



International Conference on Compound Semiconductor Manufacturing Technology

May 7th – 10th, 2018
www.csmantech.org



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Austin, Texas, USA
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MESSAGE FROM THE CONFERENCE CHAIR

On behalf of the Executive and Technical Program Committees, I would like to welcome you to Austin, TX and the 33rd annual International Conference on Compound Semiconductor Manufacturing Technology (CS MANTECH). From its inception in 1986, The CS MANTECH conference has been the only conference that is dedicated to being a forum that combines a manufacturing focus with state of the art compound materials challenges and device performance in one location. This year the conference offers a diverse technical program that supports this service and advances this discussion. Here you will find our program explores the traditional elements of RF devices, process control, reliability, manufacturing, and fabrication processes, as well as the growing areas of GaN devices, heterogeneous integration, acoustic filters, and power devices, among others. I am honored to help bring together compound semiconductor professionals from around the world to share important information, exchange cutting-edge ideas, and establish professional ties within the community. As with all previous CS MANTECH conferences, this year's conference has relied heavily on many individuals who have volunteered their time to ensure its success. I would like to thank all the volunteers on both of the organizing committees, along with their supporting organizations, who have enabled CS MANTECH to provide this important service to the compound semiconductor industry.

I look forward to this being another great conference that provides valuable technical content and the opportunity to make new industry connections and renew interactions with old colleagues.

Welcome to Austin and have a successful 2018 CS MANTECH!

Drew Hanser
Veeco Instruments, Inc.
Conference Chair

CONFERENCE AT A GLANCE

SUNDAY, May 6th

6:00 PM – 8:00 PM **REGISTRATION**
REG Counter

MONDAY, May 7th

7:00 AM – 7:00 PM **CS MANTECH
REGISTRATION**
REG Counter

7:00 AM – 8:30 AM **ROCS REGISTRATION**
Texas Ballroom Foyer

7:00 AM – 8:30 AM **CS MANTECH & ROCS
WORKSHOP BREAKFAST**
Texas Ballroom 1

8:00 AM – 5:00 PM **CS MANTECH
WORKSHOPS**
Texas Ballroom 1

8:30 AM – 5:00 PM **ROCS WORKSHOP**
Texas Ballroom 2-3

11:30 AM – 1:00 PM **CS MANTECH & ROCS
WORKSHOP LUNCHEON**
Texas Ballroom 4-7

6:00 PM – 9:00 PM **EXHIBITS RECEPTION**
Zilker Ballroom

TUESDAY, May 8th

7:00 AM – 5:00 PM **REGISTRATION**
REG Counter

7:00 AM – 8:00 AM **BREAKFAST**
Zilker Ballroom

8:00 AM – 8:30 AM **OPENING CEREMONIES**
Texas Ballroom 1-7

8:00 AM – 5:30 PM **EXHIBIT HOURS**
Zilker Ballroom

8:30 AM – 10:30 AM **SESSION 1: PLENARY I**
Texas Ballroom 1-7

10:30 AM – 11:00 AM **BREAK**
Zilker Ballroom

11:00 AM – 12:00 PM **SESSION 1: PLENARY I**
Texas Ballroom 1-7

12:00 PM – 1:30 PM **EXHIBITS LUNCH**
Zilker Ballroom

| | |
|--------------------|--|
| 1:30 PM – 3:20 PM | SESSION 2: PACKAGING AND HETEROGENEOUS INTEGRATION <i>Texas Ballroom 1-7</i> |
| 3:20 PM – 4:00 PM | BREAK <i>Zilker Ballroom</i> |
| 4:00 PM – 5:30 PM | SESSION 3: RF DEVICES <i>Texas Ballroom 1-7</i> |
| 5:45 PM – 6:45 PM | STUDENT FORUM <i>Zilker Terrace</i> |
| 5:45 PM – 6:45 PM | EXHIBITOR FORUM <i>Hill Country A-D</i> |
| 7:15 PM – 10:00 PM | INTERNATIONAL RECEPTION <i>The Speakeasy</i> |

WEDNESDAY, May 9th

| | |
|---------------------|--|
| 7:00 AM – 5:00 PM | REGISTRATION <i>REG Counter</i> |
| 7:00 AM – 8:00 AM | BREAKFAST <i>Zilker Ballroom</i> |
| 8:00 AM – 11:00 AM | EXHIBIT HOURS <i>Zilker Ballroom</i> |
| 8:00 AM – 9:50 AM | SESSION 4: PROCESS CONTROL AND YIELD <i>Texas Ballroom 1-3</i> |
| 9:50 AM – 10:20 AM | BREAK <i>Zilker Ballroom</i> |
| 10:20 AM – 12:20 AM | SESSION 5: CHARACTERIZATION OF GAN DEVICES <i>Texas Ballroom 1-3</i> |
| 10:20 AM – 12:20 AM | SESSION 6: BUSINESS AND USE CASES <i>Texas Ballroom 4-7</i> |
| 12:20 AM – 1:30 PM | OPEN <i>Lunch at your own leisure or time to explore Austin</i> |
| 1:30 PM – 3:30 PM | SESSION 7: GaN EPITAXY AND MATERIALS <i>Texas Ballroom 1-3</i> |
| 1:30 PM – 3:30 PM | SESSION 8: OPTOELECTRONICS <i>Texas Ballroom 4-7</i> |

3:30 PM – 4:00 PM **BREAK**
Texas Ballroom Foyer

4:00 PM – 5:50 PM **SESSION 9: PROCESSING:
RESIST & ETCH**
Texas Ballroom 1-3

4:00 PM – 5:40 PM **SESSION 10: ACOUSTIC
FILTERS**
Texas Ballroom 4-7

6:00 PM – 8:00 PM **RUMP SESSIONS**
Hill Country A-D

7:00 PM – 9:00 PM **SEMI STANDARDS
MEETING**
Footills 1

THURSDAY, May 10th

7:00 AM – 9:30 AM **REGISTRATION**
REG Counter

7:00 AM – 8:00 AM **BREAKFAST**
Texas Ballroom 4-7

8:00 AM – 9:50 AM **SESSION 11: TEST AND
RELIABILITY**
Texas Ballroom 1-3

9:50 AM – 10:20 AM **BREAK**
Texas Ballroom Foyer

10:20 AM – 12:30 PM **SESSION 12:
MANUFACTURING**
Texas Ballroom 1-3

12:00 PM – 1:30 PM **CS MANTECH LUNCH**
Texas Ballroom 4-7

1:30 PM – 3:40 PM **SESSION 13: POWER
DEVICES**
Texas Ballroom 1-3

3:40 PM – 4:30 PM **SESSION 14: POSTER
SESSION**
Zilker Ballroom 1-2

4:30 PM – 5:30 PM **CLOSING RECEPTION**
Zilker Ballroom 1-2

2018 CONFERENCE HIGHLIGHTS

On behalf of the Technical Program Committee for the 2018 CS MANTECH Conference, it is my pleasure to welcome you to this year's conference, and to thank you for participating. This year's technical program promises to be excellent, with a wide array of both invited and contributed talks across the breadth of topics relevant to compound semiconductor manufacturing. Here are a few highlights of the program:

