PAWR Project Office

September 2023

Welcome to the monthly PAWR update. Each month we deliver technical updates on: POWDER, COSMOS, AERPAW, ARA, and Colosseum.

ARA

Big congratulations to the ARA team on their launch event September 6-8 in Ames, Iowa. The event included speakers from across the government, industry, and academic communities. It also featured numerous demos, a training session, and a field visit to a local farm site that is part of the ARA footprint.

Among the demos was a presentation from Lie Tang, Professor & Faculty Scholar with the Plant Science Institute at Iowa State University. Dr. Tang showed how his team's PhenoBot robot could be piloted remotely using the 5G standalone network powered by Ericsson on the ARA platform. The PhenoBot is designed to travel through rows of corn stalks and take sensor measurements to provide data on crop type and health. While the robot could previously be driven with a remote control device nearby, the 5G network makes it possible for a user to control the robot at a distance through a web portal.

As the fourth and final platform in the PAWR program, ARA combines both commercial and programmable network systems. Alongside the Ericsson infrastructure, the platform uniquely combines several types of technologies in both the backhaul and radio access portions of the network from Aviat, Skylark Wireless, and NI. For backhaul connectivity, ARA uses Aviat radios operating in the 11 Gigahertz and 80 Gigahertz bands. The testbed also maintains fiber connections as backup. In the radio access network, the ARA team has partnered with Skylark Wireless in developing and deploying production-grade, many-antenna MIMO systems with research APIs for communications using TV White Space (TVWS) spectrum, and it has deployed software defined radios from NI using mid-band connectivity.

The ARA team will continue to release new capabilities and features for the

testbed in the coming months and years and is actively seeking researchers who are interested in pursuing their own experimentation and development activities on the platform. Interested parties should contact e2@arawireless.org.

POWDER

The POWDER team this month supported a long-distance C-band RF measurement study performed by the US Navy. The transmitter for the study was located at the POWDER "Behavioral rooftop" location (as a BYOD deployment), while the receiver was located "off site", approximately 37 km away. The POWDER team provided a horn antenna for the setup (see above) and designed a custom mount to facilitate the deployment of the transmitter.

COSMOS

The COSMOS team is supporting multiple new research projects under grant awards from the National Science Foundation. Teams from Duke University and the University of Central Florida received funding from NSF to pursue research experiments using COSMOS testbed resources. Tingiun Chen from Duke (above left) will experiment with programmable mmWave frontends, SDRs, edge servers, and an optical network connection to test configurable fronthaul

connectivity. The aim is to determine the feasibility of delivering software-based RAN functions from a near-edge compute site to reduce the cost of mmWave infrastructure deployments.

Murat Yuksel from the University of Central Florida (above right) will design experiments using machine learning algorithms to control mmWave beamforming in real time. Dr. Yuksel will use the mmWave phased array antenna module (PAAM) available through COSMOS to test algorithms that autonomously select the desired angle of arrival at an mmWave receiver.

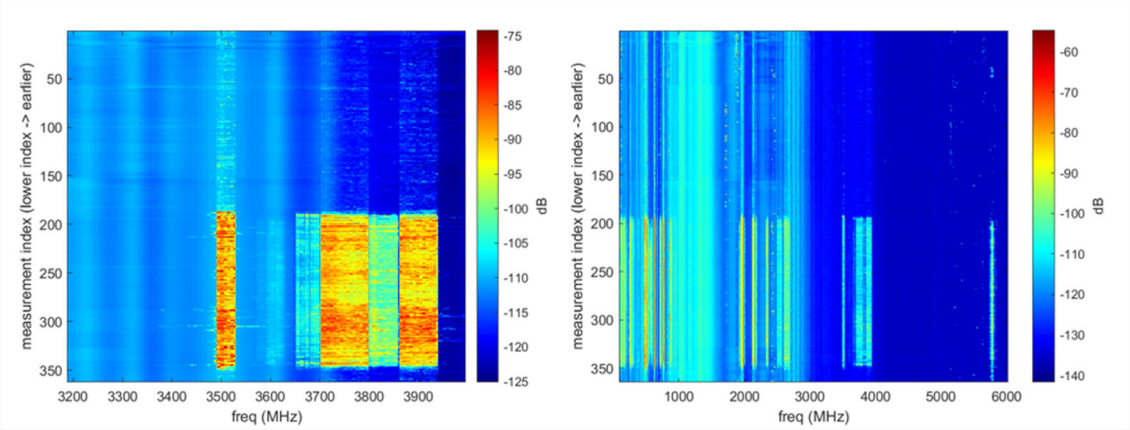
Separately, a team of professors from Northwestern and MIT won a grant connected to NSF's Spectrum Innovation Initiative (SII). The team will complement an existing project on spectrum sharing in an urban environment by examining a multi-tier contracting model for spectrum sharing across heterogenous networks through the use of Spectrum Access Agreements.

AERPAW

The AERPAW team recently participated in NC State’s Packapalooza festival, using a helikite, commercial drone, camera, and multiple radios to monitor the annual event. While the camera footage captured was for security purposes, the radios were deployed to monitor spectrum usage in sub-6 GHz bands. One of the radios did not include an RF frontend and was used to monitor the whole band from 100 MHz to 6 GHz. The other radio included the AERPAW 3.5 GHz frontend and was deployed to monitor usage between 3.2 GHz and 4 GHz.

Initial results from the two spectrum measurements are shown below. Measurement started when the helikite was on the ground and there were not many signals present. Signals start to appear after measurement index 200, and then disappear again around index 350 when the helikite is lowered.

The data collected will help the team understand the coverage of radio base stations as a function of altitude. The AERPAW team also plans to compare results from last year's event to this year’s event to understand how spectrum usage has changed over time. An early look shows that 5G activity is increasing in the 3.5 GHz band.



Colosseum

Since its relaunch at Northeastern University in October 2020, the Colosseum RF emulator has attracted 85 teams and well over 400 users. Software available through Colosseum includes open source software stacks for 4G and 5G, code for one of the original competition radios in DARPA's Spectrum Collaboration Challenge, and the new OpenRAN Gym, which is an open toolbox for data collection and experimentation with AI in O-RAN.

Platforms for Advanced Wireless Research NSF POWDER RENEW COSMOS AERPAW Aerial Experimentation and Research Platform for Advanced Wireless ARA COLOSSEUM