



SNOHOMISH COUNTY 5G FOOD RESILIENCY PROJECT SUMMARY

Prepared by: 5G Open Innovation Lab



PROJECT
CONTRACTOR



CONSTRUCTION
& OPERATIONS



RESEARCH



WASHINGTON STATE
UNIVERSITY

TECHNOLOGY
PARTNERS



INTRODUCTION TO 5G FOOD RESILIENCY PROJECT

PROJECT OVERVIEW



The Snohomish County 5G Food Resiliency Project was initiated to address the significant impact COVID-19 has had on the County's agriculture sector, affecting businesses, workers and consumers. Growers have been impacted by the lack of in person business practices due to health protocols and social distancing requirements. Labor restrictions, coupled with higher demand for food, has created a need for growers to increasingly turn to technology as a way of efficiently, and safely, producing food. The goal of this project was to establish an industry leading fifth generation (5G) communications and edge computing platform for testing of new applications, devices and services that are focused on yield improvement, labor efficiency and resource utilization. This platform is intended to facilitate academic research and industry collaboration enabling Snohomish County growers to become resilient against future disruptions. Today, growers lack access to operational data and the modern digital tools that helps them understand variables such as irrigation, chemical usage, pruning and labor management to name a few. This project (the 5G Field Labs), overtime, will bring important talent, experimentation, and proven technology capabilities to help growers in Snohomish County and throughout WA State.

TWO SITE LOCATIONS WERE SELECTED WHICH INCLUDE:



Andrews Hay LLC

located at 4304 SR 530 Arlington, WA 98223

<http://andrews-hay.com>



Swans Trail Farms

located at 7301 Rivershore Rd, Snohomish, WA 98290

<https://swanstrailfarms.com>

The technology being tested and experimented on at these locations will strengthening food resiliency for Snohomish County. A key outcome of this project is facilitated collaboration between Andrews Hay and Swans Trail Farms, companies from the 5G Open Innovation Lab, and its Partners to develop new capabilities. The Economic & Workforce Recovery Task Force approved this project for CARES funding on November 9th, 2020. All work was completed, and all project expenses incurred by December 29, 2020.



DELIVERABLES














This project oversaw the deployment of two 5G based wireless networks where dependable access to wireless and cloud computing services was limited. Each 5G Field Lab supports future academic research (via Washington State University), and industry collaboration (multiple industry partners) with an eye on advancing resiliency for Snohomish County's agricultural sector. We believe that previously limited access to telecommunications and cloud computing capabilities has hindered supply side innovation from the ecosystem (hardware and software vendors) and demand side interest from growers to embrace the use of data as critical to their efficient operations.

As a result of this project, the 5G Field Labs will make possible AgTech innovation (both hardware & software) experimented with, and guided by, grower perspectives. The 5G Open Innovation Lab intends to capture outcomes from these engagements and publicly share them where possible (without interfering with confidentiality rights). Doing so will create a constant drumbeat of documented storytelling originating from this effort and cultivated within Snohomish County. Access to data and applications is the cornerstone for modern businesses regardless of industry. By way of this project, Snohomish County's agriculture industry has the capability to lead exploration into sustainable, profitable, and efficient farming production for generations to come.

PROJECT DESIGN & ACCOMPLISHMENTS

The project objective was to build two 5G networks in agricultural locations to give Ag-tech Startups and academic researchers a network to build, test and deploy new technology capabilities. Two 5G capable Citizen's Broadband Radio Service (CBRS) networks and one Mobile Equipment Shelter (MES) for edge computing were constructed. Both farms have fully contained 5G capable CBRS networks with a dedicated evolve packet core (EPC) onsite. Each site is provided reliable backhaul access through T-Mobile's network. Over time & with available funding, we intend to physically connect each site to landline fiber optic networks.

The following summaries Partner and Startup products used in the development of the Field Lab's and MES:

Network Elements & Services	Solutions Provider		Details
RAN	 NOKIA	 intel.	Nokia CBRS RAN with support from Intel's FlexRAN initiative. Announcing mmWave RAN provider in Q2 2021.
Core	 Microsoft	 expeto	MetaSwitch (Microsoft) is the EPC for Andrew's Hay Expeto is the EPC for Swan Trails Farm
Backhaul	 T Mobile		Access to T-Mobile licensed spectrum and networks via CPE for backhaul and future mmWave deployments
OSS/BSS	 amdocs		Managed through Amdocs with focus on deploying orchestration and billing capabilities as well
Virtualization	 vmware		Full virtualization and Kubernetes orchestration
Server & networking infrastructure	 DELL Technologies	 intel.	Dell confirmed as server, networking, and storage infrastructure platform along with Intel's SmartEdge platform.
Network and application security	 f5		Full networking and application security platform
Network A&E	 Ballast NETWORKS		Responsible for all civil construction planning and delivery
Network EF&I and C&E	 expeto		Responsible for all networking planning, design, and deployment
Initial application	 innov8.ag SUPPORTING GROWERS WITH DATA		Innov8.Ag is deploying IoT devices on site, aggregating data, and providing production insights to growers