Monday, May 7th:

- Continuing the CS-MANTECH tradition, the program begins this year with a series of tutorial workshops. This year's workshop theme is on tools for big data and machine learning, and how they can be applied to CS manufacturing. Please see the CS MANTECH WORKSHOP section for details.
- Also on Monday, CS MANTECH is pleased to be hosting the internationally recognized Reliability of Compound Semiconductor (ROCS) workshop. This workshop is the premier forum for the presentation of the latest results and new developments related to compound semiconductor reliability. The JEDEC Committee JC-14.7 sponsors the ROCS workshop. Please see <http://www.jedec.org/home/gaas> for details.
- On Monday evening, the Exhibits open at 6:00 pm with the Exhibits Reception. The CS MANTECH exhibits are an excellent opportunity to visit suppliers of materials, services, and equipment from around the world. This is also a great time to reconnect with old friends and establish new connections.

Tuesday, May 8th:

- The CS MANTECH Conference formally begins in the morning with opening ceremonies that include the 2017 Best Paper awards, sponsorship recognition, and a conference overview along with a review of the conference mobile app.
- Following the opening ceremonies, we have our plenary session. The plenary will feature three prominent invited industry speakers from across the spectrum of the CS industry, including optoelectronics (Andreas Weimar from OSRAM), devices for automotive applications (Kamal Khouri from NXP), and GaN for power (Umesh Mishra from UCSB and Transphorm).
- After lunch in the Exhibits Hall, we will reconvene for two additional technical sessions featuring invited talks on Packaging and Heterogeneous Integration, as well as RF Devices.
- Tuesday afternoon's technical sessions will conclude with the Exhibitors' Forum and Student Forum. The Exhibitors' Forum provides an opportunity for exhibitors to present marketing/technical presentations to conference attendees, while the

Student Forum provides an opportunity for students to explore career options through networking with members of the CS community from industry, academia, and government.

- In the evening, CS MANTECH will host the International Reception (IR). This annual event has been a fun and memorable highlight of past conferences and we anticipate an exciting evening again this year. This year the International Reception will be held at the Austin Speakeasy (<http://speakeasyaustin.com>).

Wednesday, May 9th:

- Wednesday morning begins with breakfast in the Exhibits Hall where attendees can follow up on questions from the Exhibitors' Forum or meet with a few more vendors before the technical sessions begin at 8:00 am.
- There is a full program of parallel sessions throughout the day. Parallel sessions have been structured so that attendees can move between talks and sessions, with minimal overlap between the parallel sessions.
- Lunch will be on your own, with a little time to explore Austin.
- Parallel sessions continue in the afternoon starting at 1:30 pm.
- At 6:00 pm, the Rump Session will start, consisting of 4 parallel topics. These informal sessions thrive on audience participation, so join in the fun by voicing your thoughts on the topics.
- At 7:00 pm the SEMI Standard Meeting will be held.

Thursday, May 10th:

- Thursday morning continues with technical sessions starting at 8:00 am.
- At 12:30 pm, all conference attendees are invited to join us for the CS MANTECH Conference Luncheon.
- After lunch, we will hold our last technical session followed by the poster session. The Closing Reception features prizes for the conference contest, as well as for best poster and conference feedback; in what we believe is a first for CS-MANTECH, a mechanical bull ride is planned for the adventurous among you.. Come see the posters, join the contest, and take part in the conference Closing Reception.

Thank you again for being part of this year's conference and welcome to Austin!

Patrick Fay
University of Notre Dame
Technical Program Chair
2018 CS MANTECH

2018 CONFERENCE SPONSORS

CS MANTECH is an independent not-for-profit organization whose mission is to promote technical discussion and scientific education in the compound semiconductor manufacturing industry. The continued success of the conference is enabled by donations from corporate sponsors. The 2018 CS MANTECH Conference Committee gratefully acknowledges the support from our sponsors.

(Sponsor list confirmed at press)

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2018 CS MANTECH WORKSHOP

Monday, May 22nd, 2017
8:15 a.m. – 4:30 p.m.

The theme of this year's workshop is "Big Data - Data Storage – Data Retrieval – Machine Learning".

In recent months, we have read stories about data being the new oil, artificial intelligence being the new electricity, that robots may take away the jobs of engineers or even doctors.

We, the compound semiconductor community, must ask what this all means for our industry! Picture how much data has been collected when a product device is delivered to our customers. Of the many million product devices tested daily, it is not uncommon to test more than 1000 electrical parameters on every single one. This product is assembled not only from a compound semiconductor device, like a power amplifier, but also from SMD components, filters, switches and power controllers. Along with product test, we collect data on each component during its manufacturing like tool data, SPC data or electrical tests like PCM or die sort.

In the morning we will discuss general aspects of data systems and their advantage in bridging the different areas of the manufacturing. The amount of data collected calls for an efficient way of storing and retrieving. We will cover two commonly used philosophies of storing and retrieving data: Relational Databases and Data Lakes.

The amount of data and the complexity of our product devices poses its challenges for data analysis, to solve yield problems and alike. One aspect of artificial intelligence is machine learning, which can clearly help in this scenario. In the afternoon we will introduce machine learning and its concepts followed by a review of statistical models in JMP, a widely used data analysis software. We will close the workshop with an introduction of a Deep Learning method to classify wafer patterns.

2017 ROCS WORKSHOP

Reliability Of Compound Semiconductors

Monday, May 22nd, 2017
8:30 a.m. – 5:00 p.m.

The 33rd annual ROCS Workshop will be held in conjunction with the CS MANTECH Conference on Monday May 7th, 2018, at the Hyatt Regency in Austin, Texas, USA. This workshop is sponsored by the JEDEC JC-14.7 Committee on GaAs Reliability and Quality Standards. The ROCS Workshop brings together researchers,

manufacturers and users of compound semiconductor materials, devices and circuits. Papers presenting latest results, including work-in-progress and new developments in all aspects of compound semiconductor reliability will be presented.

