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Remote Unmanned Aircraft System (UAS) Inspection and Response Team Development in the Bering Strait Region

A presentation by

Dr. Jessica Garron, University of Alaska, *Principal Investigator*



Land Acknowledgement



My home and office are located on the traditional land of the *Lower Tanana Dene* people in an area that is now known as Fairbanks, Alaska. This project will take place on the traditional lands of the *Inupiat* and *Yupik* people in an area that is known today as Unalakleet, Alaska.

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Remote Unmanned Aircraft System (UAS) Inspection and Response Team Development in the Bering Strait Region

Principal Investigators

- **Dr. Jessica Garron**, Science Team Lead, Alaska Center for Unmanned Aircraft Systems Integration, University of Alaska Fairbanks
- **John Henry Jr**, Deputy Director, Native Village of Unalakleet
- **Margy Hall**, Associate Director, Model Forest Policy Program
- **CDR Jereme Altendorf**, USCG Sector Anchorage

Project Champions

- **CDR Chad Thompson**, USCG HQ
- **LCDR John Walters**, USCG HQ

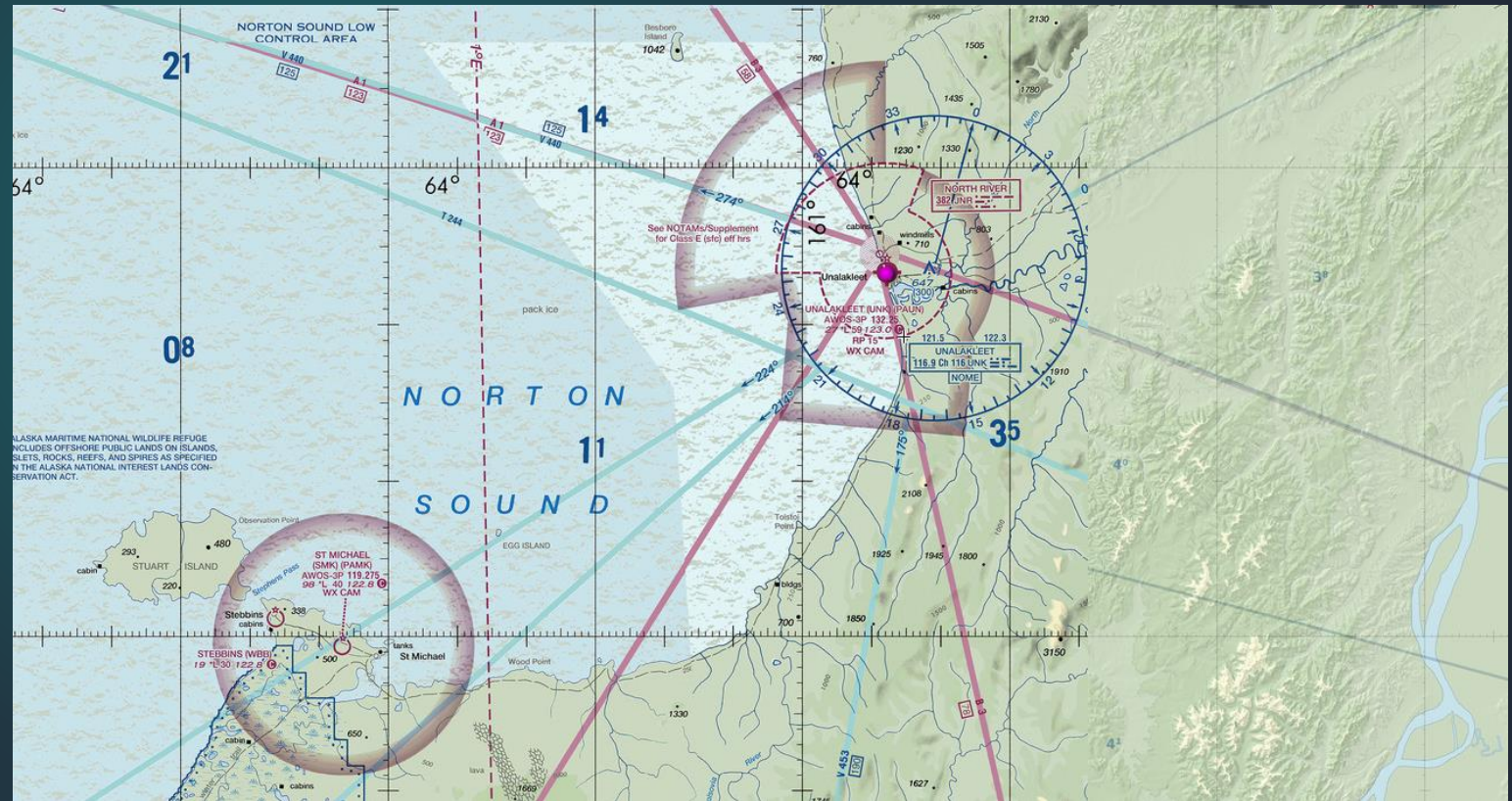


Unalakleet Shoreline (AK). Credit: MW Hall

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ADAC: Research for the Arctic Operator...

- Katie Daniels
- Les Kayokluk
- Thomas Alakayak
- George Woods
- Jerald Arca Sr.
- Joh Henry Jr.



