Passive Wireless Sensor Technology (PWST)
at WiSEE 2017

Workshop Program

Chairman: NASA/NESC – Omar Torres
Co-Chair – George Studor

October 10 -12, 2017

Omar Torres
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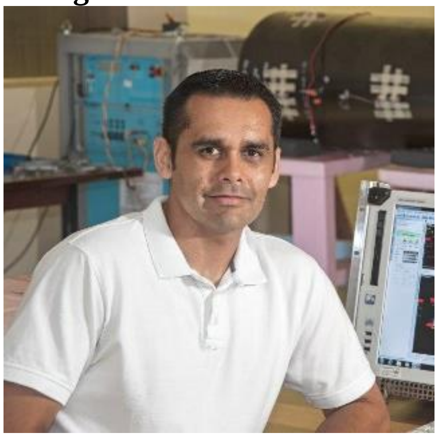
NASA Engineering and Safety Center(NESC)
Avionics Technical Discipline Team
Chairman, Wireless Avionics Community of Practice
Langley Research Center, VA

Background:



Mr. Omar Torres serves as the lead of the NASA Wireless Avionics Community of Practice where he is responsible for bringing together engineers and managers from across the agency to share knowledge and lessons learned relating to wireless technologies. Mr. Torres has been resident at Langley Research Center in Hampton, VA for 14+ years where he has contributed significantly to the research of Signals of Opportunity, using GPS reflected signals for the remote sensing of tropical storm intensity and soil moisture content. Mr. Torres is a co-author of the algorithm that relates GPS signal scattering to surface wind speeds over the ocean, which is the basis of the recent multi-satellite mission CYGNSS. In addition, Omar has years of experience as an instrumentation and analysis engineer supporting the NASA Engineering and Safety Center (NESC) in high profile tests and investigations such as the Max Launch Abort System vehicle test, the Toyota unintended acceleration investigation, the Hubble Attitude Observer Anomaly investigation, and most recently, the Commercial Crew Avionics Architecture assessment where he served as the co-lead of the GNC team.
Mr. Torres received his BSEE and MSEE from the University of Texas at El Paso and he has been the recipient of the superior accomplishment award, the engineering excellence award and the NESC leadership award.

WiSEE 2017 Program

	Tuesday	Wednesday	Thursday
	10 October	**11 October**	**12 October**
8:30	Opening Remarks	Opening Remarks	Opening Remarks
8:45	Keynote: Chris Singer	Keynote: Fassi Kafyeke	Keynote: Sterling Rooke
9:30	Networking Break	Networking Break	Networking Break
10:00	SSP S1 (Tutorial)	WiSEE S3 / SSP S4	Demonstrations and Poster Session
	PWS S1: Users - NASA	**PWS S4: Providers**	**PWS S5 Users - Aerospace**
12:00	Lunch	Lunch	Lunch
12:30	Keynote: Panagiotis Tsiotras	Keynote: Jim Lyke	Keynote: Obadiah Kegege
13:30	WiSEE S1 / SSP S2 (Panel 1)	WiSEE S4 / STINT S1	**13:00-15:00 - Wireless One-on-One Sessions**
	PWS S2: Providers	**PWS S5: Providers**	
15:30	Networking Break	Networking Break	Tour of the Canadian Space Agency (limited #) Bus leaves from Concordia at: 15:00 Bus returns to Sheraton hotel: 17:30
16:00	WiSEE S2 / SSP S3 (Panel 2)	MISS S1 / STINT S2	
	PWS S3: Providers	PWS S6: Providers	
18:00	Target End Conference Day		
18:30	Reception at Concordia	Banquet at the Sheraton Hotel	

Rm 260: Keynote Talks, WiSEE S1-S4, STINT S1-S2, and Thursday AM Posters and PM One on One Sessions

Rm 184: PWS S1-S7 Demos **Rm 204: MISS and SSP**

2017 - Passive Wireless Sensor Technology (PWST) Workshop
Agenda - Room 184

Tuesday, October 10:

8:30am Keynote: Chris Singer - "The Engine of Possibility Accelerating Development"

10:00am – Noon – PWS S1: Users

- **S1-1: NASA/NESC:** George Studor – "PWS Workshop Summary: Technology Library & User Trends"
- **S1-2: NASA/JPL**: Norm Lay – "Wireless Applique for Spacecraft Integration and Test"
- **S1-3: NASA/Ames:** Brandon Smith – "Entry Instrumentation in the Next Decade: a NASA Perspective"
- **S1-4: NASA/HQ/HOTP:** Viet Nguyen – "Technologies for high temperature (500 C) Electronics, Sensors, Actuators, Power and Comm Systems to Enable Long-lived Missions to Venus and the Gas Giants"

12:00-1:30pm Lunch/Keynote: Dr. Panagiotis Tsiotras - "The Next Frontier: The Challenges in Developing Truly Autonomous Space Robots"

1:30pm – 3:30pm - PWS S2: Providers

- **S2-1: NASA/LaRC:** Cy Wilson – "Passive Wireless Vibration Sensing to Measure Aerospace Structural Flutter"
- **S2-2: Albido Corp:** Viorel Olariu – "Passive Wireless Sensor System for Structural Health Monitoring"
- **S2-3: Univ of Freiburg:** Taimur Aftab – "Passive Wireless Sensing Using Ultrasonic Channels"
- **S2-4: Sensanna:** Jackie Hines – "Practical Considerations for SAW Sensor and Tag Deployment"

4:00pm – 6:00pm - PWS S3: Providers

- **S3-1: Jeeva Wireless/UW:** Dr. Joshua Smith – "Passive Radio Technologies from the UW Sensor Systems Lab"
- **S3-2: Univ of Central Florida:** Art Weeks – "Recent Developments in Wireless SAW Sensor Systems"
- **S3-3: Pegasense –** Don Malocha – "Recent SAW Wireless Sensor and Systems -Successes, Opportunities, and Boundaries"
- **S3-4: Demonstration Session**

Wednesday, October 11:

8:30am Keynote: Dr. Fassi Kafyeke "The Growing Use of Sensors in Business and Commercial Jet Aircraft"

10:00am – Noon - PWS S4: Providers

- **S4-1: NASA/MSFC**:Darren Boyd–"Recent Investigations into Potential Applications for Wireless Technologies"
- **S4-2: Michigan State:** Nizar Lajnef – "Ultra-low Power Wireless Sensing System for Multi-metric, Self-Powered Monitoring of Structural Components"
- **S4-3: Embry-Riddle University:** Eduardo Rojas – "Enabling Wireless Structural Electronics and Sensors: From Additively Manufactured mm-Wave Circuits to Novel Sensing Mechanisms"
- **S4-4: Omni-ID:** Matthew Pfeiffer – "Smart RFID Sensing for Wide Range of Environments"

12:00-1:30pm Lunch/Keynote: Dr. Jim Lyke "Energy Consequences of Information as it Relates to Spacecraft and Space Missions"

1:30pm – 3:30pm - PWS S5: Providers

- **S5-1: ETS/EE Dep-**François Gagnon – "Wireless with Strong Industrial Noise, Solving the Power Substation Case"
- **S5-2: Advanced Systems & Technologies** – Stephen Kupiec - "Optically-enabled RFID tracking system"
- **S5-3: Resonant, Inc:** Bob Hammond – "Fast FEM 2D Simulation of Multi-layered SAW Devices"
- **S5-4**: **Resonant,Inc**: Victor Plessky –"UWB Passive SAW Sensors Based on Hyperbolic Frequency Modulation"

4:00pm – 6:00pm - PWS S6: Providers

- **S6-1: Photon-X:** Preston Bornman – "Remote Sensing in Turbid Environments with Spatial Phase Imaging"
- **S6-2: Stevens Institute:** Rainer Martini – "Advantages of IR-based Comm and Sensing in Severe Environments"
- **S6-3: Sun Partners:**Emilie Bialic–"Semi-transparent solar cell LiFi responses and LiFi-application optimization"
- **S6-4: Demonstration Session**

Thursday, October 12:

8:30am: Keynote - Dr. Sterling Rooke – "Translational Awareness: at the Nexus of Physics and Cyber-in-Space"

10:00am – Demonstrations and Poster Sessions – Room 260

10:00am - PWS S7: Providers

- **S7-1: Airbus Operations GMbH:** Jan Mueller – "Integration of WAIC Systems into Aircraft"
- **S7-2: Safran Landing Systems:** Grant Minnes – "Opportunities for Wireless Technology in the field of Aircraft Landing Gear Systems"
- **S7-3: NASA/AFRC:** Richard Hang – "Wireless Instrumentation Systems for Flight Testing at NASA AFRC"
- **S7-4: Honeywell Intl:** Michael Franceschini –"Wireless Avionic Intra-Communications (WAIC) Status Update"

12:00-1pm Lunch/Keynote: Dr. Obadiah Kegege "User Needs & Advances in Space Wireless Sensing & Comm."

1:00 – 3:00 Scheduled One-on-One Sessions (Room 260): Providers schedule time at User Presenter Tables

Oct 10, 8:30am (Room 260) Keynote Speaker

Mr. Chris Singer

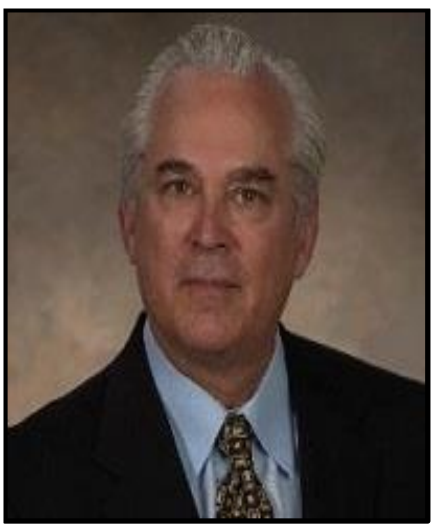
- Former NASA Deputy Chief Engineer & Marshall Spaceflight Center Engineering Director

"The Engine of Possibility Accelerating Development"

Abstract:

As the universe expansion accelerates, the exponential pace of information continues to shrink and connect the globe in unexpected ways. New discoveries in physics, biology, geology, at the macro, micro, and nano level create more questions than answers. So, the confounding question in aerospace systems, why does new capability take twice as long to infuse as 25 years ago? While technology and tools are opening the path for new capability, solving this riddle requires a much deeper look in the mirror. Only a learning culture is able to embrace innovation, uncertainty, and boldly face the risk conundrum, while infusing hard-won experiences without over-controlling. Technologies like wireless sensing and power systems, additive manufacturing, structured light scanning and advanced analytical tools are re-shaping the entire product life cycle, from design, analysis, production, verification, and logistics enabling significant increase in performance and reduction (2-10X) in cost and schedule. Maximizing these technologies requires an open environment, able to temper experienced based rules with creativity, and breaking thru our natural human desire for control with the inspiration of possibility.