INDUSTRY EXHIBITS

2018 will continue the CS MANTECH tradition of holding a robust exhibits program in parallel with the technical conference to facilitate interactions and exchange amongst members of the compound semiconductor industry. Exhibitors spanning the full range of materials, equipment, and services relevant to the compound semiconductor industry will be on hand to interact with conference attendees. Vendors of substrates, process gas and specialty material suppliers, fabrication, inspection and test equipment providers, technical and manufacturing consulting services, and industrial publication venues will be there.

To facilitate interactions between exhibitors and attendees, an **Exhibits Reception will be held on Monday evening, May 7th**, in the exhibition hall (Zilker Ballroom). The exhibits will also be open all day Tuesday, May 8th through Wednesday morning, May 9th until 11:00 am, with breakfasts, coffee breaks, and lunch on Tuesday during the conference all taking place in the exhibition hall. Additionally, **a series of Exhibitor Forum events will take place for one hour on Tuesday 5:45pm - 6:45pm in the Hill Country Ballroom A, B, C, and D..** (*Schedule of exhibitors are listed at the end of the Conference Guide*). These events provide participating exhibitors an opportunity to more fully showcase their products and services.

2018 EXHIBITORS

Accel-RF Instruments Corp.
AIXTRON Inc.
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ClassOne Technology
CS CLEAN SOLUTIONS Inc
DOWA International Corp.
ePAK International, Inc.
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Materion
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Oxford Instruments
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Revasum
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Semilab USA LLC
Shin-Etsu microSi
Siconnex customized solutions GmbH
StratEdge Corporation
Umicore Optical Materials USA
Vacuum Engineering & Materials
Virginia Diodes Inc
Wafer World Inc.
Wolfspeed, A Cree Company

INTERNATIONAL RECEPTION

The always enjoyable International Reception visits The Speakeasy on Tuesday evening May 8th 2018 from 7:15-10:00p.m. The location is nice walk less than a mile down the famous Congress Avenue Bat Bridge from the Hyatt. The Speakeasy is composed of three levels, the Music Lounge (where a live band will play), the Mezzanine overlooking the stage, and the rooftop lounge Terrace59. Please plan to join us at the Speakeasy for a fun evening of live music featuring the Cap City Band and Austin culture with a 1920's prohibition era vibe that also happens to be on the Haunted Austin Tour. <http://speakeasyaustin.com> 412 Congress Ave, Austin, TX 78701.

SEMI STANDARDS MEETING

The SEMI Standards meeting is scheduled for Wednesday May 9th, from 7:00 pm to 9:00 pm. The SEMI Compound Semiconductor (GaAs, InP and SiC) Committee invites CS MANTECH Conference attendees interested in the development of internationally approved standards for wafer specifications to attend this meeting. Topics being addressed are GaAs, InP, and SiC dimensions/orientations and electrical properties, epitaxial layer specifications (which properties should be specified, and how they are to be verified), and non-destructive test methods.

Based in San Jose, CA, SEMI is an international trade association serving more than 2,400 companies participating in the semiconductor and flat panel display equipment and materials markets. SEMI maintains offices in Brussels, Moscow, Tokyo, Seoul, Hsinchu, Beijing, Singapore, Austin, Boston and Washington, DC. For additional information, please contact: Co-Chair: James Oliver of Northrop Grumman at 410-765-0117 or j.oliver@ngc.com, Co-Chair: Russ Kremer of Freiberger Compound Materials at 937-291-2899 or russ@fcm-us.com, or at SEMI Standards contact Paul Trio at 408-943-6900 or ptrio@semi.org.

CS MANTECH CONFERENCE CONTEST

The Scavenger Hunt is back! Goal is to find the most coins during the conference before the Closing Reception in order to win the prize. Coins will be hidden strictly in CS ManTech areas of hotel – All sessions, break areas and the exhibit hall throughout the week.

2018 CS MANTECH MOBILE APP

Get the CS MANTECH mobile app! This year CS MANTECH is again featuring a mobile app that will allow attendees to customize their conference schedules, easily find event times and locations, view papers, and connect with other attendees. The CS MANTECH mobile app will also be your opportunity to rate the papers for the conference best paper awards and provide feedback on the conference

The CS MANTECH App is free and available for download on the App Store or get it on Google Play. Search “CS MANTECH” or scan the QR code below to take you directly to download the app. For non-smart phone users, a web-based version of the app is available at <http://2017CSMANTECH.connect.omnipress.com>.



2018 CS MANTECH ONLINE DIGEST

CS MANTECH will again be offering an online digital version of the conference technical proceedings. Digital copies of the papers presented at the 2018 International Conference on Compound Semiconductor Manufacturing Technology will be available for download and viewing from our online site during the conference. Printed 2018 digests were offered to attendees who requested a copy at the time of conference registration and if registration was completed by the early registration deadline (April 20th).

To access the 2018 online digest, go to www.csmantech.org and click on “2018 Online Digest”.

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TECHNICAL PROGRAM

Monday, May 7th

CS MANTECH WORKSHOPS

*“Big Data - Data Storage – Data Retrieval –
Machine Learning”*

Chair: Thorsten Saeger, *Qorvo*

- 7:00 AM **REGISTRATION**
- 7:30 AM **WORKSHOP BREAKFAST**
(CS MANTECH & ROCS)
- 8:15 AM **WORKSHOP OPENING**
Thorsten Saeger, *Qorvo*
- 8:20 AM **There's Power in Bridging Data System
Silos**
Eric Finchem, MACOM
- 9:20 AM **Relational Databases: Data Analytics
Beyond Spreadsheets and Single-Table
Databases**
Bill Adams, *Independent Contractor*
- 10:15 AM **Break**
- 10:30 AM Introduction to Data lake / Hadoop
Tony Davis, *Cloudera*
- 11:30 AM **WORKSHOP LUNCH**
(CS MANTECH & ROCS)
- 1:00 PM **Machine Learning - Demystified**
Thorsten Saeger, *Qorvo*
- 2:00 PM **Statistical Models in JMP**
Jerry Cooper, *JMP/SAS*
- 3:00 PM **Break**
- 3:30 PM **Statistical Models in JMP**
Brian Wang, *Qorvo*
- 4:30 PM **WORKSHOP CLOSING**
- 6:00 PM **EXHIBITS RECEPTION**

ROCS WORKSHOP

Chair: Martin Kuball, *University of Bristol*

7:00 AM - 8:30 AM ROCS Registration

7:30 AM – 9:00 AM **WORKSHOP BREAKFAST**
(CS MANTECH & ROCS)