Baseline Conditions and Project Relevance

USCG Mission Needs

- Diminished sea ice coverage in Northern oceans allows for more vessel traffic in the Bering Sea
- USCG responders have identified the need for more effective strategies to prevent and address marine disaster response in Western Alaska, and specifically the Bering Strait region.
- A critical need exists to improve inspections and inspection frequency of rural bulk fuel facilities across remote regions in the Arctic and Western Alaska
- USCG D17 Sector Anchorage identified staffing challenges, extraordinary logistics and associated costs of travel to remote/off road system rural Alaska
 - ❖ 363 regulated facilities not on road system requiring inspection; 6 billeted facility inspectors

Photos or Site Sketches continued

Provide Photograph(s), Site Sketches and/or Aerial Information to Document Pipe Location & Damage Observed:



Typical tankfarm piping condition showing complete coating failure and generalized corrosion.

Sample bulk fuel storage tank in remote Alaska. Image courtesy of the Denali Commission

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Baseline Conditions and Project Relevance

Unalakleet Community Needs

Impacts of **diminished sea ice** coverage in Northern oceans,

- More vessel traffic in the Bering Sea
- Reduced offshore ice protection
- Increased frequency of fall storms
- Increased current flow and direction

A precursor study completed in 2020 by the Project Leads focused on Unalakleet, Alaska, *Improving Local Decision Making in Alaskan Communities with Drones and Online Climate Data Tools - A UAS Implementation Feasibility Study Project*, identified UAS as a viable tool in support of local decision-making in remote Alaska

Changing river conditions are causing,

- Early breakup
- More turbidity
- Increased erosion

Need localized solution for broad **situational awareness** during emergencies

- Search and rescue activities
- Oil spill detection and monitoring
- Flood delineation



Mouth of Unalakleet River

Coastal segment of gabion structure



Project Rationale and Description

UAS potentially provide a localized, inexpensive, remote sensing solution, ideal for hazardous and hard to access tasks in remote Alaska.

This project is designed to develop UAS pilot teams in the Bering Strait region in support of decision-making about infrastructure status and emergency response activities. This work includes the remote training and certification of 7 members of the Unalakleet community to be UAS pilots, the coproduction of bulk fuel infrastructure assessment and emergency response UAS protocols, inclusive of remote data delivery investigations, the feasibility of expanding this training program regionally, and the broad dissemination of knowledge gained to other remote Arctic communities interested in applying UAS technology to local decision-making.



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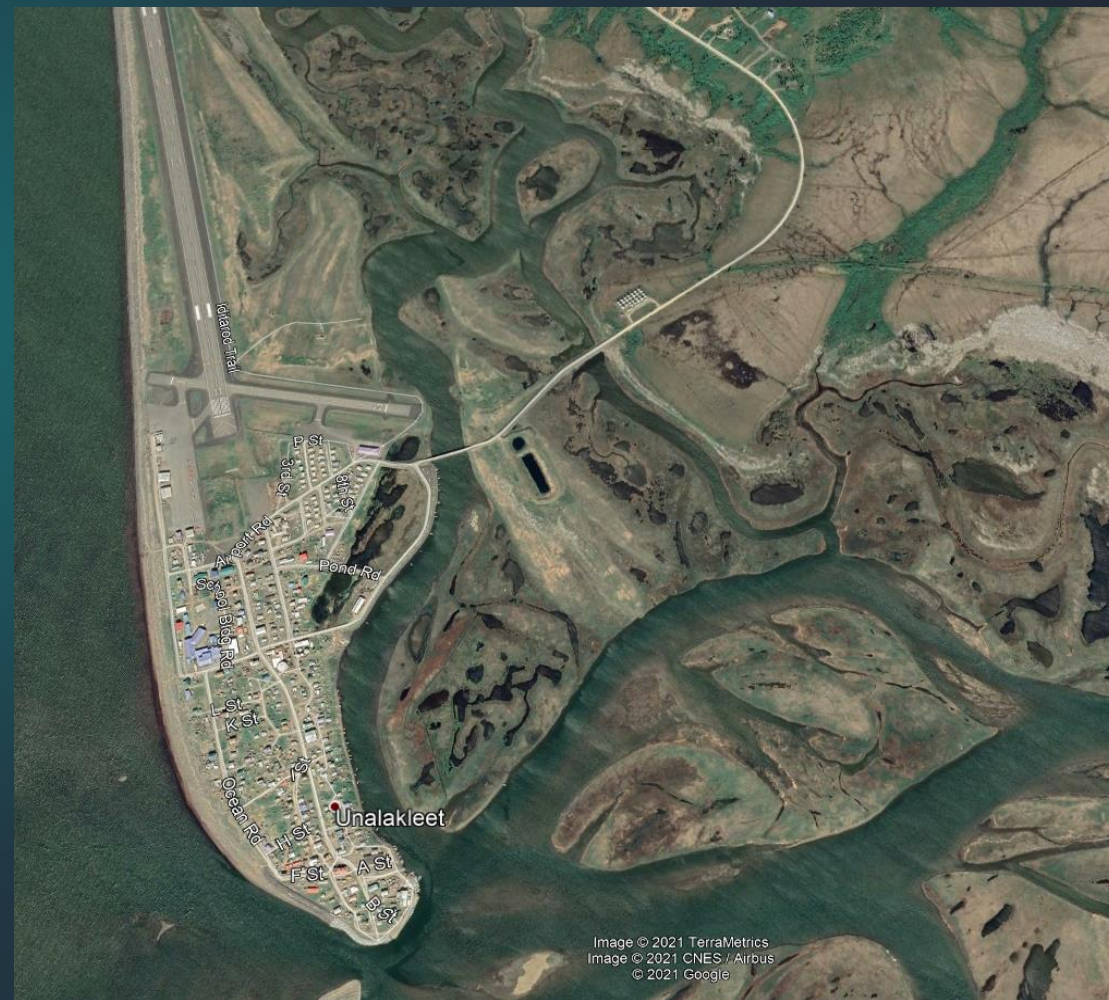


