FLC

MIDWEST & SOUTHEAST REGIONAL MEETING

September 21 - 23, 2021

WELCOME TO THE 2021 FLC MIDWEST & SOUTHEAST JOINT REGIONAL MEETING

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SCHEDULE AT A GLANCE

TUESDAY, SEPTEMBER 21 ALL TIMES EDT

TIME	ACTIVITY	INFO
11:30 – 11:40 a.m.	**Welcome**	Welcome, Regional Update and introduction
11:40 a.m. – Noon	**Networking and Information Technology Research and Development (NITRD) Artificial Intelligence R&D Interagency Working Group**	Overview of the National Artificial Intelligence policy and approach: The AI R&D Interagency Working Group will provide an overview of the National effort
Noon – 12:50 p.m.	**Legal Frameworks and Policies**	Partnerships, data, and ethics – how federal labs are positioned to accelerate and enable the National Artificial Intelligence Initiative
1 – 1:20 p.m.	**Standards for AI**	In its role as federal AI standards coordinator, NIST works across the government and with industry stakeholders to identify critical standards development activities, strategies, and gaps.
1:50 – 2:35 p.m.	**Department of Defense Panel**	Part I: Navy AI Overview Part II: Successful partnership through a CRADA
2:45 – 3:30 p.m.	**Agriculture and Environmental Panel**	Automated technologies for harvesting and quality evaluation of fruits and vegetables

WEDNESDAY, SEPTEMBER 22 ALL TIMES EDT

TIME	ACTIVITY	INFO
11:30 – 11:40 a.m.	**Welcome Day 2**	Welcome and Regional Update
11:40 a.m. – Noon	**Technology Transfer Overview**	What is technology transfer and what can the FLC do for you
12:10 – 12:55 p.m.	**Resources Session**	Part I: Venture Capital Resource Part II: SBIR/STTR overview Part III: Emerging Technology Institute, Red Springs, NC
1:30 – 2:10 p.m.	**Energy Panel**	Part I: Applying machine learning to rapidly develop a digital twin Part II: CAN-D: Machine learning for rapid characterization of automotive controller area network (CAN) bus traffic
2:20 – 3:25 p.m.	**Tools and Techniques for Creating and Maintaining AI**	Part I: Tools and techniques for creating and maintaining AI Part II: Identification of routing hijacks Part III: Ethical and trustworthy AI/machine learning for health

THURSDAY, SEPTEMBER 23 ALL TIMES EDT

TIME	ACTIVITY	INFO
11:30 a.m. – 12:15 p.m.	**Welcome and FERMILAB Panel**	Part I: Tailoring AI to the problem: Tools and opportunities Part II: Synthesizing data and making decisions at the edge: Opportunities to embed AI in the field
12:25 – 1:05 p.m.	**Aerospace Panel: Thinking Autonomous Systems**	Part I: NASA Stennis Space Center Part II: NASA Glenn Research Center
1:15 – 2:45 p.m.	**Bio Medical Panel**	Neuroimaging and Data Science
2:55 – 3:30 p.m.	**Midwest and Southeast Region Awards Ceremony and Closing Remarks**	Celebrate the region's best in technology transfer

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Transforming Ideas into Opportunities

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Argonne scientists employ machine learning to accelerate industrial design optimization process

Argonne National Laboratory

Through machine learning, ML-GA technology from the U.S. Department of Energy's (DOE) Argonne National Laboratory can speed up the product development process, cutting months off the time it takes for products to reach consumers.

In manufacturing, the traditional approach to design optimization of a new product involves a lot of experimental testing, evaluating prototypes, and multiple design iterations. One popular optimization method involves genetic algorithms (GA), which use principles of natural selection to identify the design elements that will lead to the best results.

As the volume and complexity of data increase, industry increasingly relies on high-fidelity computer models as virtual representations of real-world devices during the optimization process. This strategy is faster than physical development and testing, but it still can require two to three months to arrive at an optimal design.

