculty and students are working to develop a novel fixed-point algorithmic framework. This would lead to extreme software simplicity and enhanced robustness of the algorithm, both of which are essential for on-board applications.
Ice formation on aircraft is a serious safety concern and is currently listed on the National Transportation Safety Board’s “Most Wanted Transportation Safety Improvements” list for aviation. A significant buildup of ice on an airplane’s surfaces can alter aerodynamic performance to the point where the airplane can’t be controlled.

Icing occurs when an aircraft flies through a cloud of super-cooled water droplets that are in a liquid state at less than 32 degrees Fahrenheit. These droplets freeze when they hit the aircraft’s exposed surfaces. A multitude of factors, including the wing’s geometry, the ambient temperature, and the size of droplets in the cloud all affect how fast and where ice accumulates and the shapes it forms. The ice accumulation and shape, in turn, determine how the aerodynamics and overall performance of the aircraft are affected.

Formed in 1998, the Aircraft Icing Program at Iowa State studies the interaction of aerospace vehicles and their surrounding environment. In collaboration with the Icing Branch at the NASA Glenn Research Center, Iowa State researchers are addressing a variety of physical, modeling, and computational issues associated with simulating ice accretion on aircraft surfaces. The goal is to develop specialized modeling and simulation techniques, helping researchers to better understand and predict ice accumulation.

In recent years, the aerospace vehicle environment (AVE) group has concentrated on the development of computational fluid dynamics (CFD) methods and physical models for aircraft icing. CFD grid generation has focused on the creation of single- and multiple-block-structured grids for rime and glaze icing applications, including complex ice shapes such as shown in Figure 1. This enables researchers to more accurately predict the aerodynamic flow about these complex shapes, the effects that these shapes have on the forces and moments acting on the wing, as well as the local flow conditions required to predict the actual ice growth at the surface.

Single-block grids are constructed by using a novel technique that confines roughness to a small region about the ice. Multiple-block-structured grids incorporate wrap-around grids about the ice surface as well as zonal adjustment regions, which maintain good grid quality near the ice surface as well as approaching the free stream.

The AVE group is also engaged in multi-phase flow physics research focusing on development of surface film and surface icing models. Typical issues being studied are the formation and runback of water beads past smooth and rough surfaces; the creation of rivulets and the flow of rivulets through roughness fields; boundary layer formulation of subsonic and transonic icing; aerodynamic transition and vortex shedding from roughness elements located near airfoil leading edges; stagnation-point development of water films, beads, and rivulets; instabilities of an ice surface leading to roughness formation; the nonlinear multi-time scale coupling of air, water, and ice; and the development of droplets along their trajectories and their subsequent impact onto the ice surface.

Fig. 1. Predicted Mach number and flow pattern about a glaze ice shape.

Another aspect of the group’s work addresses the feasibility of using a quasi-three-dimensional aerodynamic simulation to predict the behavior of ice accretion on three-dimensional swept and unswept wings. Two-dimensional icing codes have limited ability to predict what happens on three-dimensional wings. However, three-dimensional codes are computationally time consuming and much more expensive than two-dimensional codes. A quasi-three-dimensional approach provides an intermediate level of complexity and functionality.

Three AVE graduate students have received notable awards. Wade Huebsch and Brian Matheis were awarded NASA Graduate Student Research Program training grants in 1997 and 2001, respectively. Oscar Murillo is spending his summers at NASA Dryden Research Center as part of a fellowship he won from the National GEM Consortium for Graduate Degrees for Minorities in Engineering and Science.

The Iowa State AVE research group is part of the Aircraft Icing Project Team that received a NASA Turning Goals into Reality Award in 2001. Other institutions on the team include the Air Line Pilots Association, Dynacs Inc., the Federal Aviation Administration, InDyne Inc., Massachusetts Institute of Technology, the Meteorological Service of Canada, Mississippi State University, NASA Ames, NASA Glenn, the National Center for Atmospheric Research, National Research Council of Canada, Ohio Aerospace Institute, the Ohio State University, the University of Illinois at Urbana-Champaign, the University of Oregon, the U.S. Army, and Wichita State University.

Visit www.aere.iastate.edu/ave for more information.
Helicopters won military fame for their versatility during the Korean War. The ability to take off and land in small areas, hover, and get to remote areas in the rugged Korean terrain made them the ideal vehicle for bringing injured soldiers to MASH units, transporting and evacuating troops, and delivering supplies.

Today helicopters are used extensively for both military and civilian purposes where versatility and speed are critical. The challenge is to continue to extend their unique capabilities to higher levels of performance.

It is the vertical/short take-off and landing (V/STOL) technology that makes helicopters much more versatile than fixed-wing aircraft. It also makes them very complex to design and operate. Most V/STOL aircraft, including helicopters, use a rotor to augment or generate all of the thrust needed to take off or land. In addition, an antitorque device, which is usually another rotor, is required. The aerodynamics of rotors (rotating wings) is an order of magnitude more complicated than a fixed-wing aircraft.

Rotorcraft technology has evolved tremendously over the last 70 years, and that evolution continues today. New techniques and materials have enabled engineers to design quieter, faster, bigger, and more versatile helicopters to meet the 21st-century needs presented by the military for tactical and support missions.

