



UNIVERSITY OF
FLORIDA



WINTER 2003

MECHANICAL & AEROSPACE ENGINEERING



Merger Molds Mechanical and Aerospace Engineering

July 23, 2002 saw the birth of the new Mechanical and Aerospace Engineering Department (MAE). Merging the former departments of Mechanical Engineering (ME) and Aerospace

Engineering, Mechanics and Engineering Science (AeMES), provides a platform of strength for future growth and collaboration. Professor Wei Shyy, chair of the former AeMES department, will serve as chair of the combined department.

Seeing the need for a stronger presence among universities nationwide, College of Engineering Dean Pramod Khargonekar actively encouraged the merger, asserting that the combination of the two departments would strategically place UF, furthering the mission of producing high-calibre research, and providing quality educational programs in aerospace and mechanical engineering. The restructuring will allow the department to pursue aggressively new areas of teaching and research, ensuring

that UF remains at the cutting edge in these fields of engineering.

“This new department will be able to take advantage of intellectual and disciplinary synergies between these fields to help build an outstanding academic department with a sufficiently large critical mass of faculty and students over the next decade,” Dean Khargonekar said.

The merger has sparked a growing sense of excitement within the faculty, as more opportunities are seen for enhanced collaboration in research and teaching. Currently, two large collaborative research efforts include grants from NASA; one, involving development of third generation reusable launching vehicles; and the second, in hydrogen research and education.

AeMES
+ ME
= MAE

GATOR
Engineering



Wei Shyy Named Chair of Mechanical & Aerospace Engineering

Chosen to lead the new MAE, Professor Wei Shyy was named chairman, following a distinguished tenure as the chair of the old Aerospace Engineering, Mechanics and Engineering Science (AeMES) department, which he had held since 1996. He first joined the College of Engineering faculty as an Associate Professor in 1988.

Prior to joining UF, Shyy was a staff scientist at GE Corporate Research and Development in Schenectady, NY. He received a B.S. degree in 1977 from National Tsing Hua University in Taiwan and received the M.S.E. and Ph.D.

degrees, both in aerospace engineering, in 1981 and 1982, respectively, from the University of Michigan.

His research interests include computational fluid dynamics, combustion and propulsion, turbomachinery flows and heat transfer, aerospace materials processing, fluid-structure interaction, biofluid dynamics, biological and low Reynolds number flight vehicles, and optimization of thermofluid systems. He is a fellow of the American Institute of Aeronautics and Astronautics and American Society of Mechanical Engineers.

CoE Dean Sees MAE Merger As Milestone



Pramod Khargonekar
Dean, College of Engineering
University of Florida

Major changes in departmental structures are rare in academe. Universities are organized around academic departments that are built around fundamental disciplines. In view of these traditions, the creation of the Department of Mechanical and Aerospace Engineering (MAE) by merging Aerospace Engineering, Mechanics, and Engineering Science (AEMES) and Mechanical Engineering (ME) signifies momentous change in the College of Engineering at the University of Florida.

We have been motivated to undertake this merger by the following considerations:

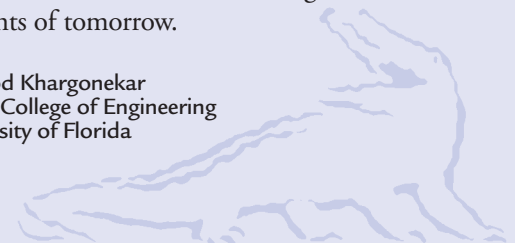
- The fields of aerospace engineering and mechanical engineering share many disciplines in common: dynamics, controls, robotics, structures, fluid and thermal sciences, design, etc. It is our hope and expectation that the merger will allow our faculty to take advantage of common resources to enrich and expand educational and research activities in these and related fields.
- The combined department will have more than fifty tenure/tenure-track faculty members. This size will facilitate formation of research groups with strong critical mass in a number of selected areas. With potential retirements and new positions, we will hire as many as ten new faculty members in the coming four to five years. This holds the potential for enhancing excellence in the selected research areas.

- The merged department will be impacted less by cyclical changes in student enrollments, allowing for better planning of educational and research programs.

