



Center for Wireless and Microwave Information Systems

Center for Wireless and Microwave Information Systems

<http://wami.eng.usf.edu/>

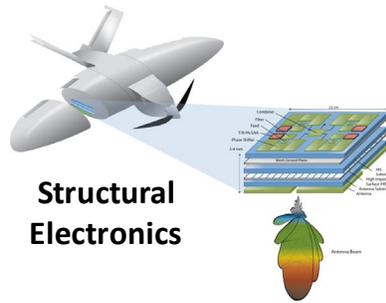
**Department of Electrical Engineering
University of South Florida**

Annual Report 2021

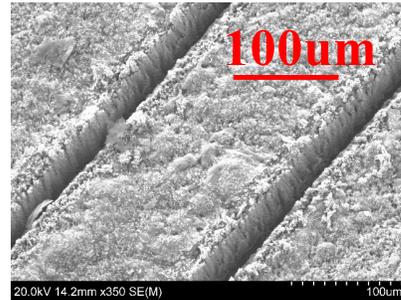
**Dr. Lawrence Dunleavy (Co-Director), Dr. Gokhan Mumcu, Dr. Ashwin Parthasarathy,
Dr. Stephen Sadow, Dr. Ismail Uysal, Dr. Stavros Vakalis, Dr. Jing Wang (Co-Director)**

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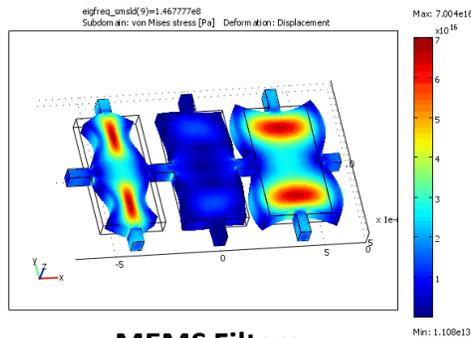
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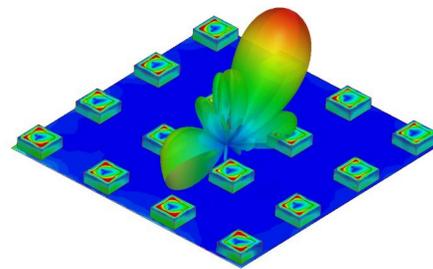
Structural Electronics



Laser Enhanced Additive Manufacturing



MEMS Filters



Mm-Wave Antenna Arrays

Summary

Now in its 25th year, the Center for Wireless and Microwave Information Systems (WAMI Center) conducts research across a broad range of technical areas that include device modeling and characterization, micro electromechanical systems (MEMS), advanced functional materials and nanoscale devices, active antennas, microwave and mm-wave front-end transceivers, cognitive or software-defined radios, next generation wireless architectures and wireless sensor telemetry. Research projects focus on basic scientific development as well as applications such as biomedical sensing, communications, advanced RF additive manufacturing and mm-wave packaging. Active collaborations have been pursued with many federal agencies and national research labs, numerous industry and university partners as well as other research centers at the University of South Florida.

In 2021/2022 the Center supported 25 MS and PhD students, and more than ten undergraduate students. Center faculty submitted over 20 research proposals in the past year, among which more than 10 proposals have been funded. The WAMI faculty had more than 30 publications in journals, conferences and book chapters, 3 invention disclosures and patent applications have been filed, and gave more than ten invited talks. The Center students and faculty member received 5 awards and distinctions including best paper/poster presentation awards and recognition for professional achievement. Since 2008 (over the last 14 years), the productivity of the center includes:

