

Preface

The 2025 Joint Cryogenic Engineering Conference (CEC) and International Cryogenic Materials Conference (ICMC) were held from May 18–22 at the Peppermill Resort Spa Casino in Reno, Nevada. As at past conferences, the international scope of these meetings was strongly maintained with 24 countries being represented by 539 attendees who gathered to enjoy the joint technical programs and industrial exhibits. In total, 183 papers were submitted for publication, and 181 of them are included in these conference proceedings.

The program for the joint conferences included a total of 416 presentations organized into 78 sessions - plenary, oral and posters, as well as awards presentations. Four plenary talks gave interesting in-depth updates and overviews on exciting topics related to cryogenics: John Davis (Zero Point Cryogenics Incorporated, University of Alberta) discussed developments in Sub-Kelvin Cryogen-Free dilution refrigerators. An insight into basic properties of unconventional superconductors and a heavy fermion superconductor with a possible new pairing mechanism was given by Laura Greene (National High Magnetic Field Laboratory, Florida State University). Parag Kshirsagar (RTX Technology Research Center) gave an overview of high-power electrification in Aerospace and Defense Applications enabled by cryocooled systems, and Brad Cage (Pulsar Helium Inc.) gave an overview of the developments ongoing at Pulsar Helium with their projects in Minnesota and Greenland.

Eight special sessions were included in the program emphasizing high-quality invited talks on different topics. Five of these sessions formed a series dedicated to the *Transportation* sector with topics ranging from views of *Government Agencies & Industry Partners*, *System Level* studies, *Materials*, *Motors and Generators*, to *High Power Components and Thermal Management*. In addition, special sessions were dedicated to *Materials for High Field Magnets*, *NASA's Cryogenic Fluids for Aerospace Propulsion Applications*, and *Liquid Hydrogen Testing for Aircraft*. In panel discussions in the latter two special sessions experts from several countries discussed developments and challenges of these technologies for the cryogenic community. Contributed presentations covered a wide range of topics including many aspects and advances in cryogenics and superconductors, along with their applications.

A program meeting held in Reno in January 2025 produced the initial draft of the conference schedule. In the four months leading to the conference, leadership teams from CEC, ICMC, and Centennial met weekly in a virtual format. Due to ongoing visa challenges, numerous adjustments were required right up to the start of the conference.

On May 18, 2025, Ignacio Aviles Santillana and Robert Walsh presented the ICMC short course *Cryogenic Mechanical Testing Methods with Displacement and Strain Measurement Techniques*, and Shreyas Balachandran presented *Mechanical Metallurgy for Non-Metallurgists*. Both courses were well attended, with a combined total of 58 scientists and students, and were very well received. Both courses were offered for the first time, and the participant response was very positive. Many regular attendees expressed appreciation for the innovative short-course topics. The attendees also made good use of the coffee breaks and the time at the end of each course for detailed and lively discussions, demonstrating a high level of engagement.

Also on May 18, the Cryogenic Society of America offered five short courses: *Cryocooler Fundamentals* (full-day) by Ray Radebaugh; *Cool Fuel – The Science and Engineering of Cryogenic Hydrogen* (half-day) by Jacob Leachman and Konstantin Matveev; *Helium Cryogenics* (half-day) by Steven Van Sciver; *Cryogenic Safety* (half-day) by John Weisend II; and *Practical Cryogenic Thermometry and Instrumentation* (half-day) by Scott Courts. These courses were also well attended and effectively supported participants at varying levels of experience.



Both the CEC and ICMC boards continue to place strong emphasis on student participation, education, and career development. This year's conference welcomed 74 student participants, 23 of whom received registration support. The strong student presence and excellent session attendance contributed to a very positive and rewarding experience for both presenters and attendees.

The CEC/ICMC Cryo Industrial Expo displayed the products and services of 42 industrial exhibitors and provided a congenial venue for a reception and refreshments throughout the week as well as for the conference poster sessions.

The social events were equally memorable and provided excellent opportunities for networking and relaxation after the technical sessions. The cornhole competition between the CEC and ICMC boards during the gala dinner was especially fun to watch and drew enthusiastic support from the audience. Later in the evening, many participants joined in the karaoke session, showcasing not only their scientific talents but also their musical flair.

The conference and its proceedings were made possible through the significant volunteer efforts of many individuals, including conference attendees, session and special session chairs, paper reviewers, and editors, all of whom contributed greatly to its success.

The 2025 Conference Chairs were Srinivas Vanapalli (University of Twente) for CEC and Sonja Schlachter (Karlsruhe Institute of Technology) for ICMC. The CEC Program Chair was Robert Duckworth (Oak Ridge National Laboratory), with Srinivas Vanapalli serving as Program Vice Chair. The ICMC Program Co-Chairs were Shreyas Balachandran (FAMU-FSU College of Engineering) and Ignacio Aviles Santillana (CERN). The Exhibit Chair was Austin Capers (Scientific Instruments, Inc.), supported by Parminder Banga (Bluefors). The Awards Chairs were Peter Kittel (Consultant) for CEC and Eric Hellstrom (National High Magnetic Field Laboratory, Florida State University) for ICMC. Additionally, Michael Sumption, ICMC Board President, and Peter Bradley, CEC Board President, contributed significantly to the conference planning and development as part of the leadership team.

The outstanding leadership of Paula Pair, Annett Cady, Carrie Lian, and the dedicated, enthusiastic, and efficient staff from Centennial Conferences ensured excellent conference management and operations. The conference organizers extend sincere appreciation to Centennial Conferences for delivering a truly memorable conference experience!

We very much look forward to the next CEC/ICMC in **Knoxville, Tennessee, June 13–17, 2027**. The 2027 conference will be held at the Knoxville Convention Center which is within walking distance of hotels, restaurants, and waterfront areas.

In addition to the diverse spectrum of research, development, and industrial cryogenic topics that shape the conference, we hope you will take advantage of the cultural offerings and outdoor attractions that Knoxville and East Tennessee provide. We warmly invite you to join us and look forward to welcoming you to Knoxville!

Srinivas Vanapalli
2025 CEC Conference Chair

Sonja Schlachter
2025 ICMC Conference Chair