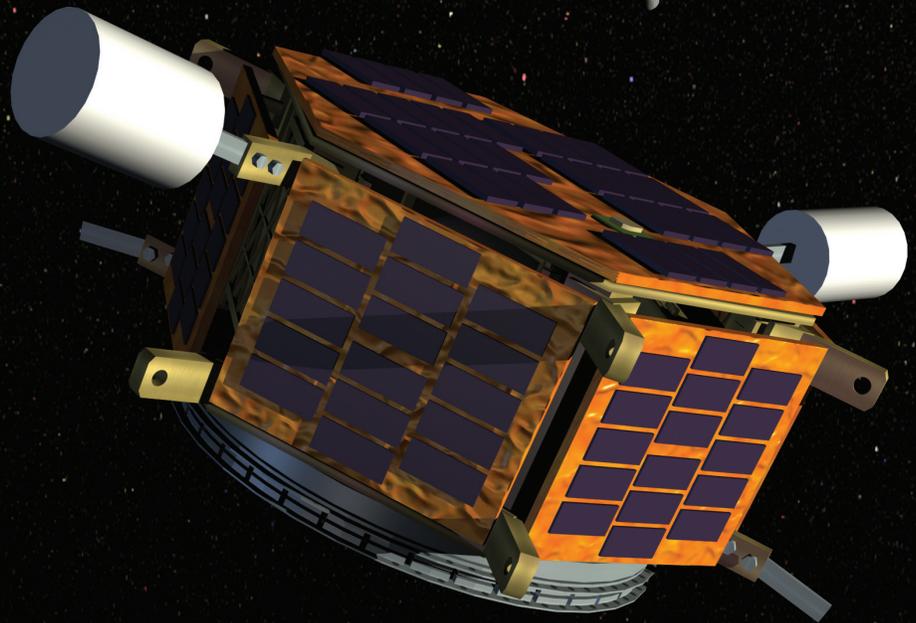


# The Longhorn Liftoff

SPRING 2011 / VOLUME ELEVEN / ISSUE ONE

## FASTRAC

**From Classroom to Space:  
Students Launch Hand-Built Satellites**

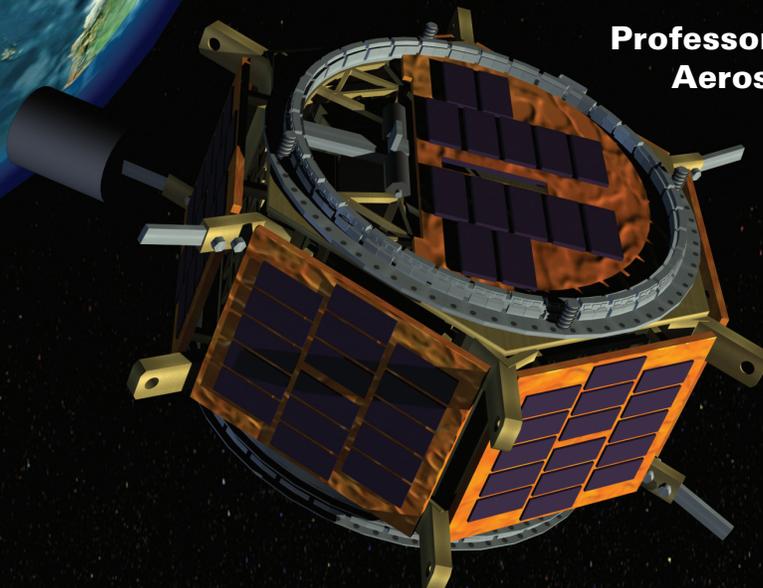


**Also in this Issue:**

**Professor Byron Tapley: A Pioneer of  
Aerospace Education & Research**

**Inspiring Women to Reach  
for the Sky and Beyond**

**Students Assist Alumnus in  
Search for Amelia Earhart**





## Chairman's Corner

By Professor Philip L. Varghese

**G**reetings from W.R. Woolrich Laboratories! As always, things are hopping in the department, and this issue will describe a sampling of the latest projects and accomplishments of our students, faculty and alumni.

For more than half a century, Professor Byron Tapley has led the way in teaching and research excellence. We take a look back at his impressive career from heading up the Center for Space Research (CSR) to overseeing the first operational NASA Earth System Pathfinder to leading the department into the space age. You'll also read about his former students' plan to recognize his dedication and service through the establishment of the Bryon and Sophie Tapley Graduate Fellowship.

Since November, what started at UT has been orbiting the world. The FASTRAC project is the first student-developed mission in which tire-sized satellites – built for only \$250,000 – will orbit, separate and communicate with each other in real-time. If successful, the boundaries of what is possible in space technology could be redrawn, opening the doors for more complex missions requiring real-time coordination between small satellites. The Longhorn Rocket Association is building its first two-stage rocket that is expected to reach transonic speeds, while another group of students has been working with alumnus Jon Thompson '71 in search of Amelia Earhart's vanished airplane.

Our students continue to win awards across campus and across the country. UT's AIAA student chapter took first place in the Student Engineering Council Energy Challenge Contest. They created a solar powered evaporative refrigerator that keeps

vaccines cold without external electric power supply, which could make a real difference in developing countries or during a humanitarian crisis such as the cholera outbreak in Haiti. Graduate student Travis Mercker was selected to receive the John Breakwell Student Travel Award from the American Astronautical Society to present his research on spacecraft attitude control. Last, but certainly not least, Bryse Ed, one of the founding members of Women in Aerospace Leadership Development (WIALD), received a Cockrell School Engineering Leadership Award.

WIALD was founded to help reverse the slow and steady decline of the number of women enrolled in our program. We certainly don't want to miss out on the talents and energy of half the population! We are making a concerted effort to recruit and retain more young women, and increasing scholarship support is a critical component. Alumnus Steve DeLeon '75 kicked off the scholarship fund and took advantage of Lockheed Martin's match to double his contribution. Brian McKee '80 and Dan Deans '90 of Millennium Engineering were the first to respond to Steve's challenge with gifts of their own. Incidentally, Brian shared his perspective on systems engineering with our students – the room was packed to capacity for his wonderfully entertaining and informative talk.

Our students also heard how aerospace principles apply to oil exploration from former Air Force fighter pilot Tom McKnight '70, who went on to found Eagle Rock Drilling. Alumni presentations give our students a glimpse into the real world so they understand the versatility of an aerospace engineering degree and that a career path rarely follows a straight line.

As we celebrate our successes, we also ponder the future of our industry and higher education. Like many of you, we

are adjusting to current economic conditions. Over the past year we've made painful cuts to accommodate budget reductions to the university while trying to minimize the impact on students. We are fiscally responsible and are operating in the most efficient way possible. Let me note that the administrative cost ratios at UT are low – less than half of the average for public universities in Texas.

The University of Texas is one of the original eight "Public Ivies" delivering an excellent education at a price far lower than a private institution of comparable academic reputation. The Texas Constitution of 1876 mandated that we be "a university of the first class," and we will continue to meet this standard. As belts tighten everywhere, we are deeply grateful for the generosity of our alumni, parents and friends. Your gifts take our students' education far beyond the classroom, and your support is more critical than ever. Thanks to you, the sky is not the limit!

