



Sensing Hazards with Operational Unmanned Technology (SHOUT) River Forecasting Center Rapid Response “Alert 48”

Mission Readiness Review
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NOAA UAS SHOUT for RFC



History: This is a result of 5 years of requirement reviews, workshops (2012 & 2014), reports (2013 & 2015) and operational assessments (ongoing).

Objective #1:

Obtain high temporal/spatial resolution **Geographical Observations** of Yukon River

- Near real-time operational forecaster Decision Support System (DSS) examination

Objective #2:

Rapid Response surveillance / River Damage & Flooding Assessment
“Alert 48” Established 04/20/2016

Objective #3:

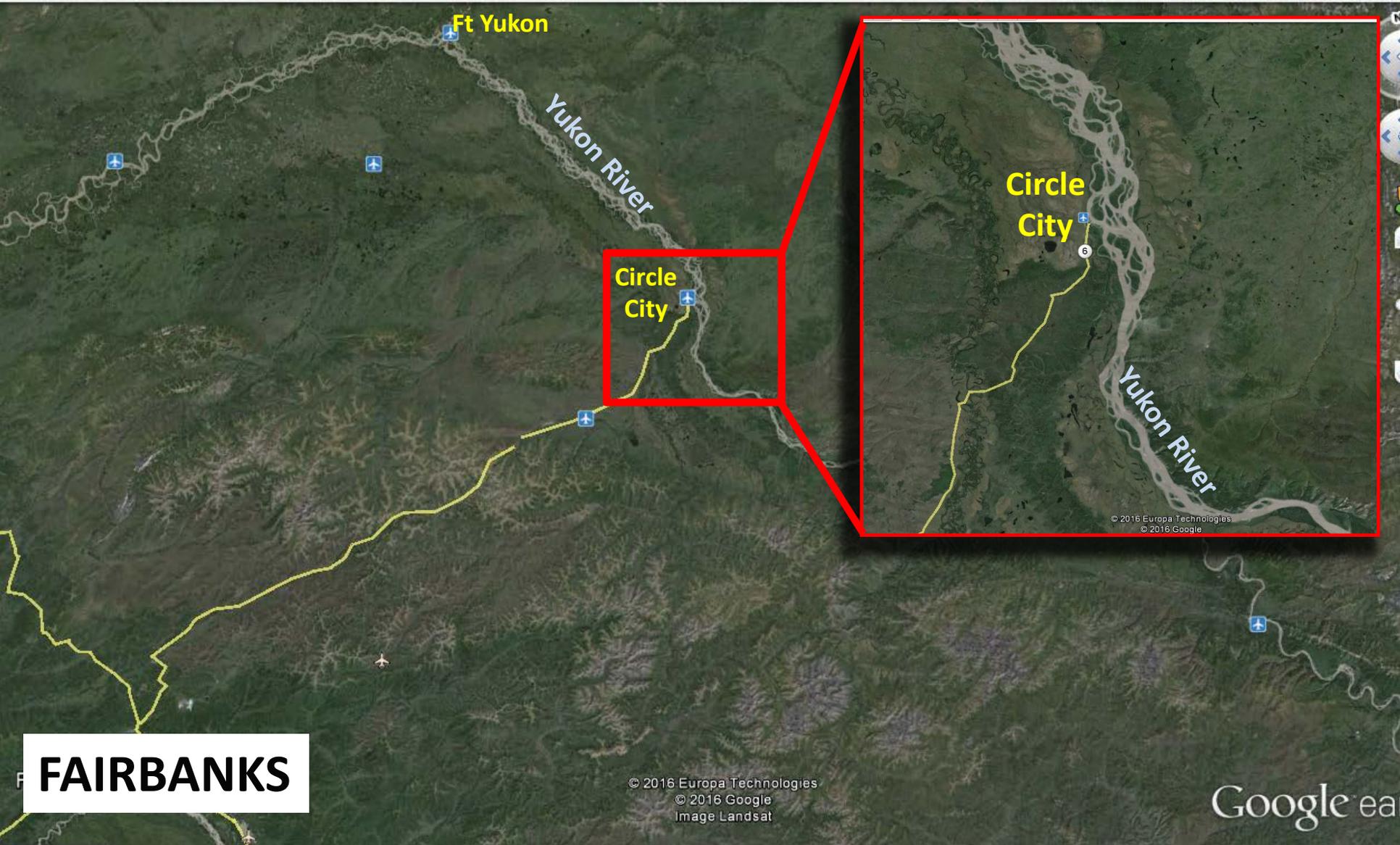
Satellite CAL/VAL/VER

NWS River Watch Requirements/CONOPS

Mission location: Yukon River at Circle City



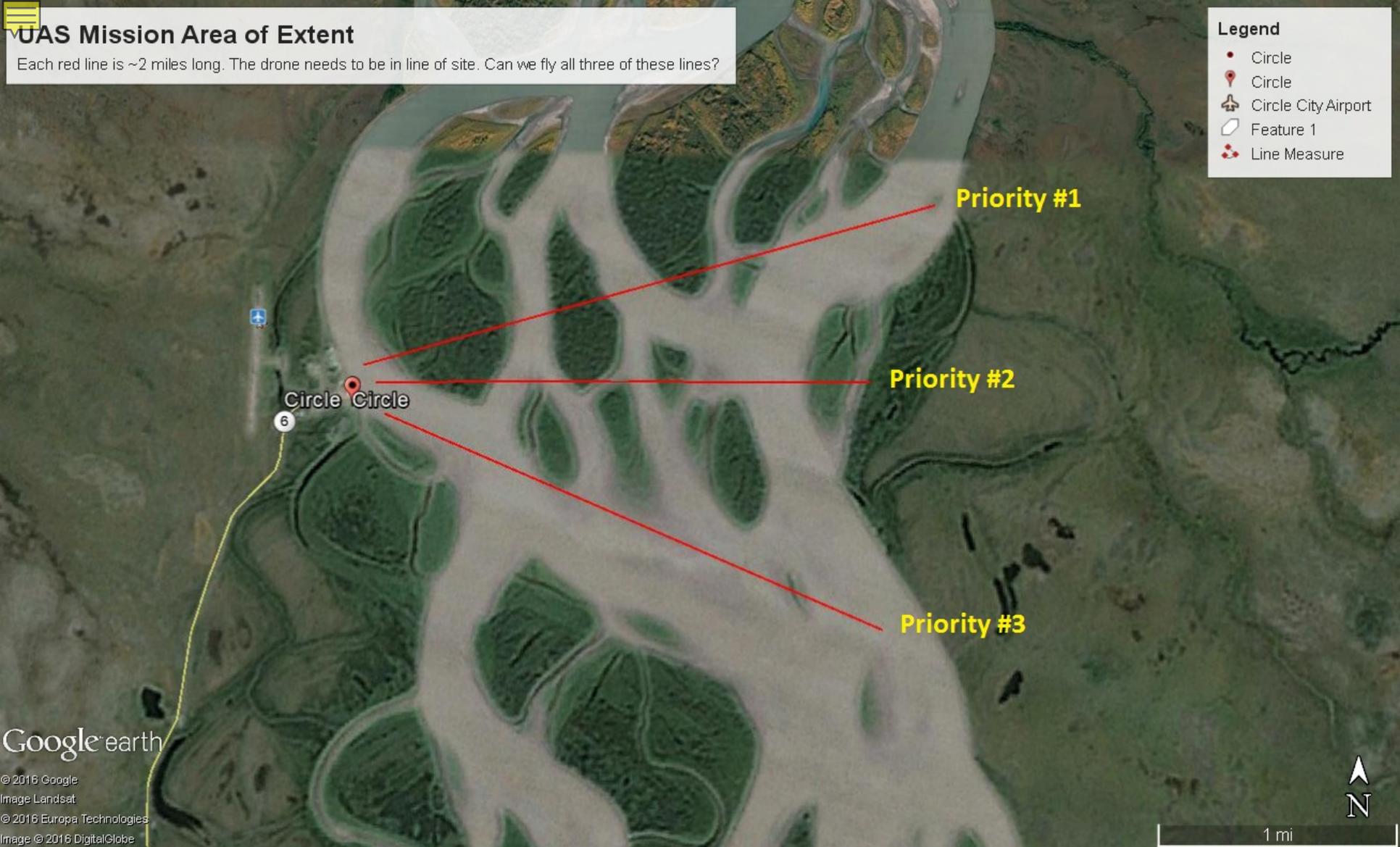
- Road accessible and near Fairbanks.
- River Watch team will be flying this reach of the Yukon River.
- This site will compliment other larger scale, fixed wing mapping in this area by UAF (Dr. Jessie Cherry)
- Circle has had ice jams floods in the past (*threat is low this year*).
- Data can be used to validate satellite derived river/ice products.