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Remote Unmanned Aircraft System (UAS) Inspection and Response Team Development in the Bering Strait Region: Methodology

Scenario-based research design

- Community needs
- USCG mission
- UAS applications



Methodology

Emergency Response

*Infrastructure
Inspection*

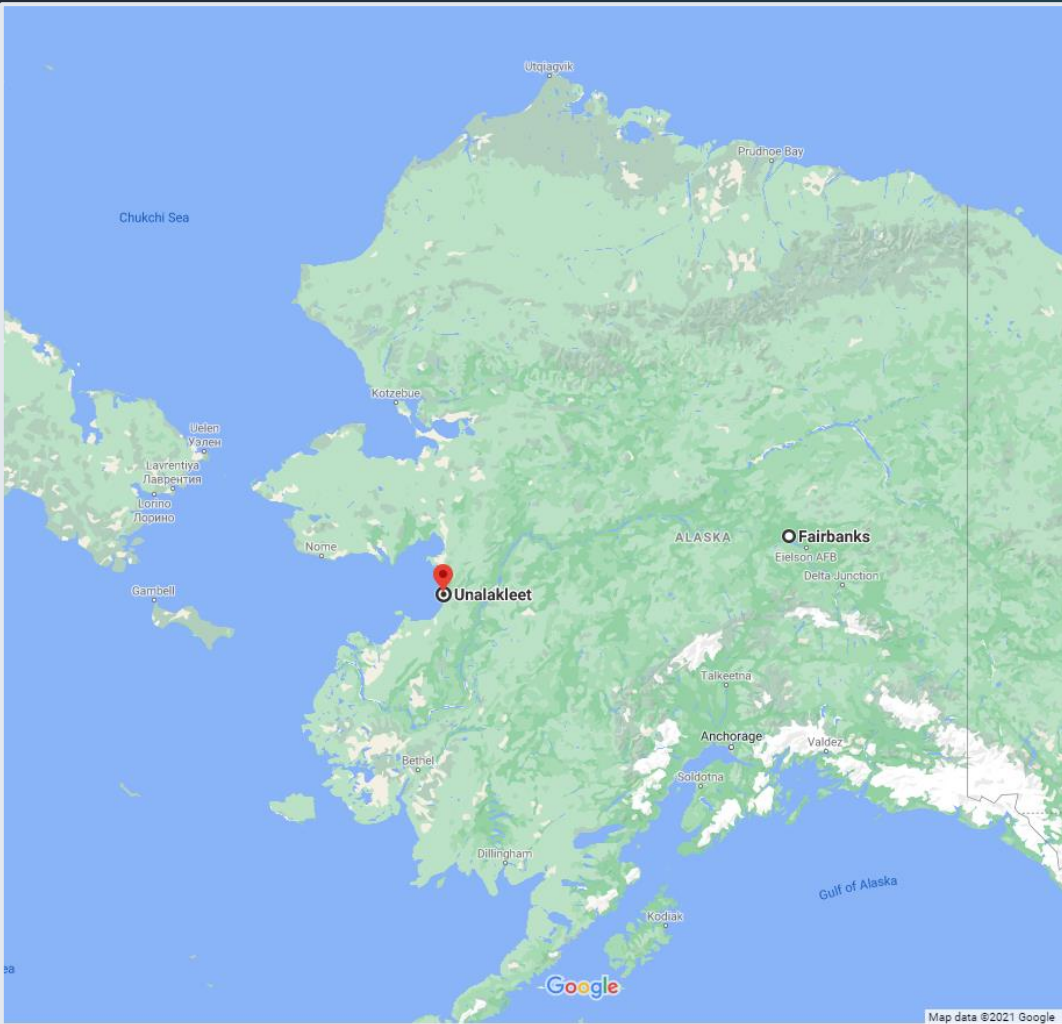
Primary Project Scenarios

1. Search and Rescue Support with UAS
2. Flood Monitoring with UAS
3. Oil Spill Detection and Monitoring with UAS
4. Bulk Fuel Storage Tank Infrastructure

Inspection with UAS



Methodology



Sequenced methodology is oriented to,

- 1) Provide UAS pilot training of rural residents,
- 2) Establish co-production of infrastructure assessment operational UAS protocols,
- 3) Establish co-production of emergency assessment UAS protocols,
- 4) Conduct information dissemination,
- 5) Provide regional expansion feasibility analysis.

Remote Unmanned Aircraft System (UAS) Inspection and Response Team Development in the Bering Strait Region: Schedule and Metrics

- Task 1: UAS Pilot Training and Certification
- Task 2: Coproduction of Infrastructure Inspection Operational Protocols
- Task 3: Coproduction of Emergency Response Assessment Protocols
- Task 4: Regional Expansion Feasibility Assessment
- Task 5: Information Dissemination



Primary Tasks and Objectives

November 1, 2020 - April 30, 2022

Task 0 – Project Coordination

Program establishment (complete),
Conduct team coordination meetings – internal/external (on-going),
Reporting (on-going).

Task 1 – UAS Pilot Training and Certification

Recruit UAS pilot teams (complete),
Deliver remote UAS pilot training (on-going),
Acquire operational UAVs, sensors and software (in-process)
Support FAA certification of UAS pilots (June),
Deliver on-site UAS flight training (June/July).

Task 2 - Coproduction of Infrastructure Inspection Operational Protocols

Determine current tank and fuel delivery infrastructure inspection requirements (on-going),
Coproduce a UAS-based tank and fuel delivery infrastructure inspection protocol (in-process),
Perform infrastructure inspection flights and product delivery tests.