I have been very pleased and gratified by the very thoughtful and constructive deliberations of our faculty and students as we went through the discussion of the possible merger of AEMES and ME during the last academic year. This process led to nearly unanimous support for the merger which became reality in July 2002. We were also fortunate to have Dr. Wei Shyy accept the leadership responsibility as chair of the MAE department.

I am convinced that the creation of the MAE department will go down as a major milestone in the evolution of the College of Engineering at the University of Florida as we seek to achieve ever greater levels of excellence in engineering education and research. The new department will be able to significantly increase the breadth and depth of educational and research activities in the most important subfields of aerospace and mechanical engineering and establish itself as a nationally prominent academic department in these fields. The real beneficiaries of this change will be the students of tomorrow.

Pramod Khargonekar
Dean, College of Engineering
University of Florida





Space Grant -- GAINESVILLE, Fla. --- An artist's rendition of one concept for a future space vehicle that would take off and land like an airplane yet travel at hypersonic speeds of more than five times the speed of sound. NASA has made the University of Florida the lead institution of a consortium of universities that will work on the design of new propulsion systems and other advanced technology for such a spacecraft. The Institute for Future Space Transport is expected to receive a little over \$3 million annually for the research for the next five years.

UF To Head Major Initiative On Future Spacecraft

GAINESVILLE, Fla. --- NASA has chosen the University of Florida as the lead institution in a nearly \$16 million research initiative aimed at making space flight as routine, inexpensive and safe as commercial air travel.

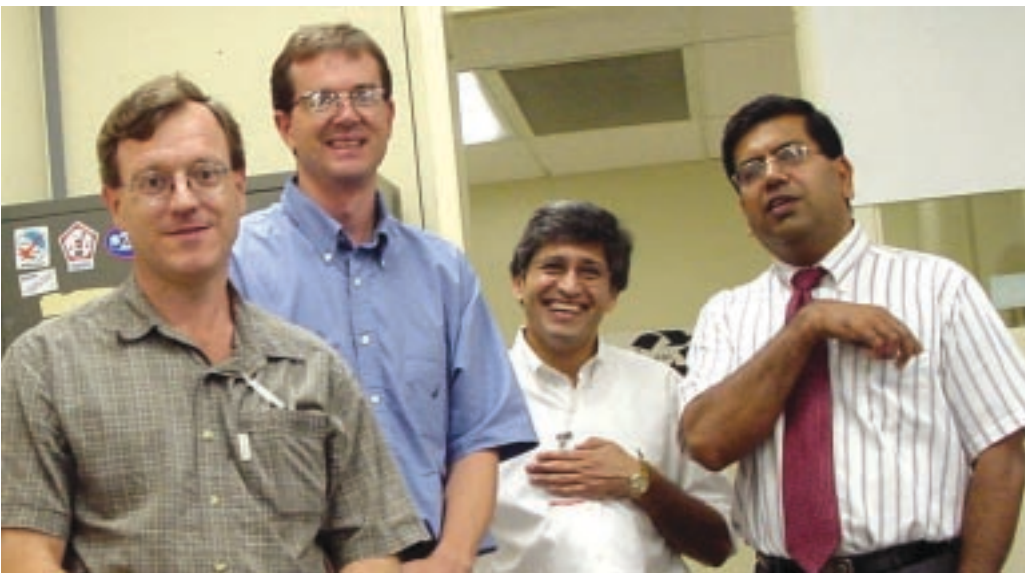
The space agency has announced that UF will lead a seven-member consortium of universities that make up its newly created Institute for Future Space Transport. The institute's overall goal is an ambitious one: to design spacecraft and systems that will reduce launch costs by a factor of 100 and increase safety by a factor of 10,000.

"We will not be able to continue to rely on the space shuttle for frequent low orbital missions - the costs are just too prohibitive," said Wei Shyy, director of the new institute and chairman of UF's department of MAE. "Instead, we'll have to develop the technology that will eventually fly spacecraft more like aircraft in terms of cost, safety and maintenance, and that's the focus of this institute."