- Timeframe: April 28th to 30th
- ~5 days for breakup front to move from Eagle to Circle.

UAS Mission Area of Extent

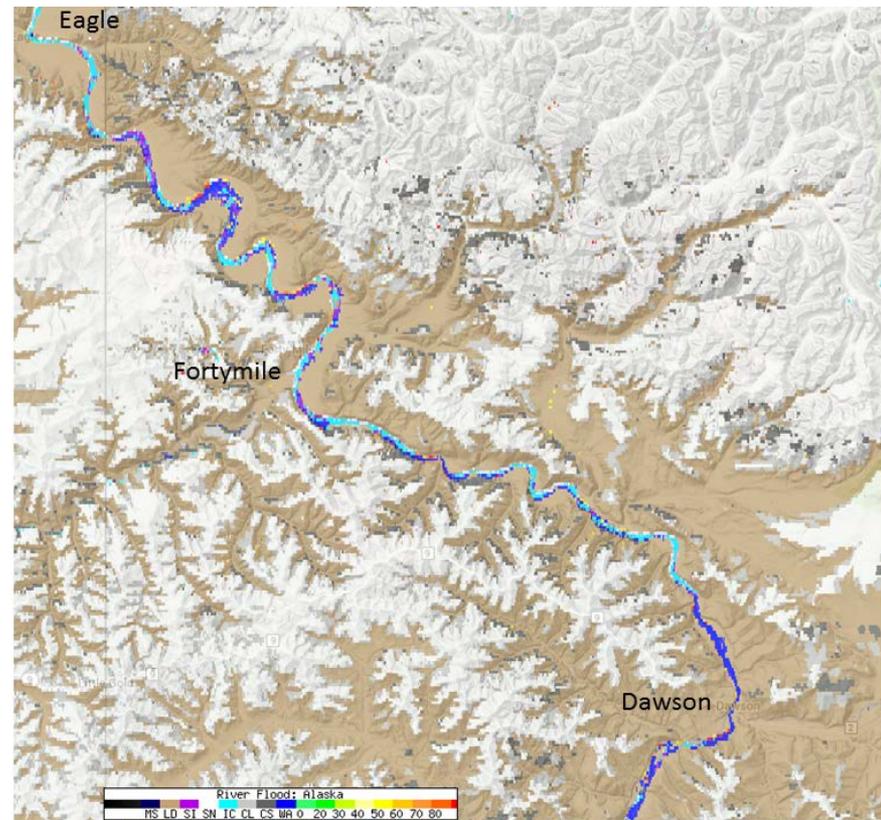
Each red line is ~2 miles long. The drone needs to be in line of site. Can we fly all three of these lines?



- Area of Extent of transects = 2 mi x $\frac{1}{4}$ mi (due to FAA restrictions)
- Observe changes in ice conditions before and during river ice breakup
- Improve lead time for breakup forecast, ice jams, and flooding.