8:30 AM - 11:30 AM ROCS Workshop Sessions

11:30 PM – 1:00 PM **WORKSHOP LUNCH**
(CS MANTECH & ROCS)

1:00 PM – 5:00 PM ROCS Workshop Sessions

6:00 PM **EXHIBITS RECEPTION**

Tuesday, May 8th

CONFERENCE OPENING

- 8:00 AM **Opening Ceremonies**
Drew Hanser, Conference Chair
Veeco Instruments, Inc.
- 8:10 AM **2017 Conference Best Paper Awards**
Drew Hanser, Conference Chair
Veeco Instruments, Inc.
- 8:20 AM **Technical Program Highlights**
Patrick Fay, Technical Program Chair
University of Notre Dame

SESSION 1: PLENARY

- Chairs: Drew Hanser, *Veeco Instruments, Inc.*
 Patrick Fay, *University of Notre Dame*
- 8:30 AM *Invited Presentation*
**1.1 Innovated volume production for III-V
Compound Semiconductor LED and
Laserchips at OSRAM Opto
Semiconductors**
Andreas Weimar
- 9:30 AM *Invited Presentation*
**1.2 Automotive Industry Trends and Their
Impact on the Future Vehicle**
Kamal Khouri
- 10:30 AM **BREAK**
- 11:00 AM *Invited Presentation*
**1.3 Looking for reliability and high
performance in RF and power conversion
applications? Use GaN.**
Umesh Mishra, *University of California Santa
Barbara*
- 12:00 PM **EXHIBITS LUNCH**

SESSION 2: Packaging and Heterogeneous Integration

- Chairs: Andy Carter, *Teldyne Scientific & Imaging*
 Barry Wu, *Keysight Technologies*
- 1:30 PM *Invited Presentation*
**2.1 Additive manufacturing solutions to
mm-wave heterogenous circuits**
Jean-Mark Rollin
Nuvotronics

- 2:00 PM **2.2 Interfacial strength and fracture toughness in bonded semiconductor materials**
 Don Lui¹, Naoteru Shigekawa², Martin Kuball³
¹University of Oxford, ²Osaka City University, ³University of Bristol
- 2:20 PM **BREAK**
- 2:50 PM *Invited Presentation*
2.3 Photosensitive Glass-Ceramics for Heterogeneous Integration
 Jeb H. Flemming
3D Glass Solutions
- 3:20 PM *Invited Presentation*
2.4 Heterogeneous Integration Technologies for Next-Generation RF and mm-Wave Subsystems
 Florian Herrault
HRL Laboratories
- SESSION 3: RF Devices**
 Chairs: Mitsuhiro Nakamura, *Sony*
 Yorito Ota, *National Chiao Tung University*
- 4:00 PM **3.1 A 15 W/mm GaN Technology for C-band Pulsed Radars with 45% PAE**
 Gabriele Formicone
Integra Technologies, Inc.
- 4:20 PM **3.2 Impact of Threshold Voltage Variation on RF Performance of 140 nm GaN MMICs**
 Robert C Fitch¹, James K. Gillespie¹, Andrew J. Green², Dennis E. Walker¹, D. Frey³, J Gassman³, Mark Walker³, Gregg H. Gessen¹
¹Sensors Directorate, Air Force Research Laboratory, ²Wyle Laboratories, ³Cobham Defense Systems
- 4:40 PM **3.3 Novel approach for ED transistors integration in GaN HEMT technology**
 Konstantin Y. Osipov, Hans-Joaquin Würfl, Ina Ostermay, Frank Brunner, Gunter Tränkle
Ferdinand-Braun-Institut, Leibniz-Institut für Höchstfrequenztechnik (FBH)
- 5:00 PM **3.4 An Improved 0.25µm GaN on SiC MMIC Technology for Radar and 5G Applications**
 Yi-Wei Lien, Wayne Lin, Richard Jhan, Jhih-Han Du, Andy Tseng, Wei-Chou Wang, Fan-Hsiu Wang, Clement Huang, Shinichiro Takatani, Walter Wohlmuth
WIN Semiconductors Corp.

- 5:20 PM **3.5 Advanced BiHEMT Technology with Quarter-um Enhancement Mode pHEMT for sub-6GHz HPUE PA Application**
Cheng Shao Chang
WIN Semiconductors Corp.
- 5:45 PM **STUDENT FORUM**
- 5:45 PM **EXHIBITOR FORUM**
- 7:15 PM **INTERNATIONAL RECEPTION**
The Speakeasy
(Less than a mile walk from the hotel)

Wednesday, May 9th

SESSION 4: Process Control and Yield

Chairs: Mike Sun, *Skyworks*
Chang-Hwang Hua, *WIN Semiconductors Corp.*

- 8:00 AM **4.1 SPC Process Revitalization in a High Mix Low Volume Fab**
Jay D. Alexander, Eric Finchem, James Carter
MACOM
- 8:20 AM **4.2 Mechanism and Resolution of Implant Induced ESD Damage in GaAs IC Processing**
Lam T. Luu-Henderson, Mehran Janani, John Bonk, Steve Canale, Mark Borek
Skyworks Solutions, Inc.
- 8:40 AM **4.3 Systematic Data Mining Approaches for Yield Improvement**
Yiping Wang, Pat Hamilton, Robert Waco, Matthew Porter, Corey Nevers, Jeremy Middleton
Qorvo Inc.
- 9:00 AM **4.4 Plating Defect Detection and Process Control**
Volodymyr Bondarenko, William Branoff, Michael Meeder
Qorvo Inc.
- 9:20 AM **4.5 Mass-Production of High Reliability GaN HEMT for Wireless Communication**
Fumikazu Yamaki, Seigo Sano
Sumitomo Electric Device Innovations, Inc.