The overall goal of the institute is to "perform research and development that not only increases fundamental understanding of phenomena but also moves fundamental advances from scientific discovery to basic technology," according to NASA. The UF-led Institute for Future Space Transport will focus on four research areas: new propulsion technologies; lighter, stronger and more reliable spacecraft; improved systems to monitor the health and well-being of the spacecraft's technological and life-support systems; and better ways to integrate all of the spacecrafts' diverse systems.

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Source: Wei Shyy, (352) 392-0961, wss@mae.ufl.edu



Scientist engineers involved in the University of Florida's hydrogen research and education grant participated in a kick-off meeting at NASA-Cape Canaveral in May 2002. (Pictured L-R): Robert Youngquist (NASA scientist) is joined by MAE professors David Hahn, Yogi Goswami, and Bhavani Sankar.

To Tap Potential of Hydrogen, NASA Turns To Florida Universities

GAINESVILLE, Fla. --- Every shuttle launch depends on cutting-edge technology, highly trained technicians, and some plain, old-fashioned tanker trucks -- 50 of them, to be exact.

The trucks haul over 300,000 pounds of hydrogen fuel 600 miles from where it is produced near New Orleans to Kennedy Space Center, a massive transportation job that costs hundreds of thousands of dollars each time the shuttle roars into orbit. Seeking to develop new technology to produce the hydrogen much closer to the launch pad -- and in a more environmentally friendly way --

CONTINUE P. 4 ➤

Mechanical Engineers Create Glow-in-the-Dark Bicycle

Using the same technology that makes wristwatch faces light up in the dark, UF mechanical engineers created a bicycle with electro-luminescent panels on the frame and tire rims. The devices make the average bike visible from up to 600 feet away, significantly reducing the risk of a collision for cyclists and motorists, said MAE Assistant Professor Christopher Niezerecki, who along with two undergraduate students, created the system.

“Drivers need to detect that there is something in the road, posing a hazard,” Niezerecki said. “Second, they need to recognize that what they have detected is a bicycle.”

Powered by a nine-volt battery that rests below the seat, the panels on the glowing bike last for years, according

to Niezerecki. The battery can last for up to four hours when the lights are used continuously, longer when blinking. Unlike reflectors or conventional lights, the electro-luminescent lighting is not subject to dimming or fading when blocked from an external light source.

One factor contributing to fatal nighttime bicycle accidents is riders’ low visibility to motorists. The Consumer Product Safety Commission has estimated that riding after dark is roughly four times riskier than riding during the day. US Dept. of Transportation studies have proven that the risk of being hit by a motorist at night is eight times lower when wearing a safety reflector.

Writer Aaron Hoover, and Jon Custer,
Summer 2002 The Florida Engineer
Photo: David Blankenship



UF Engineers Probe “Shape Memory” Alloy For Better Prostheses

GAINESVILLE, Fla. --- To keep blood vessels from clogging, surgeons sometimes implant compressed stents that expand to the right size and shape when warmed by body heat.

The tiny stents get their so-called “shape memory” from an unusual alloy called nitinol, which exhibits one shape when cool, but forms another when heated. This property has made the alloy useful in an increasing number of small-scale medical and consumer products that depend on motion, yet do not have enough space for motors or pumps.

Intrigued by the alloy’s biomedical potential, University of Florida researchers have recently begun investigating it for the much larger application of prosthetic limbs.

Under the direction of MAE Professor Carl Crane, UF master’s

student Jose Santiago-Anadon built a nitinol device that can move the equivalent of more than 100 pounds. While the apparatus is merely a weight-lifting machine now, the hope is the research will one day lead to a nitinol “muscle” that can mimic the strength and motion of the real thing -- doing the work of a tendon or other major muscle in a next-generation prosthesis.

“Basically, it’s almost the size of a tendon or other large muscle,” Crane said. “It requires a lot of electricity, but it does not require the kind of bulky motors or hydraulic pumps that drive similar devices.”

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Carl Crane, (352) 392-9461, ccrane@ufl.edu

CONTINUED FROM PG. 3 To Tap Potential of Hydrogen, NASA Turns To Florida Universities

NASA is awarding a group of Florida universities \$8.1 million for hydrogen research.

The goal of the 18-month program: To come up with new or improved technologies to produce, store and handle hydrogen on the ground and in space.

