Final Report
ASSURE A28: Disaster Preparedness and Response Using UAS
Attachment 6 – Concept of Operations (CONOPS) for Pandemic Use of sUAS (sUAS)

June 1, 2022

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TABLE OF ACRONYMS

ACUASI	Alaska for Unmanned Aircraft Systems Integration
BVLOS	Beyond Visual Line of Sight
CONOP	Concept of Operation
DAA	Detect and Avoid
DLI	Divert Land Immediately
EO	Electro-optical
EVLOS	Extended Visual Line of Sight
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
FMV	Full Motion Video
FOV	Field of View
GCS	Ground Control Station
GEOJSON	Geographic JavaScript Object Notation IFR – Instrument Flight Rules
JPEG	Photographic Experts Group
KML	Keyhole Markup Language
KMZ	Keyhole Markup Zipped
LAANC	Low Altitude Authorization and Notification Capability
NAS	National Airspace System
NOTAM	Notice to Airmen
NWS	National Weather Service
ORA	Operational Risk Assessment
PIC	Pilot in Command
RGB	Red, Green, Blue
RTB	Return to Base
RTL	Return to Land
SGI	Significant Governmental Interest
SHP	Shape file
SOSC	System Operations Support Center

TIFF	Tag Image File Format
UAF	University of Alaska Fairbanks
UAS	Uncrewed/Unmanned Aircraft System
USGS	United States Geological Survey
VFR	Visual Flight Rules
VLOS	Visual Line of Sight
VO	Visual Observer
VTOL	Vertical Take-Off and Landing

ATTACHMENT 6 - CONCEPT OF OPERATIONS (CONOPS) FOR PANDEMIC USE OF SUAS

Lead organization will demonstrate that the CONOP has been reviewed. The CONOP will be accepted if the document contains sufficient information to proceed to an operational risk assessment (ORA). The CONOP is to be submitted by the lead organization for the mission.

Approval by (Name/Org)	Title	Date	Approve Digital Signature

This CONOP will include all items needed to build out a successful mission. There will be sections included that are specific to each disaster response in the CONOP, such as under purpose of mission. Any specific information needed in the CONOP for a disaster response will be included before the summary section.

This CONOP document follows the "5-paragraph order" format, leveraged from the military operations world. The purpose is to allow operational team members to determine whether an applicant explicitly identifies key information that will be necessary for a subsequent **Operational Risk Assessment (ORA)**. These paragraphs spell out the acronym **S-M-E-A-C, for "Situation", "Mission", "Execution", "Administration & Logistics", "Command & Signal"**. This is known as the "SMEAC Sheet".

List of Revisions			
Revision Description	Approved by	Approve Digital Signature	Release Date (DD/MM/YY)

Notes on a CONOP:

The CONOP is viewed as an "evolving" document that records an analysis performed during the requirements generation process and should contain the following:

- A clear statement of the goals and objectives
- Strategies, tactics, policies, and constraints that describe how security will affect the program
- Organizations, activities, and interactions that describe who will participate and what these stakeholders do in that process
- A clear statement of the responsibilities and authority of the roles played in the process
- The specific operational processes, in overview fashion, that provide a process model in terms of when and in what order these operation processes take place, including such things as dependencies and concurrencies
- Processes for initiating the program, developing the products and components, maintaining the products, and components, and possibly for retiring the program and its products and components

CONOP:

- Narrate the processes to be followed
- Define the roles of the various stakeholders involved in the process
- Outline a methodology to realize the goals and objectives of the mission

1.1 Concept of Operation (CONOP)

No road or river transportation between two small communities in Alaska

Essential medical supplies need to travel from Allakaket to Alatna

Operation:

Medical and Critical Supply Delivery: Two Rural Communities (Allakaket to Alatna)

Duration of Operation:

Few Hours (Two flights 30 - 45 mins and removal of goods)

Outcomes/Actionable intelligence:

- Small Uncrewed/Unmanned Aircraft System (sUAS) operations move critical cargo from Allakaket to Alatna and back
- Successful switching UAS tracking between two Ground Control Stations (GCS)
- Application of communication tools and practices for sUAS operations in National Airspace System (NAS)
- Successful transfer of cargo and critical supplies by Alatna team
- Successful return of sUAS to main hub to prepare for future supply delivery mission

Metrics of success:

- sUAS successfully takes off from Allakaket with payload onboard
- Team at Alatna take over control of sUAS; still tracked by team at Allakaket
- Team at Alatna land aircraft, team at Allakaket tracks it
- Team at Alatna unload critical supplies and take-off again to go back to Allakaket
- Team at Allakaket sees supplies given to those in need at Alatna
- Team at Allakaket take over control of sUAS; still tracked by team at Alatna
- Team at Allakaket land aircraft, team at Alatna track it
- Safe landing at Alatna with Visual Line Of Sight (VLOS)/Extending Line Of Sight (EVLOS) operations
- Team at Allakaket and Alatna able to simultaneously track aircraft throughout
- Safe return of sUAS to Allakaket so that it could be reused for follow-on mission

1.2 CONOP Quad Chart: Medical and Critical Supply Delivery: Two Rural Communities [Allakaket to Alatna].

1.2.1 Mission Purpose/Objectives

Purpose: Pandemic event, Rural community low on critical supplies, no road access, Airborne only possible. Manned systems unable to fly due to Instrument Flight Rules (IFR) conditions. Do not want people moving between communities. River between them cannot be used.

Goals: Take-off from Allakaket, Safe operations in NAS. VLOS or EVLOS mission. Land at Alatna [different from the original flight crew, second crew managing landing and switch during mission]. Extra ground crew at Alatna remove supplies and support UAS to return to Allakaket.

Objectives: Large UAS operations with real-time data of flight route. Supplies received at Location #2. UAS return take-off occurs. Mission tracked at both GCS, Allakaket and Alatna.