- Papers published: 580
- Patents granted: 85
- Invited talks: 95



Newsorthy Notes

- The Center for Wireless and Microwave Information Systems (WAMI Center) started at the University of South Florida (USF) in 1997. For over 25 years, the WAMI Center has pursued excellence in research and education across many areas of wireless engineering, with a dual focus on advanced hardware technologies and wireless communications systems. The fields of application are diverse and include collaborators in marine science, pharmacy and medicine, transportation, materials science, physics, computer science, mechanical engineering, as well as chemical and biomedical engineering. Among its notable achievements, the Center has:
 - Produced over 580 refereed publications and 85 U.S. patents in the past 14 years (since the 2008 report); several patents have been licensed by major companies in the field. (all the annual reports since 2008 can be found at <http://wami.eng.usf.edu/about/mission.htm>)
 - Supported approximately 25-35 Ph.D. and M.S. students per year on a continuing basis; many of the graduates are employed at leading wireless companies and defense contractors
 - Created two internationally-recognized instructional laboratories with grant supports from the National Science Foundation (NSF), which are WAMI Lab I and WAMI Lab II.
 - Established the IEEE Wireless and Microwave Technology Conference (WAMICON) since 1999, an international event hosted in Florida each year that averages ~150 attendees and more than 25 industry exhibitors (<https://www.ieeewamicon.org/history>)
 - Generated >\$30M in research expenditures in the past 14 years (since 2008 report period)
 - Spun-out Modelithics Inc., the world's leading provider of microwave CAD models and Modelithics reached the milestone of 20 Years in establishment on March 1st, 2021 <https://www.tampabaynewswire.com/2021/03/02/modelithics-reaches-milestone-of-20-years-in-establishment-96017>
 - Helped to secure a \$250,000 donation from Mini-Circuits to establish the Design for X Laboratory for the USF College of Engineering, which is now widely utilized by students across all departments within the USF College of Engineering
 - Secured the largest in-kind donation in the history of the University of South Florida thanks to WAMI center's over 25-year partnership with Keysight Technologies, Inc., with a Lab Naming Ceremony on January 22, 2016. The donation of Advanced Design System (or ADS software) is the largest in-kind donation ever in the history of the University. In honor of the donation, the instructional lab of Center for Wireless and Microwave Information Systems (WAMI Center) is being renamed the Keysight Technologies Wireless Laboratory <https://www.usf.edu/engineering/documents/010192016-keysight-dedication.pdf>

- The **2022 Rudolf E. Henning Distinguished Mentoring Award** was presented to Dr. Christos Christodoulou, Jim and Ellen King Dean of Engineering and Computing at The University of New Mexico, has received the IEEE Rudolph E. Henning Distinguished Mentoring Award. The award was presented at the 2022 IEEE Wireless and Microwave Technology Conference (WAMICON), held April 27-28 at Clearwater Beach, Florida. The Rudy Henning award, given yearly at the WAMICON conference, that was established in 2009 and recognizes an individual who has performed exemplary service encouraging students and/or mentoring young engineers to advance careers





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in the areas of RF, microwave or wireless engineering. Factors to be considered are leadership, innovation, dedication, distinguished service and breadth of participation. Christodoulou is also a distinguished professor of electrical and computer engineering. He became dean of the School of Engineering in 2017 and has continued teaching and mentoring students throughout his term. Over his career, he has mentored approximately 40 Ph.D. and 75 master's students.

- Dr. Larry Dunleavy, recently celebrated 30 years at USF and continues to work closely with with Dr. Jing Wang as Co-Director of the WAMI Center. He has taken the lead on refreshing the WAMI External Affiliates Board Meeting and working closely with the student organizers of the student-led /student-focused USF IEEE WAMI Student Forum launched in this format in 2019. While maintaining a part-time role at Modelithics, he has been contributing updating and converting various WAMI courses to fully-on-line and flipped classroom format with a strong emphasis on lab work and practical design content.



- Dr. Jing Wang, the Co-Director of the WAMI Center, has been promoted to the Agere Systems Endowed Chair since August 7th, 2020, which is a highly prestigious endowed chair professor position at USF College of Engineering. The endowment fund provides extra operating resources to support research activities for the purpose of boosting the success of the Center for Wireless and Microwave Information Systems (WAMI). In 2021, Dr. Wang was elected as a senior member of the National Academy of Inventors (NAI) in recognition to his pioneering contributions to the frontiers of functional materials, sensors and wireless technologies. He holds 11 U.S. patents and several provisional patents. He received 2022 Excellence in Innovation Award along 5 other awardees at USF. After joining USF WAMI center in 2006, Dr. Wang has mentored and graduated 19 doctoral students, who have joined leading RF, microwave and semiconductor industries, national labs and universities. <https://www.usf.edu/research-innovation/news/2021/nai-sr-members.aspx>