Biography:



Mr. Chris Singer is recently retired from NASA as its Deputy Chief Engineer, responsible for integrating engineering across the 12 NASA centers. In June 2017, he began independent consulting for Creating Innovative Culture. From 2011 to 2016, Chris served as Engineering Director at Marshall Spaceflight Center in Huntsville, Alabama. MSFC Engineering is an organization of 1,400 civil service and 1,200 support contractor employees responsible for the design, testing, evaluation, and operation of hardware and software associated with space transportation, spacecraft systems, science instruments and payloads under development at the Marshall Center. From 2004 to 2011, Chris was deputy director for MSFC Engineering. Mr. Singer is an AIAA Associate Fellow. In 2006, he received the Presidential Rank Award for Meritorious Executives — the highest honor for career federal employees. He was awarded the NASA Outstanding Leadership Medal in 2001 and 2008 for his leadership. In 1989, he received the prestigious Silver Snoopy Award from the Astronaut Corps.

PWS S1-1 – Oct 10, 10:00am (Room 184)

"PWS Workshop Summary: Technology Library & User Trends"

George Studor
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NASA Engineering and Safety Center
Avionics Technical Discipline Team, consultant
Wireless Avionics Community of Practice
Langley Research Center, VA

Abstract: The motivation and background for the Passive Wireless Sensor Technology Workshops (PWST) will be presented. The intent of these workshops is to provide information that fosters relationships that advance technologies which reduce wires, connectors and penetrations in aerospace vehicles. Both users, stakeholders and developers and capability providers are invited that bring something new to a library of needs and technologies in world of less wires, connectors and penetrations. An overview of what is planned for the two-day workshop at WiSEE 2017 will be covered next, including the method of signing up for and conducting the one-on-one sessions. In addition, a summary of past PWST Workshop presentations will be introduced that enables interested parties to quickly discover which publicly accessible presentations are of interest. The various types of Passive Wireless Sensor Technologies are a part of the tool-box of alternatives to standard wired connections – one of three important legs of the "Fly-by-Wireless" approach George has promoted for over 17 years. The other 2 elements are: the vehicle architectural provisions and management direction, skills and metrics.

Background:

Mr. George Studor retired from NASA in October 2013. Since then he has concurrently been a consultant to the NASA Engineering and Safety Center for three Technical Discipline Teams(TDTs): Avionics TDT - Wireless Avionics Connections, Non-Destructive Evaluation TDT – In-Space Inspection, and Robotic Spacecraft TDT – Application of Natural Systems to Systems Engineering process. George organized and chaired 4 previous Passive Wireless Workshops in 2011, 2012, 2013 and 2015 supported by the Avionics TDT, the Industrial Society for Automation and DOE, Oak Ridge National Labs. In addition, he has been consultant to the Image Science and Analysis Group at Johnson Space Center through Jacobs Engineering to develop a detailed study of Soyuz Spacecraft In-Space Inspection. As a senior project engineer for technology applications in the Strategic Opportunities and Partnership Development Office of the Johnson Space Center. In the past 20 years, he has championed numerous successful wireless flight instrumentation projects for dual-purpose technology -operational use demonstrations on Space Shuttle Orbiters and International Space Station. Applying the lessons learned, he has promoted changes to future vehicle architectures to enable reduced wires and connectors through a comprehensive approach called "Fly-by-Wireless".

PWS S1-2 – Oct 10, 10:30am

"Wireless Applique for Spacecraft Integration and Test"

Norm Lay **NASA Jet Propulsion Lab**
Norman.E.Lay@jpl.nasa.gov **Manager, Communication Architectures and Research Section**
818-393-4880 **Comm, Tracking and Radar Division**

Abstract: This presentation discusses recent activities at JPL that are focused on developing the use of wireless communications for data path connectivity between instruments and subsystems within the confines of a single spacecraft. Anticipated benefits of intra-spacecraft wireless links include reduction of cable mass, improved flexibility in spacecraft design or modifications and increased efficiencies during integration and test. The talk will describe the framework for this effort, plans for retiring key risks and progress to date.

Background:

Dr. Norm Lay is the manager of the Communications Architectures and Research Section within the Communications, Tracking and Radar Division of JPL. Norm received his BSEE from Columbia University, MSEE from Stanford University and his PhD in Electrical Engineering from the University of Southern California. Prior to joining JPL in 1986, he was employed at the General Electric Corporate Research and Development Center in Schenectady, NY, where he worked on digital voice compression and land mobile radio technologies. Norm has worked on a broad range of technologies for satellite, terrestrial and deep space communications at JPL. His early work at the lab was focused on the development and demonstration of critical technologies for mobile satellite communications with an emphasis on the design of digital modems for land-, aeronautical- and maritime-mobile terminals. Norm has also worked extensively on technology development for the Deep Space Network (DSN), where he served as the Network Signal Processing Work Area Manager in the DSN Technology Program and has supervised groups specializing in RF and optical communications signal processing. While at JPL, Norm has also been involved in technology development activities for non-NASA sponsors. From 2002 to 2005, he led a JPL analysis support effort for the USAF Milsatcom Joint Program Office and provided key contributions in the negotiation and definition of the protected waveform standard used for risk mitigation during the system definition phase of the Transformational Satellite Communications Program. He has developed specialized communication signal analysis and detection algorithms which have been successfully utilized to support deep space telemetry signal anomaly analysis and recovery of weak signals for missions such as Kepler and STEREO-B. He has also led the development of the DSN Next Generation Advanced Receiver, and has been involved in advancing optical communications ground segment technologies for various NASA optical communications projects.

PWS S1-3 – Oct 10, 11:00am

"Atmospheric Entry Instrumentation in the Next Decade: a NASA Perspective"

Brandon Smith
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650-604-6578

NASA Ames Research Center
Aerospace Engineer
Entry Systems and Vehicle Development Branch

Abstract:

NASA will embark on an ambitious set of in situ exploration missions in the next decade. These missions may include a Venus lander, a Saturn probe, sample return from a comet, the Moon, or Mars, and precursor missions supporting eventual human colonization of Mars. Atmospheric entry technology limitations remain major barriers toward NASA's in situ scientific exploration of the solar system, and future missions will benefit from the recent attention NASA has paid to atmospheric entry instrumentation. Entry system performance data is sometimes valuable for the mission it is on, but it is always valuable for future missions by helping reduce risk or lower entry system mass due to reduced margins. In this talk, the speaker will highlight important data measured from past missions, describe NASA's needs for the next decade of atmospheric entry instrumentation, and describe challenges and opportunities for new technologies. Current technologists have a responsibility to continue to learn as much as possible from these future missions in order to educate our future selves and successors.

Background:

Mr. Brandon Smith joined the Entry Systems and Vehicle Development Branch at NASA Ames in 2011. His professional motivation is to help expand our national capability for in situ scientific exploration of the solar system. Brandon splits time between hardware development for active flight projects and technology maturation for future missions. He served as a system engineer on the Orion Exploration Flight Test One (EFT-1) Heatshield Developmental Flight Instrumentation (DFI) Project, which returned critical data on the performance of NASA's latest man-rated entry vehicle. More recently he served as Deputy Project Manager for the Orion Exploration Mission One (EM-1) Heatshield DFI Project. Brandon's present focus is as principal investigator for the first flight test of a deployable heatshield technology called ADEPT: Adaptable, Deployable, Entry and Placement Technology. Brandon holds B.S. and M.S. degrees in Aerospace Engineering from Georgia Institute of Technology.

PWS S1-4 – Oct 10, 11:30am

"Technologies for high temperature (500 C) Electronics, Sensors, Actuators, Power and Communication Systems to Enable Long-lived Missions to Venus and the Gas Giants"

Dr. Quang-Viet Nguyen
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Planetary Science Division
Science Mission Directorate
NASA Headquarters
Washington, DC

Abstract:

The Planetary Science Division in the Science Mission Directorate, NASA Headquarters started a new Announcement of Opportunity (AO) for research into the development of enabling technologies for long-lived missions to the planet Venus, and other extreme environment planetary locations such as the Gas Giants. This new opportunity is called the Hot Operating Temperature Technology (HOTTech) program, and it supports the advanced development of technologies for the robotic exploration of high-temperature environments such as the Venus surface, Mercury, or the deep atmosphere of Gas Giants. The goal of the program is to develop and mature technologies that will enable, significantly enhance, or reduce technical risk for *in situ* missions to high-temperature environments with temperatures approaching 500 degrees Celsius or higher. It is a priority for NASA to invest in technology developments that mitigate the risks of mission concepts proposed in response to upcoming Announcements of Opportunity (AO) and expand the range of science that might be achieved with future missions. HOTTech is limited to high temperature electrical and electronic systems that could be needed for potentially extended *in situ* missions to such environments. NASA seeks to maximize the benefits of its technology investments and consequently technologies that offer terrestrial benefits in addition to meeting needs of planetary science.

Background:

Dr. Quang-Viet Nguyen is a Program Executive (PE) in both the Joint Agency Satellite Division (JASD) and the Planetary Science Division (PSD) in the Science Mission Directorate (SMD) at NASA Headquarters in Washington, DC, where he manages reimbursable spacecraft missions including DSCOVR, Jason-3, and MetOp-C for JASD, while also serving as the PE for Technology Development and the Program Officer for the HOTTech Program in the PSD. Prior to this, Viet was the Chief of the Space Environments Branch at NASA Glenn Research Center in Cleveland, Ohio, where he was also a researcher in remote sensing and laser spectroscopy. Viet has published over two dozen refereed journal articles/book chapters and holds 9 patents. Viet received his Ph.D. in Mechanical Engineering from the University of California, Berkeley.

Oct 10, 12:30pm (Room 260) Keynote Speaker

Dr. Panagiotis Tsiotras

- College of Engineering Dean’s Professor and Director of the Dynamics and Control Systems Laboratory, School of Aerospace Engineering, Georgia Institute of Technology

“The Next Frontier: The Challenges in Developing Truly Autonomous Space Robots”

Abstract:

Several industry and government organizations are currently considering autonomous and semi-autonomous spacecraft robotic proximity operations as an enabling technology for several future space missions, such as on-orbit spacecraft inspection, surveillance, servicing, interferometry, formation flying, and many others. A crucial element of this technology is its ability to reliably perform autonomous relative pose estimation and tracking for robotic systems in orbit. Despite the tremendous recent advances in the field of ground robotics in terms of perception, learning, and control – mostly fueled by new AI algorithms and innovative computer hardware architectures where there are many difficulties that make similar implementations in a space environment much more challenging. These include, for example, harsh and rapidly changing illumination conditions (especially in LEO), long communication delays that limit human intervention in case of an emergency, severe resource (e.g., fuel, energy) constraints, much higher requirements for fail-safe operation, not to mention the physics themselves (Keplerian laws, momentum conservation constraints). The pace of new research to solve these challenges is hindered by the scarcity of suitable experimental platforms and methods to validate novel theories in a realistic space environment. In this talk, we will look at several aspects of these challenges, and offer some suggestions for potential remedies. We will present some results on spacecraft control under actuator and sensor failures and will focus on vision-based relative pose estimation, a fundamental problem in any robotic system. We will investigate both cooperative and non-cooperative vision-based scenarios, and provide experimental validation results using the 5dof spacecraft simulator facility at Georgia Tech.