1.2.2 Mission Procedures/Approach

sUAS: Operations from Allakaket → Alatna →Allakaket

Time of day - Early morning to represent overnight request for supplies

Type of operations - VLOS or EVLOS with Part 107 Waiver

Operations on ground at Allakaket

Original Flight Team will be based at Allakaket overnight

Pre-Flight checklist

Take-off from Allakaket

Flight from Allakaket to Alatna - Switch flight ops to Alatna at halfway

Watching landing at location Alatna via own GCS and Beyond Visual Line of Sight (BVLOS)

Follow unloading and take-off from Alatna back to Allakaket

Flight from Alatna to Allakaket - Switch flight ops to Allakaket at halfway

Manage landing back at Allakaket

Operations on ground at Alatna

Ground team based as Alatna overnight

Setup to track flight in parallel to flight time

Own Pre-Flight Checklist

Track take-off @ Allakaket

Flight from Allakaket to Alatna - Switch flight ops to Alatna at halfway

Lead landing at location Alatna, meet aircraft and unload

Prepare flight for take-off back to Allakaket

Lead take-off at Alatna

Flight from Alatna to Allakaket - Switch flight ops to Allakaket at halfway

Follow landing back at Allakaket via their own GCS and BVLOS

1.2.3 Mission Results

Observations: Real-time optical data from UAS along route, tracking of UAS at take-off location GCS as well as landing GCS. Recording supplies being unloaded and aircraft return take-off back to original location

Products: Electro-optical data from on-board system. Detect and Avoid (DAA) tracking from GCS. Supplies received at Alatna. Record of all flight logs showing aircraft take-off from Allakaket, Landed at Alatna, and then returned to Allakaket with take-off from Alatna [note that original flight crew will stay at Allakaket and flight crew + extra ground crew for supply removal at Alatna]

1.2.4 Mission Milestones

Outcomes/Actionable Intelligence

sUAS operations move critical cargo from Allakaket to Alatna and back

Switching UAS tracking between two GCS

Application of communication tools and practices for sUAS operations in NAS

Transfer of cargo and critical supplies by Alatna team

Return of sUAS to main hub to prepare for future supply delivery mission

Metrics of success

sUAS successfully takes off from Allakaket with payload onboard

Team at Alatna take over control of sUAS; still tracked by team at Allakaket

Team at Alatna land aircraft, team at Allakaket tracks it

Team at Alatna unload critical supplies and take-off again to go back to Allakaket

Team at Allakaket sees supplies given to those in need at Alatna

Team at Allakaket take over control of sUAS; still tracked by team at Alatna

Team at Allakaket land aircraft, team at Alatna track it

Safe landing at Alatna with VLOS/EVLOS operations

Team at Allakaket and Alatna able to simultaneously track aircraft throughout

Safe return of sUAS to Allakaket so that it could be reused for follow-on mission

1.3 Situation

1.3.1 Overview

Purpose of the mission: Urgent needed delivery of medical and community supplies from Allakaket to Alatna in rural Alaska. These two communities are cut off from the road and river network during a pandemic event. Also, they do not want people moving between communities to minimize impact and any potential spread.

Goals: sUAS flown from Allakaket to Alatna and back. First mission is with needed medical and community supplies. Return flight with items needed by Allakaket from Alatna so not an empty return. Demonstrate onboard DAA system support BVLOS operations. Demonstrate that supplies can be transferred between two communities in Alaska when other transportation means prevent transfer of essential supplies.

UAS mission lead: University of Alaska Fairbanks (UAF) Alaska Center for Unmanned Aircraft Systems Integration (ACUASI) team with support from community members in Allakaket and Alatna.

sUAS: Supply delivery between two communities

- Original launch site: Pilot in command (PIC) and visual observer (VO)
- Landing site for drop off: Engineering/supply delivery tree
- Sensor: Electro-optical visible and thermal sensors for safety and reviewing route
- Ground control team #1: Allakaket for takeoff with supplies and return of UAS
- Ground control team #2: Alatna for landing, removal of supplies, and take-off back to Allakaket
- Data feeds through ground control stations to main operations team in Allakaket as well as the original site for supplies and final location for supplies

1.3.2 Location

Allakaket airport

Latitude: 66.5518333° N Longitude: 152.6221667° W

IATA: AET ICAO: PFAL FAA LID: 6A8

https://www.airnav.com/airport/PFAL

All maps in Appendix 3

1.3.3 Systems

Central Operations

- Based in Allakaket but not co-located with sUAS flight crew
- Provide coordination with flight team
- ACUASI: Director of Operations Adkins
- Allakaket and Alatna community leads
- POC for supplies to be sent to Alatna

1st flight: Supplies to be sent from Allakaket to Alatna

- sUASsUAS
    - Vertical takeoff and landing (VTOL) from Allakaket: Skyfront equivalent type
    - Full GCS system to track aircraft and local airspace
    - Endurance for up to 50 minutes per flight: 2.7 km flying to SW at 195° direction
    - Flight team @ Allakaket
        - (PIC and VOs including sensor engineering support
        - Approved local Part 107 operator with aircraft for rapid response
        - 2.7 km mission from take-off to Alatna so need BVLOS operations or VO's tracking with radio to PIC
    - Minimum payload
        - Integrated electro-optical visible sensor
        - Nadir viewing with pointable system
        - Capacity to carry 5kg cargo include medical and essential supplies

2nd flight: Return journey from Alatna to Allakaket

- sUAS
    - VTOL from Alatna: Skyfront equivalent type
    - Full GCS system to track aircraft and local airspace
    - Endurance for up to 50 minutes per flight: 2.7 km flying to NE at 65° direction
    - Flight team @ Altna
        - Backup PIC to support tracking of flight and can take-over for manual operations
        - VOs to support tracking of UAS and surrounding airspace
        - Team members to remove supplies and check aircraft for safe return
        - Approved local Part 107 operator with aircraft for rapid response
        - 2.7 km mission from take-off so need BVLOS operations or VO's tracking with radio to PIC
    - Minimum payload
        - Integrated electro-optical visible sensor
        - Nadir viewing with pointable system
        - Capacity to carry 5kg cargo include medical and essential supplies

1.4 Mission

Disaster:

A rural community is low on supplies with no road or river access. The community members are limiting personnel entering the community. The only way to get supplies in is airborne. Manned/Crewed systems are unable to fly due to IFR conditions. The river between them cannot be used because of jammed water and local flooding.

