

# Plenary Session Kicks Off Inaugural IEEE International RFID Conference



**Speakers at the IEEE RFID 2007 plenary featured (top row, left to right) General Chair Emily Sopensky; IEEE-USA President John Meredith; and General Vice Chair Paul Hartmann; and (bottom row), IEEE Region 5 representative Jean Eason; Program Chair Daniel Engels; and Harry Pappas, CEO & Founder, International RFID Business Association.**

Emily Sopensky, General Chair for the first IEEE International Conference, held March 27-28 in Grapevine, Texas, just north of Dallas-Fort Worth, kicked off the conference with a smile . . . and a sigh of relief.

After months of hard work by many people, IEEE RFID 2007 had arrived.

She used her opportunity as host of the plenary session to welcome all participants, thank conference partners, give some background on the genesis of IEEE RFID 2007, and introduce some key individuals behind this inaugural IEEE RFID conference.

“IEEE RFID 2007 is the first in a series of annual conferences dedicated to addressing the technical and policy challenges in the areas of radio frequency identification (RFID) technologies, their supporting large-scale distributed IEEE RFID 2007 REPORT

information systems, and their applications,” said Sopensky.

She admitted that the conference organization “has been a fast-track project – nine months from conception to completion, rather than the usual 18 months for an international technical conference.

“Nevertheless, the technical program of more than 30 juried technical papers, combined with plenary and keynote addresses by some RFID luminaries, as well as panels of experts, has set a high standard for an inaugural conference.”

Sopensky added: “We are pleased to have the inaugural IEEE RFID conference co-located with RFID WORLD 2007, the premier show for the RFID industry.”

IEEE-USA President John Meredith

commented that RFID technology is evolving so quickly, impacting so many other technical disciplines, and exhibiting such potential for social and business applications that the IEEE-USA and the New Technology Directions Committee quickly signed on as prime sponsors of IEEE RFID 2007.

His remarks were echoed by Jean Eason, representing IEEE Region 5, the other primary co-sponsor of the conference.

Paul Hartmann, IEEE RFID 2007 general vice chair and vice president of engineering at RF SAW of Richardson, Texas, said:

“RFID technology and systems draw upon diverse fields of study, including electromagnetic theory; wireless communications and networking;

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## General Chair for IEEE RFID 2007 Is RFID Consultant



**Emily Sopensky**

Emily Sopensky, a former communications consultant to Texas Instruments, was the first General Chair for the first IEEE International Conference on Radio Frequency Identification

A consultant by trade, Emily Sopensky is the sole proprietor of The Iris Company, a communications business.

Her involvement in radio frequency identification began in 1996 with Texas Instruments in Dallas, where she was a consultant for six years with the RFID group (then called TIRIS).

After 20 years in Central Texas (primarily in Austin), where she worked with technology companies, especially startups, she became the second IEEE-USA Fellow to the U.S. State Department and relocated to Arlington, Virginia after the one-year fellowship.

A Senior Member of IEEE, Sopensky is actively supporting the Institute in recognizing the emerging technology of RFID. She led the IEEE-USA team that wrote the white paper on RFID (now available from IEEE-USA) as well as a position statement on the subject.

Representing IEEE-USA, she supports the new U.S. Senate RFID Caucus formed in July 2006.

*Continued from page 1*

theory and design; analog and digital VLSI design and manufacturing; embedded systems; distributed systems; database design and management; materials science; and the fields necessary to apply RFID effectively within specific applications.

“IEEE RFID 2007 was a juried conference,” he said, “meaning that all submitted technical papers were reviewed by a panel of technical experts before they were accepted for presentation.”

IEEE RFID 2007 Program Chair Daniel Engels brought together a distinguished international program committee of engineers, academic researchers and scientists to review all technical papers and select the best for presentation at the conference.

“From 105 submissions by technical experts at major universities and companies from 27 countries in Asia, Australia, Europe, North America, and South America, the technical program committee selected 31 papers.

“The topics and panels at IEEE RFID 2007 spanned a broad spectrum from antenna design to security techniques, and from integrated sensors to system protocols,” said Engels.

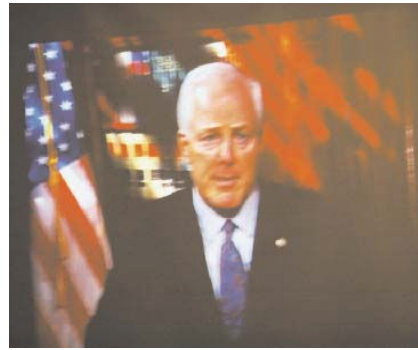
Harry Pappas, CEO and Founder of the International RFID Business Association, focused on its valuable partnerships with the IEEE, and the IEEE RFID 2007 team.

In particular, Pappas expressed his appreciation for the enthusiastic support of the RFID in the Workplace survey, which will provide data of benefit to all of the participating partners.

U.S. Senator John Cornyn (Republican-Texas) then gave a short message via video.

“RFID is an important and ever involving technology that will allow the United States to strengthen Homeland and Border Security,” said Cornyn.

“It will also revolutionize the supply



**In a special video message, U.S. Senator John Cornyn (R-Texas) talked about the Senate RFID Caucus, which “will help us to recognize ways technology can be useful in government & business processes.”**

chain and create significant advantages in various technology sectors.

“Groundbreaking ideas generated by innovation pay great dividends and improve the lives of all Americans now and far into the future,” he concluded.

The plenary session also included some remarks and slides from Mark Johnson, founder of RFID Tribe, a networking group for those interested in working within the RFID industry.

Johnson talked about the strong local environment for RFID technology innovation, development, tag manufacturing, distribution center trials, and commercial deployment.

Because more than 150 area companies, plus university RFID research and training, are involved with the technology, the Metroplex Technology Business Council, a local association of high-tech companies, has branded the area “Dallas-Fort Worth: the RFID Hub,” an appropriate locale for the first IEEE International RFID conference.



**Emily Sopensky, Andy Rittler, Congressional Director for Senator Cornyn, and Daniel Engels responded to questions about U.S. federal government policy initiatives, such as the RFID Caucus, on new technology.**



## First IEEE International RFID Conference Featured Leading RFID Experts

The first IEEE International Conference on RFID (IEEE RFID 2007) featured technical papers and panel discussions by leading RFID academic and industrial researchers from around the world.

The conference was held 27-28 March at the Gaylord Texan Resort & Convention Center in Grapevine, Texas, in conjunction with RFID WORLD, the premier RFID industry event.