Finally, let me remind you that there will be a Houston Area Longhorn Engineering Rendezvous on May 3. Almost 200 alumni attended last year, and we look forward to seeing an even bigger group this year. Further information and registration details are in this issue. As always, I encourage you to stop by campus and visit the Department to see for yourself what has changed and what remains the same.

*Above left: Philip L. Varghese,  
Distinguished Teaching Professor and Chair,  
ASE/EM Department  
Photo by Beverly Barrett*

## NASA-JSC/Houston Area Longhorn Engineering Rendezvous

### Calling all NASA-JSC/Houston Area Aerospace Engineering Longhorns...

You are cordially invited to join the Department of Aerospace Engineering and Engineering Mechanics for an evening of BBQ, drinks and reminiscing.

Join Dr. Philip Varghese, Aerospace Engineering and Engineering Mechanics Chair and other NASA-JSC Longhorns for an evening of food and fun!

### NASA-JSC/Houston Area Longhorn Engineering Rendezvous

**Date:** Tuesday, May 3, 2011

**Time:** 4:30 – 6:30 p.m.

**Location:** Gilruth Center, Live Oak Pavilion

**Registration:** We ask that you please register for this free event. For more information and instructions on registering online visit <http://www.ae.utexas.edu/resources/NASAJSCReunion2011.html>

**Stay Connected:** We encourage you to stay connected by updating your contact information online at <http://www.engr.utexas.edu/alumni/stayintouch>

Please help us to spread the word by passing along this message to other Houston Area Longhorn aerospace engineers!



*JSC-UT Longhorns enjoy a reception held at the Gilruth Center during the 2010 Longhorn Engineering Rendezvous.*

### Professor Oden wins SIAM Prize



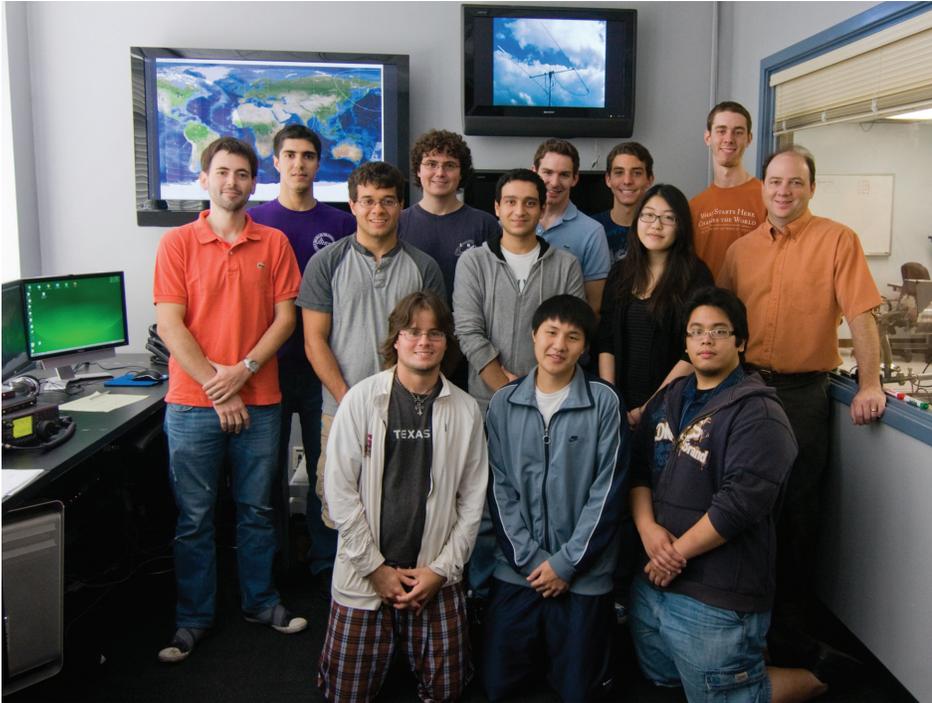
Professor J. Tinsley Oden was selected to receive the 2011 SIAM/ACM (Society for Industrial and Applied Mathematics/Association for Computing Machinery) Prize in Computational Science and Engineering (CS&E Prize) for his outstanding research contributions to the development and use of mathematical and computational tools and methods for the solution of science and engineering problems.

The award consists of a certificate containing the citation and a cash prize of \$5,000, which will be presented at the SIAM Conference on CS&E in February/March.

Dr. Oden serves as the Director of the Institute for Computational Engineering and Sciences (ICES). He holds the Cockrell Family Regents Chair in Engineering no. 2 and the Peter O'Donnell Jr. Centennial Chair in Computing Systems.

# From Classroom to Space: Engineering Students Launch Hand-Built Satellites

Story and photo by Tara Haelle



*The FASTRAC Team in the Spacecraft Control Center, where the satellite is being tracked in space. Team members from left to right: Back: Hasanain Jwair, Benton Greene, Eric Ferguson, Alan Sisson, Peter Schulte; Middle: Sebastian Muñoz, Andrew Hutcheson, Zaid Sofia, Jenny Kim, Dr. E. Glenn Lightsey; Front: Warren Hornbuckle, Sheehan Khuu, Philip Barcelon*

The FASTRAC satellites built by students over seven years were launched from the Kodiak Launch Complex in Alaska Nov. 20.

Shortly after midnight on Nov. 20, Professor Glenn Lightsey let out a “whoop” of excitement in front of his computer screen.

Seven years of work by Lightsey and more than 150 students on a shoestring budget had culminated three hours earlier in the launch of a satellite package from the Kodiak Launch Complex in Alaska. Now, the satellites were beaconing from space.

“It was almost surreal because we had been waiting for a long time to see our satellite launch, and when it actually happens, you’re not even sure how to respond,” said Lightsey, the students’ faculty advisor on the project, known as FASTRAC. “It was kind

of emotional because it was something we had invested so much of ourselves in.”

Entirely run by graduate and undergraduate students, the FASTRAC project is the first student-developed mission in which satellites will orbit and communicate with each other in real-time.

The project is sponsored by the Air Force and began in 2003 with the goal of developing space technology that’s more affordable and therefore more accessible while training and educating future engineers. Students used a hardware budget of only \$250,000, a drop in the bucket compared to the millions typically spent on spacecraft missions, to build the tire-sized satellites. Named Emma and Sara Lily, the 60-plus pound satellites have the ability to separate from one another and to communicate

with each other on their location and attitude determination data from their on-board GPS systems.

If successful, this project could redraw the boundaries of what is possible in space technology and open the door for more complex satellite missions that require real-time coordination between small satellites.

“This is very progressive, forward-looking technology that the Air Force and NASA are very interested in because you can have smaller satellites that are more effective as a group than a single more expensive satellite,” Lightsey said.

The application possibilities for the satellites are also endless – from changing the way routine maintenance is done to improving safety to helping prevent tragedies like the Columbia space shuttle disaster in 2003. The Columbia crew was unaware of a hole in the left wing that caused the shuttle to disintegrate upon reentry into the Earth’s atmosphere.