Observations

Real-time electro-optical data collected along the UAS route. Flights crews at each community will be tracking the UAS, with a take-off location GCS as well as landing GCS at the community receiving the supplies. The flight crew will provide all recording of the supplies being unloaded. The aircraft will return to the take-off at the original location.

Response mission:

This will be at the request of Alatna who needs supplies, with Allakaket having sufficient medical and every-day supplies to send to the smaller community. Allakaket will determine that a UAS is the only potential support that can get the supplies to Alatna in a timely manner.

Stakeholders:

Local community of Alatna. Those in Allakaket who provide the supplies and can spare them to ensure Alatna do not run out and to minimize the risk to the smaller community's population.

Goals:

sUAS with enhanced endurance and a significant payload capacity takes off from Allakaket. All operations occur safely in the local airspace. Given the 2.7 km distance, then either extended VLOS or beyond VLOS mission will be used to support the mission. The UAS will land in Alatna. The UAS will be tracked by two different flight crews so that the second crew manages landing and the switch during the mission, before the return flight. Extra ground crew team members in Alatna will successfully remove supplies and support UAS flight crew to return to Allakaket.

Objectives:

sUAS operations with real-time electro-optical data of flight route fed back to both GCS as well as central operations in Allakaket. Supplies successfully received in Alatna and by those in need. sUAS returns take-off from Alatna and comes back to the original site at Allakaket airport. Mission is tracked at both GCS, one in Allakaket and one in Alatna.

Real-time Mission Products:

- Electro-optical visible data from on-board system with DAA tracking from GCS
- Supplies received at Alatna

Post-Mission (fast response) Products:

- Record of all flight logs showing aircraft take-off from Allakaket, Landed at Alatna, and then returned to Allakaket with take-off from Alatna.

1.5 Execution

1.5.1 Operations Plan

<u>sUAS</u>

- Early morning to represent overnight request for supplies
- BVLOS or EVLOS with waiver
- Operations from Allakaket → Alatna →Allakaket
    - Operations on ground at Allakaket
        - Team will be based at Allakaket overnight
        - Pre-Flight checklist then take-off from Allakaket
        - Flight from Allakaket to Alatna - Switch flight ops to Alatna at halfway
        - Watching landing at location Alatna via own GCS and BVLOS
        - Follow unloading and take-off from Alatna back to Allakaket
        - Flight from Alatna to Allakaket - Switch flight ops to Allakaket at halfway
        - Manage landing back at Allakaket
    - Operations on ground at Alatna
        - Ground team based as Alatna overnight
        - Setup to track flight in parallel to flight time
        - Own Pre-Flight checklist and Track take-off at Allakaket
        - Flight from Allakaket to Alatna - Switch flight ops to Alatna at halfway
        - Lead landing at location Alatna, meet aircraft and unload
        - Prepare flight for take-off back to Allakaket
        - Lead the take-off at Alatna
        - Flight from Alatna to Allakaket - Switch flight ops to Allakaket at halfway
        - Follow landing back at Allakaket via their own GCS and BVLOS
- Flight conditions - IFR as manned/crewed unable to fly and need for rapid response

1.5.2 Data collection, processing, and dissemination

<u>sUAS</u>

- Data in flight:
    - High Precision GPS locations and time synchronization
    - Flight routes and logs sent to both GCS at Allakaket and Alatna
    - Optical data streamed to two GCS (one at Allakaket and one at Alatna)
    - On-board storage of data, downloaded upon landing and processed
    - Recording of unloading at Alatna
- Products post flight:
    - Flight logs
    - Optical imagery from on-board
    - GCS data from both locations
    - Recordings of two ground crews
    - All recordings from ground based DAA systems under BVLOS or EVLOS

1.6 Administration & Logistics

1.6.1 Planning and local logistics

sUAS flight teams need accommodation in local communities or locally based to support operations. Crew in Allakaket will need logistical support to access the runway and house the aircraft at Allakaket and provide GCS to track aircraft. UAS flight team and ground team will need accommodation and logistical support at Alatna to access the landed plane, unload supplies, and prepare aircraft for return.

Any required Part 107 waivers will be in place before missions start. Special Government Interest (SGI) waiver will be submitted to support all sUAS missions to ensure that sufficient permissions are acquired, if needed, so that they do not need to be submitted during the missions and any time lost.

1.6.2 Hazards/Risk

The following information provides specific hazards that may occur from supporting the emergency response to the pandemic event.

Hazard 1: Loss of capability for one of two GCS used in mission

- Risk: This hazard comes from loss of tracking of aircraft between two GCS's and an issue on switching control and being able to support operations. Possible effects are one GCS staying in control and being unable to track the UAS to its final location and thus requiring Return to Base (RTB) and the mission cannot be completed.
- Mitigation: Before the missions start, the two GCS crew's will be in communication and ensure that they have backup power. Also, the PICs will be aware of the geographical limitations of their tracking capabilities and the procedures to follow if one GCS is unable to operate. Lead organization that is operating the GCS will share its safety management system with the disaster response team leads so all are aware of procedures should this hazard occur. If one GCS does lose capability, the PIC at the functioning GCS will continue to be in control of the UAS and will work with their flight crew to ensure safe operations. If required, a Divert Land Immediately (DLI) will be used or a Return to Land (RTL) to the original take-off site or to a safe chosen landing site.