"RFID technology has emerged significantly over the past few years," said Emily Sopensky, IEEE RFID 2007 general chair.

"From the tracking of hospital pharmaceuticals, surgical instruments and equipment to homeland security, supply chain, e-passports, and many other areas, we are only beginning to see the potential for RFID.

"As the world's leading association for high-tech professionals, the IEEE decided that the time was right to address all aspects of this technology and its diverse uses," she remarked.

The technical papers for 27 March featured security issues; systems analysis; antennas design and analysis; loca-

tion systems; and component design and analysis. Invited papers spotlighted the latest in shared data research and educational standards.

The "RFID in Health Care" luncheon panel discussed the challenges and opportunities of RFID technology in health care and its implications on government policy.

The 28 March technical paper sessions were: "Integrated Sensors for Diagnostics" and "System Analysis," plus "Applications in Healthcare" and "Advances in System Protocols."

The "RFID in Fly-By-Wireless" luncheon panel looked at the future of RFID and wireless sensors in aerospace vehicles.

The conference concluded with the "RFID Technology Convocation." Advertised as "an expedited series of short talks on current academic research," the end-of-day program turned out to be a very engaging, informal discussion among conference participants.

Everyone had a chance to say what they thought about the current state of research and how the interaction at IEEE RFID 2007 could be continued.

### General Vice Chair Is IEEE Conference Veteran

Paul Hartmann brought his communications industry experience as a product development and engineering executive to his role as conference General Vice Chair.

Hartmann is vice president, Research and Engineering for RF SAW, Inc.

He has more than 30 years of building and leading develop-

ment teams to design sophisticated electronic products that meet stringent cost and technical requirements.

He is also a Senior Member of the IEEE and served on the Board



Paul Hartmann

of Governors of the ComSoc from 1998 to 2000.

He was the Technical Program Chair of IEEE Globecom '89, and is the Vice Chair of the Globecom/ICC Technical Committee (GITC) which is responsible for the strategic direction of technical program for Globecom and ICC conferences.

He has served as a guest editor of the IEEE Transactions on Communications and has authored numerous technical papers & magazine articles.

### IEEE RFID 2007 Program Chair is UT-Arlington Professor



Dan Engels

Dr. Daniel W. Engels, a former research director for the M.I.T. Auto-ID Lab, who now directs his own RFID research center at the University of Texas at Arlington, orchestrated technical programming for the first IEEE International Conference on RFID.

Now Associate Professor and Director, Texas Radio Frequency Innovation and Development Center at UT-Arlington, Dr. Engels relocated last fall to Texas from Boston, Mass., where he was the director and founder of the MIT Healthcare Research Initiative (HRI), founded to use RFID technologies to improve patient safety.

As Director of Research for MIT's Auto-ID Labs, his primary RFID research areas were in reader collision problems, UHF tag antenna designs, tools for RFID use, the EPC System, and the impact of RFID on Sarbanes-Oxley Act compliance.

He was the principal liaison to EPCglobal. As the supervisor/Auto-ID Center Director of Protocols, he lead the research and development of RFID standards, protocols for their use, and compliance and compatibility tests for systems developed to these standards.

Engels also lead the development of the Auto-ID Class 1 Generation 1 UHF and HF protocols.

# IEEE.TV to Produce Video Report on IEEE RFID 2007

IEEE.tv, a web-based video program for members of the IEEE, was on-site at the Gaylord Texan Resort and Convention Center in Grapevine, Texas during the first IEEE Interna-

tional Conference on RFID.

John K. Stevens, PhD, Chairman of Visible Assets Inc., was one of the business executives, conference organizers and researchers interviewed for

an upcoming video report on IEEE RFID 2007.

Dr. Stevens was a panelist on the "RFID Issues in Healthcare" luncheon panel on March 27 as well as a panelist on the March 28 "RFID in Fly-By-Wireless" luncheon panel.

He is Chairman of the IEEE standards P1902.1 Workgroup, a new radio tag protocol that uses Long Wave (LW) magnetic signals to transfer information and has many unexpected advantages in harsh environments.

His Fly-By-Wireless presentation, "An Introduction to RuBee (IEEE P1902.1) and Its Use in Real-Time Visibility Networks," gave specific characteristics of the new protocol as well as examples of applications.

Watch for news about the debut of the IEEE RFID 2007 program on IEEE.tv once post-production editing has been completed.



The cameras were rolling and recording at IEEE RFID 2007 as producer Peter Wiesner (right) manages his camera crew and asks questions.

## New IEEE Applications & Practice Magazine Debuts at IEEE RFID 2007

A new Online Magazine, **IEEE Applications & Practice**, published by the IEEE Communications Society, used IEEE RFID 2007 and the RFID World 2007 Show, to introduce itself.

A 32-page print version of the inaugural issue, April 2007, Vol. 1, No. 1, was distributed to registrants at IEEE RFID 2007 and available in publication bins on the RFID World Show floor.

Appropriately, the first issue focused on RFID and was edited by RFID Series editors Paul Hartmann of RF SAW Inc., (General Vice Chair of IEEE RFID 2007) and Daniel W. Engels, University of Texas at Arlington (Program Chair for the conference).

In his Message from the Editor-in-Chief, Thomas F. La Porta, Director of Magazines for the IEEE Communications Society, stated: "The goal of IEEE RFID 2007 REPORT

this magazine is to present articles of interest to the engineering practitioners who comprise a vital part of our membership.

"As with all of our publications, the high quality and success of A&P will

depend on the community it serves to contribute time, creative energy, and passion.

"All articles will undergo peer review so we need active involvement of 'peers' -- practitioners to review and comment on submitted papers to ensure their technical accuracy, interest-level and overall high quality."

According to La Porta, A&P will be published quarterly as an insert in IEEE Communications Magazine. Long-term, A&P will be an "e-zine," an on-line magazine with electronic delivery.

He thanked the IEEE New Initiatives Committee (NIC) for their financial support, and the IEEE's New Technology Directions Committee (NTDC) for selecting RFID as the first topic for publication. *Continued on page 5*



# IEEE RFID 2007 Examined Electronic Passports

Security was just one of the hot topics at IEEE RFID 2007.

“Two of the juried papers in particular addressed one of the travel concerns engendered by 9/11 — the use of electronic passports to verify the identity of travelers,” said IEEE RFID General Chair Emily Sopensky.

