



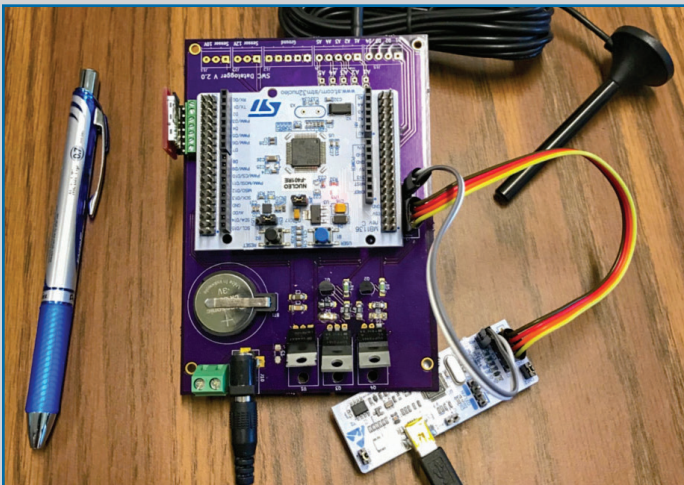
## Pushing The Boundaries With PRESENS

In 2017, the State Water Commission began work on a technology initiative to expand data collection capabilities, while saving time and money, and without requiring additional staff. The initiative resulted in the creation of a solar-powered remote sensing device called Pushing REmote SENSors (PRESENS). PRESENS was designed and tested by our existing staff of IT professionals, hydrologists, and technicians.

PRESENS delivers real-time environmental data from sensors located in remote locations to publicly accessible databases at the State Water Commission. “The goal was to create a data collection system that is rapidly deployable, rugged, and low-cost, with a small physical footprint” said Appropriation Division Director, Jon Patch. “We’ve been asked to do more with less. One way we can achieve that goal, is by putting the talents of our in-house expertise to full use.”

PRESENS has an easily programmable logic-board, a cellular network modem, SD card for backup data storage, and at least twelve analog or digital sensor inputs. PRESENS has the potential to see widespread use. Although originally designed to provide real-time water level and stream gage data, virtually any sensor can be connected: water level pressure transducers, soil moisture and temperature sensors, and atmospheric data. Eventually, the device will be capable of capturing still images and video.

Field testing of PRESENS took place over the 2017/2018 winter at the agency’s shop facility in Bismarck. Data collected demonstrated the hardiness of the components to withstand our harsh winter climate, and ongoing testing through the summer heat will test the opposite extreme to determine if any additional bugs need to be worked out.



A PRESENS unit (with case), is about the size of cell phone.

“Results from testing the PRESENS at the Water Commission shop have been promising, and the device has worked as designed” said Water Commission hydrologist, David Hisz. “The design of PRESENS allows us to make changes to the system as hardware changes over time. There will undoubtedly be issues to overcome after this year’s field tests, but this technology has the potential to greatly improve water management in North Dakota.”

There are more than 37,000 surface and ground water data collection sites that have been used to develop base water resource management information for North Dakota. From these sites, more than 9,000,000 water levels, and more than 80,000 water chemistry samples have been recorded. In 2017 alone, more than 4,600 sites were actively monitored, which included the collection of more than 900,000 water level observations and over 2,000 water quality samples.

Collecting this staggering amount of information allows Water Commission personnel to make well-informed decisions about water management, but it also has its challenges. Sending staff to manually collect data from the thousands of sites every year can prove to be a logistical challenge. Although the long hours spent collecting data are already of significant benefit to the state, there is always a need for more, better, and faster information, and PRESENS has the potential to offer just that.

Hydrologist and IT administrator Paul Moen, PRESENS hardware/software designer explains “The current version costs about \$300 per unit. I expect costs to drop as we refine the circuit board and build in components that are outside the main board. The design is modular, allowing individual components to be easily replaced if there’s a failure.” Moen adds, “The innovative part of our design, is that we control the whole stack, from the hardware and software on the device, to the

backend database. We’ve minimized power consumption by only sending data when the solar panel is charging. The device can be remotely programmed, and if the transmission to the agency database fails for whatever reason, the data remains on an SD storage card to be sent the next time it successfully connects.”

The data acquisition abilities of the PRESENS system is also being explored by other parts of the Water Commission. The Atmospheric Resource Board (ARB) hopes to utilize PRESENS to acquire additional weather and climate data from remote North Dakota locations. The data, which may include rain, snow, hail, wind direction and speed, and soil moisture and temperature, would complement ARB’s extensive volunteer precipitation observer network already numbering 500 locations statewide. “We hope to provide additional valuable data to the public through the use of this efficient, low-cost technology,” said Darin Langerud, Director of ARB. “The data will be useful to a wide variety of agencies, businesses and industries, helping people make more-informed decisions.”

If the PRESENS system works well, it is expected that many will be deployed over the next few years, with the potential to see extensive use throughout North Dakota in the future.

“After working with a number of commercial solutions over the past several years, we have a clear understanding of what works and what does not work in the range of weather conditions that exist in North Dakota,” said Chris Bader, Water Commission Director of IT. “PRESENS was specifically designed to leverage our expertise and experience to address the challenges that we face here in North Dakota, such as extreme weather conditions, deployment costs, a range of sensors, and the integration with current agency management systems. The development of PRESENS will provide the agency with the ability and utility necessary to meet the challenges that will be required for the growing data collection efforts that will drive effective management of North Dakota’s water resources in the future.”



Paul Moen examining a PRESENS circuit board.