Task 3 - Coproduction of Emergency Response Assessment Protocols

Determine key community assets for monitoring pre/post emergency response (on-going),
Coproduce emergency response UAS protocol based upon surveys of key community assets,
Perform emergency response baseline flights and product delivery tests.

Task 4 – Regional Expansion Feasibility Assessment

Summarize key (local and regional) documents for critical infrastructure and emergency response information,
Develop regional contact list and conduct regional UAS survey,
Aggregate survey results.

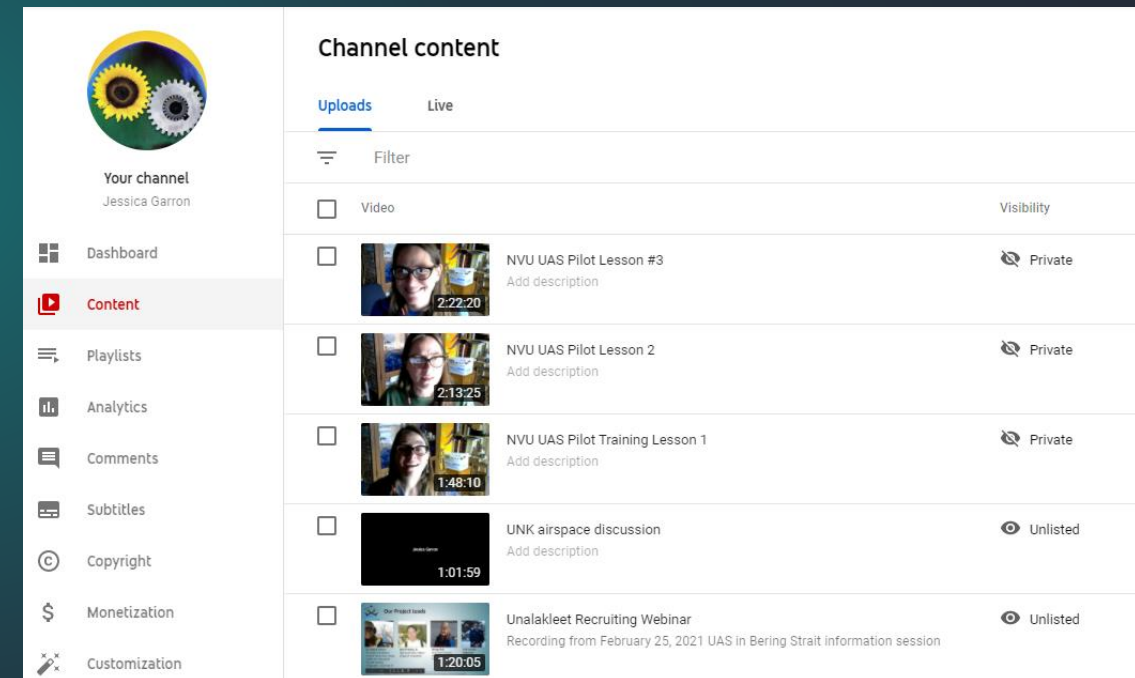
Task 5 - Knowledge Product Development Information Dissemination

Create USCG-focused Knowledge Project,
Engage non-technical stakeholders (locally, regionally, nationally) (on-going),
Develop and submit publication about sensor capacity testing and general inspection methodology to technical journal.

Remote Unmanned Aircraft System (UAS) Inspection and Response Team Development in the Bering Strait Region:

Task 1 – UAS Pilot Training and Certification

- Recruit UAS pilot teams (complete),
- Deliver remote UAS pilot training (in-process)
 - Mondays from 1300-1500 AKDT via Zoom,
- Acquire operational UAVs, sensors and software (in-process)
- Support FAA certification of UAS pilots (June),
- Deliver on-site UAS flight training (June/July).



Channel content			
Uploads		Live	
	Filter		
☐	Video		Visibility
☐		NVU UAS Pilot Lesson #3 Add description	Private
☐		NVU UAS Pilot Lesson 2 Add description	Private
☐		NVU UAS Pilot Training Lesson 1 Add description	Private
☐		UNK airspace discussion Add description	Unlisted
☐		Unalakleet Recruiting Webinar Recording from February 25, 2021 UAS in Bering Strait information session	Unlisted

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Remote Unmanned Aircraft System (UAS) Inspection and Response Team Development in the Bering Strait Region:

