

Moncrief-O'Donnell  
Endowed Chair  
2004 Annual Report

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The **Moncrief-O'Donnell Endowed Chair in Robotics** was filled in October of 1990 with the hiring of Dr. Frank L. Lewis. Dr. Lewis established the Advanced Controls and Sensors Group (ACS) of the Automation and Robotics Research Institute immediately on his arrival.

## ACSM PROGRAM OVERVIEW

The ARRI Advanced Controls and Sensors (ACS) Group consists of Dr. Lewis, 7 Ph.D. students, masters and undergraduate students, and intermittent visiting research faculty. The primary thrusts of ACS are research in controls design for robotic and manufacturing systems, intelligent control, Wireless Sensor Networks, and real-time control implementation.

Lewis has graduated 20 PhD students since arriving at UTA in 1990. Most of these students have won international and local awards for their work, and several have written books and received US patents.

Eight SBIR contracts have been received from DoD to work with small companies to transfer technology developed at ARRI. Funding in excess of \$5 million has been received from Texas State, the National Science Foundation, and the Army Research Office to perform research and develop technology in Intelligent Control Systems, Industrial Control, and Vehicle Control Systems.

## Wireless Sensor Networks

*This year we started a new initiative on Wireless Sensor Networks. WSN are needed for fast deployment in areas that could be compromised due to security threats, equipment failures, or biochemical toxins.*

*Funding of \$28,735 was received by J.B. Zhang from the Singapore Science and Engineering Research Council, to work with ARRI to develop theory for support of warehouse automation at the Singapore Changi Airport.*

**NSF Career Award to  
Two Former PhD Students**  
**Two of Dr. Lewis's former students  
received the National Science  
Foundation Career Award, the  
agency's most prestigious award for  
junior researchers.**



*Rafael Fierro  
Oklahoma  
State  
University*



*Sarangapani  
Jagannathan  
University of  
Missouri -  
Rolla*

The three missions of the group are:

- *To help companies improve their competitive advantage through advanced controls that increase product quality and production flexibility*
- *To perform high quality scientific research that expands the manufacturing science base*
- *To maintain a superior controls curriculum in the UTA Department of Electrical Engineering.*

**Wireless Sensor Networks.** This year we received equipment from J.C. Penney worth \$350,000 to set up a WSN testbed at ARRI that has mobile robot sentries as well as unattended ground sensors for Secure Area Assurance.

The Cyberguard Sentry Robot is 6 ft tall and has a payload of 250 lb. It has a sensor suite including infrared and ultrasonic intrusion detection, toxic gas detection, and heat/flame sensors. The Unattended Ground Nodes have intrusion sensors including magnetic, acoustic, vibration, and light.

We have developed a WSN Supervisory Control System on a laptop PC using our patented Matrix Controller that can sequence tasks in dynamical changing environments based on sensor surveillance readings in real-time. This controller allows fast deployment and setup of WSN for remote site monitoring.



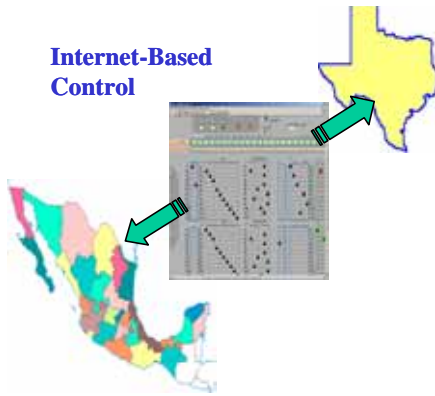
## UTA Professor Appointed Consulting Professor of South China University of Technology

Professor F. L. Lewis, Moncrief-O'Donnell Endowed Chair Professor of the University of Texas at Arlington, was elected as a Consulting Professor of South China University of Technology in Guangzhou. SCUT was founded in the late 1800's and was formerly known as Sun Yat Sen University. Consulting Professor is a title offered to internationally renowned researchers who are invited to participate in the academic life of the university. Lewis is also a Guest Professor at Shanghai Jiao Tong University, the MIT of China.

*See other side*

**Nonlinear Control Algorithms.** We have published 4 books and received 3 patents in Neural Networks for Intelligent Control of Industrial and Defense systems. Neural Networks significantly improve the response time and accuracy of systems including vehicle autopilots, aircraft control systems, industrial positioning systems.

**Internet-Based Control**



**International Relations.**

New programs were set up this year with universities in China including Chinese University of Hong Kong, Shanghai Jiao Tong University, and National University of Singapore. Activities include visiting programs, funding development, and joint research.

An \$80,000 grant from NSF received by Lewis and J. Mireles, of UA Ciudad Juarez, allows for joint programs in MEMS and manufacturing control over the internet. We are working with G. Fernandez, Director General of the US/Mexico Foundation for Science FUMEC to set up international activities.



**UTA Academy of Distinguished Scholars**

This year UTA established the UTA Academy of Distinguished Scholars. Moncrief-O'Donnell Endowed Chair F.L. Lewis was elected as a Charter Member, along with 9 other faculty members of UTA.

**SIGNIFICANT EVENTS THIS YEAR**

- Two former PhD students, R. Fierro and S. Jagannathan, received the NSF Career Award.
- Organized the ARRI Distinguished Lecture Series to invite international scientists to UTA to increase its visibility.
- Built up a new thrust area in Wireless Sensor Networks using donations from industry and international funding.
- Published a textbook on Robot Control Systems.
- Established international relations with China to set up joint educational/training programs in Wireless Sensor Networks.
- Antonio Quevedo, an NSF REU Scholar, had his paper on MEMS selected for presentation at the Society of Hispanic Professional Engineers Conference, Chicago, Jan. 2004.
- Lewis was elected as a charter member of the UTA Academy of Distinguished Scholars.

**ARRI Hosts Distinguished Lecture Series**



Dr. Lewis began the ARRI Distinguished Lecture Series at UTA's Automation & Robotics Research Institute. This series has invited top scientists from around the world to UTA including:

- Kimon Valavanis, Editor-in-Chief, IEEE Transactions on Robotics
- L.K. Mestha, Principal Scientist, Xerox Webster Labs
- T. Vardoulakis, Aristotle University, Greece
- M. Grimble, Director, Industrial Control Center, Scotland
- R. Chen, Director, Center for Chaos Research, Hong Kong
- J.B. Zhang, Singapore Manufacturing Technology Group

**ARRI Summer K-12 Program and Undergraduate Student Activities**

This year we received \$17K in supplementary funding from the National Science Foundation to support top US undergraduate students and interactions with Mexico. We ran a summer program at ARRI on robotics & that involved:

- 7 Oakridge School eighth graders
- Undergraduate minority students
- Students from Mexico

**DFW LOCAL IMPACT- PATENTS AND TECHNOLOGY TRANSFER TO U.S. SMALL BUSINESSES**

ACS has contributed to the reputation within the scientific community of both UTA and Dallas/Ft. Worth. Lewis is listed in the Ft. Worth Business Press top 200 Leaders. He served as Founding Chairman of the DFW IEEE Control Systems Chapter, which won the national best chapter award in 1994. He was selected as Fort Worth Engineer of the Year by the IEEE Section in 1995. We have received four U.S. patents and filed one more. We have received significant funding from NSF, ARO, Texas State, and the DoD SBIR program to work with local and national industry. This has enhanced the competitiveness of DFW and U.S. companies in the area of feedback control systems, automation, MEMS, and Wireless Sensor Networks.

**New Book Published**