Research at Iowa State focuses on developing computational fluid dynamics (CFD) rotor design tools that simulate the real-world problems encountered as changes are made in design. At the heart of this technology is a simplification in rotor modeling wherein the influence of the rotating blades on the fluid is introduced by adding source terms into the Navier-Stokes equations, which are the primary equations relating momentum and external forces acting on a fluid element.

This simplification led to the development of an efficient computer program that has gained widespread use. It aids in the design of new configurations such as the fantail of the Comanche (RAH-66).

The program has helped engineers analyze operations of existing aircraft such as the tilt-rotor (V-22 Osprey), tandem rotors (Chinook), and new conceptual designs such as the quad-tilt-rotor. Specifically, the tool was used in the investigation of problems with the V-22 relating to the vortex ring state, an uncontrollable descent condition.
As turbines were first used to power fighter planes in the latter part of World War II. Since that time, tremendous progress has been made in turbine science and technology. Today, gas turbines are used to power most aircraft from commercial jumbo jets to the military’s high-tech reconnaissance planes, plus a diverse range of sea and land vehicles.

Turbines are the most effective device for converting wind, water flow, and thermal energy to mechanical or electrical energy. Gas turbines, along with wind and water turbines, are used extensively to produce electricity for the national grid.

While turbine science and technology has come a long way, advances in materials and technologies provide the resources for innovations that will continually improve turbines. Progress is essential in order to meet the ongoing need for reliable and durable aircraft, to ensure the dependability of electrical power even in peak periods, and to reduce consumption of natural resources.

At Iowa State, this research program integrates thermal management with mechanics and materials, with focus on the durability and life of turbine engines. The program encompasses six areas with faculty from several disciplines involved. The areas are: (1) thermal management of gas turbines—Durbin, Hu, Inger, Pletcher, Shih, Tannehill, Wang; (2) materials and mechanics of thermal-barrier coating (TBC) systems—Bastawros, Dayal, Gleeson, Mitra, Rudolph, Sordelet; (3) nondestructive evaluation (NDE) and health monitoring—Thompson, Brasche; (4) system integration and virtual engineering—Bryden, Oliver; (5) controls and sensors—Elia, Salapaka; and (6) gasification and hot-gas clean up—Brown.

Following are some of the major activities and accomplishments.

In NDE, ongoing projects include: (1) a U.S. Air Force Center on Quantitative Inspection Technology for Assessing Military Aircraft that measures residual stresses in engine components to get two to three additional design lives; (2) an FAA Center for Aviation Systems Reliability that addresses life cycle inspection needs for aviation systems from design to production to operation/in-service use; and (3) an Engine Titanium Consortium that provides reliable and cost-effective tools for detecting cracks, inclusions, and imperfections in critical rotating materials and hardware.

In thermal management, researchers work with Pratt and Whitney, Solar Turbines, NASA, the Department of Energy, and university partners to explore and evaluate effective strategies for internal and film cooling of turbine components and endwall and blade contouring designs to minimize surface heat transfer from the hot gases. They are also investigating how the effectiveness of thermal-barrier coatings is impacted by surface roughness caused by erosion, deposition, and spallation.

From a materials standpoint, Iowa State researchers have considerable expertise in developing TBC systems to protect turbine superalloys from high temperatures, gases, and oxidation. Recent developments are an aluminum coating embedded in the superalloy that reduces the weight and a new bond coat material that significantly enhances the life of the TBC system.

Visit www.aere.iastate.edu for more information.
World-class researcher gives turbine center a boost

When the AerE department started looking for a researcher to help establish a Turbine Science and Technology Center at Iowa State University, the faculty went for one of the top scientists in the field. Paul Durbin, on sabbatical from Stanford University, spent time as a visiting professor at Iowa State in 2005, helping to establish the new center.

“Professor Durbin is internationally renowned for his highly original and innovative work in mathematical modeling of turbulence,” says Tom Shih. “He is regarded by many as one of the top scientists in the world in this area.”

Durbin, who earned his PhD at Cambridge University and BSE at Princeton University and was a researcher at NASA Lewis, has been on the Stanford faculty for seven years. With funding from the Office of Naval Research, the National Science Foundation, the Department of Energy, NASA, and GE Aircraft Engines, his research areas include modeling and simulating of turbine cooling, near-wall modeling for non-equilibrium turbulent flows, and algorithms for rapid flow and heat transfer analysis of engineering designs. On the fundamental side, Durbin’s work is in turbulence theory and direct numerical simulation and in transition theory and simulation.

In addition to his work at Iowa State, Durbin will be writing a book while on sabbatical. His recent publications include a book entitled Statistical Theory and Modeling for Turbulent Flow, two chapters in Closure Strategies for Turbulent and Transitional Flows, a chapter in the Encyclopedia of Computational Mechanics, as well as numerous journal articles.

The establishment of the Turbine Science and Technology Center is a collaborative effort, according to Shih. The AerE department, along with the Center for Nondestructive Evaluation, is taking the lead, with support from Tom Barton, director of Ames Lab, and Ted Okiishi, engineering associate dean. Several other engineering departments are also involved.

The center will focus on developing tools to predict the life cycle of engines. “No other school has this niche,” says Shih. “It’s important information for engine companies, airlines, and the U.S. military.”

Alumnus endows professorship in AerE

Roger Hanson of Fullerton, California, has endowed a professorship in aerospace engineering in honor of Martin C. Jischke, Iowa State University president from 1991 to 2000 and the first engineer to serve as Iowa State president.