In the Security Issues session on Tuesday morning, March 27, the first paper, titled “*Embedded RFID and Everyday Things: A Case Study of the Security and Privacy Risks of the U.S. E-Passport*” was co-authored by PhD student Marci Meingast, Research Specialist Jennifer King, and Clinic Director Deirdre Mulligan from the Samuelson Law, Technology and Public Policy Clinic, Boalt School of Law at the University of California, Berkeley.



**Jennifer King**

King, Meingast and Mulligan tackled the U.S. Department of State’s 2002 proposal for the adoption of an ‘electronic passport,’ which introduced RFID transponders into U.S. passports for identification and document security purposes starting in late 2006.

“In this paper, we used the U.S.

Government’s adoption process for the electronic passport as a case study for identifying the privacy and security risks that arise by embedding RFID technology in ‘everyday things.’

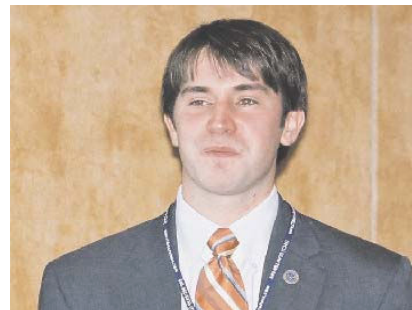
“We discuss the reasons why the Department of State did not adequately identify and address these privacy and security risks, even after the government’s process mandated a privacy impact assessment,” said Jennifer King, who presented the paper at the conference.

The authors concluded with recommendations to assist government as well as industry in early identification and resolution of relevant risks posed by RFID technology embedded in everyday objects.

The second paper, titled “*The Electronic Passport and the Future of Government-Issued RFID-Based Identification*,” was written by G. Matthew Ezovski, a PhD student in the School of Electrical and Computer Engineering at Cornell University and Steve Watkins, professor of electrical and computer engineering at the University of Missouri-Rolla.

Ezovski was a recipient of the U.S. Department of Homeland Security Fellowship and was recently appointed to the IEEE-USA Committee on Communications Policy.

“Advancements in technology have created the possibility of greater assurance of proper travel document ownership, but some concerns regarding security and effectiveness remain questionable in many political circles,”



**Matt Ezovski**

the researchers contend in their introduction.

“Through the International Civil Aviation Organization, or ICAO, the world has adopted standards whereby passports can store biometric identifiers.

“The State Department also began issuing small numbers of electronic passports to U.S. diplomats and associated personnel in early 2006, and public issuance has gradually increased since, beginning in August 2006.”

Ezovski and Watkins’ paper examined the techniques used to secure stored and transmitted data, including basic access control and the Faraday cage, and the speed and reliability of those transmissions.

Their research also looked at the progress of other governments in meeting the standards of ICAO Document 9303 in addressing the U.S. electronic passport deadline.

Also discussed were recent opinions by the U.S. Department of Homeland Security relating to the use of RFID for human identification and tracking.

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## New A&P Magazine

*Continued from page 4*

Two of the articles in the inaugural issue were papers accepted for, and presented at, IEEE RFID 2007:

“*An Exposure System for Evaluating Possible Effects of RFID on Various Formulations of Drug Products*” by Howard Bassen, Seth Seidman, Jonathan Rogul, Abiy B. Desta, and Steven Wolfgang of the U.S. Food & Drug Administration; and

“*Read Range Performance Comparison of Compact Reader Antennas*”  
IEEE RFID 2007 REPORT

for a *Handheld UHF RFID Reader*” by Leena Ukkonen, Lauri Sydanheimo, and Markku Kivikoski from the Tampere University of Technology, Finland.

Other articles in the first issue are:

“*The Unwinding of a Protocol (ISO/IEC 18000 RFID Air Interface)*” by Martin H. Mickle, and

“*Bridging the Gap*,” an overview of academic Centers of Excellence in RFID, by Bridget McCrea. Included are

profiles on RFID centers at the University of Arkansas (by Justin Patton and Bill Hardgrove) and at the University of Pittsburgh (by Martin F. Mickle).

La Porta thanked members of the publication steering committee and several individuals: Tom Kerr of Vocollect Inc.; Emily Sopensky (IEEE RFID 2007 General Chair) of The Iris Company; Al Rosenblatt, former managing editor of IEEE Spectrum; and Jack Howell, Executive Director, IEEE ComSoc.



# Healthcare Experts Discussed RFID Technology & Policy Issues at IEEE RFID 2007



The “RFID Issues in Healthcare” panel (left to right): John Stevens, Michael Meistrell, Peter Spellman and moderator Dan Engels.

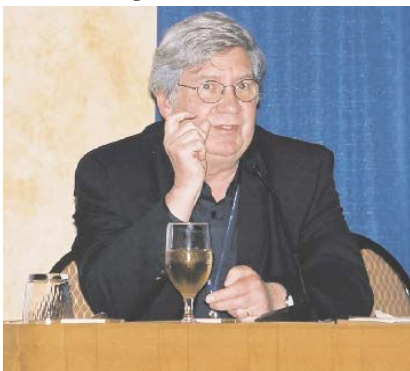
At the IEEE RFID 2007 international technical conference, technology and healthcare experts discussed a variety of healthcare technology and policy issues, including:

What are the next steps in bringing RFID to maximize efficiencies in healthcare?

What standards must be developed?

What training and processes must be installed in order to take advantage of RFID technologies?

Will government regulations need to be developed?



**John Stevens, PhD**

The “RFID Issues in Healthcare” panelists during lunch on March 27 included: Dr. John K. Stevens, chairman of Visible Assets, Inc., and chair of the IEEE RuBee Standards Working Group; Michael Meistrell, president of Healthcare Informatics & Manage

Consultancy; and Peter Spellman, co-founder and senior vice president of products and services for SupplyScape Corp.

The panel was moderated by Daniel Engels, program chair, IEEE RFID 2007, and assistant professor and director of the Radio Frequency Innovation & Technology Center at the University of Texas at Arlington.

Before he relocated to Arlington, Texas from Boston, Mass., Dr.

Engels was Director of Research for the Auto-ID Labs at MIT as well as the director and founder of the MIT Healthcare Research Initiative (HRI), founded to use RFID technologies to improve patient safety.

Dr. Engels commented on the panel’s focus: “RFID technology is already employed by many healthcare practitioners in a variety of applications.

“The discussion about how to incorporate RFID technology in healthcare delivery systems is gaining in volume, as is the debate about how to provide adequate, affordable healthcare.

“We hope our experts will shine some light on the significant opportunities for RFID technology in the healthcare industry.”