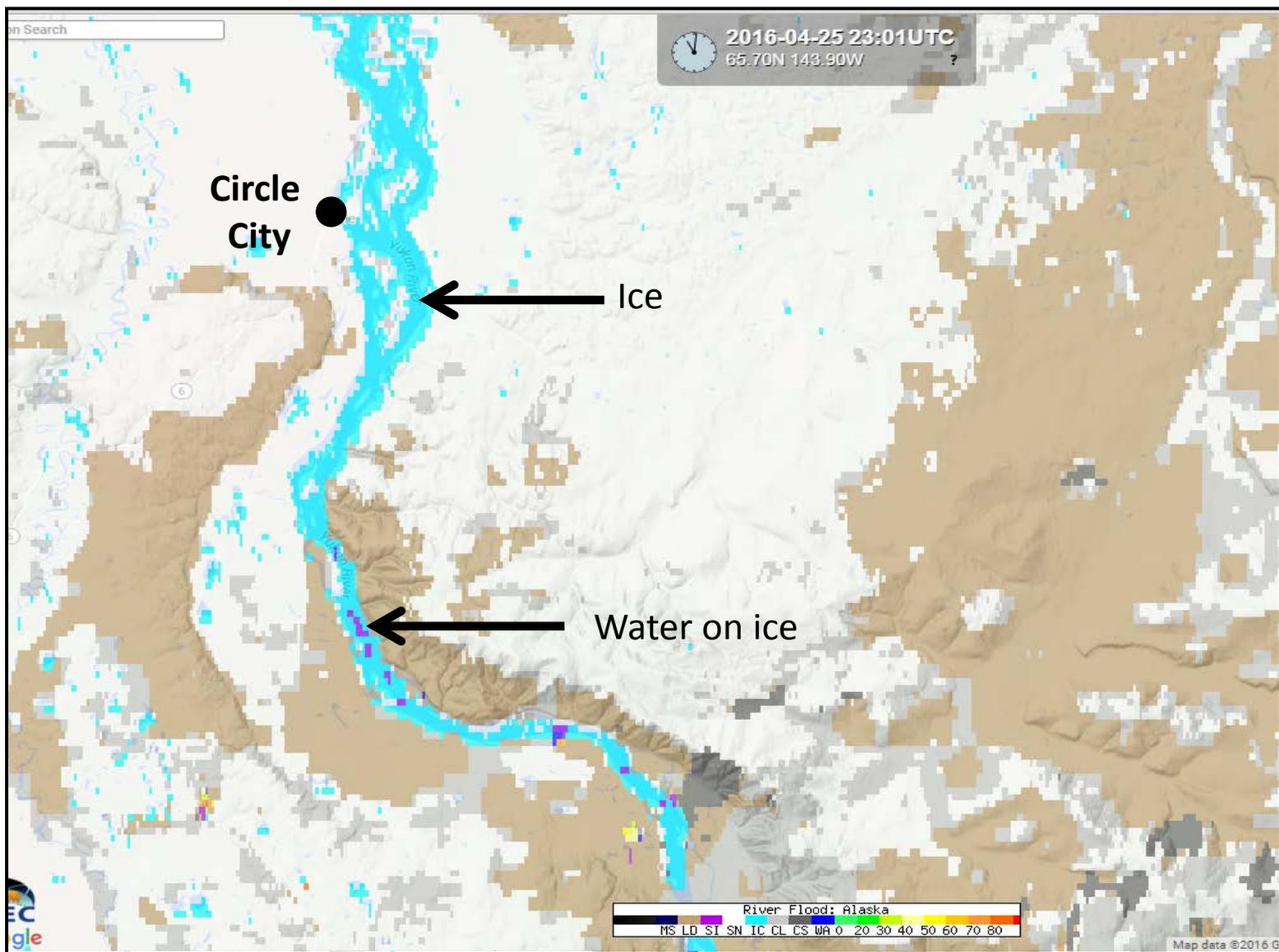


Mosaic image of the Yukon River imported into Google Earth (courtesy UAF/GINA)



River ice/flood products 4/24/16 (courtesy Sanmei Li GMU)

- UAS mission will compliment and validate other monitoring efforts in this region.