Biography:

Dr. Tsiotras joined the faculty of the School of Aerospace Engineering at the Georgia Institute of Technology in 1998 as an Associate Professor. Prior to joining the faculty at Georgia Tech, Dr. Tsiotras was an Assistant Professor of Mechanical and Aerospace Engineering at the University of Virginia. He has held visiting appointments with INRIA, Rocquencourt, the Laboratoire de Automatique de Grenoble, and the Ecole des Mines de Paris in France. He has published over 250 journal and conference papers in the areas of astrodynamics, optimal and nonlinear control, and dynamics and control of mechanical and aerospace systems. His current research interests include analysis and control of autonomous and semi-autonomous ground, aerial and space vehicles. Dr. Tsiotras is a recipient of the NSF CAREER award, the Sigma Xi President and Visitor’s Award for Excellence in Research as well as numerous fellowships and scholarships. He is a past Associate Editor for the IEEE Transactions on Automatic Control, of the AIAA Journal of Guidance, Control, and Dynamics of the IEEE Control Systems Magazine and of the Dynamics and Control journal (now merged with the Journal of Dynamical and Control Systems). He is a Fellow of the AIAA, and a Senior Member of the IEEE.

PWS S2-1 – Oct 10, 1:30pm (Room 184)

"Passive Wireless Vibration Sensing for Measuring Aerospace Structural Flutter"

William (Cy) Wilson **Research Engineer**
William.C.Wilson@nasa.gov **Nondestructive Evaluation Sciences Branch**
757-864-7105 **Langley Research Center, VA**

Abstract: To reduce energy consumption, emissions, and noise, NASA is exploring the use of high aspect ratio wings on subsonic aircraft. Because high aspect ratio wings are susceptible to flutter events, NASA is also investigating methods of flutter detection and suppression. In support of that work a new remote, non-contact method for measuring flutter-induced vibrations has been developed. The new sensing scheme utilizes a microwave reflectometer to monitor the reflected response from an aeroelastic structure to ultimately characterize structural vibrations. To demonstrate the ability of microwaves to detect flutter vibrations, a carbon fiber–reinforced polymer (CFRP) composite panel was vibrated at various frequencies from 1Hz to 130Hz. The reflectometer response was found to closely resemble the sinusoidal and spectral response as measured with an accelerometer up to 100 Hz. The data presented will demonstrate that microwaves can be used to measure flutter-induced aircraft vibrations.

Background:

Dr. William (Cy) Wilson has been employed at NASA Langley Research Center in Hampton VA for 30 years. Initially, as an engineer in the Electronic Systems Branch, where he designed flight qualified digital electronics, FPGAs, and ASICs for scientific instruments which were deployed on NASA's various Atmospheric Sciences research satellites and aircraft. More recently, he is a researcher in the Non-Destructive Evaluation Sciences Branch where he researches new sensor systems for structural health monitoring applications. His current research interests include the application of surface acoustic waves, passive wireless sensors and microwave technology to non-destructive evaluation of aerospace vehicles. In addition, he is the subtopic manager for STTR T12.01 Advanced Structural Health Monitoring, which is found in NASA's Focus Area 3 Autonomous Systems for Space Exploration. The subtopic is looking for new technologies that include small, wireless, low power, sensors for structural health monitoring.

PWS S2-2 – Oct 10, 2:00pm

"Passive Wireless Sensor System for Structural Health Monitoring"

Dr. Viorel Olariu
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719-502-1348

Cofounder and Chief Technology Officer
Albido Corporation
Colorado Springs, Colorado
www.albido.com

Abstract:

Measuring strain and temperature is essential for structural health monitoring of NASA's space and aerospace vehicle components operating in extreme environments, but also of other military and commercial structures. High magnitude and repetitive variations of these parameters may lead to fatigue or yielding in the material or even failure of the structure. Strains can be used to estimate the loads, moments, and stresses on structures, or to measure torque, pressure, vibration, and acceleration. Albido is developing a **Passive Wireless Sensor System for Structural Health Monitoring** capable of measuring high-bandwidth temperature and strain of space and aerospace vehicle components operating in extreme environments. The system uses true passive Surface Acoustic Wave (SAW) temperature/strain sensors that can be interrogated wirelessly. SAW sensors are lightweight, passive (battery-less), simple, reliable, scalable, sensitive, do not disturb the operating environment, can be permanently placed on the critical components, allow quick and inexpensive acquisition of data to diagnose structure performance or failures, and wirelessly transmit the relevant data to a remote data processing center.

Background:

Dr. Viorel Olariu, co-founder and Chief Technical Officer (CTO) of Albido. He is the technical lead and he is responsible for developing the SAW-based strain/torque sensor and system. Dr. Olariu received his Ph.D., M.S., and B.S. degrees, all from the Technical University of Iasi, Romania, Electrical Engineering. Dr. Olariu has extensive experience in RF design, Signal Processing, RFID, and Test and Measuring Equipment gained at OrganicID and the Romanian Electronic Research Institute. Dr. Olariu was an associate professor with the Dept. of Electronics and Telecommunications of the Technical University of Iasi, Romania. Dr. Olariu has extensive experience in semiconductor, analog and logic circuit design, and processing gained at Cypress Semiconductor and OrganicID. He also has extensive expertise on developing new technologies such are ferroelectric transistor memories (Cova Technologies) and printed organic electronics (OrganicID). Dr. Olariu is an inventor or co-inventor on 6 US patents (4 issued, 2 pending). He is the author or co-author on over 30 scientific publications or conference presentations.

PWS S2-3 – Oct 10, 2:30pm

"Passive Wireless Sensing Using Ultrasonic Channels"

Dr. Taimur Aftab
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+49-761-203-7183

Prof. Reindl's Laboratory of Electrical Instrumentation
Institute of Microsystems Engineering -IMTEK
Albert-Ludwigs University of Freiburg, Germany
https://www.imtek.de/home-en?set_language=en

Abstract:

Existing Passive Wireless Sensor Technologies (PWST) rely on the availability of an Radio Frequency (RF) communications channel between the battery-less sensor and the readout unit. For the sensing system to operate, the RF channel needs to fulfil certain minimum requirements such as insertion loss and variations in group delay caused by environmental resonances. This talk will present our first experimental results in chipless passive wireless sensing using across an ultrasonic channel. As a first application, passive wireless measurement of temperature from -30 °C to 90 °C is shown. Wireless passive measurements taken at a distance of 10 cm show a sensitivity of 0.52 K/Hz with a resolution of 52 mK. Potential applications of the system include measurement of temperature, pressure and humidity inside metallic chambers without windows.

Background:

Dr. Taimur Aftab was born in Rawalpindi, Pakistan. He received the B.Sc. degree in electronics engineering from the Ghulam Ishaq Khan Institute of Engineering Sciences and Technology in 2009. After working in Karachi, Pakistan as a Design Engineer at Data Communication & Control Pvt Ltd where he modelled and designed the hardware and firmware for robotic manipulators, he started graduate studies at the Institute of Microsystems Engineering, University of Freiburg form where he received a Master's degree in 2014. He since is a PhD student at the Laboratory of Electrical Instrumentation where he conducts research on passive wireless sensors funded by the German Research Foundation and the Federal Ministry of Education and Research.

PWS S2-4 – Oct 10, 3:00pm

"Practical Considerations for SAW Sensor and Tag Deployment"

Dr. Jackie Hines
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410-544-4664

SenSanna Incorporated
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www.sensanna.com

Abstract:

SenSanna works closely with customers to understand their measurement needs and develops passive wireless sensor systems customized to meet these needs. Each customer has unique goals, but the one thing they all have in common is that they involve deploying sensors into very challenging environments. Successful deployment of passive wireless sensors and sensor-tags requires that we consider a range of factors, from customer priorities & elements necessary for adoption, to application engineering considerations such as physical requirements (dimensions, temperature, packaging, mounting, lifetime, etc.), operational requirements (accuracy/precision, data rate, protocols, integration, etc.), and RF environment (including media in which the sensors are immersed during operation). This presentation reviews how these factors impact SAW sensor and sensor-tag system development in general, and provides information learned during sensor development efforts performed by SenSanna for applications in the oil & gas, manufacturing, and power distribution fields. Videos of sensor system demonstrations are included for select use cases.

Background:

Dr. Jackie Hines received a B.S. in Applied and Engineering Physics from Cornell University, and a M.S. and Ph.D. in Electrical Engineering from the University of Central Florida. Jackie served on active duty with the U.S. Navy from 1984 through 1988 as an instructor at the U.S. Naval Nuclear Power School in Orlando, FL and remained in the Reserves thereafter, obtaining qualification as an Engineering Duty Officer and leaving service with the rand of Lt. Commander. After leaving active duty, Jackie joined Sawtek Incorporated, where she led R&D activities for more than a decade. Jackie established a SAW sensor technology group at Sawtek, that developed a SAW-based chemical sensor system that is capable of detecting, identifying, and quantifying volatile organic chemical vapors alone and in mixtures of up to two vapors plus water. This work was supported by DARPA and DOE, and the sensor system was demonstrated at DOE's Savannah River site in June 1998. Jackie left Sawtek in 2000 to found her own consulting company. In August of 2005, having served as PI on two NASA contracts, Jackie founded Applied Sensor Research & Development Corporation (ASR&D), to advance passive wireless acoustic wave sensor technology. In November 2014, ASR&D was merged into SenSanna Incorporated. Located outside Annapolis MD, SenSanna is an application engineering, contract research, and wireless sensor manufacturing firm specializing in developing measurement solutions for challenging environments using innovative acoustic wave sensor technology. Jackie is actively involved in a range of professional activities, and currently serves as the Sr. Past President of the IEEE Ultrasonics, Ferroelectrics and Frequency Control Society (UFFC-S).

PWS S3-1 – Oct 10, 4:00pm

"Passive Radio Technologies from the UW Sensor Systems Lab"

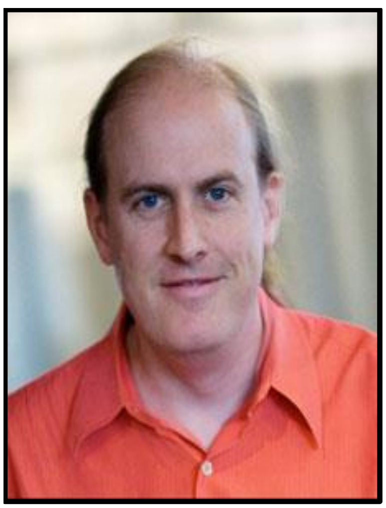
Joshua Smith
206-685-2094
jrs@cs.washington.edu

Co-Founder, Jeeva Wireless Inc
Professor, Allen School of CSE & Dept of EE
Sensor Systems Laboratory
University of Washington, Seattle, WA
https://sensor.cs.washington.edu/

Abstract:

I will describe the work of my group and collaborators on Passive Radio-based Sensor Systems. I will start with the WISP, a UHF-RFID powered and read sensor system that is fully programmable, providing computing as well as sensing, and yet can be read by standards-compliant UHF RFID readers. I will then describe Ambient Backscatter communication, Passive Wi-Fi, Power Over WiFi, and other related work.