**Michael Meistrell, MD**

## Other healthcare sessions

In the “Integrated Sensors for Diagnostics” session on Wednesday morning, March 28, three of the four papers focused on biomedical sensors:

- “Development of an Implanted RFID Impedance sensor for Detecting Gastroesophageal Reflux” is co-authored by five researchers from the University of Texas at Arlington and three scientists from the University of Texas Southwestern Medical Center;

- “An Infant Monitoring System Using CO2 Sensors,” is written by six researchers at the University of Texas at Arlington; and

- “Design Criteria for Full Passive Long Range UHF RFID Sensor for Human Body Temperature Monitoring” is co-authored by six researchers and senior researchers in the Electronics & Communications section of CEIT (Centro de Estudios e Investigaciones de Gipuzkoa ), a non-profit research organization, plus two researchers from TECNUN, the Engineering School of the University of Navarra at Donostia/San Sebastian and another researcher from the University of Las Palmas, G.C. in Spain.

In addition, the “Applications in Healthcare” session on the morning of March 28 featured three research papers examining the use of RFID tags in the tracking of pharmaceuticals as well as medical equipment:

- “An Exposure System for Evaluating Possible Effects of RFID on Various Formulations of Drug Products” by five researchers from the U.S. Food & Drug Administration (FDA);

- “Simulation and Analysis of Hospital Operations and Resource Utilization Using RFID Data” by an author from HCA and four researchers at FAMU-FSU;

- “Active RFID System Augmented with 2D Barcode for Asset Management in a Hospital Setting” by a collection of five co-authors from HCA, BMC, UMDNJ, FSU and the University of Texas at Arlington.

# Industry Leaders Unite to Benchmark the Future for RFID in the Workplace

A global research initiative is underway to quantify the direction that the RFID marketplace is likely to take in light of recent, conflicting media stories on the outlook for RFID among major retailers.

Just prior to IEEE RFID 2007, the International RFID Business Association (RFIDba), plus IEEE RFID 2007, the European Supply Chain Institute, the IEEE Communications Society, and CMP Technology, the producer of RFID World, announced the first step.

The group appointed a cross-industry advisory board to oversee the composition and administration of a multi-industry, on-line survey, expected to reach some 90,000 respondents.

Harry P. Pappas, the RFIDba's Founder and CEO, remarked: "Any shift in the RFID plans of major retailers would impact businesses globally. The time is right for the industry to come together to measure and quantify how customers and prospects view their future with RFID, sensor and wireless technologies in all areas of their businesses.

"We are pleased to be leading this important educational effort on behalf of end-users and the technology vendor

community around the world."

According to RFIDba, vendors eager to expand their markets will increasingly offer business solutions using a combination of RFID, sensor and wireless business applications outside of the well-publicized supply chain efforts of the retail industry.

IEEE RFID 2007 General Chair Emily Sopensky Conference, noted:

"As businesses come to understand that RFID, sensor and wireless technologies have an extraordinary range of value when tailored to their operations, workers, including IEEE members, will be challenged anew to develop the needed skills and knowledge to actually make these systems work.

"It's clear that the data from this research will contribute measurably to ensuring our workforces will be able to meet these challenges effectively and to remain competitive globally."

Bill Allen, Director of RFID World for CMP Technology, stated: "CMP is pleased to be a supporter of any research initiative which benefits both vendors and end-users of RFID technologies.

"The findings from this project will ultimately help vendors refine their product and service offerings to address



**Harry Pappas and Emily Sopensky** business needs in vertical markets."

According to RFIDba, Europe is seen as a pioneer in the "adaptive utilization" of RFID, sensor and wireless systems.

John Connors, Executive Director of the European Supply Chain Institute and a noted authority on supply chain optimization, believes Europe is aptly poised to lead in the next wave of RFID technology adoption.

He said: "In such areas as intelligent transportation systems, manufacturing automation, payment processing and the food supply chain, many European businesses have been leaders in RFID application innovation.

"As we survey the European marketplace, the global technology vendor community may see a bit of their future in what has already transpired throughout the European Union."

The survey can be found at [www.rfidintheworkplace.com](http://www.rfidintheworkplace.com).



During the Invited Papers session on March 27, Paul Squires of Applied Skills & Knowledge, spoke on the "RFID Educational Survey."

He described the content, meth-

odology, target audience (including suppliers, retailers & end users), and other parameters of the "RFID in the Workplace" survey being conducted concurrently with RFID World.



# 12 Countries Generated Technical Papers for First IEEE International RFID Conference

International participation on the Technical Program at IEEE RFID 2007 included technical papers from four continents (North America, Europe, Asia, Australia).

Representing RFID research from 12 countries, the participation by technical authors included more than 18 papers from the U.S.; two each from China, France and the United Kingdom; plus papers from Australia, Finland, Germany, Italy, South Korea, Singapore, Spain, and Taiwan.

The Program Committee, which reviewed more than 100 papers, included representatives from the U.S., Canada, Finland, Italy and Switzerland.

Emily Sopensky, General Chair of the IEEE RFID 2007 Conference said: "RFID technology is a worldwide phenomenon with implications of all kinds on systems and applications, from the supply chain to healthcare, security,

and aerospace.

"The IEEE is a global professional membership organization, with more than 370,000 members. We welcomed the contributions on RFID technical innovation and expertise from around the world.

"Almost 150 attendees registered at IEEE RFID 2007 to learn about the most recent research, processes and applications of RFID technologies and systems, to gather information at

the conference and the accompanying RFID WORLD Show, and to interact with their colleagues."

"We were pleased with this level of international participation at an inaugural technical conference, especially one which was put together in a very compressed time-frame," added Sopensky.

"For instance, we had papers on "UHF RFID Sensor for Human Body Temperature Monitoring" from Spain; "RFID Data Management: Challenges and Opportunities" from Australia; "Read Range Performance Comparison of Compact Reader Antennas" from Finland; "Full Wave Simulation of Flip-Chip Packaging on RFID Transponders" from South Korea; and "A RFID Reader Collision Model" from China.

"The technical research and analysis are fascinating since they cover such a broad range of topics and applications," she concluded.



General Chair Emily Sopensky welcomed delegates.

## Representation from Asia-Pac Countries Was Strong at IEEE RFID 2007

### Taiwan

A paper from Taiwan highlighted the Wednesday morning "Location Systems" session.

Researchers Ting-Shuo Chou and J.W.S. Liu wrote a paper titled "Design and Implementation of a RFID-Based Object Locator."

They defined an object locator as "a device designed to assist its user in finding misplaced household and personal objects in a home."

