

## LONG RANGE WIRELESS SENSOR NETWORK

LA-UR-19-26826

July 22, 2019

### BENEFITS

- Supports long range data transmittal, up to 40km between nodes
- Proprietary (non-point to point), self-forming, self-healing, multi-hop, mesh wireless network protocol design
- No data service fees within the system's radio network
- Designed for remote, low resource locations where power and communications infrastructure are scarce
- Enables remote operation utilizing Li-Ion battery or solar power
- Supports either 414Mhz or 900Mhz radio frequency bands
- Compatible with, and complementary to LoRaWAN and LPWAN "point to point" networks
- Cost efficient, low power design using COTS hardware components
- Easy setup and configuration



### POTENTIAL AREAS FOR PARTNERSHIP

Los Alamos National Laboratory (LANL) has invented the "Long Range Wireless Sensor Network" (LRWSN), a wireless mesh sensor network architecture that captures, collects and relays disparate field data from remote off-grid locations. LRWSN is rugged, easy to install and operate, cost efficient to scale, wireless, and uses little power --- enabling a broad variety of sensors to be located **anywhere in the field**. LRWSN can be optimized for constantly monitoring data such as: climate and ground variables, fragile ecosystems, critical boundary perimeters, and remote watershed and storm water monitoring sites.

LANL is seeking qualified commercialization partner, for LRWSN to potentially license the technology for an applicable market. The ideal partner should be able to provide engineering prototype design and testing, and outline a viable "Go-To-Market" sales and distribution plan. Areas of application include:

- Environmental, Climate and Disaster Monitoring & Management
- AgTech, Farmtech and Wildlife Management Solutions & Services
- Oil, Gas, Mineral, and Forest Lands Monitoring & Management
- Professional Property & Boundary Management
- Facilities & Infrastructure Management
- Internet of Things (IoT) & Smart City Solutions and Services

### SUMMARY

Often a data monitoring system is needed in rugged, harsh, unpredictable terrain across large swaths of territory. The required solution must be reliable and yet operators of the system are rarely able to visit the remote field site to retrieve data or perform routine maintenance.

This DOE R&D 100 award winning technology is enabled by an agile self-configuring, self-healing mesh network design that supports a variety of sensor nodes, distributed across miles of rugged terrain with minimal field support required. LRWSN is a more robust alternative to other less reliable, point-to-point wireless data networks.





## WHAT IS UNIQUE ABOUT LRWSN TECHNOLOGY?

LRWSN is able to transmit field data through an agile mesh network efficiently, node to node and across more square miles than any comparable sensor network design. The technology has been validated under numerous field conditions for extended periods of time.

This wireless mesh sensor network architecture can reliably and inexpensively capture, collect and relay disparate field data from remote off-grid locations. The design is comprised of field-deployable, temperature-resistant hardware sensor nodes that create a self-forming, self-healing wireless mesh network, which communicates and relays data via radio frequency among its nodes.

Each node includes embedded scientific processing, authentication and optional satellite or cellular transmission capability, enabling *actionable information* to be transmitted anytime, anywhere. The nodes wirelessly communicate through RF radios, with each sensor node having the option to integrate into an on-board cellular or satellite modem that allows operators to retrieve key data sets.



## WHAT'S BEHIND OUR TECHNOLOGY

This award winning innovation leverages 40+ years of Los Alamos National Laboratory technical expertise in designing ruggedized hardware for space. The LRWSN hardware has been field-tested more than seven years and is flexible enough to accommodate a variety of commercial off the shelf (COTS) sensor types based on field use cases. The adaptive wireless mesh networking protocol enables efficient and robust message passing in challenging, sometimes rugged terrain and complex environments. A list of the intellectual property and technical publications associated with this technology are listed in Appendix A.