Task 1 – UAS Pilot Training and Certification

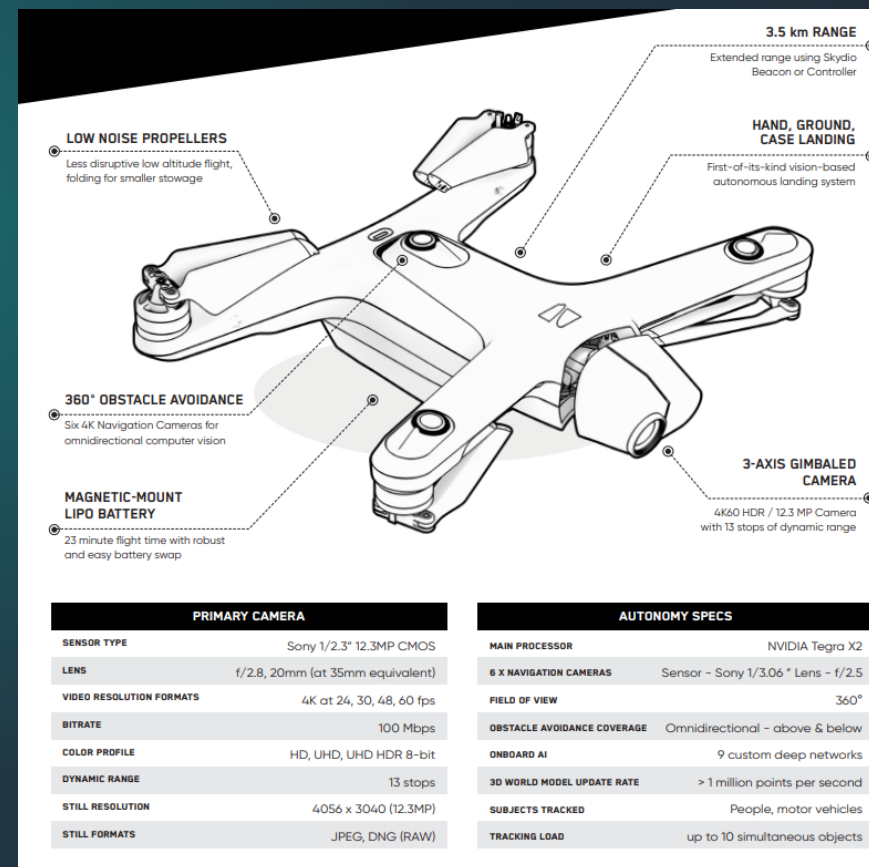
Skydio

Designed, assembled and supported in the USA

3D scan for infrastructure inspections

360° obstacle avoidance via AI powered autonomy

- S2E - Training Aircraft (2)
 - RGB sensor
 - In transit to Alaska
- X2E - Operational Aircraft (5)
 - RGB and Longwave infrared (thermal) sensor
 - Anticipated June delivery date



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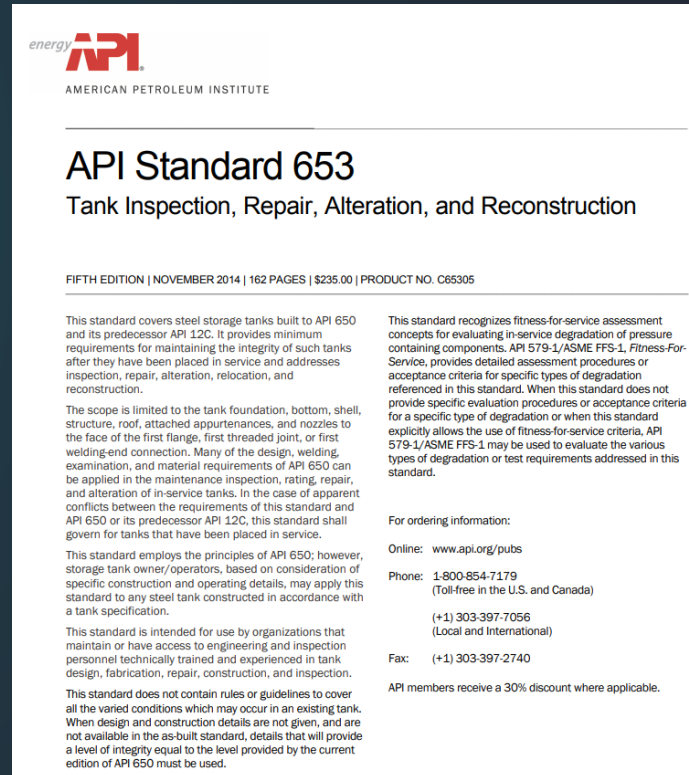


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Remote Unmanned Aircraft System (UAS) Inspection and Response Team Development in the Bering Strait Region:

Task 2 - Coproduction of Infrastructure Inspection Operational Protocols

- Determine current tank and fuel delivery infrastructure inspection requirements (in-process),
- Coproduce a UAS-based tank and fuel delivery infrastructure inspection protocol (in-process),
- Perform infrastructure inspection flights and product delivery tests (July).



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Remote Unmanned Aircraft System (UAS) Inspection and Response Team Development in the Bering Strait Region:

Task 3 - Coproduction of Emergency Response Assessment Protocols

- Determine key community assets for monitoring pre/post emergency response (in-process),
- Coproduce emergency response UAS protocol based upon surveys of key community assets (July/August),
- Perform emergency response baseline flights and product delivery tests (July/August).

