



IHCC

Solving problems that exist at, and along, the interdependencies between humans, community, and infrastructure to ultimately improve quality of life.

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If you have any questions, comments, or concerns, please contact us:

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For more information about IHCC, [visit our website](#)

CLUSTER HIRE SPOTLIGHT



Joseph Meadows

Assistant Professor

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How do you see your work contributing to the goals and vision of IHCC?

A lot of my work goes into improving efficiency, such as in power generation industry where a more efficient engine would ultimately reduce the need for fossil fuels. Some of that work can be classified as working with different types of fuels, including working with renewable fuel sources. There are a lot of opportunities to develop combustion technologies to work with renewable fuel sources, which would fall under that umbrella.

I have also been working on a new technology called rotating detonation engines (RDE), of which there are currently zero in production, but it has the potential to be the single largest increase in thermal efficiency for gas turbine engines for one technology. RDEs increase the pressure leaving the combustion device as opposed to traditional combustion engines, which experiences a decrease in pressure from the combustion device. As such, there is more available energy in the flow, which can be converted to electrical energy or increased thrust for propulsion applications. Lately I have been working on the development RDE in hopes of one day advancing the technology to market in order to increase efficiency and reduce fuel consumption.

What other areas outside of your discipline would you consider for future research and proposal work?

The days of an issue being confined to a single discipline are primarily behind us, so for most any problem today you need to take an interdisciplinary approach, so I am very open-minded to explore any opportunities that could use my expertise in ways that I have not used it before. My background is in fluid thermal sciences, and since the onset of the COVID-19 pandemic, I have developed a flow sensor to measure the flow coming in and out of patients so they can use BiPAP devices as a ventilator in case hospitals become overwhelmed. This sensor is based on fundamental science of fluid mechanics, but I have been working with doctors from the Carilion Clinic to use the device in medical applications.

Combustion
Diagnostics

Pressure Gain
Combustion

Thermoacoustic
Instability

Jet Noise

SCRAM Jet
Combustion

CLUSTER HIRE SPOTLIGHT



Enric Ruiz Geli

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How do you see your work contributing to the goals and vision of IIHCC?

My work involves designing infrastructure to combat global issues with a wholistic approach, as these issues require interdisciplinary solutions which can only be found if we operate together in a collaborative way as a cohesive unit. This is the only way to produce new infrastructure that functions in a way that addressing these transdisciplinary issues becomes foundational to how that infrastructure is designed. The solutions to global hunger and mobility as well as the way that we as humans interact with nature must be built into this new infrastructure in a way that is human centered.

Ideally, our humanity would evolve into what I like to call the civilization of empathy and then architecture would merge with natural science so that the two become integral to one another. IIHCC is the perfect opportunity and environment to produce these new designs and scenarios for pilot projects aiming for global solutions to the problems people are facing every day.

What other areas outside of your discipline would you consider for future research and proposal work?

In 2002 I met a physicist from MIT named Neil Gershenfeld who was talking about bytes of information and atoms of materials in a way that interprets architecture as molecular architecture. This interaction inspires me to want to work with physicists and motivate others within or studying architecture to work with physicists. This is because physicists do not look at a tree, for example, as a geometrical figure or a shape, but they see a tree as photosynthesis. They see the performance of the water, the sunlight, the particles, of the tree itself as defining that tree. I hope architecture can begin to adapt to this landscape of thought and design, where architecture begins to focus on the performance of materials and of the architecture itself, which would then allow architecture to more easily merge with nature and natural science.

Additionally, I am very interested in Virginia Tech's milestone of hoping to eventually turn 50% of courses into experiential learning. I think that the learning curve to students exploring experiential learning is profound in terms of how people begin to approach problems. IIHCC has served as a space for pioneers in this kind of undertaking, but to expand that to the entire university is another thing that I am exploring through the Living Labs format at the Campus.

Global Impacts

Living Labs

Experiential Learning

Infrastructural Natural Science

Digital Fabrication

ENHANCING WORKFLOW IN HEALTHCARE SPACE: ICAT AND STEELCASE TEAM UP FOR TRANSDISCIPLINARY SOLUTIONS



At the Carilion Clinic Center for Simulation, Research, and Patient Safety David Franusich, ICAT Special Projects Coordinator, uses projection mapping to mock-up a side table that doubles as a display screen.

Professors Aki Ishida and Vincent Haley of the School of Architecture + Design, computer scientist Dr. Denis Gracanin, a recent graduate of Creative Technologies program David Franusich, and students such as Carl Buck of Architecture and Reza Tasooji of computer science who quickly became essential to the project.

Steelcase's particular motivation for this project was surrounding the way information flows through medical workspaces. The project manager from ICAT, Dr. Martin, has a personal research interest in context aware objects and spaces, where the technology designed into the environment adapts the data flow so that the space better supports the situational awareness of the nurses and doctors working within that space. These are the factors that inspired the team's designs, which target the issues that the team found following observation of clinicians at Carillion Clinic and at the Intensive Care Unit at Carilion Roanoke Memorial Hospital.