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- Dr. Gokhan Mumcu has been promoted to Full Professor rank, starting on August 2021. Since joining USF in 2009, Dr. Mumcu graduated 10 Ph.D. students, who have joined to leading RF and semiconductor industries. He is a winner of NSF's prestigious CAREER award. His students regularly wins conference paper competition awards and travel awards from IEEE International Antennas and Propagation Symposium, most recent ones are in 2019 and 2020, respectively. The Electrical Engineering Department at University of South Florida (USF) aims to transform into a connected research-students-practice model that promotes faculty engagement in professional formation of students where students themselves are empowered to become active participants. A key component is “track focused advisory boards (TFABs)”, which is modeled after the success of WAMI Center. The activity is being carried out under “IUSE/PFE:RED: Breaking Boundaries: An Organized Revolution for the Professional Formation of Electrical Engineers”, a prestigious NSF award with \$2M budget, in which Dr. Mumcu is a Co-PI.
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- We are excited to report that a new faculty member, Dr. Stavros Vakalis, has just joined WAMI Center and USF Electrical Engineering Department in Fall 2022 as a result of the successful recruitment by the search committee. Drs. Dunleavy, Mumcu, Wang have been involved in the creating the topic areas for the tenure-track faculty position, while considering the feedbacks and suggestions by the WAMI Center external affiliate board (EAB) members.
 - Dr. Stavros Vakalis started as an Assistant Professor with the department of electrical engineering at University of South Florida in August 2022 after receiving his PhD from Michigan State University. His research interests include wireless microwave and millimeter-wave systems for imaging, radar, communications, and signal processing. He has experience working with microwave and millimeter-wave systems, conducting experiments and simulations, and mentoring undergraduate and graduate students. He is the recipient of multiple international awards including the 2021 IEEE MTT-S Tom Brazil Graduate Fellowship Award, the 2020 IEEE AP-S Doctoral Research Grant, the URSI Young Scientist Award in 2021, and best paper awards in two international conferences. During his PhD, he demonstrated an active high-speed millimeter-wave camera which was able to generate images at 652 frames per second.
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- We are excited to report that the USF College of Engineering has approved a new proposal for opening one new tenured/tenure-track faculty position on the following research topics that are well aligned with WAMI Center’s strategic plan and long-term missions: 1) Next generation communications including but not limited to 6G wireless or quantum communications, 2) Analog, digital, mixed-signal, RF, and photonic IC design including but not limited to emerging areas such as quantum computing and integrated circuits for 2D/3D integration. The position is expected to commence August 2023 and Drs. Mumcu and Wang joined the search.
 - Mini-Circuits continues to be a strong supporter of the WAMI Center and WAMI teaching laboratory by contributing microwave test components and instruments. The WAMI Center acknowledges the continuing strong support of Keysight Technologies, National Instruments and Modelithics for providing our students with no-cost access to their exceptional software tools. Also, Keysight supports the equipment modernization of the WAMI teaching laboratory



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that has been renamed as Keysight Technologies Wireless Laboratory by offering the special discount on a total of 7 pairs of PXI Vector Network Analyzers and PXI Signal Analyzers up to 26.5GHz that allow the completion of the equipment updates for all the seven test benches.

- Recent masters and Ph.D. graduates from the USF WAMI Center are now working for NASA, Intel, Raytheon, Qorvo, King Abdulaziz City for Science and Technology (KACST), Embry Riddle Aeronautical University, MixComm, Modelithics, Draper Laboratory, USF Institute of Applied Engineering, Georgia Tech Research Institute, II-VI, ANSYS, Maxlinear, L3harris, Collins Aerospace, Samsung Research, Qualcomm, Vectra AI (Silicon Valley startup), Sandia National Lab, and NTIA (The National Telecommunications and Information Administration).
- USF comes in at No. 42 in the U.S. News and World Report 2022 rankings, rising four spots from last year in the public university rankings. For the first time in school history, the University of South Florida received a top-100 ranking among the nation's universities. USF comes in at No. 97 among all public and private universities in the U.S. News and World Report 2022 rankings. [USF ranks as a top-100 university for the first time | WUSF Public Media](#)
- During the 2021 academic year, USF WAMI Center has conducted research projects funded by prestigious grants/contracts from National Science Foundation (NSF), Air Force Research Laboratory (AFRL), United States Army Research Laboratory (ARL), United States Special Operations Command (USSOCOM), National Institutes of Health (NIH), Florida High Tech Corridor, National Aeronautics and Space Administration (NASA), USF Institute of Applied Engineering, Certus Group, Tampa Deep Sea Xplorers, L3Harris, Modelithics, II-VI Inc., Tecomsys, nScript, Sciperio, XONAR, SOFWERX, as well as a USF Strategic Investment Pool award and a teaching technology advancement grant for creating quality remote lab experiences for the USF WAMI Lab class.
- In recognition of the mutual benefits of an External Advisory Board (EAB) for the USF WAMI center and EAB members, membership benefits in three tiers are hereby defined along with the duties, organization, and obligations of the EAB. The objective of the EAB is to draw upon the wisdom and experience of selected leaders from industry and academia by providing advices on strategic plan while serving as liaison to industry. The EAB will assist the USF WAMI Center by providing expert opinion with a goal of improving WAMI Center's national and international recognition through a process of continuous improvement.
 - Gold - Tier 2 (Gold) : with \$10K Annual Gift to WAMI Foundation
 - Silver - Tier 1 (Silver): with \$5K Annual Gift to WAMI Foundation
 - Bronze - Supporting: with \$3K< donation <\$5K Obtained through other support types – see “Other Opportunities”

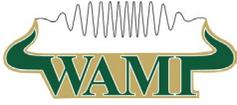


Gold - \$10,000 annual commitment (\$5,000 for companies with <100 employees)