“I am very pleased to make this commitment to support the aerospace engineering program at Iowa State,” Hanson says. “I am extremely grateful for the education and experience I received and wanted to give something back to the university.”

In accepting the gift in April 2004 at the Marston Club dinner, Dean James Melsa said, “Support from our alumni is key to realizing our vision to be an outstanding college. We are grateful to Roger Hanson for his vision and confidence in our future.”

Hanson earned three of his five college degrees at Iowa State—BS degrees in both mechanical engineering and electrical engineering in 1954 and a doctorate in theoretical and applied mechanics in 1958. He also holds an MS degree in mathematics from the University of Michigan and a law degree from the University of Southern California in 1965. Hanson remains active at Iowa State where he serves as an ISU Foundation governor and Order of the Knoll member. He is also a member of the National Planned Giving Council.
The ability to reconfigure materials at the microstructural level opens up vast opportunities in the microelectronics, micro-fabrications, and biomedical fields. These include everything from stronger and lighter materials for use in aerospace vehicles, improvements in the manufacturing of microchips, and replacement knee and hip joints that don’t wear out. The possibilities are limitless.

First, however, researchers must learn much more about how materials behave at the micro- and nanostructural levels. They know that a nanoparticle behaves differently than a large piece of the material, but they don’t know all of the facts about the physical properties. With the advanced technologies available today, scientists now have the tools to probe and manipulate materials at these very fine scales.

Research at Iowa State is conducted in a state-of-the-art experimental testing facility that’s unique at Iowa State because of the ability to test and analyze structures at a very fine scale. The facility has nano- and micro-indentation and scratch capability, full digital image analysis and finite-deformation measurement systems, and computer-controlled servo-electric universal load frame.

The aerospace engineering micro/nano mechanics of materials group is well integrated with researchers from the U.S. Department of Energy Ames Laboratory, the Center for Nondestructive Evaluation, and the Departments of Materials Science and Engineering and Chemical Engineering to address the multi-facets of this problem at several length scales. The developed insights of the material removal mechanisms, as well as the models for controlling the wafer planarity, have been embraced by Applied Materials Inc. and Strasbaugh Inc. for their new design of CMP tools.

The researchers have diverse research portfolios in the areas of micro- and nano-scale material behavior, size effects in deformation of dense materials, adhesion and friction at the nano-scale, mechanics of porous and cellular materials, mechanics of coatings, interfaces and layered structures, and mechanics of micro- and nano-manufacturing including fine grinding, surface machining, and abrasive wire cutting. The group is internationally known for its development of the boundary element method and its applications. In addition, a fleet of nonlinear finite deformation finite element routines are developed for a variety of materials' responses and structural applications.

Understanding physical properties at the microstructural level is essential to knowing how to process materials and maintain their durability for specific uses. Several Iowa State projects, for example, addresses chemical-mechanical planarization, a process to smooth the rough surface of the silicon wafers used in microchips. If the surface is rough, it can’t be patterned precisely. Very tiny particles are used to plow away the materials to make it smooth. To accomplish this task requires understanding the micromechanisms at this tiny scale.

Undergraduate and graduate students benefit from the expertise in this research group through a variety of mechanics of materials courses. These cover basic and advanced strength of materials and computational and experimental solid mechanics, as well as plasticity, creep, fracture, and fatigue characteristics of materials.
When talking about size, Ashraf Bastawros and Fred Haan work at opposite ends of the research spectrum. Bastawros uses his expertise in experimental mechanics to research how materials behave at the micro- and nano-scale, and Haan studies the impact of high winds on structures using Iowa State’s “larger-than-life” tornado simulator and wind tunnel. Both have won prestigious National Science Foundation Early CAREER Awards with funding for five years and are eager for their innovative research efforts to benefit engineers in the field.

Bastawros, at Iowa State since 1999, received his CAREER award in 2002. His work focuses on the mechanics of material properties at the micro- and nano-scale levels where materials behave very differently than at larger scales. Results from his work will be fed into a design/modeling framework that shows how a material’s actual performance differs from a theoretical model. This understanding will enable engineers to improve designs and technology with applications that cut across many disciplines.

“Aerospace materials, microelectronics, biological tissues—they all have the same governing equations,” Bastawros says. “I’m trying to develop a fundamental framework that can be applied to many areas.” The College of Engineering has also recognized Bastawros for his outstanding research accomplishments early in his career with the Young Engineering Faculty Research Award for 2004.

To help engineers in the field benefit from the many advances in experimental mechanics, Bastawros is developing a Web-based clearinghouse that describes new tools and techniques. This will give engineers a starting point for learning about advances in the field that will help them do their jobs better.

As part of his CAREER award, Bastawros hires four or five undergraduate research assistants per year. The students, including electrical engineering, mechanical engineering, and aerospace engineering majors, help design experiments, collect information, write programs for controlling the equipment, and run analysis codes.

Arriving at Iowa State in 2001, Haan has been instrumental in the planning and construction of the one-of-a-kind tornado simulator and the wind tunnel in the Wind Simulation and Testing Laboratory (WiST). With his CAREER award announced in 2003, Haan developed a plan for integrating experimental and computational research activities and for teaching people at many different levels what wind engineering research is about.