In the summer of 2017, Steelcase, a company which began over a century ago as a furniture manufacturer that has now grown into innovators of workspace design, approached the Institute for Creativity, Arts, and Technology (ICAT) at Virginia Tech about setting a precedent for the future of work environments.

Steelcase approached ICAT because of ICAT's unique placement outside of all the colleges and departments within the university, which places them in a unique position to bring in experts from a plethora of different colleges and departments. For this project and many like it, ICAT has pulled together teams of faculty and students that represent the different viewpoints of fields of study that each project wants to have to approach the issue.

Under the leadership of Dr. Ben Knapp, the institute's director, and Dr. Tom Martin, the institute's deputy director, ICAT put together a team which included clinical subject matter experts from Carilion, applied human factors expert Dr. Sarah Parker and her PhD Student Vivian Zagarese,

According to Dr. Parker one of the primary interests of the whole team was acquiring frontline user feedback throughout the whole process. She says, "Our team started from what are the gaps in care and iteratively kept coming back to the primary beneficiaries, which in this case were nurses." This approach necessitated observation throughout the project, but especially in the phase of the project that Dr. Martin has called "problem setting" which involves understanding what the problem is before trying to solve it.

The challenges that the team observed were the potential for gaps in communication and shared understanding, with the complex and often time-critical information flows in the situations that patients and other clinicians were facing, which became the focal point of the proposed designs. The team then worked collaboratively, with no one discipline commanding design decisions, to propose designs that integrated technology with the substance of the spaces themselves as well as targeting workplace efficiency and high concentration.



Vivian Zagarese (PhD candidate in Psychology), Haley, and Ishida test prototype for a side table that doubles as a display surface.

Thus, the partnership between ICAT and Steelcase in this instance not only displays some of the countless benefits of transdisciplinary solutions to issues that inhibit the quality of human life, but also the benefits of bringing together a broad range of perspectives from across the university when searching for these solutions.

Environments such as ICAT, whose mission is to reach across the departmental or hierarchical boundaries of colleges and institutions, are invaluable because of their ability to provide the right blend of expertise and perspective to identify and then solve problems for partners.

The images of the project and designs speak for themselves surrounding the success of the interdisciplinary approach to the issue, as well as of this project group. An aspect that is not readily apparent, which Professor Aki Ishida accentuates especially, is the role of student collaborators within the project. She says, “This is a team in which students were not simply assisting professors. They became essential team members to the success of the project.” The students, in addition to providing tremendous additions to the project, were able to engage with it as an experiential learning opportunity to the benefit of all.



Intensive Care Unit floor at Carilion Roanoke Memorial Hospital. The team from Virginia Tech and Steelcase observed and interviewed clinicians at work.

ICAT/IIHCC VIRTUAL PLAYDATE WITH JULIANA DUARTE

This year, IIHCC will again partner with ICAT to host talks by our 2020/21 IIHCC grant awardees. The second of the three presentations is by Dr. Juliana Duarte and her team. Please join us in their talk on March 5 from 9:00 to 9:30 at this [link](#).

Experimental Investigation of Chloride-Induced Stress Corrosion Cracking

The development of a human-centered society must include a reliable source of energy capable of delivering clean energy in a sustainable and safe manner. Nuclear power is considered a zero-emission energy source that is crucial to meet the global demand to reduce greenhouse gas emissions. In the U.S., spent nuclear fuel has been stored at nuclear power plant sites in dry storage casks (DSCs). These sites are often located close to the marine environment, which increases the concentration of salts in the atmosphere leading to aggressive chemistry that could lead to a specific corrosion mechanism: chloride-induced stress corrosion cracking (CISCC). To contribute to the nuclear energy development in the area of waste management, we are investigating CISCC using accelerated laboratory experiments. The results will lead to a better understanding of the long-term usage of DSCs.

Team: **Juliana Pacheco Duarte** (Mechanical Engineering/College of Engineering)

Abdulsalam Shakhatreh (Mechanical Engineering/College of Engineering)

Prof. Rebecca Cai (Materials Science and Engineering/College of Engineering)

Prof. Sonja Schmid (Science, Technology, and Society/College of Liberal Arts and Human Sciences)



ISCE TO HOST NSF PRESENTATION

Join ISCE as they host a presentation by [Dr. Kellina Craig-Henderson](#), Deputy Assistant Director at the National Science Foundation, [Social, Behavioral and Economic Sciences](#) directorate, on Thursday, February 24th from 1:00-2:30 p.m. via Zoom.

Dr. Craig-Henderson will present “Opportunities & Priorities: Getting NSF Support for Your Research in the SBE Sciences.” She will include information about their newly refocused funding priorities and several new programs they have initiated this year.

Click [here](#) to register or [here](#) to view the event flier. Contact [Yancey Crawford](#) with any questions.

CALL FOR ISCE SCHOLARS

Our institute partner ISCE has launched a call for grants that provide faculty support for research in the social sciences, broadly defined, and consistent with ISCE’s four thematic areas. Six to eight awards of up to \$30,000 will be awarded for a period of one year, beginning in July 2021. The deadline is March 1, 2021. More information can be found on ISCE’s [website](#).