“If they would have had the technology that could go outside the shuttle and inspect it, then the hole could have been discovered,” Lightsey said.

In fact, a small satellite may even be able to repair the hole. They could also be used to refuel other satellites, or a large group of satellites could take multiple, coordinated pictures of the Earth in a way that’s never been done before, Lightsey said.

Since the November launch, the student team is about halfway through the second phase of the project, a month-long initial check-out period. Next, the team will move to phase three – the highlight of the mission – to see if they can command the satellites to separate and successfully communicate.

Sebastian Muñoz, a graduate student and FASTRAC project manager, said this phase will demonstrate that the technology they built is functional and valuable for application.

“It really opens new, interesting frontiers for new missions,” Muñoz said. “The onboard relative navigation experiment will allow other missions to be performed that are more complex.”

Those more complex missions could involve teams of satellites working together in space, sharing the responsibilities that larger, more expensive satellites currently bear.

Like the satellites they’ve built, the FASTRAC team has relied on collaboration to make the launch, and hopefully the overall mission, a success.

An amateur radio operator in Germany let them know the satellites were working after they had been notified that the connected pair had correctly entered orbit shortly after launch. They had to wait for the first pass over Austin to see if they could communicate with the satellites – a phase of the project that has been a bit tricky.

Muñoz said the team is looking at upgrading hardware on the ground station so it can better communicate with the satellites because they sometimes do not receive messages from them.

There could be several reasons for this, Lightsey said, including the challenge of getting accurate information about their

satellite’s position. Although the Air Force tracks the satellites and passes information to the students, the team launched with six other satellites, so there was some uncertainty immediately after launch about which satellite was which. Since then, the team has been working out the bugs to improve the way it sends commands.

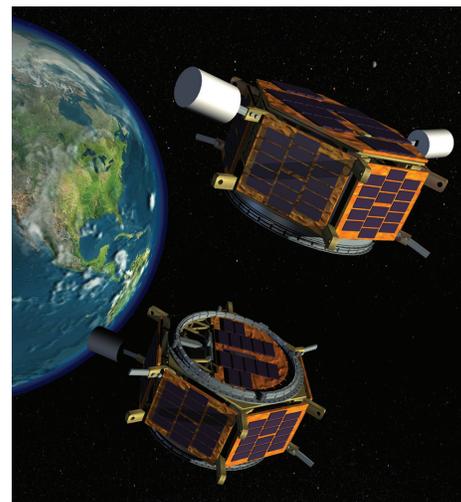
Lightsey said getting the satellites working together and sharing information is a technological innovation in itself, but equally remarkable is that students ran the project on such a limited budget, especially when cost is the biggest barrier to getting into space.

It will be a few months before the team can say whether they accomplished all the mission objectives, Lightsey said, but the most important aspect of the program – the educational component – has already been a tremendous success.

“To give students the opportunity to learn by practicing what it is like to build something that will go into space, to go through all the processes to design the satellite, to build it, to physically integrate all the parts, to test it and meet certain specifications given by Air Force or NASA, and finally to operate the satellite in space – there is no way to fully teach that in a classroom setting,” Lightsey said.

## Breaking News

After several attempts to send the separation command, the twin satellites successfully separated on the morning of March 22 at 6:35 am CDT, moving the experiment into the primary phase of its mission. This marks a major milestone for FASTRAC as the team has achieved a true first in spacecraft engineering. Watch for updates in our next e-newsletter. You can also follow FASTRAC on Facebook (<http://www.facebook.com/fastracsats>) and Twitter (<http://twitter.com/fastracsats>).



*Still shot from an animation of the FASTRAC satellites separating. View the animation at <http://www.engr.utexas.edu/fastracanimation>*

## Bryse Ed Receives Cockrell School Student Leadership Award in Engineering



Even though aerospace engineering senior Bryse Ed has poured her heart into the Cockrell School, she was shocked when she received one of the school’s most prestigious accolades, the Student Leadership Award in Engineering.

“I was really honored,” she said. “I’ve put in a lot of time, and I was really excited to see that all the work I’ve done has paid off.”

Six Student Leadership Awards, with a \$200 check and name recognition on a permanent plaque, are given each year to students who have held leadership positions in engineering student organizations, have positively affected the Cockrell School community and have dedicated

themselves to overcoming obstacles and pursuing their visions.

Nominated by Tricia Berry, Director of the Women in Engineering Program, Ed has held several leadership positions in engineering organizations throughout her undergraduate career. As a freshman, she chaired the retention and recruitment committee of the Society of Women Engineers, and she served as Student Engineering Council representative for SWE her sophomore year. She is now serving her second year as SWE treasurer.

“I’ve always loved science and thought engineering was the best option

because it was an applied science,” Ed said. “I wanted to do something hands-on, and I think that’s why I also fell in love with WIALD so much.”

Ed joined the Women in Aerospace for Leadership and Development organization at its inception last year and spent much of her summer working on WIALD’s project with Fredericksburg High School in which WIALD members built the payload for the nose cone of a rocket built by the high school students.

“It was the first hands-on opportunity I’ve gotten to experience with a team,” she said. “Doing that project with WIALD is what I’ve enjoyed about my college experience the most.”

Although Ed is still trying to determine exactly what she wants to do in her field, she knows she wants to enter the workforce immediately after graduating next year.

“I like the business and the hands-on sides of engineering,” she said. “The business side gives me a better idea of how to handle the overall planning of a project.”

For now, she is looking forward to seeing what her systems engineering class is like this semester and is happy to learn all she can about aerospace.

“Since I was really little, I’ve always loved looking at the stars and anything having to do with space,” she said.

# Longhorn Rocket Association: Design, Construct, Launch

By Shaina Shapiro, Vice President, LRA  
Advised by Dr. Charles Tinney



The Longhorn Rocket Association (LRA) continues to expand with more members taking on newer and bigger projects. With nearly 60 active members from diverse backgrounds and disciplines, we have come a long way from building small model rocket kits. The group holds weekly “rocket builds” where members design and construct small rockets for launches held at the Pickle Research Campus (PRC). This allows members to learn the basics of rocket design and construction methods, which will come in handy when working on bigger projects.

Attended by more than 80 people, including students, faculty, staff and their families, the Fall 2010 PRC rocket launch was the largest to date. For the first time, small rocket kits were made available for purchase on site so that attendees were able to build and launch their own rockets with assistance from LRA members. At least 30 different rockets were launched that day, some even multiple times.

Each year, LRA members also design and fabricate a high-powered amateur rocket similar to the two rockets that the group successfully launched at Rockets '09 in Fredericksburg, TX. In 2010, a team designed a rocket to carry a foldable glider with a camera to an altitude of one mile, where it would be released to glide to the ground, recording aerial video. Unfortunately, this rocket has not yet been launched due to poor weather conditions, but it will be launched this year along with a new rocket. Currently, members are designing a two-stage rocket that is expected to reach transonic speeds. They are looking forward to an upcoming critical design review with peers and professionals before moving forward to the construction stage.