Their paper describes alternative designs plus a proof-of-concept prototype of such object locators based on RFID technology. "Advantages of such locators include extensibility and low maintenance.

"The numeric model provided here can be used to determine figures of merit, including costs, search time and energy consumption. The results of analysis based on the model can serve as design guides."

### China

The "Advances in System Protocols" session included the second of two IEEE RFID 2007 papers from China.

Shijie Zhou, from the University of Electronic Science & Technology of China, plus Zongwei Luo, Edward Wong, and C.J. Tang from the University of Hong Kong developed the "Interconnected RFID Reader Collision Model and its Application in Reader Anti-Collision" paper.

The authors described an Interconnected RFID Reader Collision Model (IRCD), constructed upon RFID reader collision so that it is a fully distributed and self-organized overlay network.

"IRCD can be used in a dense reader environment to exchange collision related information directly among readers without any central control or intermediation."

A query-hit rate-based dynamic anti-collision scheme was also pro-

### Singapore

Edmund Chan from the School of Engineering, Republic Polytechnic, Singapore described "Application of Paired T-Test and DOE Methodologies on RFID Tag Placement Testing Using Free Space Read Distance" in Wednesday's "System Analysis II" session.

He described the use of a paired t-test to compare the readability of tags placed at two different orientations on a product.

Chan presented a case study on how a design of experiments (DOE) methodology was used to obtain and validate the optimal tag placement from different tagging possibilities that involved bending, orientation, and power supplied to the tag.

"The results should encourage RFID system testers to use DOE to obtain valid statistical results," concluded Chan.



## Two Papers from France Among the European Technical Contributions to IEEE RFID 2007

Two papers from France highlight strong European participation on the Technical Program of IEEE RFID 2007.

On the opening morning of the conference, in the session on Security Issues, thesis student Sepideh Fouladgar and professor Hossam Afifi from the Wireless Networks & Multimedia Services department of the Institut National des Telecommunications, are authors of a paper titled “*A Simple Delegation Scheme for RFID Systems (SiDeS)*.”

The authors’ abstract describes the highly-technical content of their paper: “Many privacy protecting schemes for RFID (Radio Frequency identification) technology assume that reading devices (readers) have continuous connectivity with a centralized online database in charge of the identification of a certain amount of tags.

“However, such centralised models can raise scalability and latency problems. Moreover, they are not suitable in applications where connectivity is intermittent. In this paper, we introduce SiDeS (Simple Delegation Scheme), a protocol that allows a centralised database to delegate temporarily — and in a secure manner — the capability to identify tags, to readers.

“SiDeS not only requires simple cryptography functions like XOR, hash functions and a random number generator, but also manages tags ownership transfer.”

“In this paper, we proposed a new computationally lightweight delegation protocol (SiDeS) for low-cost RFID tags.

“SiDeS allows to strongly reduce interactions between tags and central databases in pseudonym-based

privacy protection schemes, enabling off-line reading operations.

“It provides a secure mechanism that gives and revokes the ability to decode tag pseudonyms to readers.

“It also proposes an effective solution for the tag’s ownership transfer scenario. In SiDeS, the tag only needs a hash function, a nonce generator and a small memory to store the two shared key and the delegation counter.

“We show that it is robust against replay and man-in-the-middle attacks and guarantees the privacy of the tag user, independently of the number of tags delegated to the reader,” concluded Fouladgar.

On Tuesday afternoon, March 27, three researchers – Emmanuel Bergeret, Jean Gaubert and Philippe Pannier -- from the Circuits Design Team, Materials & Microelectronics Laboratory, University of Provence, UMR-CNRS 6137 were co-authors of “*Standard CMOS Voltage Multipliers Architectures for UHF RFID Applications: Study and Implementation*” in the Component Design & Analysis session.



Sepideh Fouladgar presented her team’s paper at IEEE RFID 2007 in Texas



Emmanuel Bergeret presented the multi-author paper from UMR-CNRS 6137.

The abstract summarized their analysis of RFID multipliers architectures that was tested: “An analytic model of a classical Mosfet multiplier permits determination of the main design parameters for this kind of circuit and their impacts on efficiency.

“Thanks to this study, a new architecture is proposed in order to increase efficiency. The two multipliers are designed and implemented in the same standard 0.18 $\mu$ m CMOS semiconductor fabrication process.

“Measurements have been done and show the functionality of the multipliers and an improvement between the architectures.”

In his conclusion, Bergeret said: “Design keys and implementation of Mosfet multipliers for RFID have been presented. Important design parameters have been given in our analysis.

“Both structures were implemented in a 0.18 CMOS process. Both architectures reach the desired output voltage of 1.6V.

“Measurements show an improvement in efficiency from input power of -13dBm with the new architecture. That allows powering a tag in a range around 8 m with more available power than in a traditional voltage multiplier.”

# RFID Research in Spain Highlighted at IEEE RFID 2007

A paper from Spain on RFID sensors used for human body temperature monitoring highlighted the real-world applications of RFID technology as well as valuable international contributions to the technical program of IEEE RFID 2007.

In the Wednesday morning session on “Integrated Sensors for Diagnostics,” a paper titled “Design Criteria for A Full Passive Long Range UHF RFID Sensor for Human Body Temperature Monitoring” showed the value of RFID sensors to provide vital information in hospital and personal medical situations.

The paper was a real research team effort, co-authored by six researchers and senior researchers (Roc Berenguer, Andres Garcia-Alonso, Josean Gómez, Daniel Pardo, Aritz Ubarretxena, and Alexander Vaz) in the Electronics & Communications section of CEIT (Centro de Estudios e Investigaciones de Guipuzcoa, the non-profit research organization set up under the auspices of TECNUN at Donostia/San Sebastian; by Santiago Gil and David Puente from TECNUN, the Engineering School of the University of Navarra; plus Ricardo Morales-Ramos, another researcher from the University of Las Palmas, G.C.

The Spanish paper’s abstract set the stage for the RFID technology research and discussion of its result: “Although the insertion of a sensor in a full passive UHF RFID tag for long range monitoring is a challenge itself, the main goals of this paper are discussion of the real

constraints of RFID tags and providing the design criteria to optimize the different blocks in order to achieve long read distance.

“The design has been focused on the matching network, the voltage multiplier, the ASK demodulator, the load modulator and the temperature sensor. The numerical results have been obtained using 0,35 micrometer technology from XFAB(XL035) and operating at the 868MHz ISM Europe band.”