“If you could produce hydrogen on site at Cape Canaveral or right nearby, you could at least cut the cost in half, because the transportation is a huge part of the cost,” said James Burkhart, a senior research engineer at Cleveland’s NASA Glenn Research Center, the source of the grant. “We’re also hoping to find better ways to store and transport hydrogen, both on the ground and in space, where it has also proved challenging to handle.”

The University of Florida and the University of Central Florida are heading up the research effort, with about \$5.4 million going to UCF and about \$2.7 million to UF. Other participating universities include the University of South Florida, the University of West Florida and Florida State University.

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James Burkhart, james.burkhart@grc.nasa.gov, (216) 977-7079



Ali Ismail Abdel-Hadi's Student Paper Wins

Ph.D. student Ali Ismail Abdel-Hadi was awarded second

prize in the Student Paper Competition at the 39th Annual Technical Meeting of the Society of Engineering Science (SES) held at Penn State University in October 2002.

Abdel-Hadi's paper focused on his recent research exploring "A New Experimental Setup for the Characterization of Bulk Mechanical Properties of Aerated Particulate Systems." The conference was sponsored by US Office of Naval Research. The award came with a \$250 honorarium.

Abdel-Hadi is an MAE Ph.D.candidate advised by Professor Nicolaie D. Cristescu. Ali obtained his BS degree in Mechanical Engineering in 1993 from the University of Khartoum, in his hometown of Khartoum in Sudan. He earned his MS

degree in 1998 from the University of Florida.

Ali's research is oriented towards the development of three-dimensional constitutive models for dry cohesive powders under low confining pressures. Specifically, his research focuses on powder mechanics, rheology, compaction, dilatation under shear, flow initiation and steady state flow of particulate systems. His research is sponsored by the Engineering Research Center for Particle Science and Technology (ERC) at the University of Florida.



Wesley Johnson Wins Costello Award

Wesley Johnson was awarded the Costello Award

from the Biomedical Engineering department (BME) for the Spring 2002 semester, in recognition of contributions to biomedical engineering and performance in research and course work. The annual Costello Award recognizes exceptional second-year biomedical

engineering students who show excellence in academics, leadership, and character.

The \$1,500 award is funded by the Costello family of Tampa. BME chairman Prof. William Ditto made the final award selection. "I am very pleased to receive the award and the attendant recognition of my contributions to BME," said Johnson.

According to MAE/BME professor Andrew Rapoff, Johnson made outstanding contributions netting him the award. "His work on electrode sheets used to determine epileptogenic foci caused the manufacturer to modify their design to allow fluidic communication between the brain surface and the dura mater, so as to

minimize subdural hematoma," Rapoff explained.

"Wes also brought to the attention of clinicians the necessity of accurately portraying risks of orthopedic procedures, particularly with respect to scoliotic curve progression," Rapoff continued.

Johnson received his MS in BME in May 2000, supervised by Rapoff. His MS work focused on the design, fabrication, and validation of a three-degrees of freedom mechanical testing fixture. Johnson is a BME Ph.D. candidate working on experimental biomechanics and bone.

Gunnar Tamm Sweeps ASME and ASES Solar Energy Awards



MAE Post-doctoral Fellow Gunnar Tamm won the 2002 American Society of Mechanical Engineers (ASME) Solar Energy Division Graduate Student Award and the American Solar Energy Society (ASES) Barbara and John Yellott Graduate Student Solar Energy Award at the ASME Solar 2002 Conference, in Reno, Nevada in June. Each award came with a \$1,000 honorarium and a recognition plaque.

Tamm's research interests include thermodynamics, binary mixtures and renewable energy sources. His current research is on a novel ammonia based power and cooling thermodynamic cycle which uses low temperature solar,

geothermal or waste heat. An experimental system demonstrating this cycle is operational at the Solar Energy and Energy Conversion Laboratory (SEECL). The SEECL is located in the Energy Research and Education Park (EREP) off of the main UF campus.

Gunnar earned his M.S. degree from Rutgers University in 1998 and B.E. degree from The Cooper Union in 1996, in his hometown of New York City. His prior academic research includes buoyancy induced flows and solar-generated hydrogen power systems. He intends to continue in the renewable energy field with an academic post.