As 2011 gets underway, LRA is very excited about designing and building a sounding rocket that will collect

information to aid in designing larger rockets in the future. The proposed design is a modular rocket with a payload bay to house interchangeable research packages that will be used to take specific measurements. This rocket is an important step toward our goal of reaching an altitude of 100,000 feet. In the future, LRA would like to design and build a static test stand so that the organization can build and test our own motors.

The Longhorn Rocket Association is extremely excited about our past accomplishments and where we are headed in the future! Our mission is to enhance education by providing a hands-on opportunity for students to apply classroom knowledge to design, build, and launch our own rockets. More information about LRA can be found on our website at <http://lra.ae.utexas.edu>

*Above: 2010-2011 Longhorn Rocket Association team members*

*Left: Dr. Todd Humphreys and his son attended the Fall 2010 LRA launch where they built their own model rocket seen here.*



# Off the Grid Fridge: AIAA Team Takes First Prize in Alternative Energy Challenge

Story and photo by Tara Haelle

Bill Gates might want to take notice: students in UT's Aerospace Engineering program have designed a low-cost, solar-powered refrigerator that could help in delivering vaccines to hot and arid parts of the world – with no need for electricity. The Student Engineering Council (SEC) already has taken notice: the four-person team, led by senior Travis Sanders, won the 2010 SEC Alternative Energy Challenge Award for their evaporative refrigerator.

The AEC competition encourages students to create innovative ideas for generating power through renewable and sustainable methods. Sanders' team, which included junior Kaitlin Decker, senior Eric Ferguson and senior Grant Rossman, received \$1000 as well as a bonus \$500 to their organization, the UT Chapter of the American Institute of Aeronautics and Astronautics (AIAA).

"The original intent for the refrigerator was to store vaccines in impoverished parts of the world," Ferguson said. "Through the process of transport, they're losing a lot of vaccines because they're getting too hot, and when vaccines heat up, they spoil."

The refrigerator, which took only two weeks to build and cost only \$260, uses an evaporative process to cool its contents. The compact, airtight, insulated wooden box has multiple round holes cut into the top of it, and an aluminum water bottle plugs into each one. Towel sleeves, saturated with water, are wrapped around the



*AIAA student Energy Challenge Team with their "Off the Grid Fridge."  
From left to right: Kaitlin Decker, Eric Ferguson, Travis Sanders, Grant Rossman*

bottles, and as the water evaporates from the towel, it cools the water bottle as well as the air inside the bottle. The cool air inside the bottle sinks into the box as the warmer air already in the box rises.

Because many areas where the refrigerator might be used may lack wind, which would speed up the process of evaporation, the team added a hand-cranked fan that can blow air over the system. Wind could also blow over it as the refrigerator is transported on the back of a bicycle, a truck, an animal or any other form of local transport.

"We came up with the idea for the fridge first and then thought about what would be a good application for it," Sanders said. He said one judged recommended using it for camping and backpacking. Sanders said it can be used for any kind of perishable and can be made for less money by using socks instead of towels or by building these refrigerators in bulk.

"Our goal was to make it very low cost," Ferguson said. "We wanted it to be affordable for poor areas."

*To learn more about student projects and/or to support our student teams, please contact Amanda Brown at 512-471-4046 or [amanda.brown@austin.utexas.edu](mailto:amanda.brown@austin.utexas.edu). Without the generosity of our alumni and friends, these projects would not be possible.*

# Professor Byron D. Tapley: A Pioneer of Aerospace Education and Research

Story and photo Tara Haelle

Many of Dr. Byron Tapley's students – whether they worked at NASA, in the military, in international space agencies or in academia themselves – have already retired, yet he is still actively working after more than half a century. And that's just the tip of the iceberg in Tapley's career.

The list of his professional associations, publications (over 150), awards and accomplishments, including holding the Clare Cockrell Williams Centennial Chair in Engineering, could keep a person occupied on a trip to the moon and back, and high

among them are his tremendous contributions to the Department of Aerospace Engineering and Engineering Mechanics. From heading up the Center for Space Research (CSR) since its inception in 1981 to overseeing the first operational NASA Earth System Pathfinder to leading the department into the space age, Tapley's dedication to his research and to the Cockrell School is tough to match.

With an interest in space since early high school, Tapley earned his undergraduate degree in mechanical engineering at UT in

1955, before the aerospace program existed. After earning his MS in Engineering Mechanics in 1957 and his PhD in Engineering Mechanics two years later, Tapley was approached by then-department chair M.J. Thompson to see if he would help develop a course on space. But just a course was not enough for Tapley; he wanted to see a whole sequence of courses that would teach the range of skills necessary for space exploration. So leading up to and during his tenure as department chair from 1966 to 1977, Tapley guided the department from an aeronautics program to an aerospace program during one of the most dramatic decades in space exploration.

"It was an exceptionally interesting time to launch an academic aerospace program as our country was racing to the moon," Tapley said.

Though Tapley had thought himself too young at age 33 to be the chair, then-Dean John McKetta made him an offer he couldn't refuse. Over the next decade, Tapley brought on board some of the department's most accomplished researchers and instructors, increasing the number of full-time faculty members from six to 30. He also worked hard to recruit top graduate students like William F. Powers ('66 MS ASE, '68 PhD EM), now a retired Vice President of Research for Ford Motor Company and a member of the National Academy of Engineering.

"It was an unbelievably exciting time in space research with every day bringing new changes," Powers said. While Powers was working at NASA-Huntsville, Tapley convinced him to come to UT instead of nearby choices like the University of Alabama and Auburn, and helped him procure funding for his PhD. Powers said he emulated Tapley's teaching methods later as a professor at the University of



*Professor Byron Tapley with a model of the GRACE satellites. To honor Dr. Tapley's 52-year career as a professor and researcher, several of his former students are starting a campaign to endow the Byron and Sophie Tapley Graduate Fellowship.*

Michigan, a NASA consultant for the space shuttle program and the leader of research at Ford.

“Professor Tapley would start class with a lecture and end with all of us working as a team to figure out the latest technical paper,” Powers said. “We were learning while doing, and Dr. Tapley gave us the confidence to explore any new topic.”

Tapley’s first PhD student, Vernon Lee (’54 BS AeE, ’55 MS AeE, ’63 PhD ASE), agreed that Tapley’s style was inspiring.

“He was always interested in exactly what you were doing and eager to share his enormous depth and span of knowledge,” said Lee, now a retired Vice President of Lockheed Martin (formerly General Dynamics) who spent much of his career selling the F-16 internationally. “On the other hand, he pretty much left it up to you to decide what to do. Dr. Tapley gave his students the tools and freedom to think for themselves.”

After stepping down as department chair in 1977, it was only a few years before Tapley, in collaboration with NASA, established UT’s Center for Space Research to conduct research in orbit determination, space geodesy, the Earth’s environment, exploration of the solar system and the scientific applications of space systems data. Research conducted through CSR programs has touched nearly every facet imaginable of the Earth and human interaction with it. From questions related to fisheries and agriculture to mapping ocean circulation and tracking the environmental impacts of oil spills like the Deep Water Horizon spill this past summer, CSR conducts cutting-edge research in nearly a dozen areas.