- Recognition on WAMI Center website at selected sponsorship level
- Opportunity to provide and support Capstone Design class projects
- Invitation to annual/biannual WAMI EAB Meetings
- Priority access to personal meetings with EE Department Chair and/or WAMI Faculty
- Priority communication of internship and job opening information to undergraduate and graduate students
- Opportunity for WAMI faculty to provide a free short course/workshop/seminar to company employees
- Invitation to WAMI Career Conversations student event in spring
 - o Includes receiving updated resumes from student attendees
- Invitation to exhibit at Fall WAMI Student Forum
- Recognized as a Gold Sponsor of the annual WAMI Student Forum, benefits include:
 - o Registration for 5 attendees from your company
 - o Access to resumes of student forum attendees
 - o First invitation for speaking at event
 - o Time for a 3-minute marketing/recruiting pitch about your company to forum attendees
 - o Large booth at conference (2 tables; L-shape)
 - o Logo on forum nametags, website, and agenda
 - o First priority for sponsoring student paper and poster awards

Silver - \$5,000 annual commitment

- Recognition on WAMI Center website at selected sponsorship level
- Opportunity to provide and support Capstone Design class projects
- Invitation to annual/biannual WAMI EAB Meetings
- Priority access to personal meetings with EE Department Chair and/or WAMI Faculty
- Priority communication of internship and job opening information to undergraduate and graduate students
- Invitation to exhibit at Fall WAMI Student Forum
- Recognized as a Silver Sponsor of the annual WAMI Student Forum, benefits include:
 - o Registration for 2 attendees from your company
 - o Second invitation for speaking at event
 - o Standard booth at conference
 - o Logo on forum website, and agenda
 - o Second priority for sponsoring student paper and poster awards

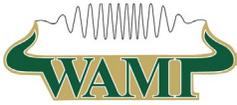


Bronze – Gifts in Kind / other contributions

- Recognition on WAMI Center website at selected sponsorship level
- Invitation to annual/biannual WAMI EAB Meetings
- Invitation to exhibit at Fall WAMI Student Forum
- Third invitation for speaking at WAMI Student Forum
- Third priority for sponsoring student paper and poster awards

Student Recognition

- **Mohamed Mounir Abdin**, who is co-advised by Drs. Weller and Wang, has completed highly prestigious one-year IEEE Microwave Theory and Techniques Society (MTT-S) Graduate Fellowship program in 2019 and he was awarded dissertation completion fellowship in 2019/2020. One of his first-author journal papers entitled “W-band MMIC Chip Assembly Using Laser Enhanced Direct Print Additive Manufacturing” has been published in IEEE Transactions on Microwave Theory and Techniques in December 2021. While working for NASA, he has successfully defended his dissertation and graduated in Spring 2022, after demonstrating a 75-110 GHz (W-band) Tx/Rx front ends by laser-enhanced direct print additive manufacturing (LE-DPAM) for packaging. This modular technology was jointly submitted for a patent application by USF and L3Harris.
- **Poonam Lathiya**, a WAMI Center Ph.D. student advised by Dr. Wang, gave a presentation entitled “Telemetry” and got People's Choice Award during the university-wide USF's 3 Minute Thesis Competition (3MT®) in November 2020 (<https://www.usf.edu/graduate-studies/research/three-minute-thesis-3mt/>). In addition, she has won the Best Poster Award for the International NanoFlorida Conference in November 2019. She has also been granted GMAG Travel Award for attending the American Physical Society (APS) March Meeting at Denver, CO, in March 2020 as well as a travel award to attend IEEE Magnetics Society Summer School at Richmond, VA in 2019. She has defended her dissertation in Spring 2022 and thereafter she joined Intel at in Chandler, AZ.
- **Vishvajitsinh Kosamiya**, a WAMI Ph.D. student advised by Dr. Wang, received “Honorable Mention” for USF Provost’s Award for Outstanding Teaching by a Graduate Teaching Assistant in 2021. Vishvajitsinh acted as the Chair for the 2021 USF IEEE WAMI Student Forum to work closely with Jason Truong, who was the Co-Chair, and an undergraduate student and a RF Engineering Intern at USF Institute of Applied Engineering.



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- **Kiran Shila**, a WAMI Center M.S. student advised by Dr. Mumcu, received student paper competition honorable mention for APS 2020. His paper was rated in top ~30 out of 203 papers for the 2020 IEEE AP-S Symposium on Antennas and Propagation and CNC/USNC-URSI joint meeting (APS 2020) that was held in Montréal, Quebec, Canada on July 5-10, 2020. He also got the Best Student Poster Award during the 2019 WAMI Forum on October 25, 2019. Since fall 2020, Kiran Shila has joined the doctoral degree program of the Electrical Engineering Department of the California Institute of Technology.