The paper was presented at the conference by Daniel Pardo, telecommunications engineer, Electronics and Communications Department, CEIT, with support from senior researcher Roc Berenguer, Industrial Engineering, Electronics & Control Dept., CEIT.

In summing up the team’s research findings, Pardo said: “This paper has presented a full passive long range UHF

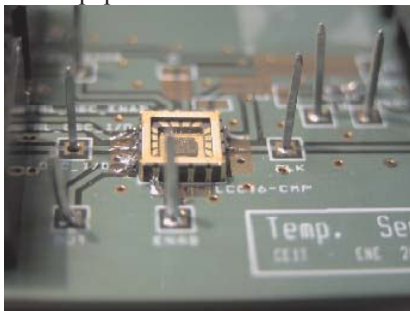
RFID sensor for human body temperature monitoring.

“With the results shown, the achieved communication range is higher than 3 meters for the 868MHz European ISM band (which allows 2W of power transmission).”

Pardo concluded: “It should be mentioned that the real limitation has been the voltage constraint whereas previous publications have focused on the power and probability of error constraints.”



Set-up for temperature sensor measurements and characterization, including climatic chamber, logic analyzer, and other RFID test equipment.



Detail of the temperature sensor die-packaged in an open cavity package ready for temperature characterization.



Roc Berenguer and Daniel Pardo of CEIT at IEEE RFID 2007 in Texas.



# Industry Researchers Present Commercial Perspectives at IEEE RFID 2007

Participation by commercial companies in the first IEEE Radio Frequency Identification international conference included two global semiconductor chip manufacturers, the inventors of many bar code scanning technology patents, a startup that utilizes an alternative technology to silicon for fabrication of RFID tags, the corporation that invented Post-It Notes and a company that provides real-time data collection systems.

Three papers from the corporate sector highlighted the Tuesday session on Systems Analysis I:

- Co-authors S. Riki Banerjee, Ronald D. Jesme, and Robert Sainati from the software, electrical and mechanical systems laboratory of 3M Corporation, wrote a “*Performance Analysis of Short Range UHF Propagation As Applicable to Passive RFID.*” Their paper describes and demonstrates a method for visualizing and analyzing short range ultra high frequency RFID propagation effects.



**S. Riki Banerjee, Senior Research Scientist in the Software, Electronic & Mechanical Systems Laboratory, presented the 3M paper.**

- Dr. Jeongki Ryoo, RFID/USN research lab, LS Industrial System, South Korea, presents a simulation model for flip-chip bonding onto a PET substrate in the paper, *Full Wave Simulation of Flip-Chip Packaging Effects on RFID Transponders*. Focusing on the manufacture of reliable, low-cost RFID transponders, this paper offers an

approach for determining the matching impedance for antenna design.

- Lewis Claiborne, VP of Strategic Engineering, and Clinton Hartmann, CEO of RF SAW, Inc., a high-technology startup in Richardson, Texas, explore and compare silicon and surface acoustic wave (SAW) technologies in *Fundamental Limitations on Reading Range of Passive IC-Based RFID and SAW-Based RFID.*



**Clinton Hartmann, CEO of RF SAW, presented their comparative analysis of silicon and surface acoustic wave RFID tags.**

“For the first time, fundamental read-range limitations are calculated for two major types of passive (battery-less) RFID systems, which are required for the majority of future RFID applications.”

The authors’ analysis shows that 2.44 GHz Surface Acoustic Wave (SAW) based RFID potentially has a 30X read range superiority compared to passive semiconductor IC-based RFID operating near 900 MHz.

The first paper in the Invited Papers session on Tuesday afternoon presented the results of joint research between a San Francisco company that provides real-time data collection systems connecting all sensor-related data including RFID, imaging systems and environmental controls, and a university in mid-America:

- CTO Raymond Huetter and John Veizades, VP of product management and business development at Sensor-

Connect, collaborated with graduate assistants Joseph Hoag and Reid Phillips, plus Dr. Craig Thompson, professor of computer science and computer engineering (CSCE) at the University of Arkansas, on the paper “*Sensor-Connect Performance and Scalability Experiments.*”

Their report describes a series of tests that were run to measure an alpha release of the SensorConnect event management database system, showing the high volume data ingestion and query rates for a synchronized sensor network typical of entire supply chains.

Wednesday morning’s Integrated Sensors for Diagnostics session features academic and industrial researchers working together to develop potential sensor systems for commercial applications:

- Alanson Sample, graduate research assistant - electrical engineering, and Daniel Yeager from the University of Washington collaborated with Joshua Smith and Pauline Powledge, of semiconductor manufacturer Intel’s research group in Seattle, for “*Design of a Passively-Powered, Programmable Sensing Platform for UHF RFID Systems.*”

Wednesday morning’s Systems Analysis II session described joint corporate research on RFID:

- Researchers from Texas Instruments and Intermec combined for a paper titled “*An Overview of Near Field UHF RFID.*”

Pavel V. Nikitin, and K. V. Seshagiri Rao from Intermec, an industry leader in mobile computing and automated data collection technology, collaborated with Steve Lazar from semiconductor manufacturer Texas Instruments.

The researchers teamed to investigate and report on the current state of near field UHF RFID.

This technology area has recently received attention because of its possible use for item-level tagging where LF/HF (low frequency/high frequency) RFID has traditionally been used.

# M.I.T. RFID Researcher Wins Best Paper Award at First IEEE International RFID Conference

Christian Floerkemeier, a researcher in the Auto-ID Labs at the Massachusetts Institute of Technology, received the Best Paper Award at IEEE RFID 2007.

The March 27-28 conference featured more than 30 technical papers by leading academic and industrial researchers from around the world.

Floerkemeier was recognized and presented with his Best Paper Award during the conference's plenary session. Bret Kinsella, Chief Operating Officer of ODIN Technologies, which sponsored the award, presented Floerkemeier with a framed Award certificate and congratulated the MIT researcher on the excellence of his work.

IEEE RFID 2007 Program Chair Daniel Engels commented that Floerkemeier's paper was unanimously selected by the conference Program Committee judges as Best Paper.

"His paper received extremely high marks for both the quality of the research and the caliber of the writing; his presentation was outstanding among many excellent papers accepted for this first IEEE RFID conference," he added.

Christian Floerkemeier holds Bachelor's and Master's degrees in Electrical



**Christian Floerkemeier received his Best Paper Award from ODIN Technologies executive Bret Kinsella during the opening plenary session.**

and Information Science from Cambridge University in the UK and a PhD degree in Computer Science from ETH Zurich in Switzerland.