Monday April 25th 3:01PM – River ice product

Expected Unmanned Aircraft Data

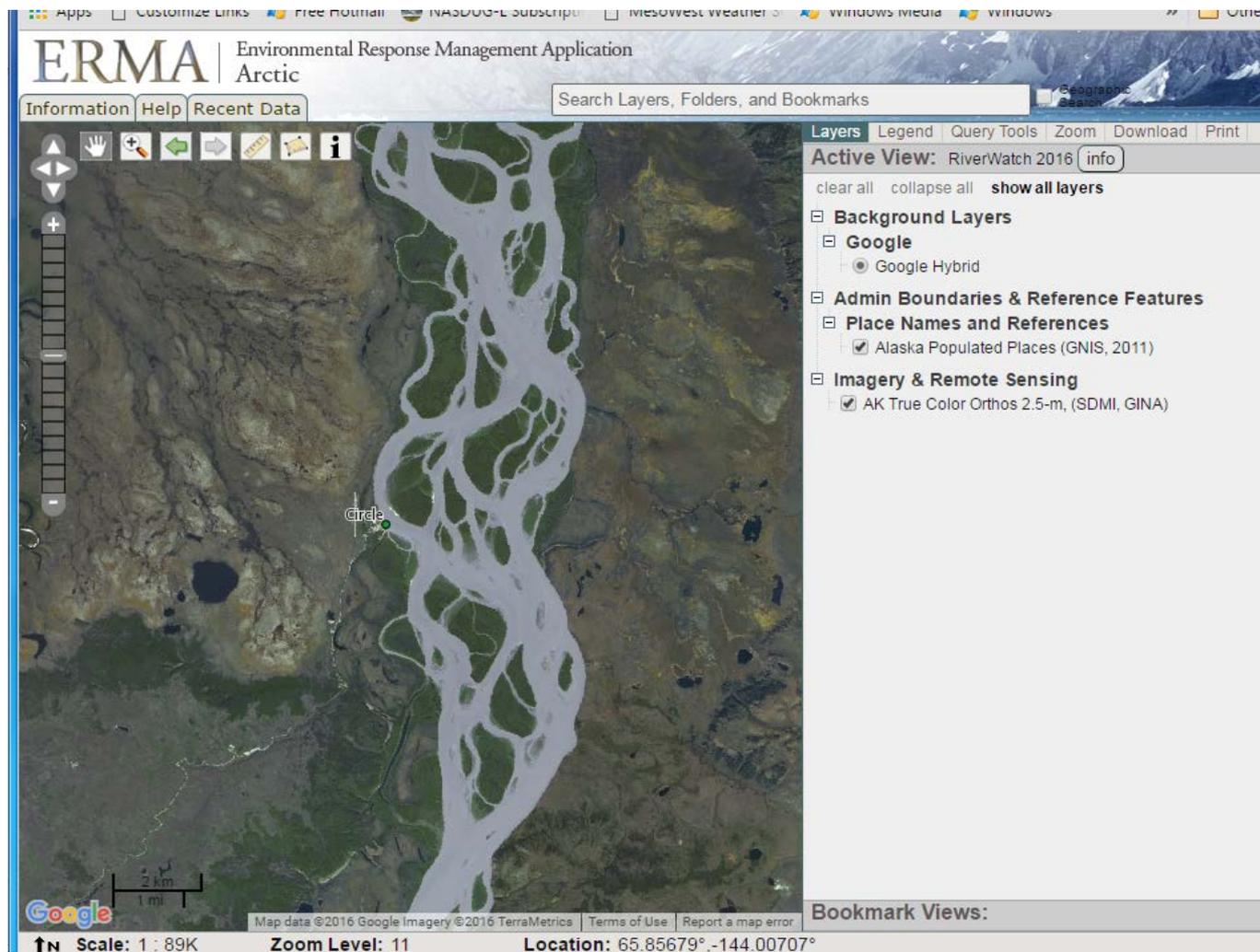
Multiple daily flights will record differential changes in ice conditions.

- Thermal IR video and imagery (mosaic images processed after the mission)
- Visible mosaic imagery
- DEM's of ice surface



ACUASI thermal video clip from mission in Homer, AK

- *NWS interested in DEM of community for flood inundation studies but FAA requires flights 500' above structures – and mission not allowed to fly above 400' AGL. ☹️*



<https://erma.noaa.gov/arctic/erma.html#/view=1472&x=-144.04827&y=65.82517&z=11&layers=4+9751+9890>

- ACUASI will upload data during the mission to ERMA for viewing by NWS, partners, and stakeholders



Alaska Center for UAS Integration-
Circle, AK river ice monitoring
mission readiness

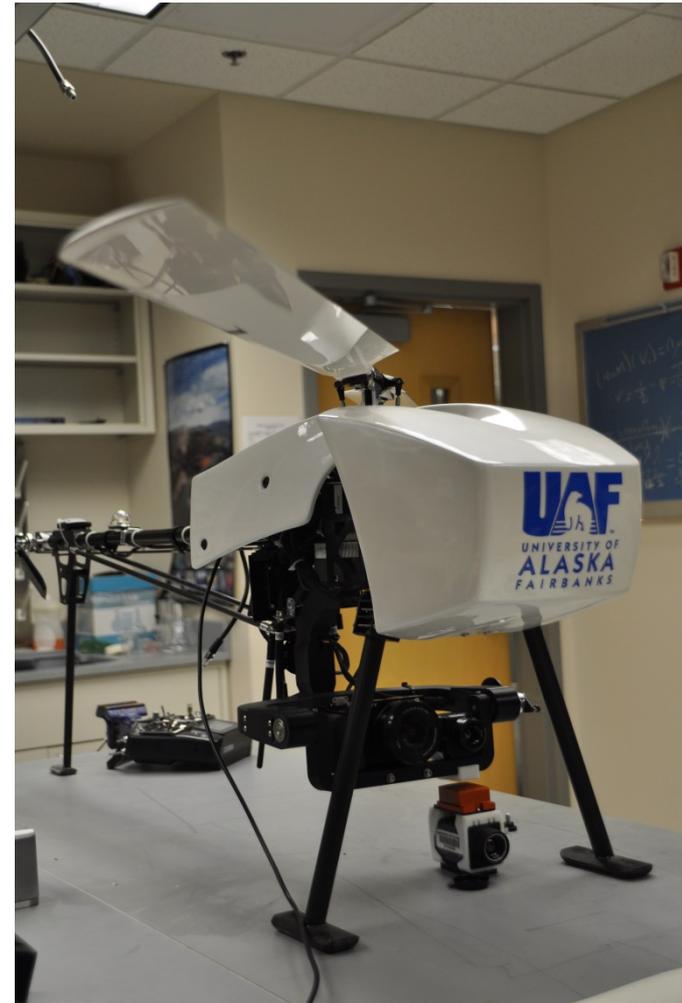
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Deployed aircrafts