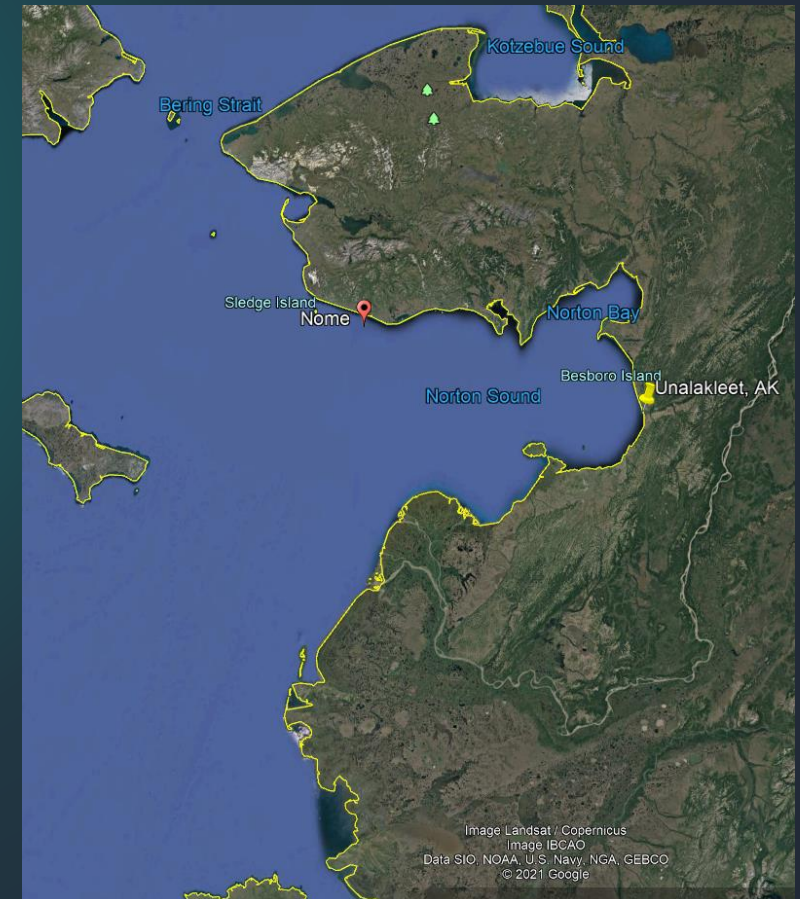


Image courtesy of skycoreaviation.com

Remote Unmanned Aircraft System (UAS) Inspection and Response Team Development in the Bering Strait Region:

Task 4 – Regional Expansion Feasibility Assessment

- Summarize key (local and regional) documents for critical infrastructure and emergency response information (June/July),
- **Develop regional contact list and conduct regional UAS survey (in-process),**
- Aggregate survey results (August).



Remote Unmanned Aircraft System (UAS) Inspection and Response Team Development in the Bering Strait Region:

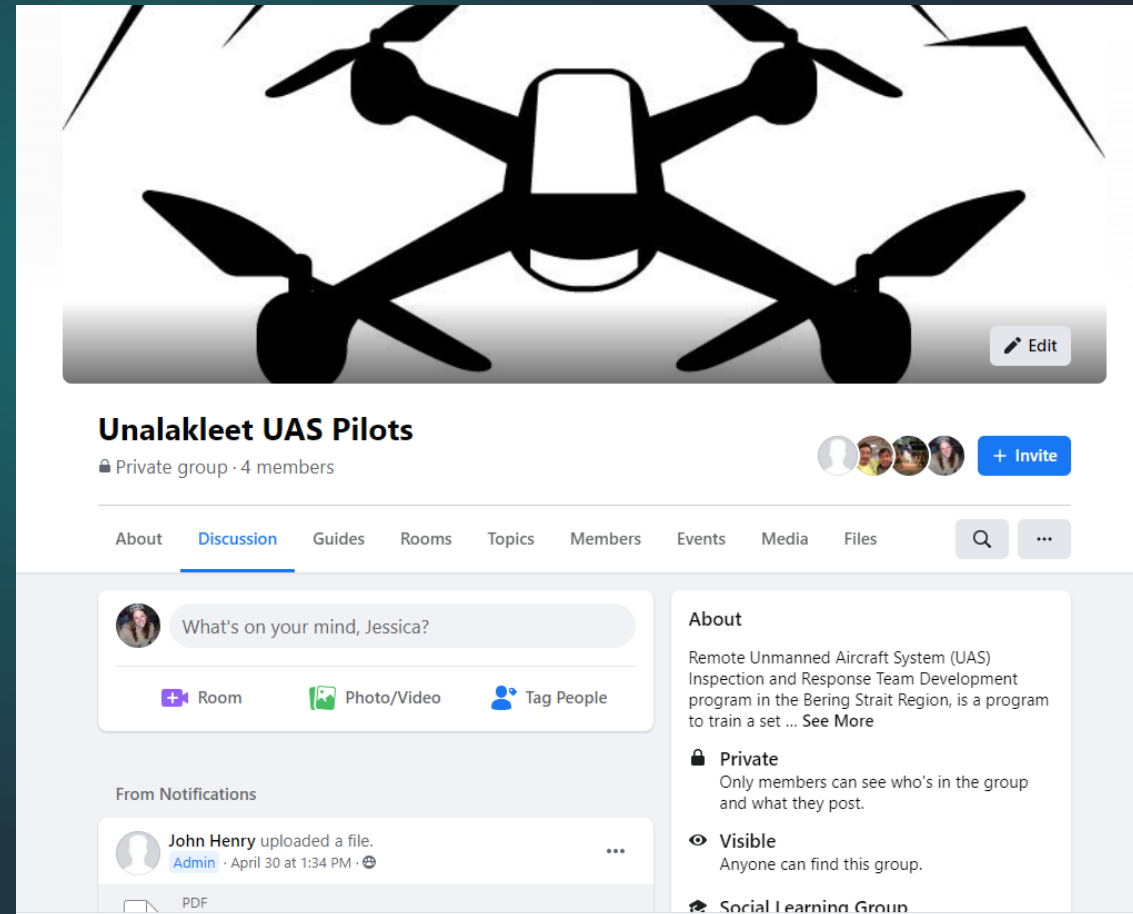
Task 5 - Knowledge Product Development & Information Dissemination

- Create USCG-focused Knowledge Project (June – December),
- Engage non-technical stakeholders (locally, regionally, nationally) (on-going),
- Develop and submit publication about sensor capacity testing and general inspection methodology to technical journal (March 2022).

Remote Unmanned Aircraft System (UAS) Inspection and Response Team Development in the Bering Strait Region: Task 5 - Knowledge Product Development & Information Dissemination

Engage non-technical stakeholders
(locally, regionally, nationally) (on-going)

- *FB page for pilot blogging and Q&A
- *Google Drive for document archiving
- *Email, text, phone communications



Remote Unmanned Aircraft System (UAS) Inspection and Response Team Development in the Bering Strait Region: Task 5 - Knowledge Product Development & Information Dissemination

Engage non-technical stakeholders (locally, regionally, nationally) (on-going)

*Quarterly newsletter
*Presentations
(WAISC, Cal-OSPR, ASSW)



Unalakleet tank farm.