Argonne's innovation uses machine learning (ML) models as surrogates for the slower high-fidelity models to improve the GA design optimization process. It takes just days to optimize a design using Argonne's ML-GA method, rather than the months needed using current state-of-the-art methods. Faster optimization, in turn, leads to faster technology development and faster delivery of advanced technologies to consumers.

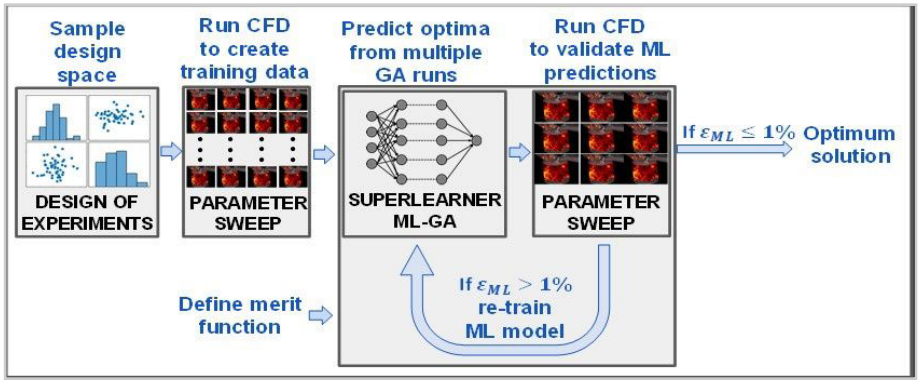
The ML-GA technology was transferred in January 2021 to Parallel Works Inc., an innovative start-up company in Chicago. The technology transfer allowed Parallel Works to integrate ML-GA into its commercial platform as a new add-on package called Learner Works.

This integrated platform has already attracted early adopters and evaluators from a wide range of manufacturing industries, including automotive, consumer goods packaging, and hydrological engineering. In addition, Parallel Works is working with researchers at New York University to evaluate its use in the design of colloidal materials and predicting biophysical properties of proteins.

The technology transfer process, coordinated by Argonne's Science and Technology Partnerships and Outreach directorate, involved two complementary mechanisms.

The first mechanism involved the DOE's Technology Commercialization Fund (TCF) program. Argonne and Parallel Works submitted a joint TCF proposal, which was selected for a funding award in 2018. The TCF program required Parallel Works to enter into a multi-year cooperative research and development agreement (CRADA) with Argonne to formalize the partnership and streamline the technology transfer process.

The second mechanism was a technology license agreement, which provided Parallel Works with rights to commercialize Argonne's copyrighted ML-GA software technology.



Right: A schematic of Argonne National Laboratory's ML-GA optimization algorithm. (Image courtesy of Argonne National Laboratory and Parallel Works.)

Indiana pitch competition showcases NSWC Crane's regional role as well as its intellectual property

Naval Surface Warfare Center, Crane Division

Inspired by an innovative pandemic recovery initiative at the Naval Surface Warfare Center (NSWC), Crane Division, a group of regional partners has created an annual pitch competition for entrepreneurs that showcases the federal laboratory's intellectual property (IP) and its pivotal role in the southern Indiana regional innovation ecosystem.

To spur economic recovery during the pandemic, the Technology Transfer (T2) Office at NSWC Crane implemented a program in the spring of 2020 offering short-term, royalty-free licenses for any technology in the lab's IP portfolio. The T2 Office utilized its network of partners to disseminate information about the program, which the FLC recognized with a 2021 National Award for Technology Transfer Innovation and a COVID-19 Response Distinction.

Radius Indiana, a regional business catalyst that has a Partnership Intermediary Agreement (PIA) with NSWC Crane, spread the word about the licensing program but wanted to do more to encourage local entrepreneurs to engage with the lab. Radius Indiana pulled together a group of partners in southern Indiana to help foster and sponsor a pitch competition focused solely on entrepreneurs and businesses interested in working with Crane IP.

That effort became what is now called the Crane IP Defense Innovation Pitch Competition. The inaugural event was held in July 2020, and a second event took place in June 2021. The goal of the pitch competition was that businesses and entrepreneurs would use NSWC Crane technologies to support new jobs and economic growth, especially during the COVID-19 crisis.