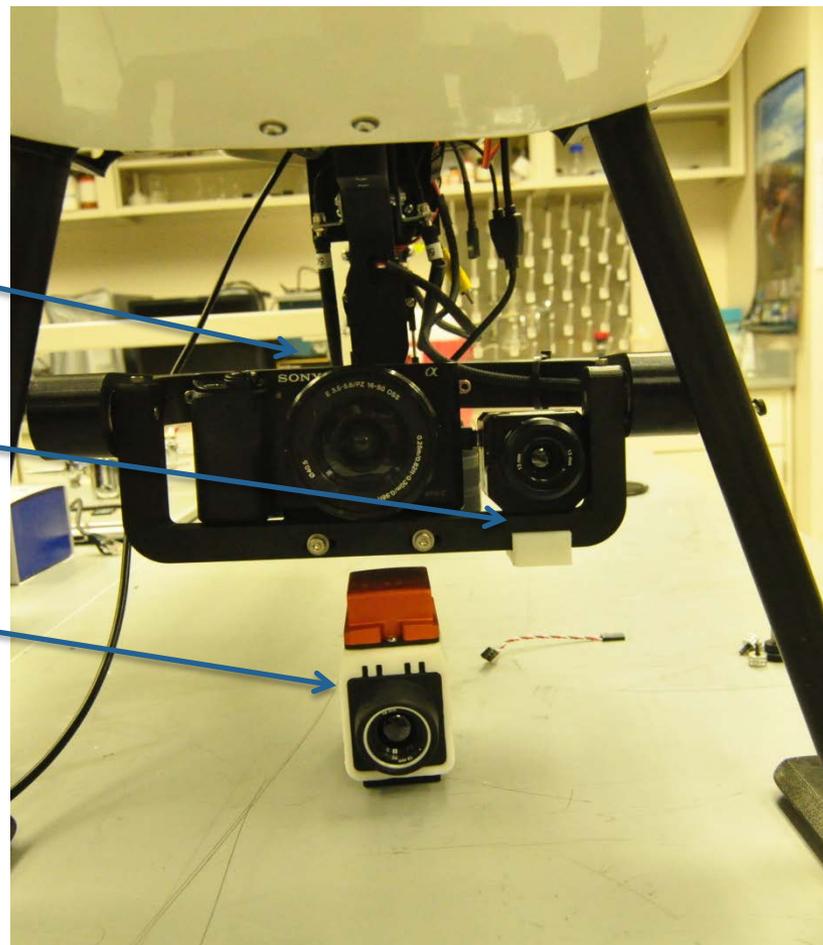
Responder

- Single rotor
- Endurance about 40 min
- Cruise speed 22 mph
- About 14 miles per flight



Mission payloads for Responder

- Payloads
 - Sony A6000 24 MP (18 mm) -pixel~2 cm
 - Flir Vue Pro 640X512 (13 mm)
 - Flir A35 320 x 256 (19 mm) -calibrated
 - 7.5-13 μm
 - -25°C to +135°C