Hazard #2: Loss of communications between crew at two GCS

- Risk: This hazard comes from two flight crews and two GCS used for the UAS operations and a drop in communications between them when based in different locations. Possible effects are a drop in GCS tracking of the UAS and/or no confirmation of the handing from the UAS from one GCS to another.
- Mitigation: Before the mission starts, the two PICs will check all communications between the two GCS's and backup communication tools that they are using to ensure that at least one GCS is tracking the UAS. They will have a procedure setup on how to perform the handoff between the two GCS's and their contingency plan if they lose communications. If there is a drop in communication, the original take-off site will stay in control of the UAS tracking as they would have been the lead until the handover. If there is no return to joint communications, then the

take-off site PIC will set the RTB on the aircraft, and this will inform the second GCS PIC that the communication issue has prevented them from completing the mission.

Hazard #3: Ground team unable to access payload bay of sUAS

- Risk: This hazard comes from the ground crew at the second site being unable to offload the supplies and/or unable to access the payload bay. Possible effects are a failure to drop off the supplies at the needed location and/or a return to the original take-off site within completing the mission.
- Mitigation: The ground team at each site will be trained in how to access the payload bay for the sUAS and will have communications with the two PICs at the GCS as well as the flight teams. Depending on the mission type, the ground team can be part of the flight team. The ground team will follow the safety procedures for the aircraft to determine where the issues reside and if this can be fixed on site using their flight crew's equipment. If the payload bay cannot be opened, then the flight crew will take over and ensure that the aircraft is safe for its return flight back to the original take-off site. Then this site will have the equipment needed to fix the payload bay issue and support another mission to deliver the payload contents.

Hazard #4: Loss of capability for one of two GCS used in mission

- Risk: This hazard comes from an aircraft loss of control between two GCS and only one of the GCS can track the UAS. Possible effects are an uncontrolled aircraft that is unable to be tracked in the NAS or an aircraft that is unable to reach its destination and that must return to its original take-off location while being unable to complete its mission.
- Mitigation: Before the mission starts, the two PICs will check all communications between the two GCS's and all backup communication tools that they are using to ensure that at least one GCS is tracking the UAS. They will have a procedure setup on how to perform the handoff between the two GCS's and their contingency plan if they lose communications. If there is a drop in communication, the original take-off site will stay in control of the UAS tracking as they would have been the lead until the handover. If there is no return to joint communications, then the take-off site PIC will set the RTB on the aircraft and this will inform the second GCS PIC that the communication issue has prevented them from completing the mission.

1.6.3 Community outreach and connections

Communication with Allakaket airport beforehand to ensure that the sUAS can takeoff and not impact manned/crewed operations in the region and that would use the airport. Central operations would communicate with the Allakaket community to set up for tracking the UAS. Ground crew in Alatna would need to communicate with organizations requiring the supplies.

Flight crews and central operations would need to submit requests to obtain Part 107 waivers, where needed

1.6.4 Disaster response mission specific information

Spot forecast for Allakaket region from National Weather Service (NWS). This is downloaded to the flight checklist documentation for each crew and GCS.

1.6.5 Mission Summary

Disaster:

Urgent needed delivery of medical and community supplies from Allakaket to Alatna in rural Alaska. These two communities are cut off from the road and river network during a pandemic event. Also, they do not want people moving between communities to minimize impact and any potential spread.

Objectives:

sUAS operations with real-time electro-optical data of flight route fed back to both GCS as well as central operations in Allakaket. Supplies successfully received in Alatna and by those in need. sUAS returns take-off from Alatna and comes back to the original site at Allakaket airport. Mission is tracked at both GCS, one in Allakaket and one in Alatna.

Flight Missions:

sUAS with enhanced endurance and a significant payload capacity takes off from Allakaket. All operations occur safely in the local airspace. Given the 2.7 km distance, then flown under EVLOS or BVLOS mission will be used to support the mission. The UAS will land in Alatna. The UAS is tracked by two different flight crews so that the second crew manages landing and the switch during the mission, before the return flight. Extra ground crew team members in Alatna successfully remove supplies and support UAS flight crew to return to Allakaket.

Metrics of success:

- sUAS successfully takes off from Allakaket with payload onboard
- Team at Alatna take over control of sUAS; still tracked by team at Allakaket
- Team at Alatna land aircraft, team at Allakaket tracks it
- Team at Alatna unload critical supplies and take-off again to go back to Allakaket
- Team at Allakaket sees supplies given to those in need at Alatna
- Team at Allakaket take over control of sUAS; still tracked by team at Alatna
- Team at Allakaket land aircraft, team at Alatna track it
- Safe landing at Alatna with BVLOS/EVLOS operations
- Team at Allakaket and Alatna able to simultaneously track aircraft throughout
- Safe return of sUAS to Allakaket so that it could be reused for follow-on mission

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1.7 Command & Signal

Aim: *This section should provide an overview of the command and communication systems to be used. This supports anyone reviewing and evaluating the CONOP to efficiently assess those sufficient communications are in place to connect the UAS flight crew with additional organizations connected to and supporting the disaster response and/or preparedness.*

For some of the details included in this section, the plans will cross reference to the ORA, as they will be mitigation plans to ensure safe flight operations and minimize the risk of hazards that can impact flight operations.

Include details on:

- Type of communications tools used to connect PIC, Observer, and other crew members

- Security measures in place to protect the flight crew
- Hand-off process, where appropriate, between the PIC and visual observer(s)
- Flight team lost link and emergency procedures to ensure safe flight operations
- Communication tools use to connect the flight team and Air Route Traffic Control Center
- Note: for each communication tool to be used, this section should also include signals used such as radio frequencies, flight control frequencies, etc.