- A Capstone Design team (Ryan Carlomany, Ariel Duarte, Trevor Saunders, Dhairya Soni) that is advised by Dr. Gokhan Mumcu has been chosen one of the as top 6 semi-finalists in the Student Design Contest of the 2021 IEEE Antennas and Propagation Symposium that was held in Singapore on December 4-10. IEEE APS is flagship conference of the IEEE Antennas and Propagation Society – it typically receives over 1,000 paper submissions and hosts over 1500 attendees.



- **Arya Menon**, a WAMI Ph.D. student advised by Dr. Tom Weller, has been awarded the prestigious IEEE Microwave Theory and Techniques Society (MTT-S) Graduate Fellowship for 2019. She also received USF Provost's Award for Outstanding Teaching by a Graduate Teaching Assistant in the STEM category for the 2017-2018 academic year. In August 2018, she transferred from USF to Oregon State University by following Dr. Weller. Arya's research focuses on the development of a security scanner that combines radar and radiometric techniques for imaging. In May 2021, she joined Texas A&M University as a postdoc fellow after defending her dissertation.



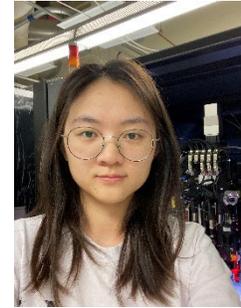
- **Ting-Hung Liu**, a WAMI Center Ph.D. student advised by Dr. Wang got the Best Student Research Poster Award for the WAMICON 2022 held in April, 2022. Along with Utkarsh Misra, an undergraduate student with a concentration in micro-/nano-electronics and RF/Microwave systems, Ting-Hung will act as Co-Chairs for the 2022 USF IEEE WAMI Student Forum on November 4, 2022. One of his first-author journal papers entitled "Piezoelectric Lateral-Extensional Mode Resonators With Reconfigurable Electrode and Resonance Mode-Switching Behavior Enabled by a VO₂ Thin-Film" has recently been published in IEEE Transactions on Ultrasonics, Ferroelectrics, and Frequency Control in August 2022. He has also acted as the MTT-s USF student branch chair.





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- **Ruoke Liu**, currently a WAMI Ph.D. student pursuing her dissertation for an Army Research Lab (ARL) funded project with Drs. Wang and Mumcu. She has been awarded Allan Gondeck Scholarship and Tom Tiedemann Scholarship in 2020 and 2019, respectively. She has made the Dean's list at USF College of Engineering in 2018 and 2019. She has been elected as the Fall 2020 EE Department Outstanding Graduate. Her research focuses on RF/mm-wave additive manufacturing and advanced packaging of mm-wave transceivers and active phased arrays using beamforming IC.

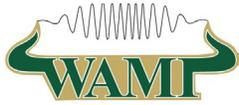


- Noah Hamilton was elected as the recipient of 2021 Professor Rudy Henning Scholarship. In each year, one chosen awardee will receive a \$1,000 Professor Rudy Henning Scholarship, who will be recognized during the annual USF IEEE WAMI Student Forum. Noah was a senior Electrical Engineering student and is the Chair of the IEEE USF Student Branch. As a recent USF EE/WAMI graduate, Noah has already scheduled to attend 2022 WAMI Student Forum on behalf of the Johns Hopkins University Applied Physics Laboratory as an event sponsor, while serving as one of the panelists during the Young Professional Panel that will be held at the end the WAMI Forum.



- It is worthwhile mentioning that the WAMI Center students has managed to sustain a six year winning streak for receiving the prestigious IEEE Microwave Theory and Techniques Society (MTT-S) Graduate Fellowship between 2013 and 2018. This prestigious fellowships have been granted to 12 awardees globally each year during IEEE International Microwave Symposium. Since 2014, WAMI Center students also won prestigious IEEE Antennas and Propagation Society (APS) Doctoral Fellowships that are granted globally up to 10 awardees each year. In addition, WAMI students have been awarded other prestigious fellowship, such as Phi Kappa Phi Dissertation Fellowship, which award 10 dissertation fellows in United States every year.