Tapley joked that it may be habit that brings him to work each day, but ultimately he realizes he can’t walk away from so many exciting developments continually going on

under his supervision.

“It’s the stimulation,” he said. “I’ve thought about retiring, but GRACE has been a really remarkable experience.”

The Gravity Recovery and Climate Experiment, or GRACE, funded by NASA and the German Aerospace Center, has been a centerpiece of CSR study since its launch in March 2002. Consisting of two satellites flying in formation 310 miles above Earth, GRACE makes detailed measurements of the Earth’s gravity field by relying on Newton’s law that objects receive a stronger gravitational tug from more massive objects.

Since the Earth’s gravity varies from one place to another, depending on planetary features like deep craters under the Antarctic ice or alterations in the ocean floor, the satellites respond to the micrometer-scale variations in the gravitational pull of mass changes on Earth. Those variations are reflected in the distance between the twin satellites, ranging from 137 to 220 kilometers apart. The GRACE satellites’ ultra-precise measurements of mass flux, whether high on mountaintops or deep under the ocean’s depths, have provided invaluable knowledge about changes in Earth’s natural systems.

“Almost every day we find a new application for GRACE” Tapley said. “We’re working to monitor the major flood zones around the world so we can predict and manage flooding.”

Just one example of what GRACE can do is the insight it provides regarding rising ocean levels.

“We know how much the ocean is rising. The question is how much mass is going into it from melting ice and how much is heat coming in from the sun,” Tapley said. “GRACE can tell you that.”

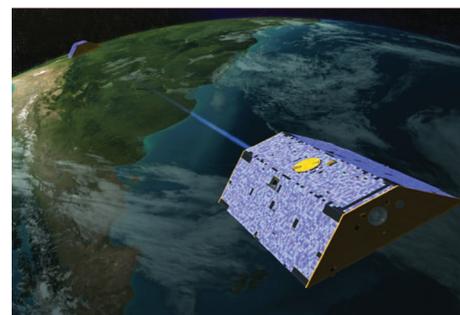
Though originally planned as a five-year

project, GRACE keeps on kicking, much like its Principal Investigator, Tapley.

As a member of the National Academy of Engineering and a recipient of the AIAA Mechanics and Control of Flight Award, the Astronomical Society Dirk Brower Award and the AGU Charles Whitten medal, Tapley has also supervised hundreds of graduate students and had the unique opportunity to see the Aerospace Department become a top-ranked international program attracting more and more exceptional students.

“The preparation of students coming into our program is markedly stronger now both at the undergraduate and graduate level,” said Tapley, who attributes the change to two sources. “One is the high school programs’ preparation for college, and another is that the university does a much better job of recruiting the best of the best.”

And with professors like Tapley guiding so many of those students toward the future of aerospace, they’re sure to remain the best of the best in the industry.



*Artist’s rendition of the GRACE satellites flying in formation 310 miles above Earth, making detailed measurements of the Earth’s gravity field. The measurements provide us with information to monitor major flood zones, determine water accumulation in the world’s river basins, measure Greenland and Antarctic ice mass changes, and much more.*

If you want to let Dr. Tapley know the impact he’s made on your life, please consider making a gift to help establish the Byron and Sophie Tapley Graduate Fellowship. This endowment will ensure Dr. Tapley’s legacy for generations to come as Tapley Fellowship recipients continue the teaching and research he began in 1958. To make your gift, please contact Amanda Brown at 512-471-4046 or [amanda.brown@austin.utexas.edu](mailto:amanda.brown@austin.utexas.edu).

## Bringing it All Together:

### Alumna Lisa Guerra Designs New Systems Engineering Course

Story and photo  
by Tara Haelle



Although she went on to a successful career at NASA after earning her MS ASE at UT in 1987, Lisa Guerra couldn't quite stay away from Austin. For the past five years, she has worked within the Cockrell School on a Intergovernmental Personnel Act (IPA) agreement first to develop a systems engineering curriculum in the Aerospace Engineering department and then, over the past year, to infuse the UTeach Engineering program with those same elements of systems engineering.

"It's teaching the skills and habits of mind that apply to anything you're going to do," Guerra said about systems engineering. "It gives students a sense of real aspects within the industry."

Guerra is certainly familiar with the industry. As the former director of the Integration Office of the Exploration Systems Mission Directorate at NASA, her catchall role involved looking at the strategies for human exploration beyond the space station, including everything from strategic planning to international partnerships.

It's an ideal position for someone with a BS in aerospace and a BA in English from

Notre Dame. Guerra said her attraction to aerospace arose from a combination of her childhood imagination and a formative high school experience.

"I think anyone from my generation who grew up watching the Apollo program and the moon landings was very inspired by that as a child," she said. But the clincher occurred during a Notre Dame engineering summer camp before her senior year of high school. She won a grant that led to involvement with the Giotto mission, building an instrument that flew on a European spacecraft to Halley's comet. She was hooked.

While her years at UT in graduate school were a blur of research and study, she does recall being the only woman in her class, an inequity she hoped would no longer exist when she returned.

"It hasn't changed much," she said. "If you roam the fourth floor, you're still not going to see many women."

But noticing the dearth of women choosing engineering didn't discourage Guerra; rather it inspired her to serve as a faculty sponsor for WIALD, the Women in Aerospace Leadership and Development

club started last year.

All the while, she focused on developing the UT pilot curriculum in systems engineering that would serve as a model for universities across the U.S. Guerra observed the senior capstone design course to assess how students were going about the design process and what they may be lacking.

Meanwhile, she drew from her involvement in the systems engineering handbook NASA was creating and the leadership development program for new systems engineers being produced at Johnson Space Center.

"This course was structured to enable a better execution of the capstone design course," she said. "It was a lot to expect of students to knit it all together in one semester, so they learn these concepts before they have to execute them in their design projects."

Knitting it all together is what systems engineering is all about.

"It's this more holistic view of the system, looking at it from a bigger-picture perspective," she said. Students learn about sub-systems like propulsion, orbital mechanics, and structures throughout their degree

plan, but there had not been a course that integrated that knowledge together and taught the technical management aspects of aerospace engineering.

“Systems engineering is trying to help them see that you’re taking everything into account,” she said.

Guerra designed the course as a series of modules, including System Life Cycle, System Architecture and Risk Analysis, so that other universities could integrate individual modules into existing courses if they were unable to create a whole new undergraduate course as UT did.

After Guerra taught the first undergraduate course in the spring of 2008, she used student feedback to improve it before making it available online to other universities in fall of 2009.

Dr. Wallace Fowler, who teaches a capstone design course, said the introduction of Guerra’s systems engineering course has made a tremendous difference in the quality of students’ designs.

“It’s just been a quantum leap in the

quality of the designs because the students know the process they’re going to have to go through and what words to associate with things,” he said. “Students are more realistic and realize what the real-world stakes are, looking at cost and some of the political realities of things as well as the engineering side of things.”