Background:



Professor Joshua Smith leads the Sensor Systems lab at the University of Washington. His group has been developing passive sensors for many years, starting with the WISP, a UHF-RFID powered and read sensor system that is fully programmable, providing computing as well as sensing, and yet can be read by standards-compliant UHF RFID readers. His group and collaborators have developed many related technologies, including Ambient Backscatter communication, Passive Wi-Fi, Power Over Wi-Fi, and most recently, LoRa backscatter. His team also recently developed the first battery-free cell phone, and battery-free cameras. Research from his lab is being commercialized by Jeeva Wireless Inc and other companies.

https://news.cs.washington.edu/2017/02/01/uw-cseee-startup-jeeva-wireless-raises-1-2-million-for-passive-wi-fi/

PWS S3-2 – Oct 10, 4:30pm

"Recent Developments in Wireless SAW Sensor Systems"

Dr. Arthur Weeks
arthur.weeks@ucf.edu
407-823-0767

Assistant Professor of Electrical and Computer Engineering
University of Central Florida
Orlando, FL
http://caat.cecs.ucf.edu/

Abstract:

Recent improvements in software defined radio (SDR) technology now makes it feasible to implement an integrated portable wireless Surface Acoustic Wave (SAW) sensor system. This talk will present the use of SAW technology for passive wireless sensors followed by a discussion of the latest developments in these sensors. Other contributors to the work being presented include Chris P. Carmichael, Michael Morales Otero, Donald C. Malocha.

Technical issues associated with using these devices as passive sensors will also be given. Next, the use of software defined radio implemented as a portable transceiver that can interrogate a passive SAW sensor(s) will be presented. The portable transceiver system can be divided into the three major sections of the RF frontend, the software defined radio system and the embedded processing computer with display and user interface. A brief discussion of the interrogator software will be presented along with some example data collected from various types of passive wireless SAW sensors.

There will be a demonstration of a wireless SAW sensor system after the counterpart presentation by Peasense.

Background:

Dr. Arthur R. Weeks is a professor in the Electrical and Computer Engineering at UCF. He received his M.S.E and Ph.D. degrees in Electrical Engineering from the University of Central Florida in Orlando in 1983 and 1987, respectively. His current research interests include RF communications, wireless sensors and Software Defined Radio. He is also interested in color image processing, and image enhancement using nonlinear filters. Dr. Weeks is also a member of the IEEE and SPIE.

Christopher P. Carmichael received the B.S. and M.S. degrees in electrical engineering from the University of Central Florida, Orlando, in 2014 and 2016, respectively. He is currently a Graduate Research Assistant with the University of Central Florida, where he is pursuing the Ph.D. degree in electrical engineering. His research interests include wireless surface acoustic wave sensors, thin film materials, and microelectronic device fabrication.

Michael Morales Otero is currently a Graduate Research Assistant with the University of Central Florida, where he is pursuing the Ph.D. degree in electrical engineering.

Donald C. Malocha - See bio in Pegasense presentation

PWS S3-3 – Oct 10, 5:00pm

"Recent SAW Wireless Sensor and Systems -Successes, Opportunities, and Boundaries"

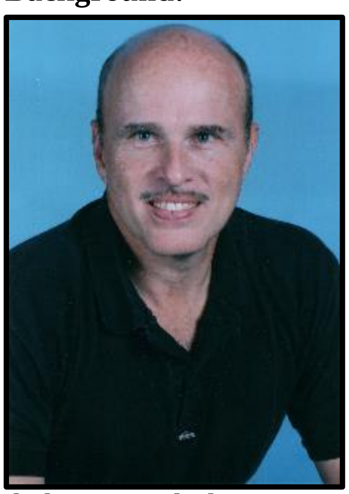
Dr. Don Malocha **CEO, Pegasense, LLC**
donald.malocha@ucf.edu **Pegasus-Professor Emeritus, Electrical & Computer Engineering Dept**
407-823-2414 **University of Central Florida, Orlando FL**

Abstract:

Great achievements have been accomplished in the past 15 years in SAW wireless sensors; it is time to reflect on successes, technological advances and some boundaries uncovered. Many key technological hurdles and limitations have been eliminated or minimized to the extent that low cost, versatile, SAW sensor systems have been demonstrated. Until recently the key technology elements that needed development for many applications were the SAW sensor device, the transceiver (reader), the analog to digital data acquisition, the post-processor elements, and the extraction software. Pegasense is established as a conduit between universities, industry and government to transition acoustic-based PWST into commercial systems.

Pegasense has experience in all aspects of the PWST –devices, RF transceivers, modeling and simulation, sensor parameter data acquisition and extraction, as well as other communication systems, and is teaming with both large and small companies to move the technology into systems. Handheld mobile transceivers have been demonstrated from 500-1000 MHz using software design radio (SDR), embedded low-cost processors, and touch-pad displays with extracted graphical sensor data. In addition, networking to a number of mobile devices and networks has been demonstrated. Sensors for detection of temperature, strain, gases -hydrogen, alcohols, acids-, magnetic flux, cement curing have been shown. Temperature extraction precision of 0.001C is obtained under high signal-to-noise ratio environments. Open range temperature measurements of 100 feet have been achieved with 0.1C accuracy. All of the key elements have had orders of magnitude advancement in reductions of their technology limitations. As an example of one element, the transceiver hardware size and cost has been reduced by factors of 10-100, software design radio (SDR) provides a universal platform for the basic receiver, and required RF components have similar reductions due to the large volume of other wireless applications. Given the demonstrated SAW sensor system technology to date, a look at some of the design boundaries, such as frequency (2-4 GHz bands), coding (CDMA, OFC, resonator), narrow and ultra-wide bandwidths (UWB), etc., and future extensions on several of the key elements (networking, cost, etc.) will be presented. In addition, new concepts, elements and opportunities for future directions will be presented.

Background:



Dr. Donald C. Malocha is currently the CEO of Pegasense LLC, specializing in solid-state acoustic devices, wireless RF communications systems, and sensors. He is also Pegasus-Professor Emeritus in the Electrical and Computer Engineering Dept., University of Central Florida (UCF), Orlando. Don received a dual BS in electrical engineering (EE) and computer science (CS), an MS in EE, and Ph.D. degree in EE from the University of Illinois, Urbana. He was member of the technical staff (MTS) at Texas Instruments Corporate Research Laboratory, Mgr. of Advanced Product Development, Sawtek, and an MTS at Motorola. He has been a Visiting Scholar at the Swiss Federal Institute of Technology, Zurich (ETH), Switzerland, and the University of Linz, Austria. He is an Associate Editor of the IEEE TRANSACTIONS ON ULTRASONICS, FERROELECTRICS AND FREQUENCY CONTROL (UFFC), a UFFC AdCom Emeritus-member, and past-President of the IEEE UFFC Society. He is chair of IEC TC49 for piezoelectric dielectric and electrostatic devices and materials for frequency control standards. He has over 250 technical publications, 13 patents awarded, and several pending. Don is a Fellow of the Institute of Electrical & Electronics Engineers (IEEE).

Oct 11, 8:30am (Room 260) Keynote Speaker

Dr. Fassi Kafyeke

- Senior Director, Strategic Technology & Innovation, Bombardier Aerospace

"The Growing Use of Sensors in Business and Commercial Jet Aircraft"

Abstract:

Bombardier is a manufacturer of planes and trains. In aviation, we develop, produce and support airplanes in the business, regional and commercial market. The presentation will discuss the growing impact of sensors technology on our operations and will discuss also our efforts to understand and document the particular environments into which long range high altitude aircraft typically fly. The use of sensors technology in aviation industry keeps growing, because sensors play a vital role in supplying information during flight. Aircraft safety relies on good operation of all systems, in any environment; and sensors have the major role of supplying vital information to the pilot about the flight. The majority of these sensors today are wired to the computers that perform signal analysis. Weight reductions and added flexibility can be achieved with wireless sensors but this can only be done once the integrity of the communication can be completely assured. Recent progress in data analytics and artificial intelligence has also increased the value of information that sensors located on various parts of the aircraft can provide. This can be used for passenger services, flight operations optimization and predictive maintenance of aircraft. At various altitudes, aircraft can be exposed to cosmic radiations coming from external galaxies above the sun. The exposure of electrical and electronic systems can lead to component failures. To further our understanding of this phenomena, Bombardier is conducting a Cosmic radiations flight measurement campaign, as part of a collaborative project with three Canadian universities and other industrial partners. Although this measurement campaign uses wired radiative Sensors, it is an example of a sensor investigation into the environments in which aircraft typically operates.

Biography:

Dr. Fassi Kafyeke has an Aerospace Engineering Master's degree from Université de Liège, a Master's degree (Air Transport Engineering) from the Cranfield Institute of Technology and a PhD (Aerodynamics) from École Polytechnique de Montréal. He joined Bombardier in 1982. In 1996 he became Chief of Advanced Aerodynamics, responsible for the design and testing for all Business Jets, Regional jets and the CSeries airliner. In 2007 he became Director of Strategic Technology and since 2015, he is a Senior Director and a member of the Bombardier Product Development Engineering Leadership team, responsible for technology innovation, products innovation and Eco-design.

PWS S4-1 – Oct 11, 10:00am (Room 184)

"Recent Investigations into Potential Applications for Wireless Technologies at NASA/MSFC"

Darren Boyd
darren.r.boyd@nasa.gov
256-544-6466

Electrical Engineer Aerospace Technologist
NASA Marshall Space Flight Center, AL

Abstract:

An overview of the various wireless projects at NASA Marshall Space Flight Center will be presented. This will begin with the current motivation and interest in wireless technologies including the benefits and challenges. Next, Marshall Space Flight Center's approach to the development of wireless technologies will be discussed. This approach demonstrates a recognition of various elements of wireless systems. These elements are targeted in focus areas that allow development and application of systems and components in different implementations and meeting various needs. Finally, a brief summary of each of the recent and current wireless projects will be presented demonstrating the effort in some of these focus areas and different implementations of wireless technology. These projects include development in various wireless sensor technologies, mesh networking applications, wireless power and data systems, a unique communication implementation, and practical targeted use of wireless solutions.

Background:

Mr. Darren Boyd is an Aerospace Technologist in the Electronic Design Branch (ES36). He has been at Marshall Space Flight Center (MSFC) since May 2014 with prior work at Langley Research Center. He earned his Master of Science in Electrical Engineering degree and his Bachelor of Science degree from the University of Kentucky in Lexington, KY. Darren's thesis is entitled "A Multi-Physics Computational Approach to Simulating THz Photoconductive Antennas with Comparison to Measured Data and Fabrication of Samples". Darren has been awarded funding for various wireless development efforts and is part of the MSFC Wireless Technology Development team. He has represented MSFC wireless efforts at the Technical Discipline Team meeting for the NASA Avionics Community of Practice. Darren is currently a co-investigator and the antenna subsystem lead for the Lightweight Integrated Solar Array and anTenna (LISA-T) project. His duties include antenna array design and transceiver integration. He has also served as the project scrum master for LISA-T Early Career Initiative project. He is listed on several New Technology Reports (NTRs). He is also currently assisting the Lander Technologies Avionics lead at MSFC working on several lander projects. His technical experience also includes board and FPGA design for data systems and computational electromagnetics. He has designed components for various data communications systems and antennas of various types and bands.