9:50 AM **BREAK**

SESSION 5: CHARACTERIZATION OF GAN DEVICES

Chairs: Yohei Otoki, *SCIOCS*
Karen Moore, *NXP*

- 10:20 AM **5.1 Thermal Analysis of GaN-HEMT/SiC on Diamond by Surface Activated Bonding**
Naoya Okamoto, Yuichi Minoura, Motonobu Sato, Toshihiro Ohki, Shiro Ozaki, Kozo Makiyama, Atsushi Yamada, Junji Kotani, Kazukiyo Joshin, Norikazu Nakamura
Fujitsu Limited and Fujitsu Laboratories Ltd.
- 10:40 AM *Student Presentation*
5.2 Device-to-device coupling via lateral conduction within the epitaxy in C-doped AlGaIn/GaN HEMTs
Manikant¹, Serge Karboyan¹, Michael J. Uren¹, Kean Boon Lee², Zafar Zaldi², Peter Houston², Martin Kuball¹

¹University of Bristol, ²University of Sheffield

11:00 AM **5.3 Influence of Substrate Removal on the Electrothermal Characteristics of AlGaIn/GaN Membrane High Electron Mobility Transistors**
Marko Tadjer¹, Peter Raad², Tatyana Feygelson¹, Andrew Kohler¹, Travis Anderson¹, Bradford Pate¹, Karl Hobart¹, Fitz Kub¹
¹Naval Research Laboratory, ²TMX Scientific and Southern Methodist University

11:20 AM *Student Presentation*
5.4 Performance and Stability of Enhancement-mode Fully-recessed GaN MIS-FETs and Partially-recessed MIS-HEMTs with PECVD-SiNx/LPCVD-SiNx Gate Dielectric
Jiabai He, Mengyuan Hua, Zhaofu Zhang, Gaofei Tang, Kevin J. Chen,
The Hong Kong University of Science and Technology

11:40 AM *Student Presentation*
5.5 Modification of amorphous-SiNx/GaN Interface Trap Density by Nitridation: A First-Principles Calculation Study
G. Zhaofu Zhang, Mengyuan Hua, Jaibei He, Qingkai Qian, Kevin J. Chen
The Hong Kong University of Science and Technology

12:00 PM **5.6 Non-contact Characterization of Bias Stress-Induced Instability of 2DEG in SiN/AlGaIn/GaN Structures**
Marshall Wilson, Alexandre Savtchouk, Andrew Findlay, Carlos Almeida, Jacek Lagowski
Semilab SDI

SESSION 6: BUSINESS AND USE CASES

Chair: Gerhard Schoenthal, *Virginia Diodes*
Hidetoshi Kawasaki, *Sony*

10:20 AM *Invited Presentation*
6.1 III-V for Logic Applications: A Design Perspective
Saurabh Sinha
Arm Inc.

10:50 AM *Invited Presentation*
6.2 The Case for All Digital Beamforming
Bror Peterson
Qorvo

- 11:20 AM *Invited Presentation*
**6.3 The Status of the U.S. Integrated
Circuit Design and Manufacturing
Industry**
Brad Botwin
*U.S. Department of Commerce, Bureau of
Industry and Security*
- 11:50 AM *Invited Presentation*
**6.4 How have we continued GaAs RFIC
business in Japan ? New Japan Radio
survival history**
Shigeki Yamaga, Hiroguki Yoshinaga,
Takehiko Kameyama
New Japan Radio Co., Ltd
- 12:20 AM **OPEN**
Lunch on your own

SESSION 7: GAN EPITAXY AND MATERIALS

Chairs: Chris Santana, *IQE*
Judy Kronwasser, *NOVASIC*

- 1:30 PM *Invited Presentation*
7.1 Real potential of GaN electric devices coming from GaN on GaN
Yohei Otoki, Hajime Fujikura, Takefumi Yoshida, Fumimasa Horikiri, Tetsuji Fujimoto, Masatomo Shibata
SCIOCS
- 2:00 PM **7.2 An Analysis of the Surface Morphology of the GaN-on-GaN Epi Wafers and the Control by the Substrate Off Angle**
Fumimasa Horikiri¹, Yoshinobu Narita¹, Takehiro Yoshida¹, Chikashi Ito², Varun Gupta², Anoop Somanchi²
¹*SCIOCS*, ²*KLA Tencor*
- 2:20 PM *Invited Presentation*
7.3 RF GaN/Si HEMT Growth Development Using Single Wafer MOCVD Technology
Ming Pan, Soo-Min Lee, Jie Su, Eric Tucker, Randir Bubber, Somit Joshi, Ajit Paranjpe
Veeco Instruments
- 2:50 PM **7.4 High quality AlGaIn/GaN HEMT for RF applications on cold-split thinned 4H-SiC substrates**
Stefano Leone¹, Birte-Julia Godejohan¹, Peter Brueckner¹, Lutz Kirste¹, Christian Manz¹, M. Swobada², C. Beyer², Jan Richter², Ruediger Quay¹
¹*Fraunhofer IAF*, ²*Sillectra GmbH*
- 3:10 PM **7.5 Innovative GaN based engineered substrates for power applications**
Eric Guiot
SOITEC.

SESSION 8: OPTOELECTRONICS

Chairs: Kevin Stevens, *IQE*
Ruediger Schreiner

- 1:30 PM *Invited Presentation*
8.1 Advances in MOCVD Technology for III-V Photonics
Eric A. Armour
Veeco Instruments, Inc.
- 2:00 PM **8.2 Status of VCSEL growth by multi-wafer production MBE at IntelliEPI**
Juan Li, Shannon M. Hill, Joseph A. Middlebrooks, Chen-Yu Chen, Wei Li, Jenn-

Ming Kuo, Kevin W. Vargason, Yung-Chung Kao, Paul R. Pinsukanja
Intelligent Epitaxy Technology, Inc.

2:20 PM *Student Presentation*
8.3 Controlling Impurity-Induced Disorder Via Mask Strain for High-Performance Vertical-Cavity Surface-Emitting Lasers
Patrick Su, Thomas O'Brien Jr., Fu-Chen Hsiao, John M. Dallesasse
University of Illinois at Urbana-Champaign

2:40 PM *Student Presentation*
8.4 Zinc-induced mirror disordering for high-speed 850 nm VCSEL operated at 40 GB/s OOK
Chun-Yen Peng, Chao-Hsin Wu, Shan-Fong Leong, Gong-Ru Lin, Cheng-Ting Tsai
National Taiwan University

3:00 PM *Invited Presentation*
8.5 Manufacturing of lasers and photodetectors on 100mm InP in GaAs IC fabrication facility
Debdas Pal, James Carter, Liza Elliot, Deylin Zhao
MACOM

3:30 PM **BREAK**

SESSION 9: PROCESSING: RESIST AND ETCH

Chairs: Hermann Stieglauer, *United Monolithic Semiconductors GmbH*
Heribert Zull, *Osram*

4:00 PM **9.1 0.20 μm gate length formation technology by using i-line stepper exposure and chemical shrink process**
Takahiro Ueno
Mitsubishi Electric Corporation

4:20 PM **9.2 Impact of Loading Effect on Retrograde Profile of CAMP Negative Photoresist in Metal Lift-off Applications**
Sarang Kulkarni, Tom Brown, Shibani Tiku, Manjeet Singh
Skyworks Solutions, Inc.