The strength of Guerra’s curriculum, aside from existing as a series of interchangeable modules, is the qualitative aspect that requires students to consider the feasibility and tradeoffs in their designs.

“It lets them take a step back and see why they’re learning this and keeps companies from [later] having to do as much on-the-job training,” she said. “It’s the bigger thinking of putting the puzzle together.” She said the approach and techniques taught can apply to large NASA programs or smaller missions that will likely be replacing programs like Constellation.

In fact, a student in her pilot class, Michael “Dax” Garner, became her TA and then went on to write his Master’s Thesis

on applying systems engineering principles to student-led projects, such as those in the UAV and satellite design labs.

“I can’t even imagine being here without having learned and worked systems engineering,” Garner wrote in an email to Guerra about his job at Odyssey Space Research in Houston. “Everyone is treating me as if I understand all the systems concepts, and I believe I owe the thanks to you.”

Emails like these – and she has received plenty – were an unexpected bonus for Guerra, who said the best part of teaching at UT has been influencing the way students think about their future careers in the aerospace industry.

“It’s been really fun to watch their trajectory, and that was the part I was totally not expecting,” she said. “You do an assignment, and you think of the nuts and bolts of it, not who you’re affecting and whose future you’ll touch.”

For more information, visit Lisa Guerra’s Space Systems Engineering website at <http://spacece.spacegrant.org>

## Travis Mercker Wins Breakwell Student Travel Award to Present Paper at AIAA/AAS Conference

While it’s helpful to know what methods have historically worked for controlling a spacecraft, it’s even better to have rigorous mathematical analysis that guarantees you can make the craft do exactly what you need it to do. Travis Mercker, an aerospace engineering PhD candidate, has spent much of his graduate career finding that guarantee.

Mercker’s paper, “Rigid Body Attitude Tracking with Vector Measurements and Unknown Gyro Bias,” and his related research earned him a John Breakwell Student Travel Award to present the paper at the Annual AIAA/AAS Space Flight Mechanics Conference in New Orleans in February of this year. The award, a \$1000 travel grant given by the Space Flight Mechanics Committee of the American Astronautical Society, recognizes Mercker’s achievement on the problem of spacecraft attitude control.

“We want to prescribe the attitude of the satellite and then precisely control it to that position,” Mercker said. “My research specifically looks at what realistic measurements we have available from sensors on the spacecraft and how to use them to control the system.”

Mercker said the technical issue he and his advisor, Dr. Maruthi Akella, are working on is well-established: engineers need to be able to orient a spacecraft toward a particular direction regardless of where it is pointed or how fast it’s moving. Most current methods rely on algorithms with empirical measures. But Mercker’s paper offers a better method because of its certitude: he and Akella have derived a mathematical proof for a technique that guarantees accurate attitude control in

every situation except in a very small well-characterized set of conditions.

“From a practical standpoint, I have a theorem that proves that, subject to these conditions, I can control my satellite every single time, no matter what happens,” he said.

Mercker became interested in this area of research in his senior year while an undergraduate in UT’s aerospace program. He had always had a general interest in aerospace, but after taking a class on flight control systems with Dr. Robert Bishop, he knew exactly what he wanted to investigate further.

“Just the idea that you can take a system that’s inherently unstable – it’s just not going to do what you want it to do – and then design a control system that is able to control it is something I found to be more interesting than anything else I had done,” he said.

After getting his BS ASE in 2006, Mercker stayed at UT to earn his MSE in 2008 and now expects to finish his PhD in spring of 2012. As a SMART (Science, Mathematics and Research for Transformation) fellow receiving a stipend for his research from the Department of Defense, Mercker will owe three years to Air Force Research Labs at Wright-Patterson Air Force Base in Dayton, Ohio, after graduation.



# Inspiring Women to Reach for the Sky and Beyond

Women represent 22 percent of the undergraduate population at the Cockrell School of Engineering, just above the national average. However, in the Department of Aerospace Engineering women only make up 11 percent of our undergraduates, down from 20 percent in 2001. Female enrollment is declining in aerospace engineering programs across the country, and UT ASE/EM is committed to reversing this trend. The department has partnered with the Women In Engineering Program (WEP) on a comprehensive recruiting campaign, and is also seeking help from alumni and corporate partners. Steve DeLeon '75 and Millennium Engineering & Integration Company have answered the call.

## Breaking Barriers and Opening Doors: Steve and Mary DeLeon

By Tara Haelle

When Steve DeLeon, '75 BS ASE, was just six years old, he built a wooden plane that eventually ended up flying into the chicken coops on his family's property. His fascination with flight never left him as he made his way to UT and then on to lead engineer at Lockheed Martin, breaking barriers as a Hispanic along the way. Now, with four grown daughters and hoping to play a part in recruiting more women into aerospace, DeLeon has gifted \$5,000, matched with another \$5,000 from Lockheed Martin, to the department that helped him make a career out of his childhood aspirations.

"I always dreamed I would end up in the aircraft industry," he said. Born and raised in San Antonio, DeLeon said he always looked up to the University of Texas, even as a child. "Aircraft was my dream, and UT was the school with a fantastic program, so no other school came to mind. I needed to go to UT. I bleed orange."

While DeLeon doesn't recall experiencing discrimination during his days at the University in the early 1970s, he does remember the loneliness of being only one of a few minorities who didn't quite fit in. But that never deterred him. In fact, his realization that UT lacked a strong support group for minorities led DeLeon to found Pi Sigma Pi, a catchall engineering service organization for pretty much anyone who didn't quite "belong," whether they were women, Hispanics or other minorities.

"Anybody who had culture shock at UT was welcome," DeLeon said. Nearly four decades

later, Pi Sigma Pi has expanded to two other UT system schools and boasts over 10,000 alumni nationwide. And DeLeon didn't stop there in improving diversity in his field. As an undergraduate in a department on the verge of losing federal funding because of low numbers of minorities, DeLeon helped Dean Ernest Gloyna recruit more women and minorities to the Cockrell School, a role that led the dean to recommend him to the Vice President at General Dynamics as a hard worker who could help that company diversify its workforce as well.

"I have always felt that there are untouched sources of people out there – white, black, brown and so on – who have a tremendous amount of talent, and they should be given the opportunity to succeed," DeLeon said. "As we become extremely global, the world is becoming smaller and smaller and we need diversity in everything we do, and not just in race. It's important to have different values and different upbringings too."

With two of his four daughters having graduated from technical fields from UT System schools, DeLeon especially sees a need to ensure more women enter engineering.

"In this day and age, when women at Lockheed Martin have made tremendous gains, it worries me that a new pool of talented women are not coming into aerospace," he said. He hopes the \$10,000 combined donation will help the department recruit more women. Though UT ranks among the top ten universities in female enrollment,



*Steve and Mary are proud parents of four girls, one of their reasons for launching a female recruiting program for Aerospace Engineering.*

the Cockrell School has seen the percentage of females enrolled in aerospace engineering drop more than five percent in the past five years.