- Arya Menon, awarded IEEE MTT-S Graduate Fellowship 2018
- Mohamed Abdin, awarded IEEE MTT-S Graduate Fellowship 2017
- Juan Castro, awarded Phi Kappa Phi Fellowship 2017
- Juan Castro, awarded IEEE MTT-S Graduate Fellowship 2016
- Abhishek Dey, awarded IEEE APS Doctoral Fellowship 2016
- Maria Cordoba Erazo, awarded IEEE MTT-S Graduate Fellowship 2015
- Maria Cordoba Erazo, awarded 2014 ARFTG Roger Pollard Memorial Student Fellowship in Microwave Measurement
- Michael Grady, awarded IEEE MTT-S Graduate Fellowship 2014
- Ahmad Gheethan, awarded IEEE APS Doctoral Fellowship 2014
- Ibrahim Nassar, awarded IEEE MTT-S Graduate Fellowship 2013
- Bryce Hotalen, awarded IEEE MTT-S Undergraduate/Pre-graduate Scholarship 2013
- Evelyn Benabe, awarded Automatic Radio Frequency Techniques Group Student Fellowship Award – Silver
- Evelyn Benabe, awarded IEEE MTT-S Graduate Fellowship 2010
- David Cure, awarded NASA GSRP Fellowship 2010 and 2011.
- Quenton Bonds, awarded NASA GSRP Fellowship 2009.



Prior Professional Activities in Last Three Years

- On April 7, 2019, the WAMI Center Advisory Board Meeting was held in Cocoa Beach, Florida at the WAMICON 2019 hotel. During this meeting, attendees have supported the idea of holding the WAMI Center advisory board meeting on a semi-annual basis with a spring meeting during WAMICON and a fall meeting during an on-campus forum. After reporting all center activities, WAMI Center Membership options have been discussed.
- On October 25, 2019, the Fall 2019 WAMI Center Advisory Board Meeting was held on USF campus, which was scheduled at 9am-12pm right before the ½ Day on-campus WAMI Center Technical Forum in the afternoon. During this meeting, the Center Advisory Board was formally renamed as External Advisory Board (EAB), while the WAMI Center membership structure has been presented after gathering feedbacks from attendees related to how to strengthen the WAMI Center’s partnership with industry and government organizations.
- On October 25, 2019, the first on-campus WAMI Center Student Technical Forum has been held, which is an annual ½ Day student focused and student led Technical Conference. The 2019 WAMI Forum held has attracted a total of 125 attendees including ~80 Students, ~20 faculty members, and ~25 corporate/government visitors. Jonas Mendoza Sandoval (VP of the USF MTT-s student chapter) and Thomas DeCanio (USF IEEE Student Chapter President) have acted as forum chair and co-chair, respectively. As a key highlight, the lunch panel with a central theme of “Career opportunities in wireless and microwave technology – might there be an exciting future here for you?” has become a big hit with student attendees. This lunch panel was followed by several technical talks and interactions between students and WAMI forum attendees during industrial exhibition hours and student research poster sessions. <https://www.linkedin.com/pulse/university-south-florida-wami-forum-panel-session-big-dunleavy/>



Professional Activities

- On December 1st, 2020, the WAMI Student Forum 2020 was successfully held as an online virtual event, which was co-chaired by Jonas Mendoza (a WAMI Center Ph.D. student) and Noah Hamilton (USF IEEE Student Chapter President). As a virtual event, WAMI Student Forum 2020 has attracted 193 registrants. It is worthwhile mentioning that the online virtual meeting motif has been developed by Jonas Mendoza along with other forum committee members, which was later adopted by the IEEE WAMICON 2021 and it has gotten lots of compliments by attendees of both events.





- On April 28-29, 2021, the WAMICON 2021 was also held as a virtual conference. The USF WAMI Center has been heavily involved in the organization of the WAMICON 2021. Drs. Wang and Dunleavy have served as TPC Co-Chair and Invited Paper Chair, respectively.



- On May 14, 2021, the Spring 2021 WAMI Center EAB meeting has been held as a virtual event. Besides providing center updates and collecting suggestions from EAB affiliates, the preliminary date of 2021 WAMI Student Forum and Fall EAB meeting was discussed and subsequent sub-committee meetings have been proposed.
- On July 16, 2021, WAMI EAB Curriculum & Senior Design Sub-Committee Meeting was held as a virtual event. During this meeting, the new process of formulating the Capstone Senior Design projects have been elaborate, which are heavily driven by industry. Industry defines the project and provides funding and/or access to needed resources. The status of the WAMI Teaching Lab renovation project has also been reported during this meeting.
- On September 21, 2021, WAMI EAB Goals & Structure Sub-Committee Meeting was held as a virtual event. During this meeting, the WAMI membership structure and benefits have been reviewed and the preliminary plan for the 2021 WAMI Student Forum and 2021 Fall EAB meeting have been discussed. We have also provided a short report on the openings of new faculty positions with research topics aligned with WAMI Center's missions.

- In the afternoon of October 28th, 2021 (the day before WAMI Student Forum), the WAMI Center external affiliate board (EAB) meeting was held on campus, during which reports of three sub-committee have been presented and discussed



with EAB meeting attendees for their suggestions and feedbacks. On the next morning, the EAB affiliates attended a virtual student/industry networking event and visited WAMI Center Instructional Lab after attending a EAB debrief meeting.