HVAC Gators Win at International ASHRAE Competition

UF MAE undergraduates took second place in the System Design Competition of the American Society of Heating Refrigeration and Air Conditioning (ASHRAE) 2002 Design Competition, with their design for a complete air conditioning system for a 25,000 square foot family and athletic facility, located in Lincoln, Nebraska. The team submitted a complete set of mechanical plans and specifications with an engineering report.

This is the first time in UF's history that ME/MAE has won in this annual international competition. First place was awarded to

Ferris State University of Big Rapids, Michigan. UF tied for second place with Chulalongkorn University of Bangkok, Thailand. The competition was judged on anticipated operating costs, environmental impact, comfort, and health and creativity.

The competition's prize nets for one student member of the design team, an expense-free trip to the ASHRAE Winter Annual Meeting, to be held in Chicago in January. The student will make a poster presentation on the project. UF student ASHRAE faculty advisors are MAE professors H.A. Ingly and S.A. Sherif.

New MAE Building Foreseen by 2010

A new MAE building is foreseen for the future, with initial estimates at about \$30M for a footprint of 100,000 gross square feet. The new building will be nearly 60,000 net actual square feet, which is about the same ratio of net to gross space as in the existing Aerospace and Mechanical Engineering buildings, according to MAE Professor Gene Hemp. Costs for the chilled water and electrical sub-station requirements still need to be refined and will be added to the overall building estimate, Hemp said. Realistically, it will be the year 2007-2008 before the department raises enough private dollars in matching funds for the project's priority to be raised so as to qualify for state Public Education Capital Outlay (PECO)

funds. It is hoped that by the end of the decade, the new MAE building will be completed.

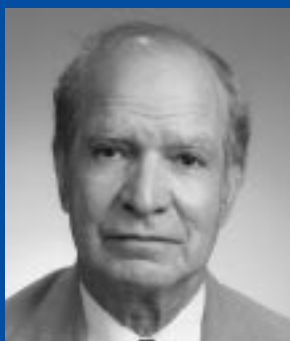
The new MAE now has offices and laboratories spread out amongst six buildings both on and off campus. These include the Aerospace Bldg., Mechanical Engineering Bldg., Mechanical Engineering Alumni Lab Bldg., New Engineering Bldg., Nuclear Science Bldg., and the Energy Park (off Archer Road). In view of the multiple locations, extensive efforts are still underway to foster collaboration by making reasonable adjustments for faculty and student spaces. Many rooms in the different buildings are under large-scale renovation with relocation of offices and labs.



This artist's rendering of the new MAE building shows a building with a footprint of 100,000 gross square feet. It is estimated that the cost of constructing the building will be about \$30M. It is hoped that by the end of the decade, the new MAE building will be completed.

In Memoriam

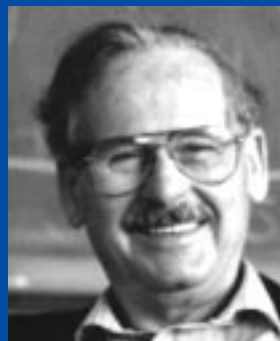
Esteemed Professor Ali Seireg



Professor Emeritus Ali A. Seireg, age 74, died September 3, 2002. A memorial service for Prof. Seireg was held at the Keen Center in Dauer Hall on the UF Campus, on October 24. Since 1986, Seireg was the Ebaugh Chair Professor in Mechanical Engineering at the University of Florida and the Kaiser chair from the University of Wisconsin. Colleagues

and students recall Dr. Seireg with respect and affection. Prof. Seireg was born in Mehalla, Egypt, and came to the U.S. for his Ph.D. in mechanical engineering at the University of Wisconsin.

Noted Professor Jiri Tlustý



Jiri Tlustý passed away suddenly the afternoon of October 20, 2002. He was 81. Prof. Tlustý was widely regarded as the top expert in the world on the design of machine tools. He was Graduate Research Professor of Mechanical Engineering at the University of Florida from 1984 to 2001 and was the founder of the Machine Tool Research Center.