This is not the first gift for DeLeon; he also established an endowed excellence fund to support the Cockrell School's Equal Opportunity in Engineering program. DeLeon, having first founded Pi Sigma Pi and later co-founding the Texas Alliance for Minorities in Engineering (TAME), sees his donations as part of his lifelong mission to help others gain the education and experience he received to pursue an engineering career.

"Everything I've done in my life couldn't have been possible without the education and the discipline I received at UT," said DeLeon, who has received Lifetime Achievement Awards from the Ford Foundation and the United Hispanic Council. "That discipline served me well, and I owe them my life. I've spent all my life recruiting minorities and women into engineering, so this is natural for me. We need all the engineers we can get."

## A Mission to Inspire: Millennium Engineering Recruits Women into Aerospace

By Tara Haelle

When Dan Deans, '90 BS ASE and Vice President of Corporate Development at Millennium Engineering, attended his first ASE/EM External Advisory Committee meeting and heard about Steve and Mary DeLeon's gift, he was inspired.

Deans immediately went back to Brian McKee, '80 BS ASE and Millennium Chairman of the Board, who agreed that Millennium should set an example for other companies by providing a substantial donation. The company gave \$31,000 to the department, \$6,000 of which is from personal donations of Millennium employees, and they plan to make it an annual contribution.

"Millennium Engineering and Integration Company is honored to be able to support UT's Aerospace Engineering and Engineering Mechanics Department," McKee said. "As a company, we are committed to diversity in the aerospace engineering career field and focused on serving our friends at UT through scholarship giving, mentorship, and partnership in student projects."

Among the Advisory Committee's priorities – and one of the biggest reasons for Millennium's gift – is the need to attract more women to engineering.

"It was discouraging to hear that female enrollment in aerospace engineering is declining, so hopefully Millennium's scholarship support will help entice more women to enroll," Deans said. "It really is important that we have a diverse mix of students in the department and that people understand that there's a tremendous opportunity out there in industry for students who have this versatile degree."

In fact, Millennium recently hired one of those outstanding students: Jill Marsh, '09 BS ASE, will be working on a new Millennium project for NASA's Ames Research Center and the Department of

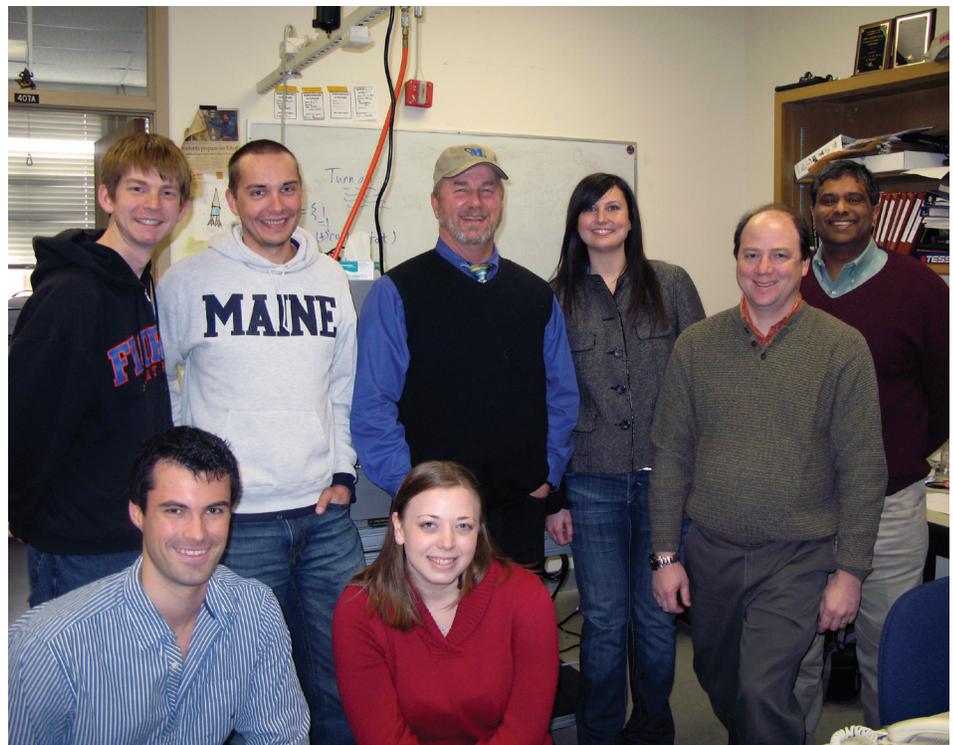
Defense that will ultimately provide the government with the ability to assemble and launch a satellite within seven days for rapid response to emergencies and/or military threats.

"I have been granted an amazing opportunity to work for Millennium on their Rapid Response Space Works contract," Marsh said. "The revolutionary work we are doing is incredible, and I am eager to inspire more young women to explore the opportunities that aerospace engineering has to offer."

Although Millennium is a small company of only about 300 employees,

they play a big part in providing engineering expertise and support in spacecraft development across government agencies, including the Missile Defense Agency, NASA and the Department of Defense. Now they want to play a big part in inspiring other companies to give to UT. Although Millennium plans to give to other universities as well, UT is receiving their first donation.

"I wouldn't have it any other way," Deans said. "Brian bleeds orange like I do, and the entire reason we're doing this is that we want to inspire others. I've always been a Longhorn, and there are very few causes as worthy as helping kids get their degree."



*During a Feb. 3 campus visit, Brian McKee '90 and Jill Marsh '09 received thanks from Chair Philip Varghese, Professor Glenn Lightsey and students in the Satellite Design Lab. Brian was also greeted by a standing room-only crowd for his presentation on systems engineering.*



*If you would like to contribute to the Women in Aerospace Engineering Scholarship Fund, please contact Amanda Brown at 512-471-4046 or [amanda.brown@austin.utexas.edu](mailto:amanda.brown@austin.utexas.edu).*

# Latest on the Search for Amelia: Jon Thompson, '71 MS ASE

By Tara Haelle

It's easy to think of the ways aerospace students are forging into the future with the skills they're learning at UT, but for a couple of students and one alumnus, these skills may help them understand a major event of the past.

"My wife, Susan, says that she's the only person she knows that lets her husband go out searching for another woman," jokes Jon Thompson MS ASE '71. That other woman is Amelia Earhart, the pioneering pilot who disappeared over the South Pacific Ocean with her navigator, Fred Noonan, 73 years ago during her attempt to circumnavigate the globe. For Thompson, Earhart's disappearance has become a real life treasure hunt, taking him to the depths of the ocean in search of the downed plane.

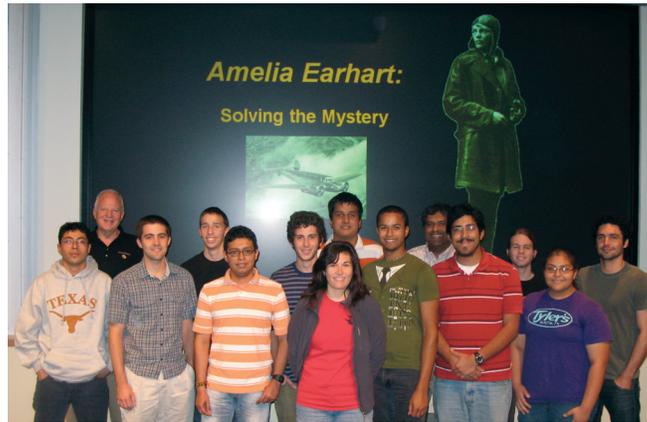
Thompson is associated with Nauticos, LLC. headed by David Jordan, arguably, the premier undersea explorer in the world today. The team will continue their search near Earhart's July 1937 refueling destination, Howland Island. Years of complex analysis involving multiple universities and companies have concluded that she simply ran out of fuel and ditched very close to her destination.