- The 2021 USF IEEE WAMI Student Forum was held on October 29th, 2021. This was the 3rd annual event with Student-led/Student-Focused format. The 2021 WAMI Student Forum was co-chaired by a doctoral student (Vishvajitsinh Kosamiya) and an undergraduate student (Jason Truong) with full support by a team of student volunteers along with WAMI faculty. The 2021 WAMI Student Forum has attracted 142 students and 45 industry/academia attendees, while





receiving sponsorships by 15 organizations. 7 companies have participated in 2021 WAMI Student Forum as exhibitors. The in-person activities started with a lunch panel with 5 industrial professionals to discuss opportunities and career paths that was followed by 5 technical talks and networking sessions. As a tradition, the 2021 USF WAMI Student Forum ended with a student research poster competition and a Young Professional panel that provided opportunities for student and industrial attendees to interact. A few interviews of undergraduate students, teaching assistants and alumni were taken during 2021 WAMI Student Forum: [WAMI Lab: Undergraduates - YouTube](#); [WAMI Lab: Teaching Assistants - YouTube](#); [WAMI Lab: Alumni - YouTube](#)

- **Dr. Mumcu** has served as chair of a special session and delivered an invited talk in 3rd URSI Atlantic/Asia-Pacific Radio Science Meeting (AT-AP-RASC 2022). His AT-AP-RASC 2022 talk was entitled “Packaging of a Beamforming IC by Laser Enhanced Direct Print Additive Manufacturing (LE-DPAM)”. **Dr. Mumcu** is acting as the general co-chair for WAMICON 2023 by working closely with Steven Lardizabal at Raytheon, who is acting acting as the general chair.
- **Dr. Dunleavy** has worked closely with Keysight Technologies and others to organize and deliver the highly successful “RF Boot Camp” at the IEEE MTT-S International Microwave Symposium. The RF Boot camp is a one day “crash course” held during IMS week each year, introducing newcomers to the field the basics of RF/microwave principles, measurements and simulations. This activity began with IMS2015, has had between 100 and 200 participants each year with very good reviews, and now offers CEU credits to boot. The recent boot camp was held in Denver in conjunction with the IEEE MTT-S IMS in June 2022. Former USF EE Chair, Dr. Tom Weller has also been involved as one of the featured tutorial speakers.
- **Dr. Wang** has served as the Technical Program Committee (TPC) Co-Chair for WAMICON 2020/2021 by working closely with Steven Lardizabal at Raytheon, who acted as TPC chair. **Dr. Wang** has given a few invited talks at conferences including: 3rd URSI Atlantic/Asia-Pacific Radio Science Meeting (AT-AP-RASC 2022), 2022 MITRE Workshop on Additive Manufacturing for Antennas and Electromagnetic Structures, 2022 International Symposium on Antennas and Propagation and USNC URSI Radio Science Meeting (APS/URSI 2022), AME Academy Summer Session 2022.
- **Dr. Mumcu** has served as the Technical Program Committee (TPC) Chair for WAMICON 2022 working with Dr. Kenle Chen at University of Central Florida who acted as Co-Chair. In 2022, the technical program of WAMICON 2022 hosted several special sessions that hosted an array of preeminent researchers in their technical fields.

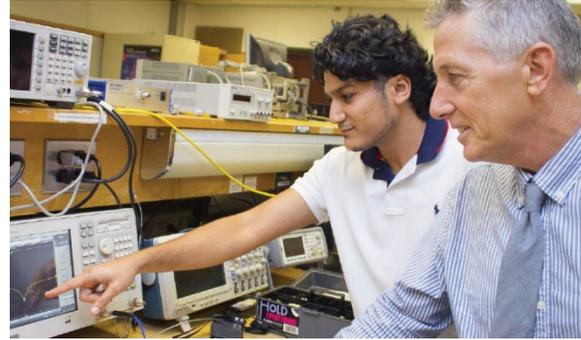




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Selected Curriculum Activities

The instrumentation in the Wireless Circuits and Systems Design Laboratory had a major upgrade at the end of 2017 and during 2019, thanks to a very generous discount (90%) on \$0.7M in new network and spectrum analyzers. All previous generations of network analyzers and spectrum analyzer such as ones shown in the image to the right have been repurposed at some legacy test benches. All 7 test benches in the lab are now equipped with 9 GHz or 26.5 GHz vector network analyzers and 26.5 GHz signal analyzers, both controlled through a PXI chassis. The teaching assistants managed to update all experiments and documents in time for the spring 2018 semester. A modulation/demodulation lab was newly introduced in the fall 2017 semester, as well.