PROJECT DESIGN & ACCOMPLISHMENTS

During the first half of 2021 we expect that [3GPP \(a telecommunication industry standards committee\) will ratify 5G support using CBRS spectrum](#). When completed our existing networks will be software upgraded to the new the new standard fully supporting standalone 5G networks operations. [CBRS is a mid-band spectrum tier](#) operated on by Federal agencies including the US Navy. Technically , CBRS accounts for 150 MHz wide broadcast band of the 3.5 GHz band (3550 MHz to 3700 MHz) and is unique to the United States. In 2012 the FCC initiated a study looking into public use of the spectrum across three tiers including Incumbent Access, Priority Access, and General Access. For the purposes of this project both sites are utilizing Priority Access Licenses (PAL) CBRS spectrum.

Unique to this project is the support 5G OI Lab Partners, and companies (Startups) have contributed. Every Partner has supported the project through deployment of their products (Intel, Microsoft, Dell, VMware, Amdocs, and F5 Networks) or access to their spectrum and network engineering resources (T-Mobile). The use of Expeto's platform (a 5G OI Lab Alumni) demonstrates the goal we've had in creating a Field Lab that's built on platform capabilities from both our Partners and Startups. Their involvement truly distinguished this project from other testbeds (aka Field Labs). Beyond the use of their technology and networks each Partner has offered access to highly skilled engineers and architects to support the design, build, and testing of both Field Labs and the MES. The result is an industrial grade 5G CBRS networks connected into a cloud scale edge computing platform (MES) that will address the experimentation demands of today and well into the future.

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The 5G Field Labs & MES are remotely managed going forward with no staff on site. Of the two locations, we have selected Andrews Hay to deploy SA 5G mmWave connectivity leveraging available licensed spectrum through T-Mobile. In Q2 we are planning to deploy mmWave O-RAN compliant RAN (RU, DU, CU) as well. The 5G OI Lab and Expeto are responsible on an ongoing network monitoring, maintenance, initial triage, and escalation management. Future 5G OI Lab companies will be provided access to the networks remotely and onsite via pre-authorized agreement from Andrews Hay and Swans Trail Farms.

CONSIDERING FUTURE WORKFORCE REQUIREMENTS

Through this initiative, and by surveying the Agricultural industry broadly, we uncovered several agricultural jobs in motion today that include:

Agricultural Operations Manager – greenhouse, feedlot, grain, plant manager and similar positions

Agronomist – specialist on crop growth

Drone Operator – operates drones for monitoring crop conditions

Precision Agriculture Technologists – support growers through technical systems such as irrigation and GPS

Hydrologists – study the efficient use of water systems

Food Scientists – applied science to improve food production and innovate new food products

Our partnership with Washington State University (WSU), will accelerate important research into food resiliency and new technological and process advancements. We also expect to validate which emerging jobs will be in demand and work with WSU, Snohomish County, and the State of Washington to evangelize for job training programs to fund future workforce training needs. As mentioned earlier in this report the Agricultural industry will increase its dependency on technology and access to operational data. In doing so, we believe the job landscape will evolve overtime as will skills development and training.

INITIAL USE CASE TRIALS



The foundation of the field lab is a dynamic testing platform with dedicated access to a 5G-capable, CBRS LTE private networks. The two sites operating in Snohomish County are: Swans Trail Farms, a retail farm and event venue featuring apple orchards and strawberry fields; and Albert's Hay, Inc., a commercial grower and supplier of premium feed for horses, cattle, livestock and seed crops. Each site will connect to an edge computing environment allowing developers to tap into cloud computing capabilities essential for latency-sensitive and compute-intensive applications. IoT applications include soil sensors measuring temperature, volumetric water content, oxygen levels and photosynthetic radiation, as well as supply chain and logistics tracking of food from farm-to-table to ensure safety and security.

Faculty from Washington State University's Mount Vernon Northwest Washington Research and Extension Center will be collecting and analyzing real-time in-field weather and soil attributes from the sites with remotely sensed crop physiological data products to guide informed irrigation management and precision chemical application decisions with the goal of improving produce quality and yield. Additionally, WSU's Center for Precision and Automated Agricultural Systems has been a valuable partner assisting the 5G OI Lab in the development of its strategy for the deployment of 5G technologies in the agriculture industry.

INITIAL USE CASE TRIALS

C O N T I N U E D



As an unfortunate outcome of COVID-19, farms focused on both agritourism and commercial farming had their business models disrupted by weak consumer engagement and interruptions in farming supply chain statewide. This required a greater degree of innovation and efficiency in farms of all sizes, to absorb the fiscal impact of COVID-19 and help keep farms profitable through this disruptive period.