A memorial service was held for Professor Tlustý, on November 14, 2002 at the Baughman Center on the University of Florida campus.

Major Renovations Restore the MEAL Bldg.

Major renovations to the Mechanical Engineering Alumni Laboratory (MEAL) building, has taken a building which was referred to as a “dingy, dismal, ratty old place” into a spacious and light-filled office complex. Once considered a dark and depressing location where the department of Mechanical Engineering housed several of its student teaching laboratories, MEAL now showcases expanded carpeted classroom space, dry labs for students, and faculty offices.

The renovations to the south end of the MEAL cost about \$370,000, and were completed in a phenomenal 8 weeks, according to Harold Barrand, assistant director of the UF Physical Plant’s

Architecture and Engineering division, which managed the remodeling efforts. “We are very enthusiastic about the big windows,” he added.

“It’s the windows which are driving this renovation,” said Chandler Rozear, project manager from UF’s Physical Plant. The darkness of the old building was dealt with by removing the existing industrial steel frame windows and replacing them with banks of store-front type window systems. Interior office spaces are now brightly sunlit by windows that open onto the hallway window banks. The original windows had been partially painted over, obscuring the light.

During the renovations to the south end

of the old MEAL building, the two ME machine shops were relocated to the north end. The shops’ previous space was renovated for dry laboratory space for electronic- and machine-type experimentation. Some of the shop equipment available for student class work include a digital milling machine and digital lathe, band saws, drill presses, and metal cutters.

Other changes to the MEAL include new lighting, new power and data lines, fire alarm upgrades, HVAC upgrades, handicap accessibility upgrades, and the installation of both new women’s and men’s toilet rooms as well as adding a unisex handicap toilet room.

Engineering®



During the renovations of the MEAL building, MAE professor H.A. “Skip” Ingley interfaced with UF Physical Plant’s Architecture and Engineering division, to provide seamless communication between the department, the architect, and the construction team.



During the 1950s, the Mechanical Engineering Alumni Laboratory (MEAL) building was used by the UF Physical Plant division. (Photo courtesy of the UF Archives at the Smathers Libraries.) Today, the renovated MEAL provides spacious and light-filled office spaces. Pictured is MAE Assoc. Prof. Ashok Kumar.





Jim Rice, discussing Drucker's concept of material stability and constraints on inelastic constitutive response at the October 2002 Drucker Symposium.

Drucker Memorial Symposium Held

A memorial symposium celebrating Professor Dan Drucker's contributions to the engineering profession was held October 8-10, 2002 at the University of Florida's conference center. The seminar, "A Survey of Frontiers in Solid Mechanics," drew speakers and university researchers from Harvard, Brown, MIT, Caltech and Cambridge, to name just a few. Presentations centered on Prof. Drucker's influence on current research.

Upcoming MAE Conferences

Winter 2003 Topical Meeting of the American Society for Precision Engineering January 22-23, 2003: "Machines and Processes for Micro-scale and Meso-scale Fabrication, Metrology, and Assembly," J. Wayne Reitz Union, University of Florida, Gainesville, FL. Two day conference focusing on new developments in micro-scale and meso-scale manufacturing processes and equipment. Papers are sought which describe both theoretical and applied research related to machines, systems, and processes for the fabrication, metrology, and assembly of complex, three dimensional devices and components. The conference is co-sponsored by the UF Dept. of MAE. For more information contact MAE professor John Ziegert at johnz@ufl.edu, or 352-392-9930.

Recent Faculty Honors

Many of the MAE faculty earned honors and awards during the past year. Here are just a few of them.

- **Bruce Carroll** – Best Paper Award, AIAA Ground Test Technical Committee, Aerospace Sciences Meeting, January 2002, Reno, Nevada.
- **Lou Cattafesta** and **Mark Sheplak** – Best Paper Award, AIAA Aerodynamic Measurement Technical Committee, Aerospace Sciences Meeting, January 2002, Reno, Nevada.
- **Yogi Goswami** – Governor-elect, ASME International, term to begin in 2003.
- **Christopher Niezrecki** – Winner of the 2002 H.J. Leonhardt Business Plan Competition.
- **John Ziegert** – President, American Society for Precision Engineering, 2002.



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