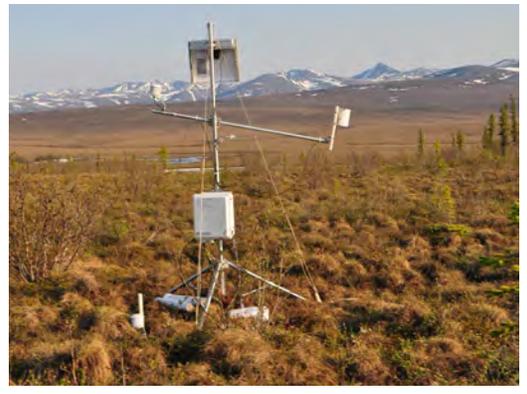
## OUR COMPETITIVE ADVANTAGES

- Low cost hardware with a Bill of Materials (BOM) less than \$600 per unit in component costs
- Long range node to node communications of up to 39.8 Km at 414Mhz
- Low power functional operation at 30 mA/12 V/ 360 mW
- Enables creation of a self-forming, self-healing, multi-hop mesh network
- No cellular or satellite service fees necessary within the on-the-ground equipment array network
- Delivers high Quality of Service (QoS) and system-wide State of Health (SOH) verification back to home
- Preserves integrity of operations and data fidelity even in locations w/o power or communications



## OUR TECHNOLOGY STATUS

Currently, an array of LRWSN equipment has been operating for nearly three years, enabling a regional storm water monitoring system, across 150 meshed sensor nodes covering some 39+ square miles of complex high altitude geography in northern New Mexico. This achievement is a milestone toward offering an elegant, affordable, and easy to use remote sensing solution that is ready for commercialization.



## PREFERRED PARTNER ATTRIBUTES

- Interest in a commercial license for patents and copyrights for LRWSN within a limited field of use
- OEM USA-based manufacturing, or substantial operational presence in USA with a capacity to build, certify, produce, assemble and deliver to market within 6-18 months from license execution
- Technology commercialization strategy (e.g., in-house manufacturing, direct sales, channel partners, sublicensing, etc.)
  - Including business and marketing plan for commercial sales and channel distribution
- Personnel and financial resources dedicated to this commercialization project
- Current or planned entry into key markets or customer sectors to generate sales revenues beyond DOE and U.S. Government
- Instrumentation, technical design, testing and both FCC and UL certification expertise relevant to EMF, RF and commercial/industrial electronic device compliance
- One or more senior U.S. based executives with whom LANL personnel may interact
- Ability and willingness to ensure compliance with U.S. Export Control law is a requirement



## INTERESTED? HERE ARE YOUR NEXT STEPS ---

Please submit an email letter of interest outlining how your organization envisions utilizing and deploying this innovative technology. Please include background about your organization, relevant information of your ability to commercialize innovative technologies and your access to working capital.

Please respond with “**LRWSN – Commercial Interest – Company Name**” in the subject line, to: **Christopher J. Meyers** at [chris.meyers@lanl.gov](mailto:chris.meyers@lanl.gov) on or before **COB, Monday, September 30, 2019**.

We will acknowledge receipt of each respondent and advise next steps once this commercial call is officially closed. Depending on the responses received additional requirements may be requested including: a commercialization plan, attending a web-based commercialization workshop, or an on-site technical briefing.

## APPENDIX A: PUBLICATIONS AND IP

### **Patents and Copyrights:**

U.S. Pat. No. 10,015,259: “Deployable Sensor System Using Mesh Networking and Satellite Communications, issued July 3, 2018 (S133265)

U.S. Pat. No. 10,291,711 “Real-time Predictive Sensor Network and Deployable Sensor” (S133568)

Stormwater ISCO Software, Copyrighted Software (C18061)

Stormwater PRTP Software, Copyrighted Software (C18055)

Stormwater GUI/database Software, Copyrighted Software (C18061)

### **Publications:**

Janette Frigo, Hudson Ayers, Shawn Hinzey, Sanna Sevanto, Mike Proicou, Xiougang Yang, Alex Saari, Vinod Kulathumani, “Novel WSN Hardware for Long Range Low Power Monitoring,” DCOSS, June, 2017. <https://ieeexplore.ieee.org/document/8271949>

Laboratory Equipment Magazine:

<https://www.laboratoryequipment.com/article/2019/01/los-alamos-long-range-radio-networks-monitor-earths-extremes>

R&D Magazine:

<https://www.rdmag.com/article/2019/01/new-wireless-sensor-network-monitors-earths-extremes-thousands-miles-away>

### **Videos:**

<https://www.youtube.com/watch?v=mtW-CvPkMu8&feature=youtu.be>