Individuals and teams were invited to develop an innovative 20-minute proposal for one of the many technologies in NSWC Crane's IP portfolio. In 2020, the offering was for 10 unique technologies, but in 2021 contestants could choose any technology from the entire list of 300+ patents. Participants included entrepreneurs and businesses in the local area, the state of Indiana, other states, and even Japan.

In addition to Radius Indiana and NSWC Crane, the organizational partners for the inaugural event included the Indiana Small Business Development Center and Elevate Ventures, an entrepreneurial development nonprofit. For the 2021 event, they were joined by the Indiana Innovation Institute (IN3) and Dimension Mill, the largest coworking space in southern Indiana and a 501(c)(3) nonprofit center for entrepreneurship in Bloomington. Dimension Mill and NSWC Crane have now signed a PIA.

The top three finishers split $5,000 in cash prizes in 2020 and $6,000 in 2021. Teams are in ongoing communication with the T2 Office at NSWC Crane, with at least one team working with partnership intermediary TechLink currently to license two Crane patents in the artificial intelligence and machine learning areas.

For NSWC Crane, the impact of this pitch competition goes beyond monetary prizes or IP metrics. It has raised regional awareness of the resources NSWC Crane has to share with entrepreneurs and small businesses, and it has more firmly cemented the lab's strategic relationships within its region.

ARS scientists enlist detector dogs to combat the disease threatening $3.35 billion citrus industry

USDA, Agricultural Research Service, U.S. Horticultural Research Laboratory

Researchers in the U.S. Department of Agriculture's Agricultural Research Service (USDA-ARS) have discovered that the best way to protect citrus crops from a devastating disease is to let a dog follow its nose.

Citrus growers in Florida and California, where citrus is a $3.35 billion industry, would benefit significantly from rapid and reliable detection of the bacterium that causes citrus greening, known as Huanglongbing (HLB). Both states are experiencing severe epidemics of HLB, which stunts the growth of trees and fruit and ultimately leads to tree death.

The gold standard diagnostic test for CLas (short for *Candidatus* Liberibacter asiaticus), the bacterium that causes HLB, is polymerase chain reaction (PCR)—a technique used in many COVID-19 tests. However, because CLas is not always uniformly distributed throughout a citrus tree, small samples of leaves collected for PCR testing may not contain any CLas even if the sampled tree is infected. Thus, PCR misses up to 80% of infected trees due to insufficient sampling. Additionally, detecting infected trees by PCR can take months to years following infection—delays that allow the disease to spread. In every geographic location where PCR has been used as the primary method for CLas detection, efforts to halt progression of the citrus greening outbreak have failed.

To address this conundrum, researchers from USDA-ARS studied the techniques used to train dogs to detect drugs and explosives, then adapted those techniques for the detection of citrus greening and transferred them to industry partner F1K9. USDA-ARS researchers developed new methods to capture and present scents to the dogs during training, and F1K9 developed new methods to focus canine attention onto these scent sources.

Citrus greening detector dogs have demonstrated 99% accuracy. This is possible because detector dogs simultaneously sample the scent from the entire tree (a process that takes only about two seconds), rather than the small samples used for PCR. In tests, canine detection occurred between two weeks and a few months after infection—much earlier in the disease's progression than when relying on small samples and PCR.

Above: Canine Tina ready to work on residential properties in California. (T. Gottwald)

Since being commercialized by F1K9 in 2018, the citrus greening detector dogs have surveyed more than 31,500 citrus trees in California and Florida. In locations where dog-identified trees were removed, disease incidence the following year decreased by 95% or more.

Disease modeling shows that reliance on sampling and PCR detection results in exponential spread of the disease and rapid loss of orchards and profitability, whereas detector dogs are capable of continuously protecting citrus orchards against citrus greening over many years.

Although this technology was developed and transferred to aid the U.S. citrus industry, it has the capacity to be applied to other agricultural commodities. The research team has already demonstrated efficient canine detection of citrus canker, plum pox and viral watermelon vine decline, and is extending the technology to wine grapes as well.