His current research includes RFID projects at the MIT Auto-ID Lab, part of the federation of research universities that has evolved from the MIT Auto-ID Center.

Floerkemeier presented his winning paper, titled "*Bayesian Transmission Strategy for Framed ALOHA Based RFID Protocols*," during the Wednesday morning, March 28 "Advances in System Protocols" session.

Floerkemeier's abstract described the intent of his RFID research, which relates to RFID tag reader architecture and operation: "Transmission control strategies can increase the throughput of the shared wireless channel and thus accelerate the identification of large RFID tag populations.

"As the number of objects that are equipped with RFID tags increases, it is becoming increasingly important to identify large tag populations quickly," said Floerkemeier.

"This mandates, among other things, a high throughput over the shared radio channel. The throughput performance of RFID medium access protocols, such as framed ALOHA, depends, however, on a transmission scheme that estimates the (unknown) number of stations transmitting.

"The number of RFID tags transmitting remains uncertain, since RFID readers cannot detect the multiplicity of conflict if more than two RFID tags transmit simultaneously.

"We showed that a Bayesian transmission scheme that updates the tag number estimate after each slot of an ALOHA frame outperforms those transmission schemes that only update the



**IEEE RFID 2007 General Vice Chair Paul Hartmann took a look at Christian Floerkemeier's presentation prior to the last technical paper session.**

estimate at the end of the frame.

"The comparison with 'perfect estimator' shows that this is due to the unknown number of tags arriving and departing during an ALOHA frame.

"Our Bayesian transmission scheme minimizes the response time to any changes in the number of tags transmitting, since the estimate is updated after every slot.

"The evaluation also shows that our Bayesian approach outperforms the Q algorithm specified in the ISO 18000-6 Part C at the expense of a significant amount of computations."



**Christian Floerkemeier makes last-minute tweaks to his PowerPoint presentation.**



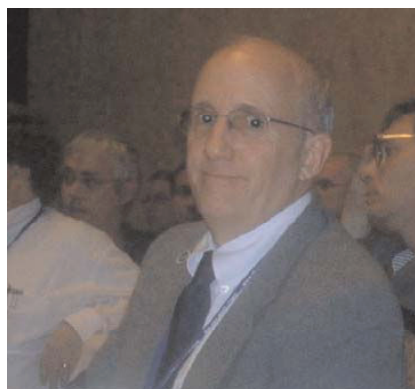
# Experts Debated RFID in Aerospace during “Fly-By-Wireless” Panel at IEEE RFID 2007

“Fly-By-Wireless,” a concept that recognizes the increasing importance and potential for wireless systems in aerospace vehicles, was just one of the “Hot Topics” at IEEE RFID 2007.

The conference lunch hour on March 28 featured a powerful panel of experts discussing the use and benefits of RFID sensor tags in aerospace vehicles.

The panel included a government official from the FAA, a corporate officer from Visible Assets, Inc., a technology research manager from Sandia National Laboratories, a program manager from an aircraft manufacturer (Boeing), and an academic researcher from the University of Colorado who also works with an aerospace supplier.

The panel was moderated by George Studor, a Senior Project Engineer, Structural Engineering Division, NASA/Johnson Space Center, who hopes to improve the modularity, functionality and performance for future NASA vehicles by promoting the ‘Fly-By-Wireless’ effort across the aerospace industry.



**George Studor**

“The approach is to minimize cables and connectors by providing reliable, lower cost, and higher performance alternatives for the entire vehicle and program life-cycle,” said Studor.

“NASA needs the entire aerospace community to join with others waging a ‘war on wires’ to elevate the state of the art across the board and provide

the basis for efficiencies and capabilities that NASA needs for its upcoming Lunar and Mars missions.”

“*Perspectives on Aircraft Wireless System Certification*,” by David Walen, Chief Scientific and Technical Advisor - Electromagnetic Interference, Federal Aviation Administration -Aviation Safety, addressed several of the issues related to widespread implementation of wireless RF networks and systems on aircraft.

“These issues include the electro-



**David Walen**

magnetic compatibility between the wireless systems and other aircraft systems, coexistence between wireless systems, and the integrity of wireless systems for critical airplane functions,” says Walen.

Meanwhile, John K. Stevens, Chairman of Visible Assets, Inc., who is also chairman of the IEEE P1902.1 Standard Workgroup, used his inside knowledge of standards development to provide “*An Introduction to RuBee (IEEE P1902.1) and Its Use in Real-Time Visibility Networks*.”



**John Stevens**

For those who don’t know, RuBee (IEEE 1902.1) is a new radio tag proto-

col that uses Long Wave (LW) magnetic signals to transfer information and has many unexpected advantages in harsh environments.

“The new specification will be used to create cost-effective visibility networks to provide the pedigree, status and location of assets, people or other high-valued items,” said Stevens.

“RuBee networks are deployed in commercial applications including smart shelves for high-value medical devices in hospitals and operating rooms; smart, in-store and warehouse shelves for inventory tracking; and a variety of agricultural visibility networks for livestock, elk and other exotic animals.”

In his talk on “*Multiple Passive Sensors Interrogated with 1 mW of RF over 10 meters—a promising foundation*,” David W. Palmer, Manager, RF and Optics Microsystems Applications Department, Sandia National Laboratories, reported on technology problem-solving.



**David Palmer**

“Sandia scientists were challenged by NASA’s desire to add distributed sensors to the shuttle and space station without the cumbersome tapping into existing data and power busses.

“So we developed a passive sensor system that is interrogated by low power RF (like a radar gun) at free space distances of 10 meters,” said Palmer.

Kenneth D. Porad, Associate Technical Fellow, The Boeing Company, Program Manager, Automated Identification Program, Boeing Commercial Airplanes, described “Progress on De-

*Continued on page 14*

## Fly-By-Wireless

Continued from page 13

veloping Radio Frequency Identification Within Commercial Aviation.”



**Ken Porad**

Porad commented: “The world’s airlines are eager to take advantage of automated identification technology to increase the efficiency of their product life-cycle tracking and parts trace- ability.

“RFID will improve airline con-

figuration control by increasing the accuracy of the known “as-delivered” configuration.”

He added: “When fully implemented, RFID “will reduce ownership costs by identifying rogue parts, help minimize inventories, and improve the accuracy of information exchanged between the airline industry and suppliers.”