PWS S4-2 – Oct 11, 10:30am

"Ultra-low Power Wireless Sensing System for Multi-metric Self-Powered Monitoring of Structural Components"

Dr. Nizar Lajnef
lajnefni@msu.edu
517-802-8800 (cell)

Associate Professor
Department of Civil and Environmental Engineering
Department of Electrical and Computer Engineering
Michigan State University, East Lansing, MI

Abstract:

Among the most serious challenges that have hampered the practical application of the field of SHM for damage detection in extended structures, is the infeasibility of using a sufficient number of conventional sensors (such as strain gages, accelerometers, etc.) to provide a high-enough spatial resolution so as to capture small cracks that may be precursors to serious structural damage. Keeping in mind that the collection of measurements needs not only the sensors themselves, but also an extensive instrumentation network to collect and transmit the measurements, which constitutes a major impediment. Additionally, there is a need for robust energy sources to drive the sensors and associated data acquisition network. This presentation will discuss the developments and results from several Federal Highway Administration (FHWA) funded projects aiming at demonstrating the validity of using a novel self-powered sensor technology (referred to as Piezoelectric-Floating-Gate (PFG)) for the monitoring of structural components. The developed ultra-low power computation and data logging technology is capable of autonomous long-term monitoring of dynamic loading events. The sensing technology offers several novel features which are not available in other classical SHM methods including: low power requirements, self-powered continuous sensing, possibility of deployment in dense networks, autonomous computation and non-volatile storage of sensing variables, and wireless communication. In order to achieve all the described capabilities, the data is compressed and stored on the sensors as histograms of cumulative events. The unique new type of data requires specific data interpretation techniques. The developed advanced methods will be also presented.

Background:

Dr. Nizar Lajnef is an associate professor of civil engineering at Michigan State University. His current research activities include sensors design for structural health and usage monitoring, damage detection algorithms with application to civil, mechanical and biomechanical structures, nano-watt and self-powered sensors, and smart materials/composites/alloys and systems. He holds two patents in the area of sensor design, and has submitted three patents on advanced material designs. Dr. Lajnef is the author of more than fifty publications in the area of sensors design and energy harvesting. He was a recipient of the Lilly Teaching Fellowship in 2012 and the Nothstine fellowship in 2007. Dr. Lajnef is a member of the American Society of Civil Engineers (ASCE), the Institute of Electrical and Electronics Engineers (IEEE), and serves on the Energy Harvesting committee for the American Society of Mechanical Engineers (ASME).

PWS S4-3 – Oct 11, 11:00am

"Enabling Wireless Structural Electronics and Sensors: From Additively Manufactured mm-Wave Circuits to Novel Sensing Mechanisms"

Dr. Eduardo Rojas-Nastrucci — **Assist. Prof. Dept of Electrical, Computer, Software and Systems Eng**
e.rojas@erau.edu — **Embry-Riddle Aeronautical University**
(813) 817-7147 — **Daytona Beach, FL, 32114**

Abstract:

Passive wireless sensors are continuously gaining acceptance over the traditional wired sensor networks. Among the main advantages of wireless sensors are: (a) overall weight reduction due to the absence of wired connections, (b) reduced cost of installation and ease of retrofitting existing platforms, and (c) sensing in areas that are not accessible when using wired connections due to extreme environmental conditions (such as high temperatures) or structural limitations. Two key enablers to passive wireless sensors are Additive Manufacturing (AM) and new sensing mechanisms using functional nanomaterials, both covered in this work. AM enables the fabrication of optimized geometries that can lead to better performance and increased integration or miniaturization. Also, with AM the complexity of the components is not necessarily correlated to the cost of fabrication. Therefore, the designer has an increased level of freedom and the ability to integrate the devices into functional structures. Moreover, turn-around times are significantly reduced when compared with traditional manufacturing methods, which accelerates the progress at the prototyping stages. Functional nanomaterials also possess immense possibilities to be used in passive wireless sensors. Various types of nanomaterials, such as carbon nanotubes or zinc oxide, can be embedded or solely used to form new sensing mechanisms enabling highly-efficient unobtrusive sensing. Combing both AM and nanomaterials has a great potential in advancing passive wireless sensing technologies in future.

In this work, the technologies of micro-dispensing of silver paste, fused deposition modeling (FDM), and picosecond laser machining (1064 nm wavelength) are combined to manufacture passive elements and vertical interconnect access (vias) with the goal of fabricating multilayer mm-wave packaging with embedded MMIC dies.

Background:

Dr. Eduardo A. Rojas-Nastrucci earned his B.S. in Electrical Engineering from the Universidad de Carabobo, Valencia, Venezuela, in 2009; and M.S.E.E. and Ph.D. from the University of South Florida in 2014 and 2017, respectively.

His work is oriented towards developing new structures, materials, and techniques with the objective of creating 3D printed wireless devices with improved performance. He has more than 24 peer-reviewed publications. He is also a reviewer of the journals IEEE MTT-S Transactions on Microwave Theory and Techniques, and Proceedings of the IEEE. He is an Assistant Professor of the Department of Electrical, Computer, Software and Systems Engineering, at Embry-Riddle Aeronautical University, Daytona Beach, FL.

Credits:

Thomas Weller, University of South Florida, Tampa, FL; weller@usf.edu
Daewon Kim; kimd3c@erau.edu
Sirish Namilae; namilaes@erau.edu

PWS S4-4 – Oct 10, 11:30am

"Smart RFID Sensing for Wide Range of Environments"

Mr. Matthew Pfeiffer
954-609-8975
matthew.pfeiffer@omni-id.com

Senior Director Global Sales
Omni-ID, Rochester, NY
www.omni-id.com

Abstract:

The objective of this workshop is to explore Harsh Environment Passive RFID Tagging as well as Omni-ID's award-winning Internet of Things (IOT) revolution in IT, aerospace, manufacturing and Industry. The main goal is to create conversation around how aerospace companies can adapt their current processes to incorporate wireless passive technologies.

Omni-ID began as a research and development team formed in the 1990s within QinetiQ, an international defense and security technology company. The team was charged with exploring and challenging the boundaries of RFID. The result was a groundbreaking technological improvement — passive UHF RFID tags that provide near perfect accuracy in harsh environments, including in the presence of metals and liquids. This represented a fundamental shift in the way the RFID tags were viewed and broadly expanded the practical use applications. Omni-ID was launched as a stand-alone company.

Known for consistently setting industry standards, Omni-ID is the original inventor and patent-holder of the on-metal passive RFID tag. In 2012, the company launched ProVIEW — the world's first visual tagging system — to replace paper-driven processes in manufacturing, providing not only the ability to track assets; but dynamic, readable instructions right on the tag, completely changing the auto-identification industry landscape.

Omni-ID's award-winning, patented technologies excel in solving tracking and identification challenges with unprecedented accuracy for customers in the Aerospace, Manufacturing, Supply Chain, Oil & Gas, Energy, IT Asset Management and Tool & Rental Equipment industries.

Background:

Mr. Matthew Pfeiffer is the Senior Director of Global Sales for Omni-ID. He is responsible for developing Strategic Global Accounts as well as Latin America. Matthew's objective is to help global manufacturers grow digitally by providing IoT technologies such as active and passive RFID solutions. Matthew has worked for more than 25 years in leadership roles at The Gund Company, Sensormatic, ADT, Tyco Fire and Security, Johnson Controls and Omni-ID. Recently Matthew has held global leadership roles at Tyco/JCI as well as the General Manager for Tyco Caribbean based in San Juan, Puerto Rico. Matthew has an MBA and Bachelor of Science Degree in International Business from Saint Louis University and speaks Spanish, Portuguese, English and conversational French. He based in of Boca Ragon, Florida.

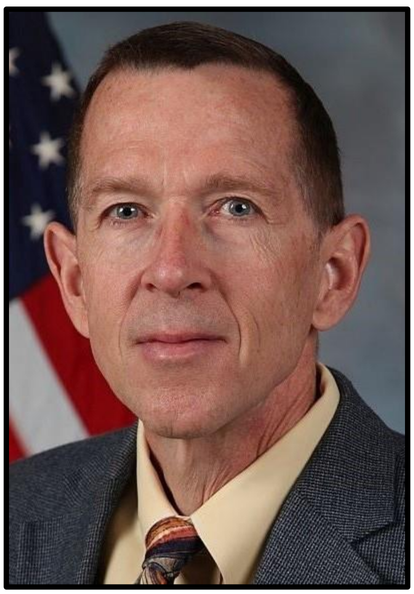
Oct 11, 12:30pm (Room 260) Keynote Speaker

Dr. Jim Lyke

- Research Program Manager, Space System Branch, Air Force Research Laboratory, Space Vehicles Directorate, AFRL Fellow

"Energy Consequences of Information as It Relates to Spacecraft and Space Missions"

Biography:



Dr. James Lyke (Senior Member, IEEE) received the B.S. degree in electrical engineering at the University of Tennessee, Knoxville, TN, USA in 1984, the M.S. degree in electrical engineering at the Air Force Institute of Technology, Wright-Patterson Air Force Base, Ohio, USA in 1989, and the Ph.D. degree in electrical engineering from University of New Mexico, Albuquerque, NM, USA in 2004.

He was in active duty miltary service with the US Air Force from 1984 through 1995. Since 1990, he has supported the Air Force Research Laboratory (AFRL), Space Vehicles Directorate (AFRL/RV), Kirtland Air Force Base, NM, USA, including its precursor organizations (Weapons Laboratory, 1990-1991, and Phillips Laboratory, 1991-1998), in a number of capacities. He is currently a program manager in the Air Force Research Laboratory's Space Systems Branch (Space Vehicles Directorate) and an AFRL Fellow. Dr. Lyke has lead over one hundred in-house and contract research efforts involving two- and three-dimensional advanced packaging, radiation-hardened microelectronics, and scalable, reconfigurable computational, communications and systems architectures, with recent emphasis on modularity and the rapid formation of complex systems. He has authored over 100 publications (journal and conference papers, book chapters, and technical reports), four receiving best paper awards, and he has been awarded eleven US patents.

Dr. Lyke is an Associate Fellow of the American Institute of Aeronautics and Astronautics (AIAA), serving on the Computer Systems Technical Committee. He was selected as recipient of the Federal Laboratory Consortium award for Excellence in Technology Transfer in 1992 and for the U.S. Air Force Science and Engineering Award in Exploratory and Advanced Technology Development in 1997 and 2000.