In summer 2020, Dr. Dunleavy has submitted a proposal and won an internal teaching technology advancement grant (\$33.2k) for creating quality remote lab experiences for delivering the WAMI Lab class. This grant enables WAMI lab to add state-of-the-art AV tools on each test bench, while adding a 50" Microsoft Surface Hub for in-lab lectures. In summer 2021, EE department chair also

provided additional funds to acquire 22 new test benches and 2 cabinets, while installing new floor and painting walls to complete the WAMI lab renovation project. The newly renovated and fully equipped Keysight Technologies Wireless Lab will support several EE Department courses and it will be ready for a lab tour by WAMI EAB affiliates during the fall 2021 EAB meeting.



The Electrical Engineering Department at University of South Florida (USF) aims to transform into a connected research-students-practice model that promotes faculty engagement in professional formation of students where students themselves are empowered to become active participants. A key component is “track focused advisory boards (TFABs)”, which is modeled after the success of WAMI Center. The activity is being carried out under “IUSE/PFE:RED: Breaking Boundaries: An Organized Revolution for the Professional Formation of Electrical Engineers”, a prestigious NSF award with \$2M budget, in which Dr. Mumcu is a Co-PI. <https://govtribe.com/award/federal-grant-award/project-grant-2022299>

EE Science II – continues as a 4 credit-hour course in the core of Electrical Engineering curriculum. The additional 1 credit hour is used to teach a weekly laboratory session that gives students hands-on experience with EM concepts. (Ironically, in 1997, what was then a 1 credit hour “EM Laboratory” was converted to the Wireless Circuits and Systems Design Laboratory, i.e. our well-known WAMI Lab.) WAMI faculty and graduate students continue to be heavily involved with course and its laboratory content.



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The RF and Microwave Power Amplifier Design Course (EEEL6368), currently offered once a year (both in-class and on-line) focuses on leading students through the process of completing a fabrication-ready high power GaN amplifier design. Selected designs are fabricated and tested by Modelithics, other sponsors that offset some of the cost related to this fabrication are Qorvo and Transline.



To keep up with the growing student interest in wireless communications, Dr. Stavros Vakalis, who just joined USF WAMI Center in Fall 2022, has agreed to take over the Wireless Communications System Laboratory course, which is also known as “WAMI Lab II” course in Spring 2023.

Capstone Activities

USF Electrical Engineering Department, [under “IUSE/PFE:RED: Breaking Boundaries: An Organized Revolution for the Professional Formation of Electrical Engineers” a prestigious NSF award with \$2M budget in which Dr. Mumcu is a Co-PI] has transitioned into a new capstone course model where all students carry out industry or faculty sponsored capstone projects.

Special Thanks to Capstone Sponsors and Advisors!



IEEE

F2020 – S2021, Sponsored by Dr. Mumcu and IEEE: A capstone design team that is advised by Dr. Gokhan Mumcu has been chosen one of the as top 6 semi-finalists in the Student Design Contest of the 2021 IEEE Antennas and Propagation Symposium to be held in Singapore on December 4-10, 2021. IEEE APS is flagship conference of the IEEE Antennas and Propagation Society. It typically receives over 1,000 paper submissions and hosts over 1500 attendees. Students received budget to build and test their direction of arrival antenna array concept.



Collins Aerospace

F2021 – S2022, Sponsored by Collins Aerospace: A capstone design team carried out design, fabrication, packaging and testing of a dual band active GPS antenna according to specifications of Collins Aerospace. The team was advised by Mark Billsberry (Collins) and Gokhan Mumcu (USF).



F2021 – S2022, Sponsored by Mini-Circuits: A capstone design team carried out design, prototyping and testing of a VNA extender that will convert a 6 GHz VNA to characterize devices at 28 GHz band. The team was advised by Stephen Leone (Mini-Circuits) and Larry Dunleavy (USF).



S2022 – F2022 (ongoing), Sponsored by SOFWERX: A capstone design team is carrying out design, fabrication, packaging and testing of



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a capacitive wireless charging system according to specifications of SOFWERX. The team is advised by Brian Andrews (SOFWERX) and Gokhan Mumcu (USF).



Collins Aerospace

F2022 – S2023 (ongoing), Sponsored by Collins

Aerospace: A capstone design team is carrying out design, fabrication, packaging and testing of a compact single band active GPS antenna according to specifications of Collins Aerospace. The team is advised by Mark Billsberry (Collins) and Gokhan Mumcu (USF).



F2022 – S2023 (ongoing), Sponsored by Mini-Circuits:

A capstone design team is carrying out design, prototyping and testing of a VNA extender that will convert a 6 GHz VNA to characterize devices at 28 GHz band. The team is advised by Stephen Leone (Mini-Circuits) and Larry Dunleavy (USF).