The final presentation, “Wireless Communications and Standards Activities in support of NASA’s Exploration Mission” by Dr. Kevin K. Gifford, Aerospace Research Faculty, University of Colorado at Boulder/Lead Automation Engineer, BioServe Space Technologies, focused on the goal of the Consultative Committee for Space Data Systems Wireless Working Group.

“The WWG’s objective is to provide the development community and par-

ticipating members with the standards-based resources to achieve inter-operable wireless communications, including specific protocol recommendations for anticipated communication scenarios associated with but not limited to, Lunar then Martian, exploration activities,” reported Gifford.



**Kevin Gifford**

# IEEE RFID Conference Received Support from Technical Co-Sponsors

Eight IEEE technical societies plus The University of Texas at Arlington joined with IEEE-USA, the IEEE New Technology Directions Committee and IEEE Region 5 as technical sponsors of IEEE RFID 2007.

The eight IEEE technical societies were: the Circuits & Systems Society (CAS); the Communications Society (ComSoc); the Electron Devices Society (EDS); the Engineering in Medicine and Biology Society (EMB); the Microwave Theory and Techniques Society (MTT-S); the Professional Communication Society (PCS); the Society on Social Implications of Technology (SSIT); and the Vehicular Technology Society (VTS).

“Each of these technical societies provide a focus and services to many thousands of IEEE members – engineering professionals at companies, universities and research institutions

around the world – centered around specific technologies and applications of technology,” said Emily Sopensky, general chair of IEEE RFID 2007.

“The IEEE society leadership recognize how RFID technology and applications impact and utilize the technologies and systems of their society’s members.

“Accordingly, these societies are enthusiastically co-sponsoring a conference which will broadly discuss RFID technical design, system implementation and policy challenges of RFID.

“And we appreciate their participation and support for this new IEEE conference,” Sopensky emphasized.

In addition, The University of Texas at Arlington was a technical co-sponsor of IEEE RFID 2007.

Daniel Engels, assistant professor and director of the Texas Radio Frequency Innovation & Technology Center, UT-Arlington, took on a leader-

ship role with the IEEE RFID 2007 organizing committee.

As program chair for the conference, he brought together a distinguished international Program Committee, comprising engineers, researchers and scientists,

The Program Committee reviewed all 105 submitted technical papers and selected the best-of-the-best for presentation at the conference.

“Many of these committee members are active leaders within the co-sponsor technical societies and brought the perspectives, interests and concerns of their members to the quality-intensive selection process.

“As a result, the topics of the technical papers and panels at IEEE RFID 2007 span a broad spectrum from antenna design to security techniques, from integrated sensors to system protocols,” said Engels.



# RFID Technology Convocation Ends IEEE RFID 2007

The final element of IEEE RFID 2007 was “the ‘unconference’ part of the program -- which worked just as I had envisioned it,” said Program Chair Daniel Engels.

He gathered together students, professors, presenters, researchers, attendees and others, pulled the chairs into a circle of sorts, and had a roundtable dialog about the first IEEE RFID conference -- and what comes next.

The free-flow conversation generated thoughts, comments on actions, and reactions, for everyone’s consid-



Being co-located with RFID World 2007 gave IEEE RFID 2007 attendees a chance to roam the Show floor, see exhibits by RFID industry vendors and to talk with exhibitors and other RFID World attendees.

IEEE RFID 2007 appreciates its valuable partnership with CMP Media, producers of the RFID industry’s largest annual show and exhibition.

# Feedback

*“Continue the co-location with an industry show. Bring more relationships with RFID World.”*

*“Offer cheaper hotels within reach. Grapevine has no public transportation.”*

*“How about a conference outside the U.S.?”*

*“Servers at lunch were very friendly and did a great job. Housekeeping staff that I met were very nice and helpful.”*

*“It would have been nice for RFID World to offer IEEE members either a discounted registration fee or the opportunity to attend specific sessions at a pro-rated fee.”*

*“Conference administration: Excellent work.”*

## See you at IEEE RFID 2008!

IEEE RFID 2008 will take place April 16-17, 2008 at The Venetian Resort-Hotel-Casino in Las Vegas, Nevada, USA.

The IEEE RFID 2008 conference will be co-located with the RFID Journal LIVE! 2008 exhibition.

For information on Paper submission deadlines and Registration, go to:

**[www.ieee-rfid.org/2008](http://www.ieee-rfid.org/2008)**

The IEEE RFID 2007 REPORT was produced by Publicity Chair Brian Fraser of Complete Communications. Contact him at Email: [bfraserpr@verizon.net](mailto:bfraserpr@verizon.net).

# Special Thanks



**Debbie Rudolph and Merrily Hartmann had everything ready at check-in.**

*Thanks to everyone: it was a real team effort. Emily.*

Merrily Hartmann, our never-goes-to-sleep Registrar & Local Arrangements Chair, who thought of every detail before anyone else;

Brian Fraser, who wrote a slew of news releases, gracefully captured so many excellent photos while also steering the IEEE.tv camera crew and subjects to ever-changing locations for interviews;

Luke Maki, thanks for delivering a great Publications Chair;

Brenda Huettner, for pinch-hitting so capably and agreeably, producing a fabulous printed Final Program and Proceedings on CD;

Bob Shapiro, Finance Chair, for always keeping us on-track and on-budget;

Paul Hartmann, overcommitted but calm in the face of normal conference turmoil, we need to bottle your steady, behind-the-scenes skill & knowledge;

Dan Engels -- who would have imagined such a successful response to a call for papers that gave authors just a few weeks to get their papers in, plus pushing reviews out over the holidays -- a sign of dedication, panache and someone with really good friends;

John Yaglenski, for the logo, which did us well: recognizable and concise, plus imaginative, practical website design & management;

Debbie Rudolph, for very pragmatic advice, executive committee minutes, on-site staffing as well as great spirit and cheer;

Chris McManes, for all-around PR and marketing efforts and an IEEE USA presence at the Show, which gave the conference added substance;

Pradeep Misra, for managing the complexities of PaperCept for paper submissions, review, acceptance, and integration into the Program and Proceedings;

Peter Wiesner, for orchestrating the IEEE.tv conference videotaping;

Bernadette Concepcion, for behind-the-scenes teleconference reminders, and first-rate certificates;

Chris Brantley, IEEE-USA Managing Director, for providing the resources;

Bichlien Hoang, New Technology Directions Committee, for full support;

Bill Allen, Art Norman, and Jason Baglin, CMP Media, organizers of RFID World, for being such great partners;

Roger Bridgeman, Kim Novino, and Ashley Peterson, of Bridgeman Communications, for responsive coordination with attending media.