Deployed aircrafts

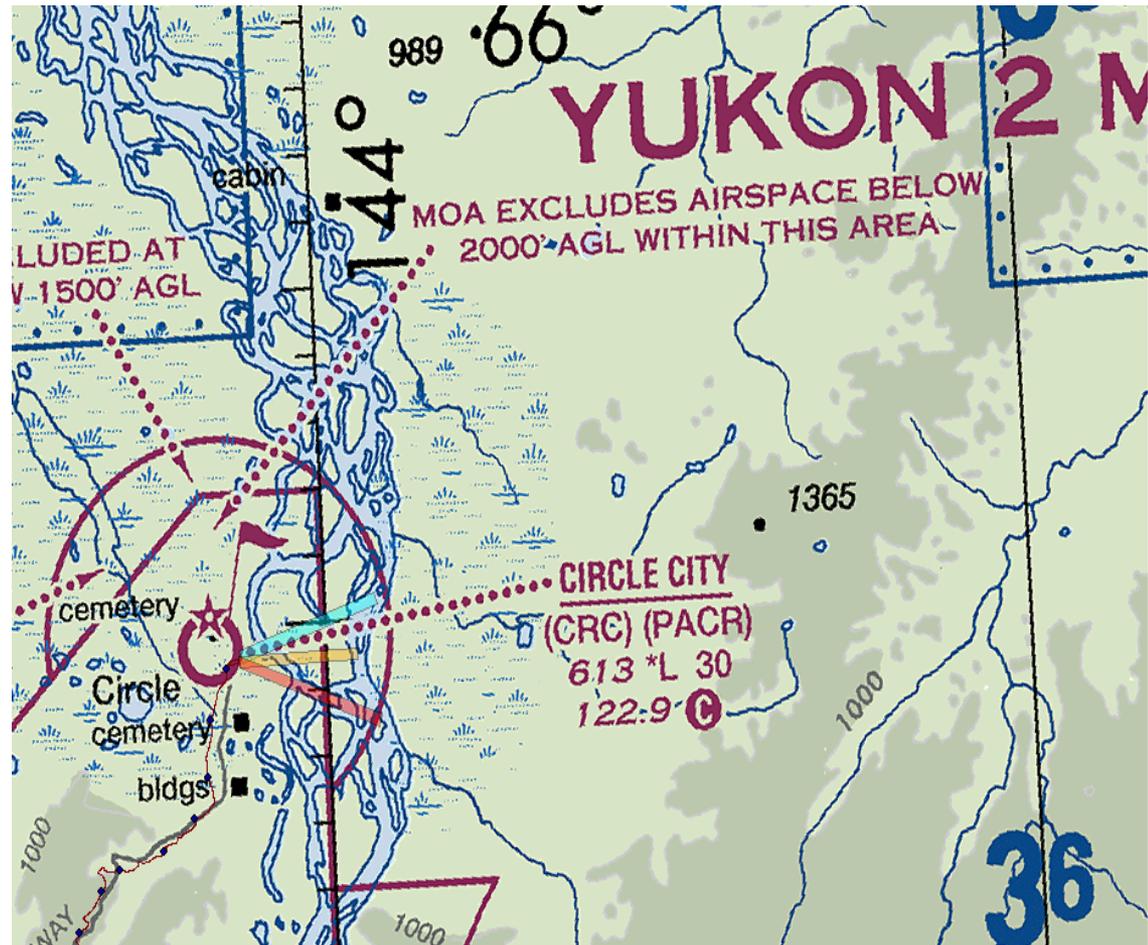
Aeromapper

- Fix wing
- Hand launch
- Parachute/belly landing
- Cruise velocity 37 mph
- Endurance about 40 minutes
- About 24 miles
- Sony a6000



Mission profile

- COA ceiling 400ft
- Yellow line about 2 mile (range)
- Nontowered airport- Class E



Raw data output

- Sony 6000
2X0.2 mile² = 25 min flight = 755 images x 4MB = 3.02 GB
 - 80% overlap forward and 60% overlap on the side
- A35
2X0.2 mile² = 30 min flight = 1857 images x 0.321MB = 0.56GB
 - 80% overlap forward and 60% overlap on the side

Daily data products

- Visible mosaic
- Visible DEM
- Thermal mosaic

All daily products are internet dependent

- Data uploaded to university FTP site and from there, pulled to the ERMA site

School outreach

Presentation

- River breakup updates
- About UAS
- UAS supporting river breakup



Wrap Up



- ✓ **Refined Requirements**
- ✓ **Concept of Operations**
 - ✓ **Aircraft**
 - ✓ **Payloads**
 - ✓ **Operators**
 - ✓ **Airspace**
 - ✓ **Ready Alert > Rapid Response**
- ✓ **Technology Readiness Level**
 - Aircraft - 9**
 - Payloads - 9**
 - Applications – 7>8**
- Director's Comments**



Data Services Checklist



Section 1

Government Data Services - End Product / Best Value Determination Tool

Purpose: This worksheet provides decision-making guidance when there is a need for a product, such as an aerial photograph, that could be obtained by a commercial company that uses unmanned aircraft systems (UAS). This worksheet should be used to make a best value determination by comparing UAS-obtained products and costs with alternative methods of obtaining the needed product. Contact the Government UAS Program for additional UAS platform or sensor guidance.