4:40 PM **9.3 Evolution and Challenges of a TaN Resistor Lift-off Process from a Lithography Perspective**
Tom Brown, Sarang Kulkarni, Shibani Tiku, Manjeet Singh
Skyworks Solutions, Inc.

5:00 PM **9.4 Extending MTBC to High Productive Performance Levels in ICP SiN Etching for Advanced RF Applications**
Elena B. Woodard¹, Daniel K. Berkoh¹,
Stevphen Vargo², Miki Takagi², Michael
Blair²
¹*Skyworks Solutions, Inc.*, ²*SPTS
Technologies, Inc.*

5:20 PM *Invited Presentation*
9.5 Neutral Beam Technology for Damage-free Etching Processes
Seiji Samukawa
Tohoku University

SESSION 10: ACOUSTIC FILTERS

Chairs: Shalini Gupta, *Northrup Grumman*
Thorsten Saeger, *Qorvo*

4:00 PM *Invited Presentation*
10.1 High Frequency, High Power, Low Loss, Wideband BAW Filters Using Single Crystal AlN-on-SiC Resonators
Ramakrishna Vetury, Jeffrey Shealy, Michael
D. Hodge, Shawn Gibb, Mary Winters, Pinal
Patel, Michael A McLain, Ya Shen, Daeho
Kim, Ken Fallon, Rohan Houlden, David
Aichele
Akoustis

4:30 PM *Invited Presentation*
10.2 Recent Advances in Bulk Acoustic Wave Filter Device Performance and Miniaturization
Paul Stokes, Gernot Fattinger, Fabian
Dumont, Ralph Rothemund, Alexandre
Volatier, Robert Aigner, Erika Fuentes,
Thomas Russel, Vishwvasu Potdar, Bang
Nguyen, Buu Diep, Robert Kraft
Qorvo

5:00 PM **10.3 Copy, Scale, Develop, and Match - A Methodology for 200mm Bulk Acoustic Wave Filter Pilot Production Line Start up at Qorvo**
Xiaokang Huang, Charles Dark, Mike
McClure, Buu Diep, Craig Hall, Harold Isom,
Donna Mortensen
Qorvo

5:20 PM *Student Presentation*
10.4 Impact of device parameter on performance of SAW resonators on AlN/sapphire
Shuai Yang, Yun Zhang
*Institute of Semiconductors, Chinese
Academy of Sciences*

6:00 PM **RUMP SESSIONS**

Rump session A: Chinese Compound Semiconductor Foundries Update

Moderator: Marty Brophy

Fabless semiconductor companies abound in the Si world, but have not yet been widely seen in compound semiconductors. Will the new CS fabs in China change that? Can you take your design to market without the expense of a fab? Come and bounce around ideas with other interested attendees over drinks before you quit your day job!

Rump session B: 5G – Why aren't you fabricating devices?

Moderator: Gerhard Schoenthal

5G will be slapped on boxes and devices starting this year. Your smart thing may show it in the upper right or left hand corner of the screen soon. For at least a couple of years the three main focuses of 5G have been eMBB (enhanced mobile broad band), URLLC (ultra reliable low latency communications), and IIoT/IoT (industrial/internet of things). Has all the hype flowed down to your research lab, development line, or fabrication facility? Come discuss whether the III-V rubber is starting to meet the road.

Rump session C: How many VCSEL's does the world really need?

Moderator: Paul Cooke

To misquote a well-known US wireless commercial, "Can you see me now?" With the advent of facial recognition, the III-V content of high end cell phones has taken a quantum leap. 3D sensing is arguably in its infancy with many intriguing possibilities on the horizon. Combined with more traditional applications such as datacomms, are VCSEL's on the threshold of becoming the dominant III-V device technology that drives GaAs production capacity, technical insight, investment and ultimately, profit? Dare we ask, how many VCSEL's does the world really need?

Rump session D: RF GaN Reliability: Good Enough or Just OBE (Overcome By Events)?

Moderator: Dave Via

RF GaN performance has made it the go-to technology for applications like telecommunications and military/defense where high power amplifiers are required. RF GaN has

reached a process maturity level on par with competing RF technologies and has been subjected to more reliability analysis than the technologies it displaces. Millions of devices/circuits have been fielded and billions of cumulative hours of operations have been logged, so I guess that means RF GaN reliability is good enough. But what does “good enough” mean? Are cumulative hours of operation an accurate indication of lifetime? Are accelerative life tests an accurate prediction of wearout?

There’s no denying RF GaN technology is being used, but is RF GaN reliability completely understood or is the overwhelming performance advantage of RF GaN and the need for RF power driving adoption? Are we, the RF GaN reliability community, overcome by events?

7:00 PM **SEMI STANDARDS MEETING**

Thursday, May 10th

SESSION 11: TEST AND RELIABILITY

Chairs: David Meyer, *Naval Research Laboratory*
Randy Lewis, *Air Force Research Laboratory*

8:00 AM *Invited Presentation*

11.1 The Reliability of Compound Semiconductors, Proving It’s Good Enough

Willam J. Roesch
Qorvo

8:30 AM *Invited Presentation*

11.2 Guidelines for Space Qualification of GaN HEMT

John Scarpulla
The Aerospace Corporation

9:00 AM *Invited Presentation*

11.3 Aspects of High Volume Test for Semiconductor Devices

James Migliaccio
Qorvo

9:30 AM *Student Presentation*

11.4 Gate Resistance Thermometry for GaN/Si HEMTs under RF Operation

Georges Pavlidis¹, Shamit Som², Jason Barrett², Wayne Struble², John Atherton², Samuel Graham¹

¹*Georgia Institute of Technology*, ²*MACOM*

9:50 AM **BREAK**

SESSION 12: MANUFACTURING

- Chairs: Guoliang Zhou, *Skyworks*
Corey Nevers, *Qorvo*
- 10:20 AM *Invited Presentation*
12.1 Global Cycle Time Reduction Methodologies
Juan Velasquez, Heather Knoedler, Sergio Garcia
Skyworks Solutions
- 10:50 AM *Invited Presentation*
12.2 The Package Trend for Compound Semiconductor
Chuck Huang
WIN Semiconductors Corp.
- 11:20 AM **12.3 Operational Yield Improvements Through Application of Lean, 5S, Employee Engagement, Root Cause Investigations and Culture Change**
Peter Melnik, Daniel Sullivan, Joseph Santa,
Skyworks Solutions
- 11:40 AM *Invited Presentation*
12.4 New Product Introduction and Design for Manufacturability in GaAs IC Industry
Shiban Tiku
Skyworks Solutions
- 12:10 PM **12.5 Fabrication of 4-inch GaN/Diamond HEMT in a Compound Semiconductor Foundry**
Mo Wu¹, Won Sang Lee², Daniel Hou¹
¹*Global Communication Semiconductors, LLC*, ²*RFHIC USA*
- 12:30 PM **CS MANTECH LUNCHEON**