1.8 Supplementary appendices to accompany CONOP

1.8.1 *Appendix 1: Operational Details – One Pager*

Mission and Disaster Preparedness/Response

Medical and Critical Supply Delivery: Two Rural Communities [Allakaket to Alatna].

Mission Purpose/Objectives

Purpose: Pandemic event, Rural community low on critical supplies, no road access, Airborne only possible. Manned systems unable to fly due to instrument flight rules (IFR) conditions. Do not want people moving between communities. River between them cannot be used.

Goals: Take-off from Allakaket, Safe operations in National Airspace System (NAS). Visual line of sight (VLOS) or extend-VLOS mission. Land at Alatna [different from the original flight crew, second crew managing landing and switch during mission]. Extra ground crew at Alatna remove supplies and support UAS to return to Allakaket.

Objectives: Large UAS operations with real-time data of flight route. Supplies received at Location #2. UAS return take-off occurs. Mission tracked at both GCS, Allakaket and Alatna.

Mission Results

Observations: Real-time optical data from UAS along route, tracking of UAS at take-off location ground control station (GCS) as well as landing GCS. Recording supplies being unloaded and aircraft return take-off back to original location

Products: Electro-optical data from on-board system. Detect and avoid (DAA) tracking from GCS. Supplies received at Alatna. Record of all flight logs showing aircraft take-off from Allakaket, Landed at Alatna, and then returned to Allakaket with take-off from Alatna [note that original flight crew will stay at Allakaket and flight crew + extra ground crew for supply removal at Alatna]

Mission Procedures/Approach

Small UAS: Operations from Allakaket -> Alatna -> Allakaket
Time of day - Early morning to represent overnight request for supplies
Type of operations - visual line of sight (VLOS) or EVLOS with Part 107 Waiver

Operations on ground at Allakaket
Original Flight Team will be based at Allakaket overnight
Pre-Flight checklist
Take-off from Allakaket
Flight from Allakaket to Alatna - Switch flight ops to Alatna at halfway
Watching landing at location Alatna via own GCS and BVLOS
Follow unloading and take-off from Alatna back to Allakaket
Flight from Alatna to Allakaket - Switch flight ops to Allakaket at halfway
Manage landing back at Allakaket

Operations on ground at Alatna
Ground team based as Alatna overnight
Setup to track flight in parallel to flight time
Own Pre-Flight Checklist
Track take-off @ Allakaket
Flight from Allakaket to Alatna - Switch flight ops to Alatna at halfway
Lead landing at location Alatna, meet aircraft and unload
Prepare flight for take-off back to Allakaket
Lead take-off at Alatna
Flight from Alatna to Allakaket - Switch flight ops to Allakaket at halfway

Mission Milestones

Outcomes/Actionable Intelligence
Small UAS operations move critical cargo from Allakaket to Alatna and back
Switching UAS tracking between two GCS
Application of communication tools and practices for small UAS operations in NAS
Transfer of cargo and critical supplies by Alatna team
Return of small UAS to main hub to prepare for future supply delivery mission

Metrics of success
Small UAS successfully takes off from Allakaket with payload onboard
Team at Alatna take over control of small UAS; still tracked by team at Allakaket
Team at Alatna land aircraft, team at Allakaket tracks it
Team at Alatna unload critical supplies and take-off again to go back to Allakaket
Team at Allakaket sees supplies given to those in need at Alatna
Team at Allakaket take over control of small UAS; still tracked by team at Alatna
Team at Allakaket land aircraft, team at Alatna track it
Safe landing at Alatna with VLOS/EVLOS operations
Team at Allakaket and Alatna able to simultaneously track aircraft throughout
Safe return of small UAS to Allakaket so that it could be reused for follow-on mission

1.8.2 Appendix 2: Flight Checklists

Aim: This appendix collects all flight checklists the mission team would complete pre-, during, and post-flight while at the mission location as well as pre- and post-operation before arriving and after leaving the mission location. Each flight checklist is included in a supplementary document. These checklists are to supplement the maintenance checklists that would go with the organization leading the missions for the disaster response and/or preparedness that they use to ensure the safety of their aircraft and equipment. These maintenance checklists will likely be a part of the organization's own safety assessment process.

Include details on:

- Before CONOP development: Site Survey (details on assessment of mission location)
- Before Operations: Mission checklist (complete at home for lead organization)
- Pre-deployment: Checklist to complete prior to leaving for mission site
- Deployment: Checklists for flight operations, once arrived at mission site
- Pre-flight: Checklist to follow prior to flight including example of flight readiness review
- Post-flight: Checklists to follow including log sheet
- Post-mission: Checklists to follow at the end of all flights for the mission