Haan and his graduate students are developing computational simulation tools, based on discrete vortex methods, to simulate flows around different types of structures. Using the wind tunnel, they will do experimental work that will enable them to continuously validate and improve the computer models.

One of Haan’s projects relates to the aerodynamics of long bridges. In this case, the computer code will simulate the wind flow around a bridge deck, and that will be compared to wind tunnel work. Using laser-based methods, the researchers will measure pressure, wind speed, and flow velocity around the deck. The data will help them learn more about what happens when wind hits a bridge. By understanding flow physics better, Haan says they want to develop simplified design tools for engineers.

The Design and Teaching Environment (DTE) component of Haan’s CAREER project offers several benefits. “We want visitors to learn about wind hazards, see the tools that we use in wind engineering, and get a real feel for how engineers design structures to resist the wind,” he says. “And each time we explain a concept to others, we go through a new level of understanding ourselves.”

More information about the WiST lab and DTE can be found on page 6.
The Lockheed Martin Corporation has given $1.5 million to fund the Vance D. Coffman Endowed Chair in Aerospace Engineering. The gift honors Vance Coffman, who retired as CEO of Lockheed Martin in August 2004 and as chair of the board of directors in April 2005. Coffman earned his BS degree in aerospace engineering in 1967.

"Vance Coffman is one of the great leaders of the aerospace industry, and we are extremely proud of him as an alumnus of Iowa State University," said Iowa State President Gregory L. Geoffroy at the announcement of the chair in September 2004. "We are deeply grateful to Lockheed Martin for its generous gift to endow this chair in Vance's honor. It will help Iowa State continue to provide a top-quality education to our students and prepare them to become the future leaders of the aerospace industry."

Coffman joined Lockheed's space systems division as a guidance and control systems analyst in 1967 after completing his BS at Iowa State. While working for the company, he earned an MS and a PhD from Stanford University in aeronautics and astronautics.

"Clearly, there is no better example than Vance Coffman of the caliber of people who have passed through our programs," said Professor Tom Shih, AerE department chair. "His early work on the space program and later efforts on the Hubble telescope project are widely known and admired. It's a great distinction to have an ongoing relationship and association with Dr. Coffman."

Coffman and his wife, Arlene, grew up in Iowa and attended Iowa universities. "I know that this great university will use the chair as a vehicle to enhance aerospace engineering and help our nation's preeminence in this arena through research and professional development," said Coffman. "Arlene and I hope this chair will help in a small way to keep Iowa's education system strong for the future."

Lockheed Martin, the world's largest aerospace and defense company, employs 130,000 people around the world. The company established the endowed chair to honor the impact Coffman had on Lockheed Martin, to bring lasting recognition to his leadership, to encourage cutting-edge research in the aerospace field, and to encourage others to follow in his footsteps.

Coffman is a member of the National Academy of Engineering, an Honorary Fellow of the American Institute of Aeronautics and Astronautics, and a Fellow of the American Astronautical Society. He has received numerous honors and awards for his national defense contributions, his business leadership, and his scientific accomplishments.

While Coffman may be the most prestigious Iowa State alumnus at Lockheed Martin, the company currently employs approximately 350 Iowa State alumni. In addition to several past gifts supporting the College of Engineering, Lockheed Martin is a regular research partner.

Lockheed Martin's gift was made through the Iowa State University Foundation—a private, non-profit organization dedicated to securing and managing private gift support for Iowa's land-grant university.
The more you understand about something, the better chance you have of improving it.

That philosophy drives Hui Hu, aerospace engineering's newest assistant professor, in his quest to understand complex flow and heat transfer phenomena. For nearly a decade, Hu has been developing novel diagnostic techniques that provide researchers not only with more accurate measurements but also with new insight into these fundamental behaviors.

Ultimately, Hu's work could lead to quieter jet engines and improved propulsion efficiency of aero-engines.

Hu's interest in how airplanes work and what can be done to make them work better began as he was growing up in southern China. He earned his BS, MS, and PhD degrees in aeronautical engineering at Beijing University of Aeronautics and Astronautics. His coursework and graduate research experience at the Jet Propulsion Laboratory led to a fellowship from the Japan Society for Promotion of Science to continue his research at the University of Tokyo's Institute of Industrial Science in 1997.

While there, Hu worked on development and application of advanced diagnostic techniques like particle image velocimetry (PIV) and laser-induced fluorescence. His dual-plane stereoscopic PIV system is one of very few PIV systems that can achieve the simultaneous measurements of all three components of velocity and vorticity vectors in fluid flows. He earned a second PhD, this one in mechanical engineering from the University of Tokyo, and won several awards from the Visualization Society of Japan.

In 2000, Hu went to Michigan State University as a research associate in mechanical engineering and began pioneering work on the development of molecule-based diagnostic techniques like molecular tagging velocimetry and thermometry.

“A particle of 1–10 microns, compared to a molecule, is still very big,” Hu explains. “With the particle-based diagnostic techniques, you just get velocity measurements. With our techniques, you can get velocity vectors and achieve simultaneous imaging of multiple fluid variables including concentration, temperature, and even pressure.”

At Iowa State, Hu continues his quest to improve optical diagnostic techniques that delve into the mysteries of flow fields. The university, he says, provides the perfect environment for interacting with students and exploring new ideas.
From designing and building their own pico-satellite to testing space-related hardware in high altitude balloon experiments, students are learning by doing in the Spacecraft Systems and Operations Lab (SSOL). Sponsored through NASA’s Iowa Space Grant Consortium, the SSOL mission is to encourage active participation of students and faculty at all levels in research, development, and implementation of spacecraft, systems, and related projects.