PWS S5-1 – Oct 11, 1:30pm (Room 184)

"Wireless with Strong Industrial Noise: Solving the Power Substation Case"

Dr. François Gagnon
françois.gagnon@etsmtl.ca
+1-514-396-8997

École de technologie supérieure
Electrical and Computer Engineering
Montreal, Quebec, CA

Abstract: The emergence of smart grid, specifically substation automation, requires the design of new robust communication media. Wireless technology allows for an easy network installation within power substations with a very low cost. However, power substations generate RF noise and interferences that disturb existing wireless systems. Electricity providers are planning for the expansion of remote operations, such as protection, maintenance, and control, all of which requires secure communication protocols with high throughputs and low latency. The collaboration between ETS, McGill University, and Hydro-Quebec has contributed to enhancing wireless communications for power substation environments. In addition, the Richard J. Marceau research chair at ETS is currently working towards low-latency and highly secure protocols for critical communications, which will be required for wireless substation automation. This presentation intends to highlight the results obtained through this collaboration and to present solutions for future installations of robust wireless sensor networks in harsh environments.

Background:

Dr. François Gagnon holds a Bachelor of Engineering degree and a Doctorate in Electrical Engineering from the École Polytechnique de Montréal, and has been a professor in the Department of Electrical Engineering at the École de technologie Supérieure (ÉTS) since 1991. He served as director of this department from 1999 to 2001. He has held industrial research chairs since 2001. In addition to holding the Richard J. Marceau Industrial Research Chair for Wireless Internet in developing countries, François Gagnon also holds the NSERC-Ultra Electronics Chair in Wireless Emergency and Tactical Communication, the most prestigious industrial chair program in Canada. He also founded the Communications and Microelectronic Integration Laboratory (LACIME) and was its first director. He has been very involved in the creation of the new generation of high-capacity line-of-sight military radios offered by the Canadian Marconi Corporation, which is now Ultra Electronics Tactical Communication Systems. Ultra-Electronics TCS and ÉTS have obtained the NSERC Synergy prize for this collaboration. Professor Gagnon serves on the boards of funding agencies and companies, he specializes in wireless communications, modulation, coding, microelectronics, signal processing, equalization, software defined radio, mobile communication and fading channels. He is actively involved in the SmartLand project of UTPL, Ecuador, the STARACOM strategic research network and the Réseau Québec Maritime.

PWS S5-2 – Oct 11, 2:00pm

"Optically-Enabled RFID Tracking System"

Dr. Stephen A. Kupiec
skupiec@asatechinc.com
949-733-3355 x225

Senior Scientist
Advanced Systems and Technology, Inc.
Irvine, CA
http://www.asatechinc.com/

Abstract:

While conventional UHF RFID technologies allow items to be tracked from room to room, but accuracy beyond that point is severely limited. As a result, AS&T has developed the Wireless Hybrid Identification and Sensing Platform for Equipment Recovery (WHISPER) system, a hybrid Optical-enhanced RFID system which employs optical beacons and matched sensors, combined with smart RFID tag chips to provide precise tracking of position and orientation. The basic approach consists of a series of wide angle Optical Angular Beacons consisting of a near infrared Texas Instruments Pico Digital Light Processor (DLP) projection engine combined with a hyperfocal f-theta fisheye lens operating within the space to be tracked. Each pixel within the DLP chip flips a unique recursive binary code burst, which, when received by a matched COTS sensor in the illuminated space determines the angular position of the tag relative to the beacon. By sequentially illuminating the sensor with bursts from two separate OABs it is possible to locate the sensor in three dimensions. By connecting the matched sensor to an Ultra-Low Power (ULP) MicroController Unit (MCU) and a corresponding smart EPCGlobal Class 1 Gen 2 (C1G2) RFID tag it is possible to transmit the received optical burst sequences back to a RFID reader thus locating the tag in 3D with sub-centimetric accuracy. By mounting multiple tags to the same rigid body or articulated structure it is possible to track the position and orientation of the rigid body in a highly resilient fashion using AS&Ts proven Manifold Compliant Particle Swarm Optimization (MCPSO) algorithm. Since the OAB modules broadcast angular position data without the need for response from the sensors employed any number of location sensors may operate without degrading the system. The simplicity of the approach makes it perfectly suited to power harvesting dependent approaches such as RFID, the same matched sensor and MCU modules may be incorporated into arbitrary hardware providing precision position and orientation tracking services to robots, free flyers, and Virtual Reality(VR) and Augmented Reality(AR) systems.

Background:

Dr. Stephen Kupiec has specialized in motion tracking, heterogeneous sensor fusion, DLP based optics, and Space Situational Awareness (SSA). He has developed a variety of tracking and fusion methods based on Particle Swarm Optimization applied over Lie Groups via manifold constraint techniques accelerated via GPGPU methods via OpenCL. He has developed innovative DLP tracking systems specifically WHISPER technology. He has also done cutting-edge research into inertial sensing, vestibular compensation, eye tracking, and holographic display technology. He has developed novel types of vestibular monitoring systems for prevention of motion sickness and head trauma, and for increased understanding of fall dynamics. Dr. Kupiec received his Ph.D. (1995) in physics from the University of Alaba ma at Huntsville.

PWS S5-3 – Oct 11, 2:30pm

"Fast FEM 2D Simulation of Multi-Layered SAW Devices"

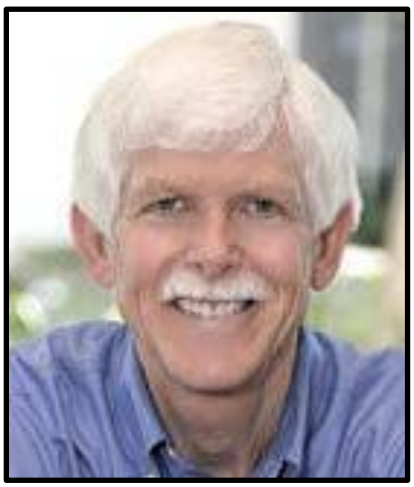
Dr. Bob Hammond
bhammond@resonant.com
805-308-9451
805-708-5284 (cell)

Chief Technical Officer
Resonant Inc.
110 Castilian Drive, Suite 100
Goleta, CA 93117
http://www.resonant.com/

Abstract:

Modern high-performance temperature-compensated TCSAW filters utilize multi-layered thin-film technology to optimize losses, temperature stability, filter bandwidth, and manufacturing sensitivity. Fast development of these complicated structures calls for accurate and more general simulation tools that improve device performance. The versatility of the finite element method (FEM) makes it attractive for this purpose. However, the application of FEM in the SAW field has been hampered by the associated very large memory requirements and excessive computation times. Another challenge is the presence of open boundary conditions, usually solved using Perfectly Matched Layers (PML). However, PMLs are known to be unstable in certain crystal cuts on substrates with unsuitable anisotropy including standard SAW substrates $LiTaO_3$ and $LiNbO_3$. Here, we present the solutions of these issues.

Background:



Dr. Robert B. Hammond received his BS, MS, and PhD in physics and applied physics from Caltech. Under thesis advisors James W. Mayer and Thomas C. McGill, he measured for the first time the thermodynamic properties of the electron-hole-liquid in silicon, and the splitting of the silicon exciton ground state. From 1976-1987, he was with the Los Alamos National Laboratory, where he led Electronics Research and Exploratory Development, and established a semiconductor physics and device development and manufacturing group. He led the development and production of a variety of novel devices and instruments; including subnanosecond radiation detectors, multi-gigawatt switches, subpicosecond electrical characterization measurements, laser position sensors, and beam diagnostics. He contributed to the understanding of the fundamental mechanisms of pulsed laser annealing of silicon and the fundamental properties of highly excited silicon at low temperature. In 1987, he co-founded Superconductor Technologies Inc., in Santa Barbara, California; where he was Chief Technical Officer through 2012. At STI he built a team of engineers and scientists, lead technology development, directed corporate technology strategy, and intellectual property. Under his leadership STI pioneered the development and manufacturing of superconducting TlBaCaCuO and YBaCuO thin films, superconducting wireless filter chips, and a no-maintenance Stirling cryocooler, all incorporated in STI's flagship product SuperLink. These RF front-end systems operate in 7,000 cellular base stations in the US. In 2012, Dr Hammond co-founded Resonant Inc, where he is CTO. Resonant designs SAW filters and multiplexers for RF Frontend.

PWS S5-4 – Oct 11, 3:00pm

"UWB Passive SAW Sensors Based on HFM signals"

Dr. Victor Plessky
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+41 32 8463039
+41 78 7547089 (cell)

GVR Trade SA
(A wholly owned subsidiary of Resonant Inc.)
Gorgier, Switzerland

Abstract: We present here the possibility of using Hyperbolically Frequency Modulated (HFM) signals in UWB passive SAW sensors [1]. Linear frequency modulated (LFM) UWB signals were earlier proposed for use in SAW tags [2]. D. Malocha *et al*. proposed "Orthogonal Frequency Coding" for SAW sensors [3]. To get the processing gain the chirp signal must be compressed, but the high temperature coefficient of delay of LiNbO3 results in changed frequency characteristics of the SAW device in both mentioned approaches and the signal compression becomes more difficult, especially if the sensor temperature changes over a wide range. The work reported here demonstrates that the HFM transducer has significant advantages for such devices.

The HFM transducer (or reflecting grating) is invariant to wide temperature variations, which is very convenient for the time compression of signals returned by the sensor to a reader. Owing to the exponential change of the grating period with the number, the expansion of the length of all the signal periods with varying temperature is equivalent to a shift in time and the compressed signal remains unchanged in shape, just slightly shifted. Such a shift has no importance for SAW sensors, which operate on the difference of delays of two compressed peaks. We designed a reflective delay line with chirped reflector, whose period increases linearly with distance (correspondingly, the frequency of its impulse response has *hyperbolic* dependence on time). The Band*Time product of 500 means that we expect the processing gain to be >20 dB. Simulation shows that the $LiNbO_3$ substrate has too strong coupling K^2 and the metal electrodes would be reflecting the SAW too strongly, introducing phase deviation from desired phase dependence with time. Therefore, we use shallow grooves for reflectors. Now we are producing the sensor samples. This work is a part of Swiss-Lithuanian *Eurostars project No. E!10640 UWB_SENS,* co-funded by State Secretariat for Education, Research and Innovation, Switzerland.

Background: Prof. Victor Plessky has worked in the field of SAW technology for more than 40 years. He is known as one of the authors of the STW (**S**urface **T**ransverse **W**aves), and as the author of the so called "*Plessky equation*" describing the dispersion of leaky SAWs in periodic gratings, presented by paragraphs in D. Morgan and K. Hashimoto books on SAW technology. Currently V. Plessky is developing high performance SAW filters, SAW-ID tags and sensors. In total he has published about 300 papers on SAW and authored more than 20 patents. Prof. Plessky has been Visiting Professor for many years in HUT, Helsinki, in Uppsala University, in EPFL, Lausanne, and in Freiburg University. During years 2010-2012 worked at FEMTO, Besançon, in the project "Chaires d'excellence" dedicated to the development of UWB SAW devices. He has supervised 15 Ph.D. theses. From 2003 he was an owner and director of consulting company GVR Trade SA (Gorgier, Switzerland) active in design of SAW devices, software development, consultations, etc. Recently (July 2016), the company became wholly owned subsidiary of Resonant Inc., Santa Barbara, and now concentrates on TC SAW device development. V. Plessky continues research in area of wireless SAW sensors in frames of Swiss-Lithuanian project Eurostars E!10640 UWB_SENS.