1.8.3 Appendix 3: Additional Requirements

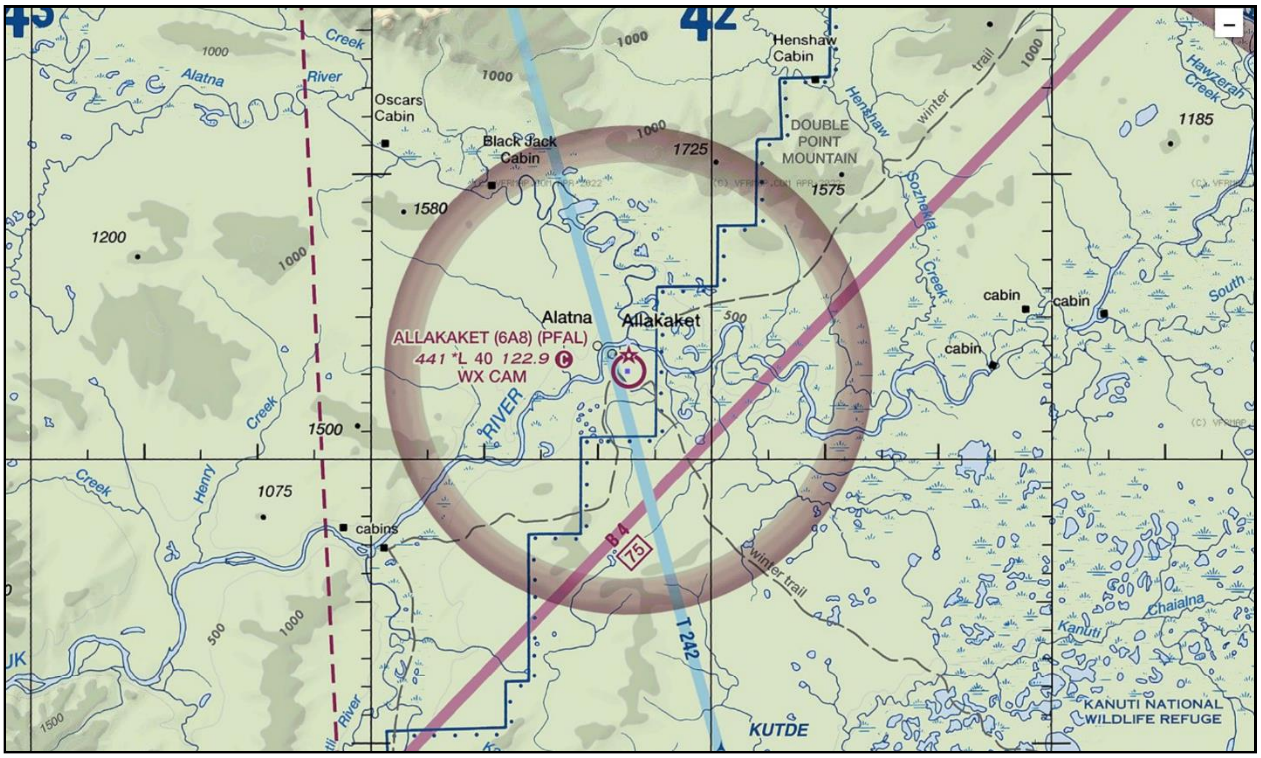
Allakaket airport

Latitude: 66.5518333° N Longitude: 152.6221667° W

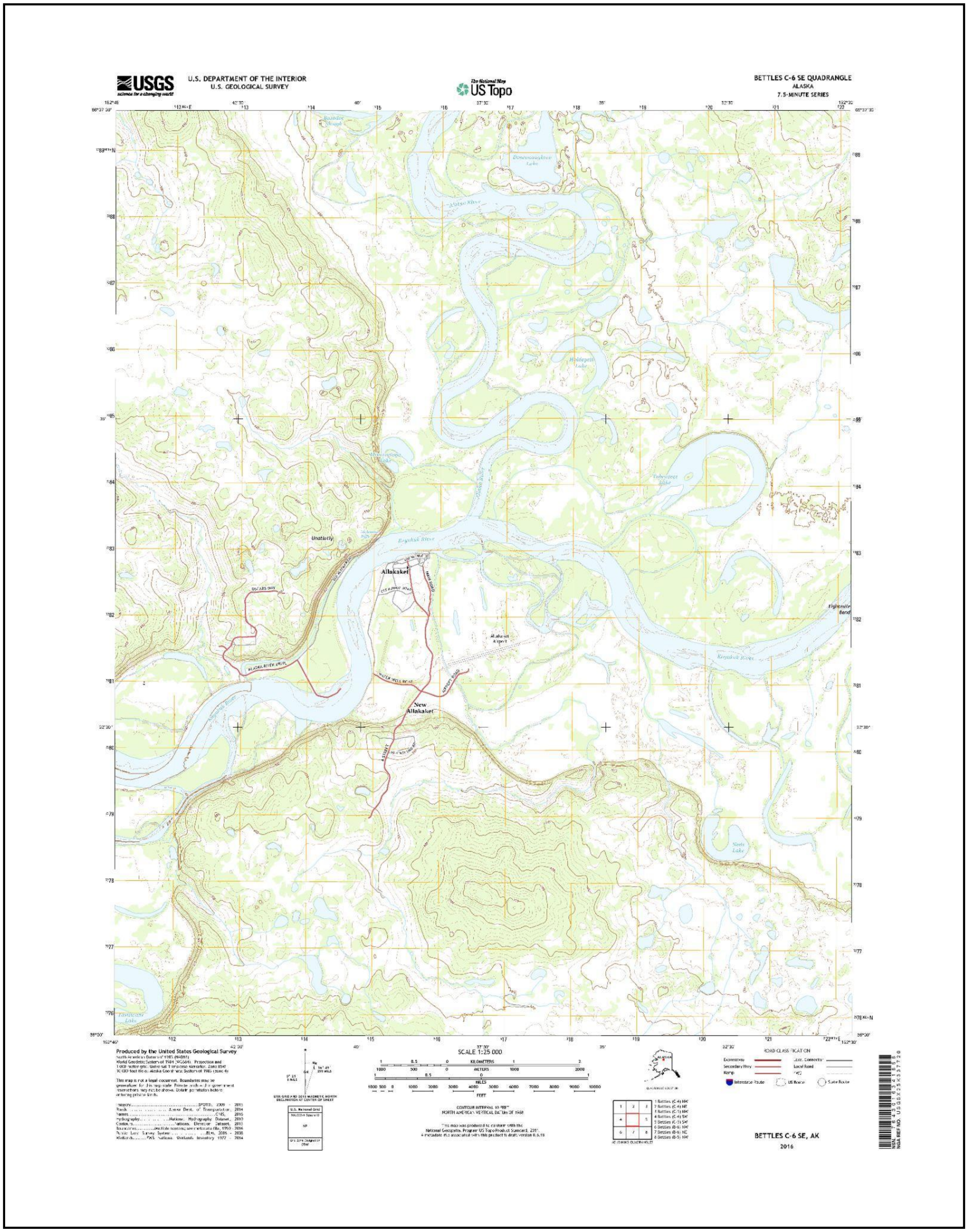
IATA: AET ICAO: PFAL FAA LID: 6A8

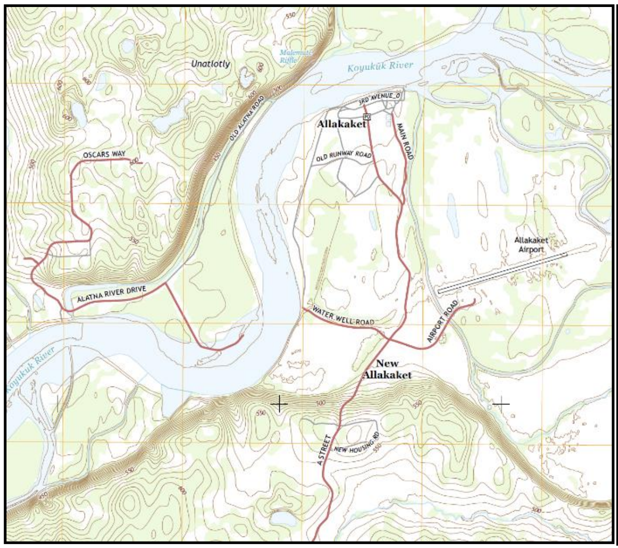