Photo courtesy of Unalakleet Economic Development Plan 2014-2019.

Remote Unmanned Aircraft System (UAS) Inspection and Response Team Development in the Bering Strait Region

Spring 2021, Issue 1

Remote UAS Project Officially Launched—February 2021

Despite communities dealing with COVID-19 and its challenges, an exciting new project has been launched in the Alaskan Native Village of Unalakleet (NVU). On February 25th, a virtual forum was held to inform interested NVU community members about the "Remote Unmanned Aircraft System (UAS) Inspection and Response Team Development in the Bering Strait Region" project (the "UAS Project"). The Zoom meeting was held not only to share details but also recruit 6 NVU individuals, to join the NVU Project Lead—John Henry, to train to become FAA Part 107 Certified Remote Pilots. Once certified and fully trained in the operations of the drones and sensors, the goal is that these individuals will be able to conduct local and, potentially, regional flight operations.

As many are aware in the region, oil spills are of increasing concern and have grown in probability because of the reduction in sea ice and climate change. More on-the-ground monitoring of a community's infrastructure (e.g. bulk fuel tanks and water tanks) has also become critical, especially for those structures that may be located in coastal inundation or flood zones. Search and Rescue efforts have also become more challenging because of the shifting climate in the Norton Sound and Arctic region. This UAS Project is designed to develop the use of UASs to increase situational awareness with regards to oil spills, as well as the use of UASs in assessing critical community infrastructure and responding to search and rescue missions.

The Project, which is funded by the Arctic Domain Awareness Center (ADAC), a Department of Homeland Security Center of Excellence, is scheduled to run from the end of February 2021 to the end of April 2022. Over this time period the UAS Project will work to accomplish the following objectives:

- Train pilot teams in the regional hub of Unalakleet to
 - ◊ Acquire real-time, or near real-time situational awareness.
- Develop operational UAS protocols to
 - ◊ Monitor infrastructure for compliance and potential oil discharge prevention by developing infrastructure inspection protocol, specifically bulk fuel tank farm; and
 - ◊ Support emergency response through regional preparedness by

Developing Search and Rescue, oil spill detection and mapping, and flood mapping protocols.

- Conduct Bering Strait regional feasibility assessment to
 - ◊ Use as a possible case study by USCG and others.
- Share lessons learned and resulting products with the broader USCG, AK communities, and others interested.

The Project is led by Dr. Jessica Garron, Science Team Lead, Alaska Center for Unmanned Aircraft Systems Integration (ACUASI), University of Alaska Fairbanks. Other Leads include John Henry, Deputy Director of the Native Village of Unalakleet. John was the Project Lead on a recently completed BIA-funded Feasibility Study related to the use of UASs. Margaret Hall, Associate Director of the Model Forest Policy Program, and Commander Jerome Altendorf, Arctic Emergency Management Specialist, U.S. Coast Guard Sector Anchorage, are also Project Leads. In addition to Dr. Garron's work, ACUASI is also providing virtual pilot classroom instruction, assistance with identification of applicable equipment, development of protocols, and on-the-ground instruction. MFPP and its team will undertake the feasibility study, develop outreach materials, and work with other Team members to coordinate 2022 Community Project Fair and final webinar(s).

So Where Are We Now & Where Are We Going?

The 6 pilot trainees were chosen in March, each bringing to the table diverse, but complementary, background/expertise that should provide a strong support group to one another. The first virtual FAA Part 107 Remote UAS Pilot Training was held on April 12th, with the last expected to wrap up first part of June. After completion of the virtual sessions, the trainees will then go to Anchorage to sit for the FAA Part 107 exam. Protocols will be developed during early summer. Mid-summer, the ACUASI flight instruction team, COVID-19 travel restrictions permitting, will provide on-site training. Research and assessment of regional expansion will take place in summer and fall. The Community Fair is scheduled for February 2022. Depending on COVID restrictions, or not, it may be a combination of in-person and virtual. Final UAS Project are expected to take place first part of Spring 2022.

Finally, How Will USCG Interface with the Project?

Stay tune for updates...

Project Leads

Dr. Jessica Garron
Principal Investigator
Science Team Lead, Alaska Center for Unmanned Aircraft Systems Integration, University of Alaska Fairbanks

John P. Henry, Jr.
Deputy Director, Native Village of Unalakleet

Margaret Hall
Associate Director, Model Forest Policy Program

Cmdr Jerome Altendorf
Arctic Emergency Management Specialist, USCG Sector Anchorage

Project Funder

Arctic Domain Awareness Center, A Department of Homeland Security Center of Excellence

Land Acknowledgement

The University of Alaska Fairbanks is located on the traditional land of the Lower Tanana Dene people in an area that is now known as Fairbanks, Alaska.

Unalakleet, Alaska, the focal point of this project, is on the traditional lands of the Kallipet, speakers of a dialect of Interior Salish.

The Model Forest Policy Program's home base is Bonner County, Idaho, the traditional lands of the Kallipet, speakers of a dialect of Interior Salish.



ADAC's Project Website
arcticdomainawarenesscenter.org/P29_UAS



Officially Launched— cont.

are also Project Leads. In addition to Dr. Garron's work, ACUASI is also providing virtual pilot classroom instruction, assistance with identification of applicable equipment, development of protocols, and on-the-ground instruction. MFPP and its team will undertake the feasibility study, develop outreach materials, and work with other Team members to coordinate 2022 Community Project Fair and final webinar(s).