[1] Plessky, V., and M. Lamothe. "Hyperbolically frequency modulated transducer in SAW sensors and tags." *Electronics Letters* 49.24 (2013): 1503-1504. **[2] Lamothe, Marc, and Victor Plessky**. "Temperature measurements with Ultra-Wideband SAW sensors." *Ultrasonics Symposium (IUS), 2012 IEEE International*. IEEE, 2012. **[3] Malocha, D. C., D. Puccio, and D. Gallagher**. "Orthogonal frequency coding for SAW device applications." *Ultrasonics Symposium, 2004 IEEE*. Vol. 2. IEEE, 2004.

PWS S6-1 – Oct 11, 4:00pm – Remote Speaker

"Remote Sensing with Spatial Phase Imaging – Occam's Razor"

Mr. Preston Bornman
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Abstract:

With NASA currently assessing the life extension capacity of the International Space Station (ISS), inspection techniques are used as a critical element in determining how long the ISS can be safely operated. Since there are limited resources available on the ISS, techniques that are lightweight, utilize low power, perform multiple functions, and require no radiation sources are preferred. Photon-X has developed and demonstrated a high-resolution inspection technique that utilizes Photon-X's proprietary Spatial Phase Imaging (SPI) to provide 3-D imaging using a single lens camera and natural lighting. SPI can be used across a broad dynamic range detect emitted and reflected energy to create a high-resolution and highly accurate 3-D image of the object under examination. SPI systems are typically comprised of an SPI camera and a laptop. SPI imaging has been used to assess corrosion and physical damage on surfaces, biometric analysis, and object tracking, among others. The broad range of applications to the ISS, as well as future NEO and deep space operations, similarly includes corrosion damage, micro-meteoroid/orbital debris (MM/OD) damage assessment, autonomous rendezvous and docking/berthing, logistics management, biometric measurement, and autonomous robotics. The presentation introduces the fundamentals of SPI, discusses previous applications and demonstrations, and gives an overview of potential ISS and other space bound applications.

Background:

Mr. Preston Bornman is a Director for Photon-X, LLC. The Company designs and builds optical sensors and software applications that provide real-time numerical 3D capture and intelligent analytics of the physical world using the proprietary measurement of emitted electromagnetic energy. From driverless vehicles and oil rig maintenance to surgical procedures, the Photon-X Spatial Phase Imaging (SPI) technology has revolutionized the manner in which computers and humans see and interpret the world around them. The SPI optic sensor and companion analytic software has the potential to replace current optical sensors in nearly every current and future product that needs to see the world. Photon-X is the New Generation of Optical Sensing and Analytics. Preston is the President of Wyatt Petroleum, Founder of One World Sports, a U.S. cable sports network and a Director of Photon-X. Preston also serves on the board of Light Data Labs, which is the commercialization company for Photon-X in the Aerospace, Defense, Energy, and Transportation business segments. Preston has a BA from Southern Methodist University.

PWS S6-2 – Oct 11, 4:30pm

"Advantages of IR-based Communication and Sensing in Severe Environments"

Dr. Rainer Martini
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201-216-5634

Associate Dean for Graduate Studies
Engineering and Sciences, Department of Physics
Stevens Institute of Technology, Hoboken, NJ
https://web.stevens.edu/facultyprofile/?id=439

Abstract:

With tremendous advances in the Free Space Optical Communication (FSO) technology over the last decade excellent progress has been made to showcase the potential of modern FSO and optical interrogated sensors. However, the Achilles heel of the FSO approach is still reliability – especially under low visibility conditions – especially in challenging environments. Based on our research, the solution to overcome this roadblock lies in the utilization of more resilient spectral regions.

Our measurements in lab as well as in an outdoor setup has shown that classical models overestimate losses based on visibility (Kruse-Mie model), where measured MIR losses diverged already for 6km visibility and the model overestimated the MIR drastically for visibility below 1km. Additionally the beam wander associated with scintillation effect are far lower for longer wavelengths, favoring MIR systems in areas with strong temperature variation. Most recent we have examined the combined losses due to scattering on small particles (like aerosols) in strongly turbulent media and have found much higher losses for the commonly used NIR wavelengths compared to MIR links (under same conditions the NIR link had more than 40dB losses and the MIR link less than 8dB losses). All of this three shortcomings clearly showcase that longer wavelength (MIR) has much better propagation condition – especially in low visibility conditions and hence should be favored for FSO communication links – or for remote sensing. The possibility to utilize these advantages in remote probing and interrogating of sensors will be addressed in this talk as well.

Background:

Dr. Rainer Martini received the Diploma degree in physics from the University of Bonn, Germany, in 1995, and the Ph.D. degree in physics from the RWTH Aachen, Germany, in 1999 focused on the far-infrared (terahertz-) emission from impulsively excited semiconductor heterostructures and its amplification. In 1999, he entered a joint research program with Bell Laboratories, Lucent Technologies, and Stevens Institute of Technology, where he achieved for the first time high frequency modulation from semiconductor mid-infrared lasers above 10 GHz and transmission of digital data up to 2.5 GBit/s.

Since August 2001, he has been with Stevens Institute of Technology, Hoboken, NJ, recently appointed as Associate Dean for Graduate Studies in the school of Engineering and Sciences. His research explores the possibility of communication in *up till now* 'vast' and 'unused' regions of the light spectrum (like the mid-infrared and the far-infrared) as well as the possibility of ultra-high-speed communication and sensing using all-optical techniques. Recent research results include first non-resonant optical modulation of QC-lasers and a polymer based room temperature 2 Megapixel image system working from 400nm (UV) to 70 GHz (RF). He has authored and coauthored nearly 100 articles with more than 1000 citations to date and holds 4 US patents. He is on the scientific committee for 4 international conference and serves as editor for two international journals.

PWS S6-3 – Oct 11, 5:00pm

"Photovoltaic technologies for Visible Light Communication"

Dr. Emilie Bialic
Bialic.Emilie@gmail.com

LiFi Project Leader, Advanced R&D Division
Sunpartner Technologies, Aux-en-Provence, FR
sunpartnertechnologies.com

Abstract:

Research in Light-Fidelity, also called Visible Light Communication (VLC) generates increasing interest but numerous difficulties remains. In such a communication system, a luminous modulation flux, produced by LED, is translated at reception into an electrical signal by an optical sensor, before decoding. To consider LiFi as an alternative solution for wireless communication, the receiver has to be operational indoor and outdoor. Photovoltaic modules appear as a solution to this issue. For a few months, Sunpartner Technologies has worked with IM2NP, a laboratory of the Aix Marseille University and University of Toulon with the aim of improving the photovoltaic receiver solution. We developed a LiFi characterization test bench in order to measure LiFi performance of photovoltaic modules. In particular, we study the effect of ambient lighting on specific semi-transparent modules developed by Sunpartner Technologies. We use unusual semi-transparent modules to understand why under specific conditions some modules have an uncommon LiFi performance, which is for example to show some insensitivity to ambient lighting. We also study the effect of shading LiFi on performance of photovoltaic modules.

Background:

Dr. Emilie Bialic has a Telecom Engineering Master's degree from Telecom Bretagne (a French High School) and a Physics Master's degree from Université de Bretagne Occidentale (2007). She got her PhD in 2011 in the field of optics. During her, postdoctoral position (2013-2014) at the CEA LETI, a French research organism, she contributed to the development of a bidirectional visible light communication system, so called LiFi (Light-Fidelity). In particular, she studied LED dynamic electro-optical-responses for LiFi improvement. Since 2015, she is a researcher at Sunpartner Technologies, which develops invisible, transparent solar energy solution. She worked about specific LiFi receiver solution to allow good LiFi reception under strong ambient lighting condition. In 2016, with the contribution of the CEA-LETI, Sunpartner Technologies developed the first bidirectional LiFi system using semi-transparent photovoltaic modules developed by Sunpartner Technologies.

Oct 12, 8:30am (Room 260) Keynote Speaker

Dr. Sterling Rooke

- Founder Brixon, Inc., & Director-Elect ISA Communications Division (2018-2019)

"Translational Awareness: at the Nexus of Physics and Cyber-in-Space"

Abstract:

Reliability combined with measurement possibilities highlight ubiquitous wireless sensors as a tantalizing option for total system awareness. However, the ability of sensor systems to translate physical measurements into actionable information becomes even more challenging in extreme environments such as space. While factors such as co-existence in the wireless domain and anomaly rejection, have been presented by others, this presentation focuses on the interplay between physical measurements in an industrial system and cyber as an interlaced consideration. Recently, there was a notional discussion in the United States for creating a 6th military branch that will exclusively focus on the Space Domain, and by extension cyber-in-space itself. Satellites and instruments on orbit well be at the *nexus of physics and cyber-in-space*. Understanding the interplay between physical and cyber sensors is critical for the viability of orbital vehicles of the future.

Biography:

Dr. Sterling Rooke is the Founder of Brixon, Inc., and Director-Elect Communications Division (2018-2019) for the International Society for Automation. Brixon is focused on sensor systems that secure key cyber terrain through the fusion of sensor derived physical measurements and information system analytics. Sterling is also the CEO of X8 a government contracting company focused on cybersecurity, and systems engineering. Further, as incoming Director of the ISA Communications Division, Sterling regularly interfaces with a variety of industrial control and automation experts to better standards and best practices. Sterling is active in IEEE, and serves as Chair of the Washington, DC area IEEE Instrumentation and Measurement Society Chapter. On a part-time basis, Sterling is an Air Force Reservist and Cyberspace Operations Officer.

PWS S7-1 – Oct 12, 10:00am (Room 184)

"Integration of WAIC Systems into Aircraft"

Jan Müller
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Senior Expert End to End Connectivity
Design Office IFEC Architecture
& Head of Wireless Competence.
Center Airbus Operations GmBH
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Abstract:

Airbus was involved right from the beginning in the field of frequency regulation for WAIC systems. This is to replace the heavy and expensive wiring used in aircraft. WAIC consists of short-range radio communication (less than 100 metres) between two or more points of a single aircraft. Potential applications for this technology include sensors to detect smoke or to monitor cabin air pressure, fuel tank levels, humidity, corrosion or health monitoring. The achievements in regulatory process is the first step to get WAIC onboard commercial airplanes. The presentation will give an inside to the topics to be addressed for the A/C integration. It focusses on the delta compared the general electronic system integration:

- Simulation for validation and verification
- RF Propagation & coexisting to RA and other WAIC A/C
- Certification: Jamming, Health
- WAIC as shared resource
- Data security
- Configuration
- Impact to A/C functions (new or replace existing)

.

Background:

Jan Müller received in 1999 the Dipl.-Ing. Degree from Cologne University of Applied Sciences in Electrical Engineering, with emphasis on tele-communications. Since graduation he has worked for Bosch Telecom and Siemens in the field of mobile telecommunications.