The aerospace engineering department is expanding and building on the SSOL concept by creating open undergraduate research laboratories in computations and experiments. These are labs where students can work on their senior design projects and other special projects that link to faculty research such as aircraft icing or turbine engine thermal management. The labs will facilitate interdisciplinary projects with students collaborating with and learning from those in different fields.

“Our goal is to provide facilities where students can work on projects that go beyond the scope of a class or program,” says Tom Shih. “We envision labs where students can explore, discover, invent, create, design, analyze, build, and test. These kinds of opportunities motivate and excite students about learning, self-learning, and life-long learning.”

Currently more than 75 undergraduate students, 2 graduate students, and 10 faculty members are associated with the SSOL, according to Mani Mina, SSOL director and faculty member in electrical and computer engineering. The students collaborate with scientists and engineers from many other fields. By summer 2005, four new graduate students in systems engineering, aerospace engineering, and electrical and computer engineering will be studying and advancing the technological developments in the SSOL.

**HABET**

Iowa State’s High Altitude Balloon Experiments in Technology (HABET) program is a major research element in SSOL. Since 1994, HABET has flown over 80 science and engineering missions. Able to reach flight altitudes of more than 100,000 feet, this program offers the most affordable method for development and testing of satellite systems and hardware. In addition, it is used in the evaluation of atmospheric conditions and the study of biological life responses in a reduced gravity environment.

The primary goals for the ballooning program are research and hands-on education for engineering students and practical technology development. **HABET missions are listed at [cosmos.ssol.iastate.edu/HABET/Home.html](http://cosmos.ssol.iastate.edu/HABET/Home.html).**

**CySat**

Since January 2003, a team of Iowa State students has been designing and constructing CySat, a pico-satellite (a 10-centimeter cube that weighs one kilogram or less). CySat is part of the CubeSat community comprising 30 universities worldwide building pico-satellites to be flown in low Earth orbit upon completion. The pico-satellite’s mission is to take digital pictures of the Earth, successfully downlink the images, and conduct measurements of the Earth’s magnetic field. The project requires undergraduate students to solve complex problems such as satellite tracking, communications, structural and thermal design, and power regeneration, as well as devise and implement a system that will have effective attitude determination and control.

This summer, CyCADET II (CySat’s Control and Attitude Determination Evaluation Testbed II) will be tested aboard NASA’s Boeing KC-135 aircraft used for zero gravity experiments. The student team from SSOL, one of 50 selected to participate in the Reduced Gravity Student Flight Opportunities Program at NASA’s Johnson Space Center, will test the ability of the software and hardware to detumble and orientate the satellite.

"Students use helium balloons to carry scientific and engineering payloads to the edge of space as part of the HABET program."
CySat and its subprojects are funded by the Iowa Space Grant Consortium along with donations from the Departments of Aerospace Engineering and Mechanical Engineering. Information about CySat is available at cosmos.ssol.iastate.edu/cysat/home.html.

Light Sport Plane

John Anastos and Nathan See love a challenge. The two aerospace engineering seniors decided it would be a great learning experience to design and build an airplane. Their goal is to construct and fly a light sport aircraft, defined as having one engine, one propeller, and two seats.

Initiated in January 2005, AirISU has gotten off to a promising start. Given the go-ahead by the department, Anastos and See worked out the logistics and schedule. Design is underway this spring, and construction is scheduled to begin in the summer. See says he’s already benefited from the project. “We’re getting hands-on experience applying what we learned throughout our coursework—aerodynamics, structures, controls, and stability. We’re seeing how it all relates.”

Student interest in the project is high. The first public meeting drew 25 students, and that was just with word-of-mouth advertising. Since then, 60 students have joined the project. The road ahead is challenging, though. Costs are estimated to be from $75,000 to $100,000. Anastos is using his experience on the solar car team as background. “We’ll use many of the same processes,” he says. “We’re seeking in-kind donations from industry, and we’re fundraising.”

See and Anastos (below left and right, respectively) agree that the commitment of time and effort is well worth it. Their goal is to have the plane ready to fly in April 2006.

Visit www.airisu.org for more information.

F-100 Pratt and Whitney engine dedicated

A delegation from the Iowa Air National Guard (ANG), Dean Mark Kushner, Cory Tallman from Lockheed Martin, and faculty and students were on hand for the dedication of the F-100 Pratt and Whitney engine recently acquired by the Department of Aerospace Engineering. Tom Shih, AerE department chair, thanked the Iowa ANG for helping to get the engine and delivering it to the department. “We’re so used to flying that we forget about the marvels of flying and don’t fully appreciate the enormous science and technology used for such a complicated machine. We are very grateful to be able to use it in the education of our students.”

Students win AIAA awards

At the American Institute of Aeronautics and Astronautics (AIAA) Region V Student Conference held at Wichita State University in April 2005, our AerE students came away with some impressive awards.

Kara Kranzusch won 1st place and Andrew Wick won 2nd place in the student paper competition. This follows a fine showing in 2004 when Nathan Thomas and Jake Sullivan won third place.