ERDC wastewater treatment system slashes costs of removing 'forever chemicals' from environment

U.S. Army Engineer Research and Development Center, Environmental Laboratory

A portable wastewater treatment system developed by the U.S. Army Corps of Engineers (USACE) makes it 90 times less expensive to keep "forever chemicals" out of the environment, where they have become a serious health issue.

Per- and poly-fluoroalkyl substances (PFAS) are manmade compounds that are extremely resistant to environmental degradation. This property has made PFAS useful for creating products like Teflon, Scotchgard, and the foam used to control jet fuel fires at Department of Defense (DoD) bases. However, the same property also makes PFAS persistent environmental pollutants—sometimes called "forever chemicals"—that are being implicated in various health disorders.

Commercially available solutions to remove PFAS from wastewater rely on costly permanent site-built facilities, which are too expensive for small accumulations of 250 million gallons or less. To address this problem, researchers at the USACE Engineer Research and Development Center – Environmental Laboratory (ERDC-EL) invented the PFAS Effluent Treatment System (PETS) and the related PFAS Water Treatment Research Reactor (PWTRR) to remove PFAS from contaminated waters.

PETS is a stand-alone, trailer-mounted water treatment system specifically designed to treat PFAS. Providing its own power via a generator, PETS features an ion exchange system that separates the contaminants from water and a granular activated carbon media bed to collect the contaminants. Treated water is either discharged or reused, and residual waste is incinerated.

A second form of the same basic technology, PWTRR, is built inside a shipping container. PWTRR is designed to be left in one location to provide continuous treatment; however, it can be easily moved with a medium-sized forklift.

The National Defense Center for Energy & Environment provided funding to design and build the PETS system. Under a technology transition

Above: *The PETS System* ***Below:*** *The PFAS Water Treatment Research Reactor (PWTRR)*

agreement, the PETS and PWTRR have been successfully deployed at multiple DoD installations—including two located in Japan. These efforts required extensive collaboration and coordination, made even more difficult due to the global COVID-19 pandemic.

In these deployments, PETS dramatically reduced the volume of material requiring disposal by an 8,000-fold decrease. Calculations show that PETS or PWTRR can be 90 times less expensive (over a five-year period) than traditional cleanup efforts.

The technology has wide-ranging applications beyond its current implementation, which could include disaster response scenarios and water treatment for soldiers in the field. DoD partnership intermediary TechLink is actively soliciting and vetting commercial licensing prospects for the technology. Patent applications have been filed for both PETS and PWTRR.

Longtime USACE-USAF partnership uses rapid heating to revolutionize pavement repair technology

U.S. Army, Engineer Research and Development Center
U.S. Air Force, Air Force Civil Engineer Center

Potholes and other small but dangerous areas of pavement damage can now be repaired more quickly, more conveniently and more effectively—even at sub-freezing temperatures—using a technology developed by longtime collaborators within the U.S. Army Corps of Engineers (USACE) and the U.S. Air Force.

Induction Hot Mix Asphalt (iHMA) is the brainchild of scientists from the Geotechnical & Structures Laboratory (GSL) within the USACE's Engineer Research and Development Center (ERDC) and the Air Force Civil Engineer Center (AFCEC). This partnership dates back to the 1940s, when ERDC was tasked with building runways to support bomber aircraft during World War II.

Designed to protect multimillion-dollar Air Force planes and pilots from accidents caused by damaged runways and taxiways, iHMA can also help address the potholes that cost U.S. civilian drivers $3 billion each year in automobile repairs. It is now being marketed as "Hot Patch on Demand (HOTPOD)" to military and private entities around the world by industry partner necoTech.

Pavement repairs typically involve a two-step process. Non-durable cold mix asphalt is used first as a temporary fix, then factory-sourced hot mix asphalt (which is significantly more resilient but less easy to attain) is applied. In contrast, the iHMA system offers an easy, one-step process with the convenience of cold mix asphalt and the toughness of hot mix, saving both time and cost.

What sets iHMA apart is the use of induction—electromagnetic activation of metallic particles in the asphalt mix—to heat the asphalt, giving it the workability needed for durable repairs.