Since 2002 he was with Airbus as system engineer for Communication Systems. He was responsible for Design, Development, Integration, Certification and Support of various Wireless Communication Systems in Airbus aircraft.

Jan is certified senior expert in the field of end to end connectivity addressing wireless systems for passenger, crew and machine communication applications. The key points are architecture, measurements, modeling, and radio networks management, communication protocols (e.g.3G,4G, WLAN, ZigBee, 802.15.4), radio regulation and aircraft system certification. He was responsible as project manager for various wireless projects for introduction of new connectivity services to the aircraft. Since 2012 he is Head of Wireless Competence Center at Airbus. In this role, he coordinates and manages a wide range of application in the field of wireless for the Airbus group.

PWS S7-2 – Oct 12, 10:30am

"Opportunities for Wireless Technology in the field of Aircraft Landing Gear Systems"

Mr. Grant Minnes
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905-903-8999 (cell)

VP of Systems Integration and Test
Landing Gear and Systems Integration Division
Safran Landing Systems
Ajax, Ontario

Abstract:

This presentation is intended to serve as a conversation starter between the wireless technology community and aircraft landing gear system equipment providers. Safran Landing Systems is a Tier 1 provider of landing gear equipment to all the major aircraft manufacturers – designing, testing, manufacturing and servicing the equipment from the cockpit controls and the control systems to the landing gear structure, wheels and braking components. The equipment operates in extremely harsh and exposed environmental conditions and must do so with a reliability that reflects that critical safety nature of the equipment, as well as the dispatch availability expected by operators. This presentation provides an introduction to the components that comprise the landing gear system and then provides an outline of the opportunities that could exist for wireless technologies throughout the lifecycle – from production/assembly and development testing to in-service health monitoring and ground inspection.

Background:

Mr. Grant Minnes is the Vice-President of Systems Integration and Test at Safran Landing Systems, a subsidiary of the Safran aerospace and defence group based in France. Working from the Toronto site, Grant is responsible for a global team of engineers conducting landing gear systems design and integration as well as the testing of these systems and the associated landing gear structure. Safran Landing Systems supplies commercial and military landing gear equipment and services to a world-wide customer base which includes Boeing, Airbus, Bombardier, Dassault and Sukhoi. Grant has had the opportunity to work with all of these companies in various capacities, from the start of his career as a Performance Engineer on the Bell-Boeing V-22 tilt-rotor program, to the position of Program Chief Engineer (PCE) on the Airbus single aisle family and most recently as PCE on the Boeing 787 program.

PWS S7-3 – Oct 12, 11:00am

"Wireless Instrumentation systems for Flight Testing at NASA AFRC"

Mr. Richard Hang
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661-276-2090

Chief of the Sensors and Systems Development Branch
NASA Armstrong Flight Research Center (AFRC).
https://www.nasa.gov/centers/armstrong/capabilities

Abstract:

NASA Armstrong Flight Research Center is revolutionizing its traditional wired instrumentation systems with wireless technologies. This effort faces many technical challenges, such as spectrum compliance, time synchronization, power distribution and airworthiness. This presentation summarizes NASA AFRC's flight test capabilities with current conventional instrumentation methodology and highlights the technical challenges of wireless systems used for flight test/research applications. The presentation discusses the kind of wireless instrumentation systems that are best suited for the dynamic nature of flight research, as well as the development of a Software Defined Radio based instrumentation system at AFRC to accommodate different data communication protocols from multiple types of wireless sensors, simultaneously, while accommodating quick and easy configuration changes. The presentation also provides information for potential industry partners seeking to verify and validate wireless sensors and systems through flight at AFRC.

Background:

Mr. Richard Hang currently serves as the Chief of the Sensors and Systems Development Branch (Code RD) at NASA Armstrong Flight Research Center (AFRC). Before leading Code RD, he served as the Chief of the Flight Instrumentation Branch for two years. He was a senior engineer on open-architecture real-time embedded data systems development for over 15 years prior to becoming supervisor. Richard aims to doing in-house research and development of wireless instrumentation systems for flight research and testing applications, or using available COTS devices to solve issues raised by the conventional flight instrumentation methodology.

PWS S7-4 – Oct 12, 11:30am – Remote Speaker

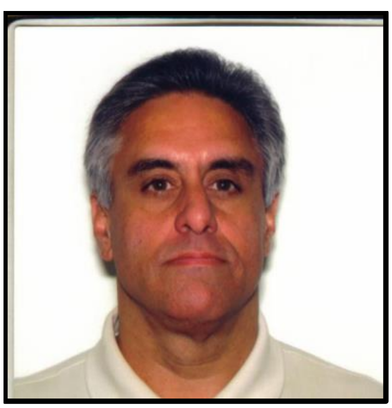
"Wireless Avionic Intra-Communications (WAIC) - Status Update"

Michael Franceschini **Engineer Fellow**
Michael.franceschini@honeywell.com **CNS Advanced Technology**
631-754-8996 631-697-0970 (cell) **Honeywell International**

Abstract:

The status and technical challenges of developing a new generation of on-board wireless communications systems for protected safety services that will improve aircraft reliability, operational/maintenance efficiency, and flight safety will be discussed. WAIC liberates avionic interconnections from tethered wiring, offering designers and operators flexibility, and opportunities for applications that are impractical with today's conventional wired architectures. WAIC will reduce overall aircraft weight, providing fuel burn reduction, with subsequent environmental benefits and more cost-effective flight operations. WAIC also supports reduced aircraft design/manufacture complexity, lowers maintenance costs, and affords greater flexibility to incrementally enhance aircraft systems with appliques that could improve an aircraft's performance and extend its useful lifetime. World Radio Conference 2015 allocated the aeronautical 4200-4400 MHz spectrum for WAIC in November 2015, creating a need to define implementation regulations to maintain safe operation both of the new WAIC systems, while safely co-existing with the incumbent Radio Altimeters that previously had exclusive use of this band. Joint RTCA Special Committee 236 / EUROCAE WG-96 is developing the MOPS (Minimum Operational Performance Standard) for future development and implementation of WAIC systems that will provide guidance for preventing interference with existing RadAlt systems both on an aircraft and between neighboring aircraft, while not impacting changes to existing aircraft. The new MOPS may then be invoked by a Technical Standard Order providing the basis for the FAA and user community to accomplish procedural planning, investment analysis and architectural decision making. Likewise, the ICAO FSMP is developing SARPs for both WAIC and Radio Altimeters to ensure this safe co-existence in the band as well.

Background:



Mr. Michael Franceschini is an **Engineer Fellow** in Honeywell's Advanced Technology Communications, Navigations, & Surveillance Research & Technology Center. He is the Honeywell Principle Investigator for the ongoing WAIC On-Board Wireless development program, and on an AVSI consortium for WAIC development/standardization for the past 10 years under AFE-73 and AFE-76. Mike is the Chairman of joint RTCA SC-236/Eurocae WG-96, and a member of the ICAO FSMP working group for both WAIC and Radio Altimeters SARPs development. He was a member of the US delegation to ITU-R Working Party 5B, CPM-15-2, and WRC-15, focused on securing the protected spectrum for WAIC. Mr. Franceschini is a recognized expert in robust and reliable communications systems research, design, development, and analysis, and particularly for military wireless, datalinks, and software defined radios. He has taught highly acclaimed courses on Military Communications Systems and Efficient Spectrum Utilization for over 10 years, and holds several patents on communications signal processing and networking techniques.

Oct 12, 12:15pm (Room 260) Keynote Speaker

Dr. Obadiah Kegege

- NEN Development Manager, Exploration & Space Communications Projects Division, NASA /GSFC

"User Needs and Advances in Space Wireless Sensing & Communications"

Abstract: Decades of space exploration and technology trends for future missions show the need for new approaches in space/planetary sensor networks, observatories, internetworking, and communications/data delivery to Earth. The "User Needs" to be discussed in this talk include interviews with several scientists and reviews of mission concepts for the next generation of sensors, observatories, and planetary surface missions. These sensor nodes or instruments are envisioned to operate in extreme space environments, with advanced autonomy, whereby communication to Earth is intermittent and delayed. In these scenarios, the sensor nodes would require autonomous networking capabilities in order to learn and adapt to the environment, collect science data, internetwork, and communicate. Also, some use cases require the level of intelligence to manage network functions (either as a host), mobility, security, and interface data to the physical radio/optical layer. For instance, on a planetary surface, autonomous sensor nodes would create their own ad-hoc network, with some nodes handling communication capabilities between the wireless sensor networks and orbiting relay satellites. A section of this talk will cover the advances in space communication and internetworking to support future space missions. NASA's Space Communications and Navigation (SCaN) program continues to evolve with the development of optical communication, a new vision of the integrated network architecture with more capabilities, and the adoption of standardized space internetworking protocols. Advances in wireless communications hardware and electronics have enabled adaptive (DVB-S2, VCM, ACM, DTN, Ad hoc, etc.) protocols for improved autonomous wireless communication and network management. Developing technologies to fulfill these user needs for wireless communications, standardized internetworking protocols, and enhanced autonomy will be a huge benefit to future planetary missions, space observatories, and manned missions to other planets.

Biography:

Dr. Obadiah Kegege currently serves as the Near Earth Network (NEN) Development Manager in the Exploration and Space Communications Projects Division, NASA Goddard Space Flight Center, Greenbelt, Maryland, USA. Dr. Kegege previously served in the technical management team for the Ocean Color Instrument, part of the Plankton, Aerosol, Cloud, ocean Ecosystem (PACE) mission. Prior to that, Dr. Kegege had several years of research and technology development and worked on a number of projects focusing on the development of communication and navigation systems for space exploration. He has authored/co-authored several publications related to space communication systems and network architectures. He has received a number of NASA awards for his exceptional service. Dr. Kegege obtained his BS in Control and Instrumentation Electronics from the University of Houston, MSEE from the University of Texas Pan American and a PhD from the University of Arkansas. Dr. Kegege is a member of IEEE, SPIE, NSBE, Instrumentation, Systems, and Automation Society (ISA), and National Technical Association (NTA).

One-on-One Sessions – Oct 12: 1pm – 3pm Room 260

The One-on-One session facilitates (mostly) private discussions between those Users with potential needs for wireless technologies and the Providers of those technologies and capabilities.

Technology Providers will sign up for 15 minute time slots on a board near the registration desk ahead of the Thursday pm One-on-One Session.

Below is a Representative List of User Tables and Time Slots:

Table #	User Organizations (pending)	1300-1315	1315-1330	1330-1345	1345-1400	1400-1415	1415-1430	1430-1445	1445-1500
Keynote	Singer (Retired NASA)								
Keynote	Georgia Tech								
Keynote	Bombardier								
Keynote	ISA Comm Div/Brixton								
Keynote	NASA/GSFC								
S1-1	NASA/NESC Wireless & PWS								
S1-2	NASA/JPL								
S1-3	NASA/ARC								
S1-4	NASA/HQ/HOTP								
S4-1	NASA/MSFC & WiSEE 2018								
S7-1	WAIC								
S7-2	Airbus								
S7-3	SAFRAN								
S7-4	NASA/AFRC								
	Others								