Directions: For each option, place a check in the box that applies (Yes or No). Do not fill out the grayed-out boxes. To fill out the "Cost" column, you must obtain a quote from commercial companies. Contact the controlling Government aircraft office for additional guidance.

All Options Should be Considered:	Will the Government Have Operational Control?		Take-Off/Landing Operation Within Park Boundaries		Complies with All Relevant Legal and Policy Requirements ³		Data Captured Meets Projected Need		Provider for this Option is Available		Cost
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	
Ground-Based Options (e.g. elevated structures, land masses)											
Manned Aircraft	1		2								
Unmanned Aircraft	1		2								
Other (e.g. kites, balloons, satellites)											

If Unmanned Aircraft meets all requirements and represents the best value to the Government, go to Section 2.

¹ If your answer is "Yes" for the "Operational Control" column, either the flight services must be procured through Government approval is required and the agency's internal approval process for UAS operations must be completed. For definition purposes, "Operational Control", with respect to a flight, refers to the exercise of authority over initiating, conducting, or terminating a flight." (14 CFR 1.1)

² If the answer is "Yes" for "Take-Off/Landing Operation Within Park Boundaries" for manned aircraft, superintendent approval is required. For UAS operations, approval is required and the Government internal approval process for UAS operations.

³ Examples include but are not limited to requirements associated with the Wilderness Act (including a Minimum Requirements Analysis), Endangered Species Act, National Historic Preservation Act, Marine Mammal Protection Act, Migratory Bird Treaty Act, National Environmental Policy Act, and other applicable legal or policy requirements.

- Every Emergency is Local
- Data Buy of Airborne Imagery
- Affordable – Nation-Wide
- Numerous Government Agencies
- Real-Time Data Available

Section 2

Government Simplified Acquisition Procedures for UAS End Product Contracts

From all legal and policy aspects, the Federal Aviation Administration (FAA), UAS are considered aircraft. While government agency policies may require that all *aviation services* must be obtained through an aviation oversight office, an "End Product Contract" or "Data Buy" is used to acquire a product for the Government. The intent of this type of procurement is for the contractor to supply all personnel and equipment in order to provide an "end product" or "end result."

Generally, if the cost of the supply is over the micro-purchase threshold, a Government contracting officer must issue a solicitation. Otherwise, in general, if the cost of the supply is under the micro-purchase threshold (currently \$2,500-5000), a purchase charge card may be used. Refer to the site's specific policy regarding procurement. In either case, some or all of the following will apply:

1. Supervisory approval must be obtained.
2. An authorized Government credit card holder with purchase authority must make the purchase. **Note:** the vendor must invoice for the supply or product, not "services provided."
3. Verify the vendor meets all FAA requirements.
4. A written agreement with the vendor must be signed by both parties and will include, at a minimum:
 - a. A detailed description of the product desired, the date of delivery, and note all products are the property of Government.
 - b. Windows of opportunity to achieve best results for obtaining the product(s).
 - c. Vendor's responsibility for complying with all local, state, and federal regulations, such as minimum altitudes above area commensurate with Federal Aviation Regulations and including FAA certification and [Section 333 Exemptions](#).
 - d. Areas to be avoided; measures to avoid impacts on natural resources and personnel.
 - e. A vendor-provided operational safety plan.
 - f. Procedures for data management and processing.
 - g. Procedures and responsibility for recovering a downed aircraft and any associated damage to resources.
 - h. Representations that the operator is properly insured and adequately indemnifies the Government (as applicable).
5. The written agreement **shall not** include:
 - a. Specified aircraft type
 - b. Pilot requirements
 - c. Point(s) of departure
 - d. Any authorization for take-off, landing, or operation.
6. The Government may need to coordinate with the vendor to restrict areas of operations for public/resource protection.