The student branch won the Section of the Year award for activities and accomplishments in 2003–04 under the leadership of Chris Kostyk and his cabinet.
From the very first class in 1943, the list of graduates from Iowa State’s aerospace engineering department reads like a Who’s Who of the aerospace industry.

In April 2004, the department unveiled the Hall of Distinguished Alumni as a permanent tribute to those who have brought honor to the program and Iowa State University through their professional achievements. “We want students, visitors, and faculty to be aware of who our alumni are,” says Tom Shih, AerE department chair, “and how proud we are of them.”

The first five inductees are: Arthur E. Bryson, Jr., BS’46, Pigott Professor of Engineering Emeritus, Stanford University; Vance Coffman, BS’67, chairman and CEO, Lockheed Martin; Kevin L. Petersen, BS’74, director, NASA Dryden Flight Research Center; and (posthumously) T. A. Wilson, BS’43, former chairman of the board of directors, the Boeing Company, and John F. Yardley, BS’44, former senior vice president, McDonnell Douglas Corporation.

Arthur Bryson came to Iowa State in 1943 as a member of the Navy’s V-12 program. His studies were interrupted by the war, but he returned in 1946 to finish his undergraduate degree. With a flood of veterans in school on the GI bill, Bryson was recruited to teach a graduate math course. “I did it with great trepidation,” he laughs, “but I kept a day ahead of the class.”

Although Bryson had planned a career designing airplanes, that early teaching experience combined with the recommendation of one of his master’s professors at Cal Tech convinced him to
get a PhD. After two years at Hughes Aircraft, Bryson joined the engineering faculty at Harvard in 1953 and moved to Stanford University in 1968. During his distinguished academic career, Bryson gained an international reputation as the “father of modern optimal control theory” and wrote four widely used books on control theory and practice.

A native Iowan, Vance Coffman entered Iowa State in the early 60s when the race for the moon was on. After graduation, he joined Lockheed’s space division as a guidance and controls-systems analyst and later earned MS and PhD degrees at Stanford University.

During his 35-year tenure with Lockheed Martin, Coffman was responsible for the Hubble Space Telescope, the Milstar communications satellite program, the Follow-on Early Warning System, and the corporation’s work on the Iridium Satellite Communications System. Coffman has served in a series of elected corporate leadership positions, becoming CEO and chairman of the board in 1998. (See information about the Vance Coffman Endowed Chair on page 14.)

Director of NASA Dryden Flight Research Center since 1999, Kevin Petersen got early experience working at NASA as a co-op student beginning in 1971. The experience, he says, helped him decide what specialty areas interested him most and that led to good choices for coursework and projects during his senior year. After completing his undergraduate degree, Petersen earned an MS at UCLA in 1976 specializing in control systems.

As a research engineer at Dryden, Petersen worked on the F-8 digital fly-by-wire, highly maneuverable aircraft technology, and the X-29A forward swept wing experimental aircraft programs. He received NASA’s Exceptional Engineering and Exceptional Service Medals in 1987 and 1989, respectively, and the Outstanding Leadership Medal in 2000.

T. A. Wilson joined the Boeing Company following his 1943 graduation but returned to campus in 1946 to help teach the influx of students. At Boeing, Wilson was project engineer of the B-52 program during the latter stages of its design, and he led the proposal team that won the Minuteman intercontinental ballistic missile program. Elected vice president of Boeing in 1963, Wilson was named president in 1968 and chief executive officer in 1969. He was chairman emeritus from 1988 until his resignation in 1993. Wilson passed away in 1999. While at Iowa State, Wilson met his wife, Grace, on a blind date. “T was a low-key type,” Grace Wilson says, “but he got things done.”

A U.S. Navy veteran of World War II and member of the Navy’s V-12 program, John Yardley completed his undergraduate degree in 1944 and then earned an MS at Washington University. In a career that included leadership positions at McDonnell Douglas and NASA, Yardley played a key role in the development and expansion of the human space flight program. He served as project engineer for the Mercury spacecraft and technical director of the Gemini program, and he was heavily involved in the Apollo and space shuttle programs.

Yardley retired as senior vice president of McDonnell Douglas in 1989. He passed away in 2001. On his induction into the “Hall of Fame,” his family wrote, “Our father was fairly unimpressed with awards, but we feel he would have been proud to have been honored in this way by his alma mater.”

Visit www.aere.iastate.edu/distinguishedalumni.asp for more information.

2005 Distinguished Alumni

Four alumni are being inducted into the Hall of Distinguished Alumni in 2005.

- James T. Johnson, BSAER’64, MSAER’65, president, Gulfstream Aerospace Corporation; also 28 years at Boeing, where his positions included vice president of engineering and product development and vice president and general manager of the divisions that produced the Boeing 747, 767, and 777

- David L. Klinger, BSAER’67, executive vice president, Lockheed Martin Space Systems; also served as executive vice president of quality and operations, missiles and space

- Dennis A. Muilenburg, BSAER’86, vice president and general manager, combat systems, Boeing Integrated Defense Systems, and program manager, future combat systems; also served as vice president of programs and engineering for air traffic management charged with modernizing the system to support complementary global communication, navigation, and surveillance services

