

**Annual Report on Collaborations Between
Oak Ridge National Laboratory and Georgia Institute of Technology
November 1, 2014-October 31, 2015**

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Over the past year, Oak Ridge National Laboratory and the Georgia Institute of Technology collaborations continued to reach new levels with ever increasing breadth and depth. At the institutional level, Bob McGrath, Director of the Georgia Tech Research Institute (GTRI), served as a member of the UT-Battelle Board of Governors and on ORNL's newly established Science Advisory Board. In mid-summer, Tim Lieuwen, Director of GT's Strategic Energy Institute, took over these roles for Bob following his retirement from the university. Marilyn Brown (School of Public Policy) continued to serve as the Georgia Tech representative on the ORNL Core University Liaison Committee. David Bucknall (Materials Science and Engineering) played a supporting role as a contact with Georgia Tech's College of Engineering.

Interactions between GT and ORNL have been strong for more than a decade. Over the last two years, five GT faculty members have held joint faculty appointments with ORNL:

- Matt Wolf (GT- Computer Science) and Massimo Malagoli (GT- Chemistry and Biochemistry) hold joint appointment with ORNL's Computing and Computational Science Division.
- Samuel Graham (GT-Mechanical Engineering) holds a joint appointment with ORNL's Energy and Transportation Sciences division.
- Nolan Hertel of (GT- Nuclear Engineering) held a joint appointment with ORNL's Nuclear and Radiological Engineering Division, and was the acting director of the center for Radiation Protection Knowledge
- Comas Haynes of (GT- Fuel cells and battery technologies) holds a joint appointment with ORNL's Materials Science and Technology Division.

In addition, Georgia Tech hosts two ORNL joint appointments from ORNL:

- Costas Tsouris of ORNL's Energy and Transportation Sciences Division, and
- Jeff Vetter of ORNL's Computing and Computational Sciences Division.

As a result of the strong ties between faculties and researchers from both institutions, Georgia Tech students participate in collaborative research at multiple levels. For example, the "GO" Program currently involve four university faculty members and four students, with each student being paired to an ORNL mentor/TPO. For example, Adewale Odukumaiya (GT-ME), who worked in the ORNL Building Technology Program as a GEM fellow (Graduate Degrees for Minorities in Engineering) with Roderick Jackson (ORNL), has transitioned into the GO! Program, where he is conducting research at ORNL on building/HVAC energy simulations and the development of a novel, hybrid micro-hydro/compressed-air energy storage technology in on-going collaboration with ORNL. An other example is Anne Mallow, a fourth year PhD

student in Mechanical Engineering at the Georgia Institute of Technology is a GO! Student at ORNL. She is working on the design and testing of phase change heat exchangers with Dr. Samuel Graham of Georgia Tech and Dr. Omar Abdelaziz of ORNL.

Over the last year, other partnership arrangements have allowed numerous GT undergraduate and graduate students to visit and work at ORNL, along with multiple postdoc fellows. For example, PhD student from Nolan Hertel's group is funded through the safeguards and security program to stay up to 50 days at ORNL over the next three years for his Ph.D research. An M.S. student is funded by the ORNL Environmental Science Division and will complete her M.S. thesis on the project.

With help from Ian Anderson of ORNL and Shannon Yee of GT, the GT Energy Club visited ORNL in Spring 2015. In the Fall 2015 semester, eight GT graduate fellows in with research interests in energy fields toured multiple ORNL facilities including SNS. These eight PhD students are all participants in the Georgia Tech Integrative Graduate Education and Training (IGERT) Program on Nanostructured Materials for Energy Storage and Conversion. In 2014, the Deputy Director of Science at ORNL – Ramamoorthy Ramesh – gave a keynote presentation at the request of the Georgia Tech Energy Club. David Rosen (GT-ME) and Chad Duty (ORNL) hosted a GT student at ORNL for the summer.

GT research for the Bioenergy Sciences Center (BESC) focuses on developing switchgrass and populous varieties that are more fermentable for biofuel production where novel enzymes for biomass deconstruction is studied and analytical techniques for biomass research is improved. Art Regauskas became a Regents' Professor at UT-ORNL in 2014, after years of work with BESC at Georgia Tech.

While at ORNL, Nazanin Bassiri Gharb studied new ways of exploring phase transitions in ferroelectric materials. She also explored novel approaches to study the dynamics of ferroelectric materials at nano-, micro- and meso-scale, attempting to separate the domain wall and intrinsic polarization dynamics. Dr. Bassiri-Gharb also probed a new method to process ferroelectrics: an ORNL pulse thermal processing technique that can heat a material up to 600,000 degrees Celsius in a second.

The University Liaison Committee convened in Spring 2015 at ORNL (see photo below) and in Fall 2015 at Vanderbilt University to discuss forthcoming activities and further coordination opportunities. The focus of the meeting at Vanderbilt was on grand challenges being pursued at ORNL and its core universities. The possibility of holding one or more workshops in early 2016 was discussed to pursue common interests to support the ORNL LDRD program.

At the Vanderbilt meeting, ORNL and Duke committed resources to support the ORAU "Challenge Program," focusing on two energy challenges: fusion energy and the smart grid. Led by Craig Layman (ORAU), ORAU resources will be used to select 4-6 undergraduate winners from universities across the U.S. to participate in the Challenge Program. These students will spend 10 weeks at ORNL during the summer of 2016. Martin Mourigal (GT-Physics) will be supported to spend 1-2 weeks at ORNL during this period to provide lectures and research oversight.



ORNL University Liaison Committee (from left): Ian Anderson (ORNL), Ray Fornes (NCSU), Marilyn Brown (Georgia Tech), Chris Erlen (Duke University), Jeff Fox (University of Virginia), Arlene Garrison (ORAU), Ross Ellington (FSU), Greg Walker (Vanderbilt University), and Terry Herdman (Virginia Tech)

In conclusion, the relationship between ORNL and GT has proven to be very beneficial for Georgia Tech. It has provided opportunity for discovery through expanded interactions with world-class scientists. Capacity building through exchange of faculty and students in education and research has grown. There has been an expansion of R&D resources and access to new programs, especially DOE based. Access to unique, world-class research equipment and cyber-infrastructure-assisted collaboration has also been made possible. There are expanded resources for dissertation research by GT PhD students at ORNL. GT has been able to hire joint faculty at ORNL. Additional jobs for GT graduates at ORNL as post docs and full-time employees are available. Finally, the national and international prestige of GT energy research is more visible as a result of these collaborations.