https://www.airnav.com/airport/PFAL

Sectional Charts

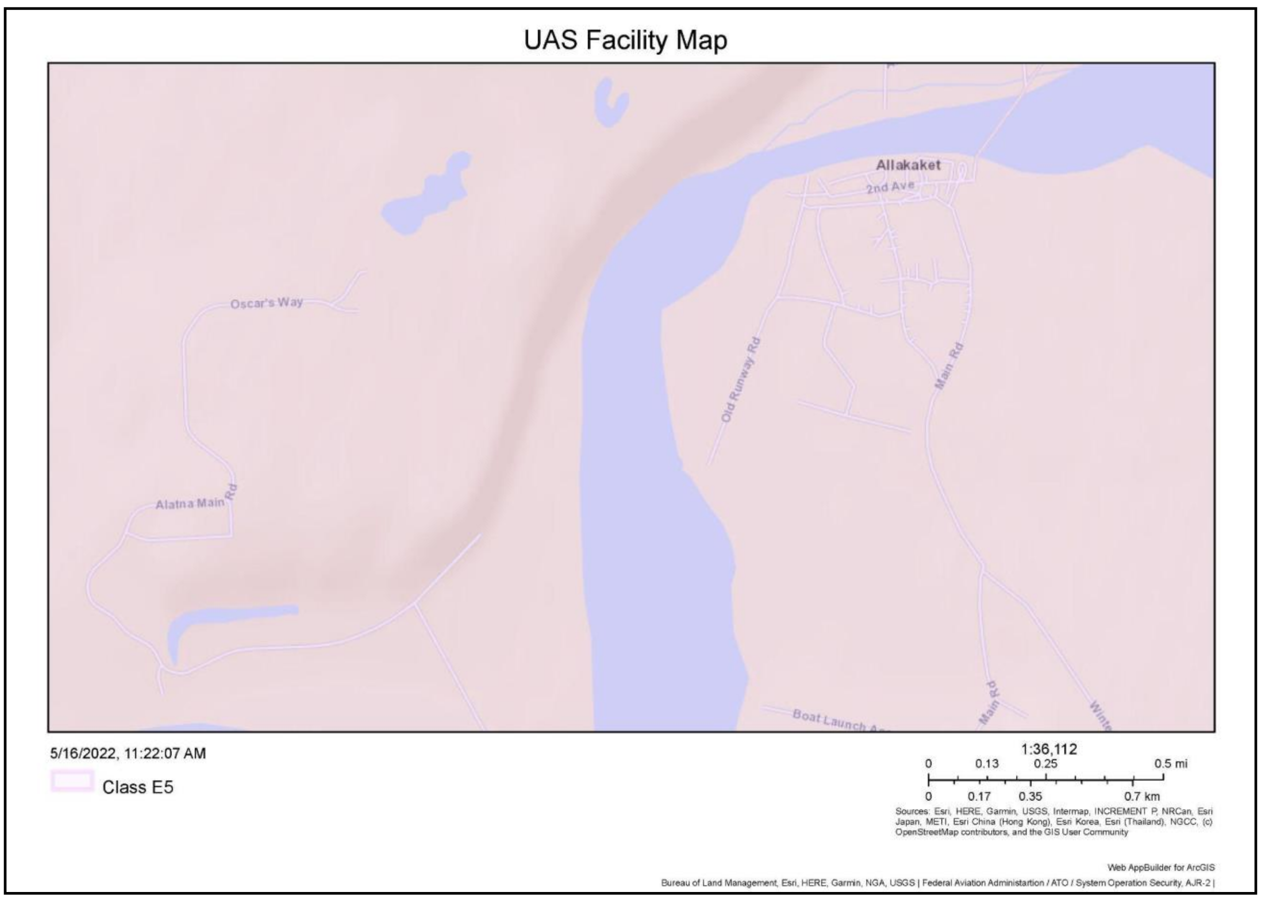


United States Geological Survey (USGS) 7.5-minute topographic map





[Low Altitude Authorization and Notification Capability (LAANC) Facility Maps]