SESSION 13: POWER DEVICES

- Chairs: S. C. Shen, *Georgia Institute of Technology*
Eric Stewart, *Northrup-Grumman*
- 1:30 PM *Invited Presentation*
13.1 Performance and Manufacturing Perspectives of SiC T-MOS Devices
Martin Huber¹, Dethard Peters², Wolfgang Bergner¹
¹*Infineon Technologies Austria AG*, ²*Infineon Technologies AG*
- 2:00 PM *Invited Presentation*
13.2 Comparison between GaN and SiC from the Viewpoint of Vertical Power Devices

Jun Suda
Nagoya University

- 2:30 PM *Invited Presentation*
13.3 Developments of Ga₂O₃ Electronic Devices for Next-Generation Power Switching
Masataka Higashiwaki¹, Man Hoi Wong¹, Keita Konishi², Yoshiaki Nakata¹, Chia-Hung Lin¹, Takafumi Kamimura¹, Naoki Hatta³, Kuniaki Yagi³, Ken Goto⁴, Kohei Sasaki⁴, Akito Kuramata⁴, Shigenobu Yamakoshi⁴, Hisashi Murakami², Yoshinao Kumagai²
¹National Institute of Information and Communications Technology, ²Tokyo University of Agriculture and Technology, ³SCIOCS Corporation, ⁴Tamura Corporation
- 3:00 PM **13.4 Advances towards industrial scale epitaxial β-Ga₂O₃ and β-(Al_x, Ga_{1-x})₂O₃ for power electronics**
Ross Miller, Fikadu Alema, Andrei Osinsky
Agnitron Technology
- 3:20 PM **13.5 Growth of 50mm Beta-Gallium Oxide (β-Ga₂O₃) Substrates**
John Blevins
Air Force Research Laboratory

SESSION 14: POSTER

Chairs: Nick Kolarich, *II-VI EpiWorks*
Doug Campbell, *ePak*

- 3:40 PM - *Student Presentation*
4:30 PM **14.1 Epitaxial Bonding and Transfer for Heterogeneous Integration of Electronic-Photonic Circuitry**
John Carlson, Patrick Su, John Dallesasse
University of Illinois at Urbana-Champaign
- 14.2 TaC Coated Wafer Carrier for GaN MOCVD for Blue Light-Emitting Diodes**
Hao Qu¹, Brian Kozak¹, Gregory Shaffer¹, Creighton Tomek¹, Sudarshan Natarajan¹, Daniel Feezell², Morteza Monavarian², Ashwin Rishinaramangalam¹, Wei Fan¹
¹Momentive Performance Materials, ²University of New Mexico
- 14.3 Reactive Sputtering: TaN Process Characterization and Post PM Qualification Improvements**
Jeremiah Sires
Skyworks Solutions

Student Presentation

14.4 Process Optimization and Characterization of 25 GHz Bandwidth 850 nm P-i-N Photodetector for 50 Gb/s Optical Links

Yu-Ting Peng, Dufei Wu, Ardy Winoto
University of Illinois at Urbana-Champaign

14.5 AlGaN/GaN hetero-junction bipolar transistor with selective-area regrown n-type AlGaN emitter

Lian Zhang¹, Jianping Zeng², Yun Zhang¹, Zhe Cheng¹, Hongzi Lu¹, Hongri Lv¹, Wei Tan², Junxi Wang¹

¹*Chinese Academy of Sciences, China*
Academy of Engineering Physics

14.6 Development of Si-doped 8-inch GaAs substrates

Masanori Morishita¹, Hidetoshi Takayama¹, Shuichi Kaneko¹, Hirokazu Ota¹, Tatsuya Moriwake¹, Satoshi Horikawa², Kouji Morishige², Yoshiaki Hagi², Yoshiki Yabuhara²

¹*Sumiden Semiconductor Materials Co.*,
²*Sumitomo Electric Industries, Ltd*

Student Presentation

14.7 Threshold power density reduction of 272-nm lasing from AlGaIn/AlN multiple-quantum-wells grown on nano-grating AlN/sapphire template

Ruxue Ni
Chinese Academy of Sciences

14.8 High Voltage Vertical GaN p-n Diode With N₂O Sidewall Treatment on Free-standing GaN Wafer

Hsien-Chin Chiu¹, Xinke Liu Liu²,
¹*Chang Gung University*, ²*Shenzhen University*

14.9 Fabrication of True Vertical GaN Schottky Diodes from 150 mm Engineered Substrates

Andrew Koehler¹, Lunet Luna¹, Marko Tadjer¹, Ozgur Aktas², Travis Anderson¹, Karl Hobart¹, Fritz Kub¹

¹*U.S. Naval Research Laboratory*, ²*Qromis Inc.*

14.10 Fabrication of Hollow Structures Using Atomic Layer Deposition

Masayuki Nakamura¹, Takayuki Kobayashi¹, Tatsuro Sagawa¹, Shin-ichi Motoyama¹, Kouichirou Yuki², Ryo Inomoto², Osamu Tsuji², Kazuyuki Tadatomo², Peter Wood¹

¹*SAMCO Inc.*, ²*Yamaguchi University*

Student Presentation

14.11 Fabrication and Characterization of Diamond FETs with 2D Conducting Channels

David Shahin¹, Kiran Kovi², Aayush Thapa¹,
Yizhou Lu¹, Ilya Ponomarev², James Butler²,
Aristos Christou¹

¹University of Maryland, ²Euclid TechLabs

14.12 Enhancing the Manufacturability and Evolving the Technology of GaN on SiC Back-Side Vias

Walter Wohlmuth, Chia-Hao Chen, Yu-Wei Chang, Shih-Hui Huang, Fraser Wang, Benny Ho

WIN Semiconductors Corp

Student Presentation

14.13 Design of Graded AlGaIn Channel Transistors for Improved Large-Signal Linearity

Shahadat Sohel¹, Sanyam Bajaj¹, Towhidur Razzak¹, David Meyer², Siddharth Rajan¹

¹The Ohio State University, ²Naval Research Laboratory

Student Presentation

14.14 AlGaIn/GaN MOS-HEMTs with Dual Field Plates for Stable High-Performance Operation

Ryota Yamaguchi, Taisei Tamazaki, Takashi Nishitani, Joel Asubar, Hirokuni Tokuda, Masaaki Kuzuhara