The iHMA product is produced in small batches and packaged in five-gallon containers, which are heated on demand at the repair site. Once the asphalt material is placed in an induction chamber, the iHMA system heats the mix above 300°F in less than five minutes—90% faster than traditional heating methods.

Above: *Thanks to iHMA's induction heating method, asphalt repairs can now be made in any weather condition—including freezing or even sub-freezing temperatures.*

Testing the iHMA concept in ERDC's F-15E load simulator was critically important. In previous tests, commercial cold patch materials failed after only one to two aircraft passes. The first test of iHMA, however, revealed that within two hours of repair, it could withstand 100 passes with minimal damage.

The team then demonstrated that iHMA could be used in cold temperatures, something that plagues all current repair techniques. On a January day in Vicksburg, Mississippi, iHMA achieved 320°F within five minutes despite the air temperature being a chilly 13°F. In the frigid regions of the Canadian north, iHMA reached the desired temperature in less than four minutes, shocking the local maintenance workers who operate only two months a year because of the harsh environment.

The team relied on connections with multiple organizations to build, test, and transfer iHMA, including DEFENSEWERX, ERDCWERX, Mississippi State University, AFWERX, and the Canadian military. This process resulted in a cooperative research and development agreement (CRADA) and nonexclusive commercial license with clean tech company necoTech, both in 2020. A patent was issued in March 2021.

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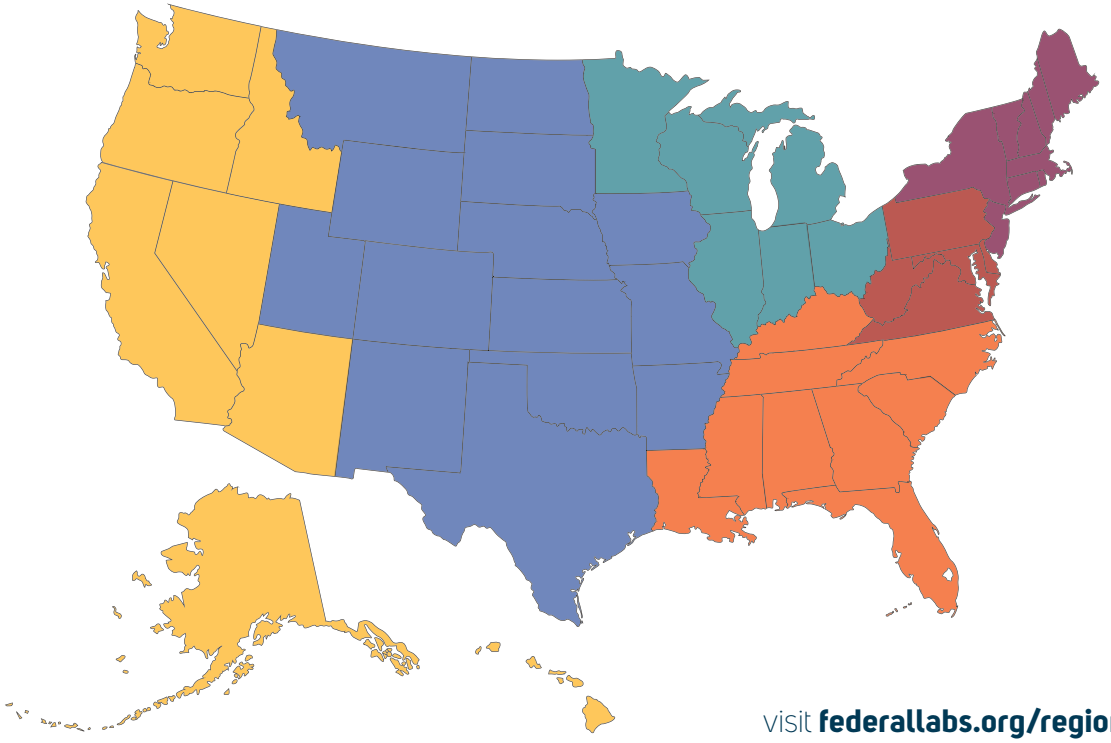

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