1.8.4 Appendix 4: Special Government Interests (SGI) Process Documentation

- FAA Order JO7200.23B
  Processing of UAS Requests. Effective: July 14, 2020
    - Page 16 to 19: Chapter 6. 14CFR Part 91, COA Processing
    - Page 17 – SGI information: The SGI process will be managed by Systems Operations Security as per FAA Order JO 7210.3
- FAA Order JO7210.3CC
  Facility Operation and Administration. Effective: June 17, 2021
    - Page 469: Section 21-5-4. UAS SGI Addendum Request Process and Coordination
    - System Operations Support Center (SOSC) Contact Phone Number - 202-267-8276
- FAA Request Form for Expedited SGI Waiver or Authorization for UAS Operation – Form # SOSC 2020/02/20 1125Z

1.8.5 Appendix 5: Data Archive Plan

Processing specifications

- Imagery and video collected at maximum resolution
- Sufficient overlap to support Structure from Motion processed
- Full motion video captured where possible from available payload

File formats

- Detailed descriptions: https://www.ogc.org/docs/is
- Electro-optical visible and multispectral visible - near-infrared imagery
    - Joint Photographic Experts Group (JPEG): containing lossy and compressed data
    - Tag Image File Format (TIFF): store raster graphics and image information
- Broadband thermal infrared imagery
    - Radiometric JPEG: JPEG and TIFF for thermal data
    - Stores Temperature data as well as RGB JPEG of thermal data
- Electro-optical visible and multispectral visible - near-infrared video
    - MPEG-4 format (MP4, note MOV from EO visible on dual camera system)
    - High compression international audio-visual coding standard
- Broadband thermal infrared video
    - SEQ/FFF - Proprietary FLIR video formats that store images and thermal data
    - MOV - MPEG 4 video container file
- Point clouds - LiDAR data
    - LAS (binary file format) or LAZ (compressed LAS file)
- Geospatial data - GEOTIFF
    - Standard file for GIS with embedded geolocation data
- Google Keyhole Markup Language (KML)
    - KML (default Google Earth geospatial format)
    - KMZ (compressed KML file format)
- Geographic JavaScript Object Notation (GEOJSON)
    - GEOJSON (coordinates as text in JavaScript Object Notation form

- Shapefile (SHP)
  - SHP (feature geometry), SHX (shape index position), DBF (attribute data)
  - PRJ (projection system metadata), XML (associated metadata)

Data archiving locations

- In-Flight:
  - Onboard storage of all data as well as through specific GCS
  - Data streamed through GCS to operations center to support secondary archive
- Post-Flight:
  - Online secure file storage per UAS and per mission (password protected)
  - Folders for raw sensor data as well as flight logs and route data
  - Folders to store post-processed data and all planning documents

1.8.6 Appendix 6: Rationale behind each section in CONOP

Situation

High level situation awareness and sufficient information to clearly define each element.

Template items

- *Organization's business (manufacturer, operator, system integrator, etc.).*
- *Geographic operating boundaries (lack of specifics implies very broad NAS access).*
- *Describe if launch/ fly/ recover only over private property with owner's permission.*
- *Define the minimum and maximum operating altitude of the vehicle.*
- *Describe if operating within or beyond VLOS.*
- *Define command and control link.*
- *Provide details on dimensions and materials for vehicle design.*
- *Identify the vehicle's maximum cruise speed and maximum operating gross weight.*
- *Describe Proposed Airspace Classes (A, B, C, D, E, F, etc.).*
- *Define the Proposed Operating Airspace (character aspects – regardless of class).*
- *Describe location of the control station.*

Mission:

Sufficient, clear, and concise statement of what the flight team and lead organization and/or stakeholders for the disaster response mission request want to accomplish. Provide the most important large-scale information and provide sufficient information and clearly define each element.

- *Describe the intended mission of the UAS (surveillance, response, preparedness, etc.).*

Execution:

Thoroughly state how you will "execute" the mission and provide sufficient information and clearly define each element.

- *Identify Airspace Considerations (peculiarities and congestion, special use, etc.)*
- *Give information on Launch and Recovery Details / Location(s)*
- *Identify and describe the vehicle's proximity to people, infrastructure, and surface vehicles*
- *Identify and describe the vehicle's proximity to other NAS users*
- *Identify whether you want to Flight into Known Icing*
- *Identify meteorological conditions you want to operate in Visual / Instrument conditions*
- *Identify the flight rules you want to operate in Visual / Instrument Flight Rules*
- *Describe whether your geographic and airspace boundaries are physically contiguous*
- *Identify Automation Level (occasional autopilot, 100% autonomous, manual control, etc.)*
- *Identify minimum crew and support personnel*
- *Identify the role(s) of the crew and support personnel*
- *Identify whether you will fly over people not involved in the operation*
- *Identify any requests for airspace be blocked off for your exclusive use*
- *Identify your operator/vehicle ratio (1:1, etc.)*
- *Identify day and/or night operations*
- *Describe your plan for safety of Operator(s) and Observer(s)*
- *Describe the training level of each team member*

Command & Signal:

Sufficiently provide information of their plans involving command and communication functions between different portions of the UAS and stakeholders. Clearly describe how you will command and signal amongst the various components of the entire system (vehicle, control station, control link, observers, etc.)

- *Describe Communication between Operator, Observer, Crew Members (visual, radio, etc.)*
- *Describe the Electronic Security of the Control Link*
- *Describe the Physical Security of the operator and control station*

- *Describe real time situational awareness features*
- *Describe the # of operators, and hand-off between control*
- *Describe Lost Link Procedures or loss of Positive Control*
- *Describe Communication Expectations with Air Traffic Control*
- *Describe Emergency Procedures*

Administration & Logistics:

Adequately provide the information or instructions pertaining to how and with whom they will coordinate to conduct the operations.

- *Details on Community Outreach (Flying / Non-Flying Public, municipalities, airports, etc.)*
- *Describe when if flight routes will be filed with Air Traffic Control (VFR / IFR)*
- *Identify Liaisons with Air Traffic Control*
- *Identify MISHAP Reporting Procedures*
- *Identify when NOTAMs will be posted*