- Robert E. Uhrig, MS’50, PhD’54 (both in theoretical and applied mechanics), distinguished professor, nuclear engineering, University of Tennessee, and distinguished scientist, Oak Ridge National Laboratory; also former dean of engineering at the University of Florida and former vice president for advanced systems and technology at Florida Power and Light
Experts from throughout the United States and beyond give presentations to students and faculty as part of the Midwest Mechanics Seminars and the Distinguished Lecture Series held throughout the academic year. Here are recent speakers and their topics:

**Midwest Mechanics Seminars**

**Rohan Abeyaratne, Professor and Chair**
Department of Mechanical Engineering
Massachusetts Institute of Technology
The Mobility of Phase Boundaries in Crystalline Solids

**Mary C. Boyce, Distinguished Alumnae Professor**
Department of Mechanical Engineering
Massachusetts Institute of Technology
Mechanics of the Finite Deformation Behavior of Biocatalytic Networks

**Young Huang, Grayce Wicall Gauthier Professor of Mechanical Engineering**
The University of Illinois at Urbana-Champaign
Nanomechanics: A Continuum Theory Based on the Inter-atomic Potentials

**Stelios Kyriakides, Temple Foundation Endowed Professor**
Center for Mechanics of Solids, Structures & Materials
The University of Texas at Austin
On the Mechanical Behavior of Cellular Materials

**Kenneth Liechti, E.P. Schoch Professor of Engineering**
The University of Texas at Austin
Extracting the Elastic and Surface Properties of Thin Polymer Films and Self-Assembled Monolayers from Interfacial Force Microscope Experiments

**Arun Majundar, Almy and Agnes Maynard Chair, Professor**
Department of Mechanical Engineering
The University of California at Berkeley
Thermal and Fluidic Transport in Nanostructured Materials and Devices

**Ray Ogden, Professor**
Department of Mathematics
University of Glasgow, Scotland, UK
The Biomechanics of Arteries: Structure and Modeling

**K. R. Rajagopal, Distinguished Professor**
Forsyth Chair in Mechanical Engineering
Texas A & M University
The Navier-Stokes Equations and Beyond—According to Stokes

**Richard Rand, Professor**
Department of Theoretical and Applied Mechanics
Cornell University
Recent Advances in Parametric Excitation

**Distinguished Lecture Series in Aerospace Engineering**

**Robert Brodsky, Department Head, 1971–1980**
Department of Aerospace Engineering
Iowa State University
The Great Aerospace Events of the 20th Century

**Anthony J. Calise, Professor**
School of Aerospace Engineering
Georgia Institute of Technology
Case Studies in Neural Network Based Adaptive Control Technology

**Brian Cantwell, Edward C. Wells Professor in Engineering and Chairman**
Department of Aeronautics and Astronautics
Stanford University
High Performance Fuels for Hybrid Propulsion

**Vance Coffman, Chairman of the Board**
Lockheed Martin
A 21st Century Model for Aerospace

**Paul Durbin, Research Professor**
Department of Aerospace Engineering
Stanford University
A Perspective on Recent Development in RANS Modeling

**Guowei He, Research Scientist**
The Chinese Academy of Sciences, Institute of Mechanics
Mapping Closure Approximation Approach for Turbulent Mixing

**John L. Junkins, Distinguished Professor and George J. Eppright Endowed Chair**
Department of Aerospace Engineering
Texas A&M University
Mission Analysis for a New Way to Visit Near Earth Asteroids

**Ed. C.K. Law, Robert H. Goddard Professor**
Department of Mechanical Engineering and Aerospace Engineering
Princeton University
Frontiers of Combustion: From Micro-Gravity to Micro-Engines

**Wei Shyy, Distinguished Professor and Chair**
Department of Mechanical and Aerospace Engineering
University of Florida
Membrane Wing Aerodynamics for Micro Air Vehicles

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**College honors outstanding faculty**

**John Jacobson**, assistant professor, received the College of Engineering Superior Advising Award for 2003 to recognize his work helping aerospace engineering students succeed at Iowa State. When Jacobson joined aerospace engineering in 1996, 140 students were enrolled. He established a variety of student-focused and service-oriented processes and activities to recruit, advise, and retain students. Jacobson's efforts paid off. Today, the department has more than 400 students, with around 135 new students each fall.

**Richard Hindman**, associate professor, has helped aerospace engineering students gain the skills and knowledge needed to succeed in the professional world. In recognition of his dedicated work, Hindman received the College of Engineering Superior Engineering Teacher Award for 2003. With primary responsibility for planning, preparing, and teaching design-thread courses, Hindman stays abreast of current design technology. He also works conscientiously with other faculty to ensure that appropriate analysis tools are incorporated in design course activities.
Thanks to each of these alumni and friends who generously contributed to the department from July 1, 2003 to December 31, 2004. This support plays a critical role in providing scholarships and enhancing our programs.

Alumni News

Our department plans to restart the alumni newsletter. Please send your latest contact information, your professional status, information about your family, and any other special events to tomshih@iastate.edu or the department mailing address. Our department’s alumni include those from aerospace engineering and engineering mechanics as well as theoretical and applied mechanics. We would all love to hear from you.
The Department of Aerospace Engineering is very pleased to have 13 distinguished engineers from industry and academia serve on our Industrial Advisory Council (IAC). Members provide the department an outside perspective on the teaching, research, and outreach components of the department.