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Finally, How Will USCG Interface with the Project?

Stay tune for updates...

The Background Story—The "Feasibility Study"

The Feasibility of Improving Local Decision Making in Alaskan Communities with Unmanned Aircraft Systems and Online Climate Data Tools (Feasibility Study) is the culmination of a project analyzing the feasibility of establishing a regional data collection program utilizing an unmanned aircraft system (UAS) compared to other data collection systems.

In 2018, the Alaska Native Village of Unalakleet (NVU) received funding from the Bureau of Indian Affairs' Tribal Resilience and Ocean and Coastal Management and Planning Program. The project goal and objectives were to build local capacity to: (1) Address future climate related ocean and coastal management planning and challenges; and (2) Build long-term resilience through the establishment of a self-sustaining, localized and on-going data collection and analysis program.

To address the climate risks that NVU and other Norton Sound Native Villages face, research was conducted under nine scientific study areas: coastal erosion, flood preparation (river and sea), infrastructure, water quality, plant community, cultural and historical sites, extractable materials, wildlife, and air quality. Individually researched final documents include: UAS Operational Solutions Matrix, Online Tools Comparison Matrix, Environmental Monitoring



with Unmanned Aerial Vehicles: Cost Estimating & Analysis, Integration and Applications of UAS and Online Climate Tools Data - Document Review, Partnership Options/Considerations template, and a related survey summary.

The UAS in the Bering Strait Region project has provided the opportunity to apply lessons learned from the Feasibility Study to real-life.

[Feasibility Study link: <https://drive.google.com/file/d/150HAZ7x0D3ad0fCvP26PshEK1Ks/view?usp=sharing>]

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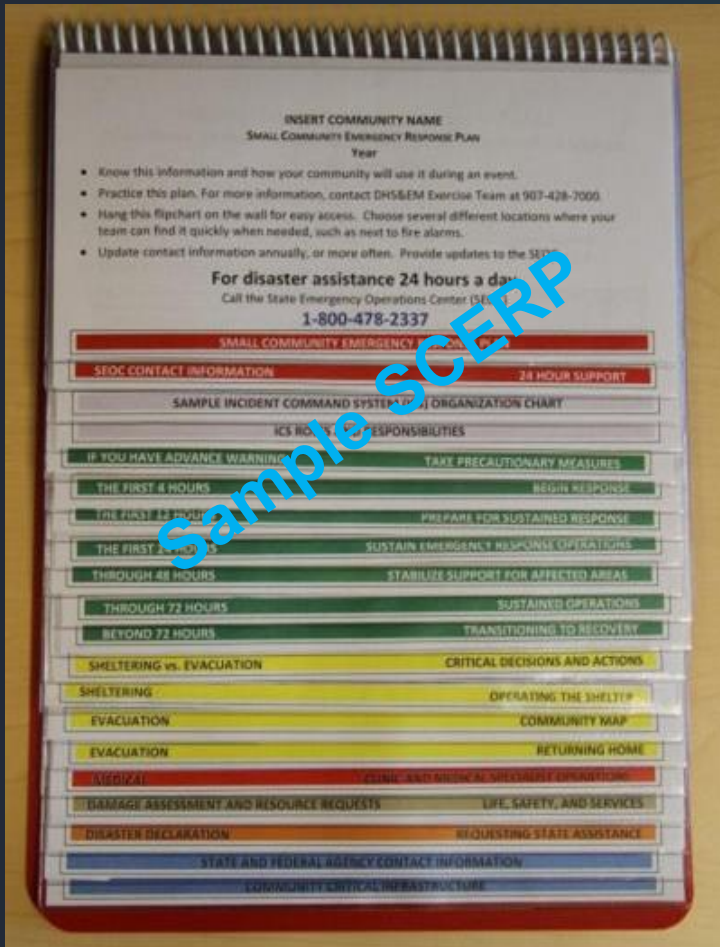
*Remote Unmanned Aircraft System (UAS) Inspection and Response Team Development in the Bering Strait Region: **Planned Research Outcomes***

- A knowledge product for the USCG as a possible use case for other areas/applications
- A developed set of operational UAS protocols for
 - Monitoring infrastructure for compliance and prevention of potential oil discharge identification
 - Emergency response support through regional preparedness
- Development of pilot teams in the regional hub of Unalakleet
 - Creates the ability to acquire real-time, or near real-time situational awareness where there currently is none
- Bering Strait regional feasibility assessment for UAS program implementation



Photo courtesy Charlie Parr/Alaska Upward Bound.

Impacts and Applications



UAS enhanced support of...

- FEMA Hazard Mitigation Plans
- State of Alaska DHS&EM Small Community Emergency Response Plans (SCERP)
- Local infrastructure monitoring capacity and fund acquisition
- USCG regional inspection support
- USCG regional emergency response
- Arctic security - surveillance
- State of Alaska DOT asset integrity - Runways, roads, bridges
- Bering Strait regional energy planning processes
- Bering Strait economic development plans

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Beyond Unalakleet...



Regional Expansion Feasibility Analysis in Support of Transition Planning

- Determine long-term implementation strategies in the region.
- Identify, assess, and prioritize critical infrastructure, vulnerable community assets, and emergency response capacity and protocols.
- Outreach to local, regional and federal entities (e.g. IGAP coordinators, public works staff, emergency responders and communications technicians) for critical input.
- Clarify entities' relationships to an expanded program.
- Report findings.



Remote Unmanned Aircraft System (UAS) Inspection and Response Team Development in the Bering Strait Region: Questions and Feedback

Dr. Jessica Garron
jigarron@alaska.edu

Thank You



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