A team of UT aerospace engineering students are now along for the ride. Led by Vishnu Jyothindran, who graduated this past December, and senior Michael Rose, the students are conducting a flotation analysis that examines two scenarios under the assumption her plane landed in the ocean. The first is a center of gravity study (CG) that assumes she was able to safely land the plane in the ocean by flaring the plane, a technique used by pilots to gently land an aircraft by pointing its nose upwards before touch down.

Their study showed there was no possible

way an unfavorable CG location at the time of touchdown could have been a catastrophic issue, Jyothindran said. Since Earhart's Electra L-10E plane was custom-made for her, it was harder to track down flight drawings and weight calculations, but Jyothindran said the data Thompson provided was very valuable.

"The data collection of such an old airplane has been quite remarkable," Jyothindran said. "It has been fun working with old type-written reports and hand-drawn engineering drawings, something we are not used to in this age of computer-aided design (CAD)."



*Alumnus Jon Thompson visited aerospace engineering students on campus last fall to engage them in a study. The students' findings will be used in an expedition to the South Pacific in search of Amelia Earhart's lost airplane later this year.*

After more than 15 hours in the cockpit, Earhart's visual acuity, reaction time and sheer physical strength would certainly be impaired. In addition, the 1937 non-feathering propellers would act like a barn door restricting airflow over the wing and elevator control surfaces significantly slowing the powerless, gliding Electra. The time to flare the plane from the reported 1,000 feet altitude would be about 20 seconds. Given the empty fuel tanks, the plane's weight would be at its front causing it to fly at a downward, slanted angle. If the plane went down in this manner, Thompson said it

could have flipped violently and broken up on impact.

Jyothindran's team will study this scenario next and will include the floatation time of the Electra, buoyed by empty 1100 gallon capacity fuel tanks slowly filling with sea water.

"It is quite fascinating to work on a project that potentially could change aviation history," Jyothindran said. "Our education in UT's aerospace program has prepared us to tackle the technical questions posed to us, but this unique project is something no class lecture can prepare you for. It does help having experience working in teams like we do in our student projects."

The students' findings will be used to help Thompson and an approximately 35-member crew look for the plane when they go on their third expedition to the South Pacific sometime in late summer or fall. The expedition team has already combed over 2,200 square miles of ocean bottom since 2002 and plans to search another 400-600 square miles during the upcoming trip using sonar equipment that can detect something as small as one meter, even in the 18,000-ft. deep ocean where the plane is believed to rest.

"I'm excited about getting the UT students involved because the rest of the team is versed in the undersea aspect, but few in the group are pilots who understand the flight characteristics," Thompson said.

The students share Thompson's enthusiasm to help solve the greatest mystery of the last century.

"This is different from any other project we work on in school," Jyothindran said. "In class, you expect you'll get a question that you can solve with data in the textbook. We don't have that guarantee here, but that is what makes the project so exciting."

## Cal Walsh '10 BS ASE Lands Job with LEGOLAND Discovery Center

By Cal Walsh

Not only do I get to tell people I won my job in a competition, I am graced with the privilege to combine both work and play in the ultimate dream job!

It started out as a whim of curiosity from seeing an article in *The Dallas Morning News* newspaper, which was calling all LEGO fans to participate in a multi-round, two-day build off competition. The grand prize was the opportunity to be named the Master Model Builder – a full-time, salaried job with benefits – for the new LEGOLAND® Discovery Center Dallas/Fort Worth, opening March 30, 2011 at Grapevine Mills Mall in Grapevine, Texas.

With little thought to actually winning the competition, I went to shake hands with the right people, drop my resume and have a little fun on a Saturday afternoon. However, as the final round on Sunday commenced, I realized that if I could show the judges my mix of creative and artistic engineering design capabilities, along with my love of interacting with children, I might have a chance to really impress.

My final creation was a compilation of objects representing both physical and psychological characteristics of myself. A spaceship, riding atop a large letter “C,” represented my degree in Aerospace Engineering from The University of Texas at Austin. This was followed by a unicycle, depicting my love of travel, sense of balance, uniqueness and mystique and dedication to seek and overcome great challenges. The unicycle also represented the playful enjoyment and childish nature of active learning that I apply to my everyday life. Lastly, a tennis shoe in the shape of a large letter “L” represented the importance of exercise in my life, including my position as President of the Texas Running Club at The University of Texas. Using a forgiving imagination to see the unicycle as the letter



*Cal Walsh lands a job as a Master Model Builder of LEGOLAND Discovery Center after entering a local building competition. He is seen here with his winning model, which combines the spelling of his name, CAL, as well as representations of his characteristics, one of which included a spaceship to represent his degree in Aerospace Engineering from The University of Texas. Photo courtesy of LEGOLAND® Discovery Center Dallas/Fort Worth.*

“A”, the combination of all three elements then spelled my first name: CAL.

As Master Model Builder of LEGOLAND Discovery Center Dallas/Fort Worth, I am excited to aid in the construction and maintenance of MINILAND, the attraction’s key feature, as well as the large seasonal models. Additionally, I look the most forward to my responsibility of teaching children the secrets of being a LEGOLAND Master Builder and inspiring creativity and passion in the minds of our future engineers!

Opening at Grapevine Mills Mall in Grapevine, Texas on March 30, 2011, LEGOLAND Discovery Center Dallas/Fort Worth will be the second LEGOLAND Discovery Center venue to open in the U.S. and the fifth in the world. For more information visit [www.legolanddiscoverycenter.com](http://www.legolanddiscoverycenter.com).

### Alumni Notes

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#### KEEP IN TOUCH

We enjoy receiving your alumni news and need more from you to keep the "Blast From the Past" column up to date. Photos are encouraged! Please visit our alumni web page to update your email, address, and send us your news at <http://www.ae.utexas.edu/alumni>

Updates, news and photos may also be sent directly to:

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Thank you for your interest in the department. We look forward to hearing from you soon!

## NASA-JSC/Houston Area Longhorn Engineering Rendezvous

The Department of Aerospace Engineering and Engineering Mechanics invites you to an evening of BBQ, drinks and reminiscing at the **NASA Gilruth Live Oak Pavilion** on **Tuesday, May 3** from **4:30-6:30 p.m.**



**Tuesday, May 3, 2011**  
**4:30-6:30 pm**  
**NASA-JSC Gilruth Center**  
**Live Oak Pavilion**

For more information and to register online for this free event visit <http://www.ae.utexas.edu/resources/NASAJSCReunion2011.html>