IAC members (Iowa State alumni are noted with degree dates) for 2004–05 are

**Vincent Baker, BSAerE’67, MSAerE’68**
Weapon Systems I&T
Lockheed Martin
Marietta, Georgia

**Raymond R. Cosner**
Senior Technical Fellow and Director for Technology
Boeing—Integrated Defense Systems
St. Louis, Missouri

**Michael J. Gries, BSAerE’87**
Director, Engineering Support
Commercial Systems
Rockwell Collins
Cedar Rapids, Iowa

**Kenneth Longacre, BSAerE’94**
Ascent/Entry Flight Dynamics, DM46
NASA Johnson Space Center
Houston, Texas

**Mark Thomas Miller, MESysE/AerE’03**
Flight Control Systems Engineer
Rockwell Collins
Cedar Rapids, Iowa

**Hukam Mongia**
Manager, Advanced Combustors Engineering
GE Aircraft Engines
Cincinnati, Ohio

**Ross Scheckler, MSAerE’91, IAC President**
President
Calmar Research Corporation
Cato, New York

**Robert J. Shaw, 2004–05 IAC Chair**
Associate Director, NASA Partnership Programs
NASA—Glenn Research Center
Cleveland, Ohio

**George S. Springer**
Paul Pigott Professor of Engineering
Department of Aeronautics and Astronautics
Stanford University
Stanford, California

**Bill Vavra, BSAerE’74**
Experimental Test Pilot
Raytheon Aircraft Company
Wichita, Kansas

**L. S. “Skip” Fletcher**
Director, Aeronautics Directorate
NASA—Ames Research Center
Moffett Field, California

**Dietz Professor and Regents Professor**
Department of Mechanical Engineering
Texas A&M University
College Station, Texas

**David E. Halstead, BSME’86, MSME’89, PhDME’96,**
Manager, GE Honda Engineering
GE Aircraft Engines
Cincinnati, Ohio

**David C. Wisler**
Manager, University Programs and Technology Laboratories
GE Aircraft Engines
Cincinnati, Ohio

**Elizabeth Bierman, BSAerE’99**
Rockwell Collins
Burlington, Massachusetts

**Vera Martinovich, BSAerE’88**
Stability and Control Product Development
Boeing Commercial Airplanes
Seattle, Washington

**Members who completed their terms in 2004 are:**

**Also, Hukam Mongia, BSAerE’99**
Rockwell Collins
Cincinnati, Ohio

Three new members who just joined the IAC in April 2005 are:

**Hukam Mongia, Mark Miller, Ross Scheckler, George Springer, Mike Gries, Tom Shih, and Robert Shaw; Back: Raymond Cosner and Kenneth Longacre.**
Aerospace Engineering Faculty

27 (15 full, 8 associate, 4 assistant), 8 adjunct, 2 affiliate, 3 courtesy; 2 members (1 emeritus) of the National Academy of Engineering; 9 fellows of professional societies; and 14 journal editorships/members on editorial boards. (Visit www.aere.iastate.edu for more information.)

Aerodynamics / Propulsion

Chen, Hudong** (Exa Corporation)
lattice gas/Boltzmann methods; statistical physics and kinetic theory, theoretical turbulence and modeling

Cox, Ron*
wing design

Durbin, Paul
fluid mechanics, mathematical modeling of turbulence

Haan, Fred
fluid-structure interactions, wind engineering

He, Guowei** (Chinese Academy of Sciences)
PDF methods for mixing and chemical reacting turbulent flows, LES of aeroacoustics, high-performance computing, microfluidics

Hindman, Rich
design optimization, unsteady aero, CFD

Hu, Hui
mixing, flow control, microfluidics, optical diagnostics

Inanc, Feyzi*
nuclear reactors, industrial and medical radiography

Inger, George
hypersonics, ablation

Oliver, Jim***
UAV, combat coordination, virtual engineering

Rajagopalan, Ganesh
rotorcraft, wind turbines, UAV/MAV, CFD

Rothmayer, Alric
icing physics, asymptotic methods, CFD

Shih, Tom
inlets, turbines, icing, thermoelectrics, CFD

Tannehill, John
hypersonics, scramjet, CFD

Wang, Z. J.
aeroacoustics, electromagnetics, CFD

Structures / Mechanics and Materials

Bastawros, Ashraf
experimental micro and nano mechanics

Biner, Bulent*
computational materials

Chandra, Abhijit***
nano mechanics, boundary elements

Chimenti, Dale
ultrasonics, rough surface scattering, NDE

Dayal, Vinay
composites, smart structures, ultrasonics, NDE

Gray, Tim*
NDE

Hilliard, Jim
dynamics

Holger, Dave
acoustics, noise control

Hsu, David*
composites, ultrasonics, NDE

Jacobson, John
mechanics

McDaniel, T. J.
composites, dynamics of aircraft and space structures

Mitra, Ambar
solid mechanics, inverse problems, manufacturing processes

Roberts, Ron*
NDE

Rudolphi, Tom
fracture mechanics, boundary elements

Sarkar, Partha
structural dynamics, wind engineering

Schmerr, Les
artificial intelligence, ultrasonics, NDE

Sturges, Leroy
rheology and non-Newtonian fluid mechanics

Thompson, Bruce
NDE, ultrasonics, probability of detection

Tsai, Yu-Min
NDE, fracture and crack propagation

Zachary, Loren
experimental stress analysis

* Adjunct Faculty
** Affiliate Professor
*** Courtesy Appointment