The 5G Food Resiliency Program provides technology access to solve several use cases tied to efficient farming practices, reducing the overall cost, and on improving yields and revenues. In addition, retail specific technologies as part of this initiative will help to boost agritourism specific use cases thereby providing best practices and supporting technologies.

A 5G OI Lab company, [Innov8.Ag](#), is working closely with [WSU Mt Vernon's](#) team to enable research as follows:

Phase 0 – December 2020

- Objective: Site survey & farmer interviews at both farm sites to specify optimal sensors [complete]

Phase I – January 2021

- Objective: Install foundational weather, soil, & irrigation sensors at both farm sites

USE CASE

SENSORS/DATA SOURCES

Irrigation management

Water pressure sensors, soil moisture/temp probes, air temp, wind speed, solar radiation

Mildew
Disease risk
Spray timing
Freeze determination
Plant germination

Soil moisture/temp, nano climate temp/humidity/leaf wetness > Growing Degree Days

Pest risk

Temp/humidity > Growing Degree Days

Phase II – Summer 2021 (pending funding)

- Objective: enable ‘enhanced insights’ that enable growers to take actionable decisions

Onsite Data Screens (inside)

60” Touch Screens

Variable Rate Spray (apples only)

Smart Apply Sprayer

Soil Nutrient Mapping

soil mapping + soil lab tests

Plant Stress Mapping

Drone + satellite imaging (data collection only): multi-spectral & thermal

Equipment Tracking & Telemetry

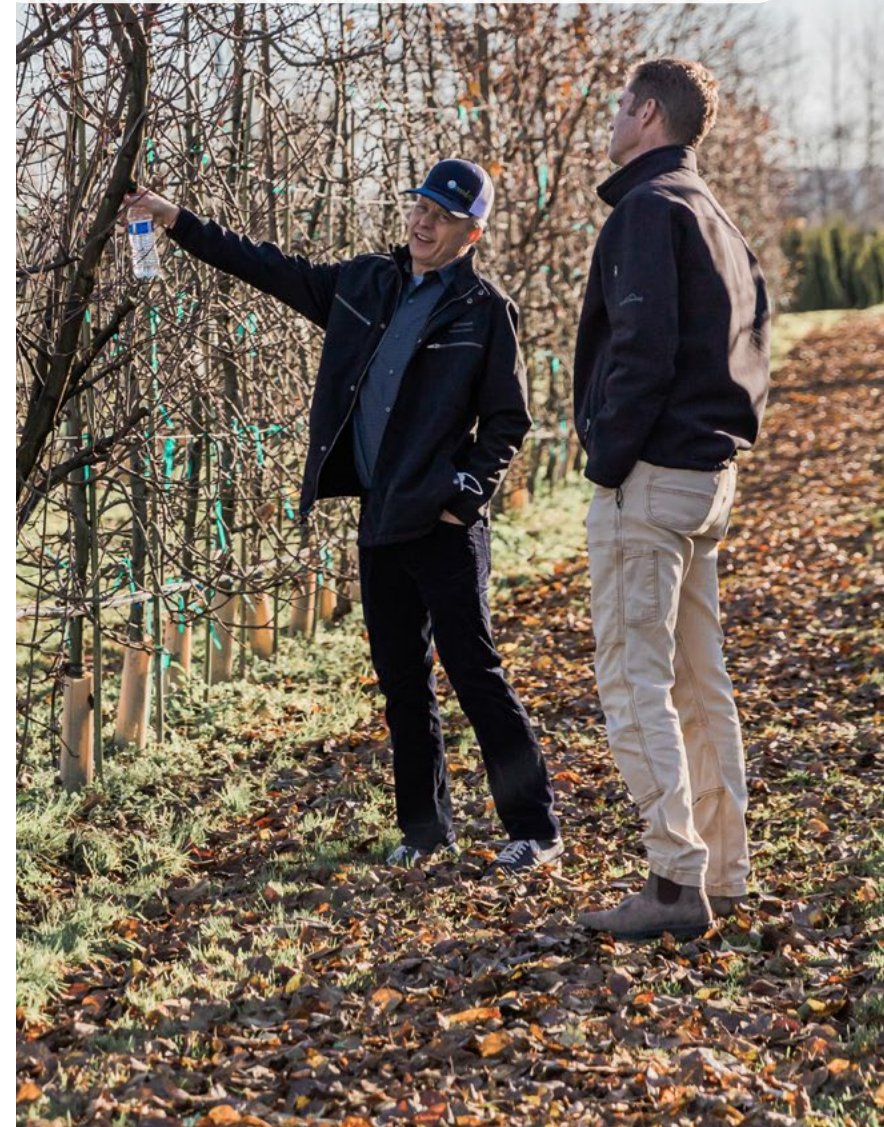
TBD

Yield Mapping – Apples only

GreenAtlas ATV

Future phases with a broader set of participants may include:

- Edge data collection, caching, & serving
- Camera monitoring – security + labor and plant insights
- Retail Point of Sale Analytics / Reporting
- Food distribution optimization
- Time tracking
- Semi-autonomous equipment



HOW WE HAVE HELPED ECONOMIC RECOVERY AND RESILIENCY



By leveraging several contractors from Snohomish County to complete our engagement, we have been able to provide funding through this initiative to several contractors in and around Snohomish County as well as helping drive positive attention statewide and beyond to the that will have a long-lasting impact on the economic landscape.

Furthermore, the use cases we have targeted to optimize farming practices at both of our locations will have a domino effect in the economic viability of farming across Snohomish County, as best practices and solutions are shared as part of our work to the broader farming community within Snohomish County. This, along with a strong PR / marketing presence related to our activities, will further draw positive economic activity and viability to the farming sector for years to come.

PROJECT METRICS & OUTCOMES

METRICS	OUTCOMES																																			
Up to 3 locations	<ul style="list-style-type: none">• Andrews Hay (Arlington)• Swans Trail Farms (Snohomish)• Mobile Equipment Shelter (undisclosed)																																			
Up to 5 Snohomish County business contracted and jobs engaged	Ballast Networks: 3 employees Wren Construction: 25 employees Lynx Electric: 2 employees	Camp & Associates: 20 employees Zipper Geo: 13 employees CG Engineering: 27 employees	Olympic Trailer: 6 employees Skyline Vinyl & Sign: 2 employees Signs & Printing: 2 employees																																	
WSU sponsor research	WSU Mount Vernon, in partnership with the 5G Open Innovation Lab, has begun a sponsored research project under the guidance of Dr. Gabriel LaHue focused on soil-water relations and soil fertility at the Swans Trail Farms location. Sensors and supporting wireless technologies were installed to aid in Dr LaHue’s research to begin in early 2021. More information on the WSU extension at Mt Vernon can be found at http://mtvernon.wsu.edu/																																			
Public relations efforts	Tuesday February 2, 2021 press event @ Swans Trail Farms Target a minimum of 50 media stories in business & technology trades with a press release pick of more than 500 million Proactive reach into the following publications to cover 2/2/2021 press event: <table><tr><td>Association of Washington Business</td><td>Good Fruit Grower</td><td>Light Reading</td><td>USApple</td></tr><tr><td>Capital Press</td><td>Herald Business Journal</td><td>Puget Sound Business Journal</td><td>Wall Street Journal</td></tr><tr><td>CNBC</td><td>KING-TV</td><td>Q-13 FOX Seattle</td><td>Washington Farm Bureau</td></tr><tr><td>Daily Herald (Everett)</td><td>KIRO Radio – MyNorthwest</td><td>RCRWireless</td><td>Washington Post</td></tr><tr><td>FierceTelecom</td><td>KIRO-TV</td><td>Seattle Times</td><td>Western Fruit Grower</td></tr><tr><td>FierceWireless</td><td>KKOL-AM Radio</td><td>Techcrunch</td><td>WZAB 880 Biz Radio</td></tr><tr><td>Geekwire</td><td>KOMO-TV</td><td>Telecompetitor</td><td>Yakima Herald</td></tr><tr><td></td><td>KSER Radio</td><td>Union Bulletin</td><td></td></tr></table>				Association of Washington Business	Good Fruit Grower	Light Reading	USApple	Capital Press	Herald Business Journal	Puget Sound Business Journal	Wall Street Journal	CNBC	KING-TV	Q-13 FOX Seattle	Washington Farm Bureau	Daily Herald (Everett)	KIRO Radio – MyNorthwest	RCRWireless	Washington Post	FierceTelecom	KIRO-TV	Seattle Times	Western Fruit Grower	FierceWireless	KKOL-AM Radio	Techcrunch	WZAB 880 Biz Radio	Geekwire	KOMO-TV	Telecompetitor	Yakima Herald		KSER Radio	Union Bulletin	
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Geekwire	KOMO-TV	Telecompetitor	Yakima Herald																																	
	KSER Radio	Union Bulletin																																		
Marketing collateral	<ul style="list-style-type: none">• Full version video and vinettes (smaller format videos) shot and produced by Digital Vindetta. Videos are interviews including Snohomish County growers and representatives from Snohomish County, 5G OI Lab, its Companies & Partners.• Project overview page created by 5G OI Lab and hosted on www.5goilab.com• Position the Food Resiliency Project and field lab as a global proof point for the convergence of technology and agriculture with a targeted reach beyond Washington State to the nation and global agricultural centers.																																			