University of Fukui

14.15 InP/Si Fusion Wafer Bonding in Low Temperature

Xuanxiong Zhang

University of Shanghai for Science and Technology

Student Presentation

14.16 Comparison of MOCVD Grown GaSb on (001) Si Substrates Using the Aspect Ratio Trapping and Interfacial Misfit Growth Methods

Billy Lai, Qiang Li, Kei May Lau

Hong Kong University of Science and Technology

14.17 Towards Manufacturing Large Area GaN Substrates from QST® Seeds

Jacob Leach¹, Kevin Udvary¹, Paul Quayle¹, Vladimir Odnoblyudov², Cem Basceri², Ozgur Aktas², Heather Splawn¹, Keith Evans¹

¹Kyma Technologies, ²Qromis Inc.

4:30 PM CONFERENCE CLOSING

You don't want to miss our "Everything's Bigger In" Texas closing reception this year, complete with Mechanical Bull Riding, Ice Cold Lone Star and Shiner. So, put down your periodic table and see how long you can last on the Bucking Bull!

2017 BEST PAPERS AWARDS

On Tuesday morning, CS MANTECH will formally recognize the authors of the best paper and best student paper from the 2017 conference. Both awards are based on conference attendee on-line feedback. The Best Paper Award is named in honor of Dr. He Bong Kim, the founder of the International Conference on Compound Semiconductor **MAN**ufacturing **TECH**nology.

2017 He Bong Kim Best Paper:

The 5G Effect on RF Filter Technologies

Steve Mahon

Feldman Engineering

2017 He Bong Kim Best Paper Honorable Mention:

Effect of Manufacture on the Microstructure of GaN-on-Diamond

Dong Liu^{1,2}, Daniel Francis³, Firooz Faili³, James W. Pomeroy², Daniel J. Twitchen³, and Martin Kuball²

¹University of Oxford, ²Center for Device Thermography and Reliability, University of Bristol, ³Element Six Technologies

2017 Best Student Paper:

Cubic Phase GaN Integrated on CMOS-Compatible Silicon(100)

Richard Liu and Can Bayram

University of Illinois at Urbana-Champaign

Congratulations to these award winning teams for their excellent presentation and technical contribution to our field!

MESSAGE BOARD

A Conference Message Board will be maintained at the Registration & Information Center during registration hours. Please advise callers who wish to reach you during the day to ask the hotel operator to deliver a message to the CS MANTECH Conference Registration Desk. Please check the message board periodically.

REGISTRATION INFORMATION (US\$)

For Conference Registration, register online at www.csmantech.org or on-site at the Conference Registration Desk.

Pricing

| | |
|--|-------|
| Regular Conference Registration ¹⁾ | \$695 |
| Student Conference Registration ²⁾ | \$125 |
| Government Conference Registration ¹⁾ | \$595 |
| 1-Day Conference Registration (May 8 th) ³⁾ | \$300 |

| | |
|---|-------|
| 1-Day Conference Registration (May 9 th) | \$300 |
| 1-Day Conference Registration (May 10 th) | \$300 |
| 1-Day Exhibits Only Registration (May 8 th or May 9 th) ³⁾ | \$100 |
| Workshop Registration (May 7 th) | \$275 |
| Government Workshop Registration (May 8 th) | \$175 |
| Ticket for International Reception (May 8 th) | \$75 |

¹⁾ Does not include Workshop Registration Fee

²⁾ Includes Workshop Registration Fee

³⁾ Does not include International Reception Ticket

Payment of the **regular, student, or government conference registration** fee includes:

- Access to the 2018 Online Conference Digest
- Access to the 2018 Conference Papers through the CS MANTECH mobile app
- Admission to all technical sessions and the exhibits
- One International Reception (IR) ticket
- Access to the Exhibits Reception, the Exhibits Luncheon, the Panel Session, the Conference Luncheon, the Poster Session, the Conference Closing Reception, the buffet breakfasts, and refreshment breaks

NOTE: Printed 2018 digests were offered to attendees who requested a copy at the time of conference registration and if registration was completed by the early registration deadline (April 4th). Conference Papers will be available for download and viewing from our 2018 online digest site.

The **one-day conference registration** includes:

- Admission to all sessions, to the Exhibits Hall, buffet breakfast, and break refreshments for that day only
- Access to the 2018 Online Conference Digest
- Access to the 2018 Conference Papers through the CS MANTECH mobile app
- Included in the Tuesday-only registration is the Exhibits Lunch (**NOTE: Tuesday's one-day conference registration does not include admission to the International Reception**). Tickets for the International Reception can be purchased separately through the registration site or at the conference pending ticket availability.
- Included in the Thursday-only registration is the CS MANTECH Luncheon as well as the Poster Session and Conference Closing Reception

NOTE: The one-day registration option can be taken only once during the conference (no multiple one-day registrations).

Payment of the workshop registration includes one copy of the Workshop Digest, breakfast, Workshop Luncheon and break refreshments. Additional copies of the Workshop Notes may be purchased for \$100 pending availability.

Registrants may pay by credit card. The only acceptable credit cards are Master Card, VISA, and American Express. **REGISTRATION WITHOUT PAYMENT WILL NOT BE ACCEPTED.**

TRANSPORTATION INFORMATION

Transportation from **Austin Bergstrom International Airport** (approximately 11 miles):

Taxi:

Taxi transportation to and from Hyatt Regency Austin is approximately \$20 - \$27 for one passenger. Taxi transport to the Amtrak station is approximately \$5 (1.5 miles).

Local Transit:

Single ride is only \$1. Day pass is \$2. Get around town using Capital Metro's convenient app. Buy passes, plan trips, and get real-time arrival information on the go.

[//www.capmetro.org/app](http://www.capmetro.org/app)

Airport Flyer Bus Service:

Austin's Capitol Metro offers direct airport bus service via a dedicated route that travels between the airport and downtown, the Capitol and The University of Texas. \$1.50 one way.

Call: 512-474-1200 // Toll-free: 800-474-1201

Airport Super Shuttle:

Transfer from the airport to the hotel is \$14 per person. Reservations are not required for transport from the airport to the hotel, but advance pickup arrangements must be secured to travel from the hotel to the airport. Please call 512-258-3826 or contact the concierge to arrange a pickup.

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