



A 10x5 grid of 50 line-art icons related to drones and technology. The icons include various drone models, remote controls, cameras, GPS devices, and other tech-related symbols. The icons are arranged in a repeating pattern of 10 rows and 5 columns. The first row contains a drone, a remote control, a camera, a GPS device, and a drone. The second row contains a camera, a drone, a drone, a drone, and a monitor. The third row contains a remote control, a GPS device, a drone with a lightning bolt, a GPS device, and a drone. The fourth row contains a drone, a smartphone, a drone, a camera, and a camera. The fifth row contains a drone, a drone with a box, a target, a wrench and screwdriver, and a head with a brain. The sixth row contains a drone, a drone, a laptop, a GPS device, and a head with a brain. The seventh row contains a GPS device, a remote control, a drone, a location pin, and a drone. The eighth row contains a drone, a drone with a box, a target, a wrench and screwdriver, and a head with a brain. The ninth row contains a drone, a drone, a laptop, a GPS device, and a head with a brain. The tenth row contains a GPS device, a remote control, a drone, a location pin, and a drone.



Get Your Drone Business Flying: Tips and Best Practices from FAA Insiders for Getting to YES for Your Part 107 Operational Approvals



Sabrina Saunders-Hodge,
FAA UAS Integration
Office



Paul Strande,
FAA UAS Integration
Office



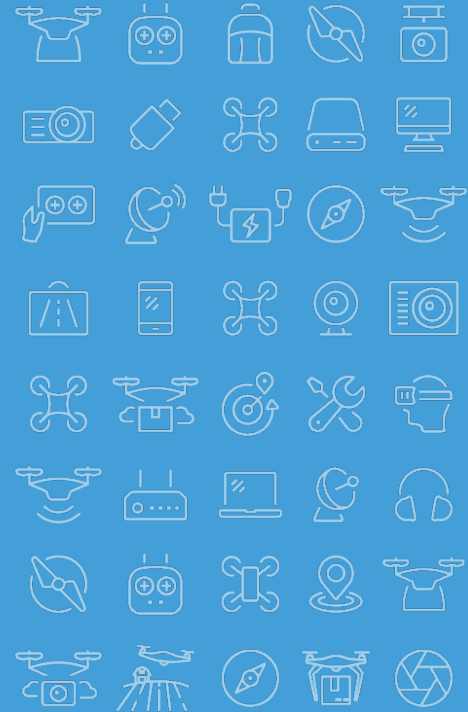
Jeremy Grogan,
FAA Flight Standards
Service



John Page,
FAA Emerging
Technologies Team



Rachel Carlstrom,
FAA UAS IPP





FAA UAS SYMPOSIUM

Getting to Yes with Part 107 Waivers

Rachel Carlstrom

AUS-400 UAS IPP SLT Program Manager

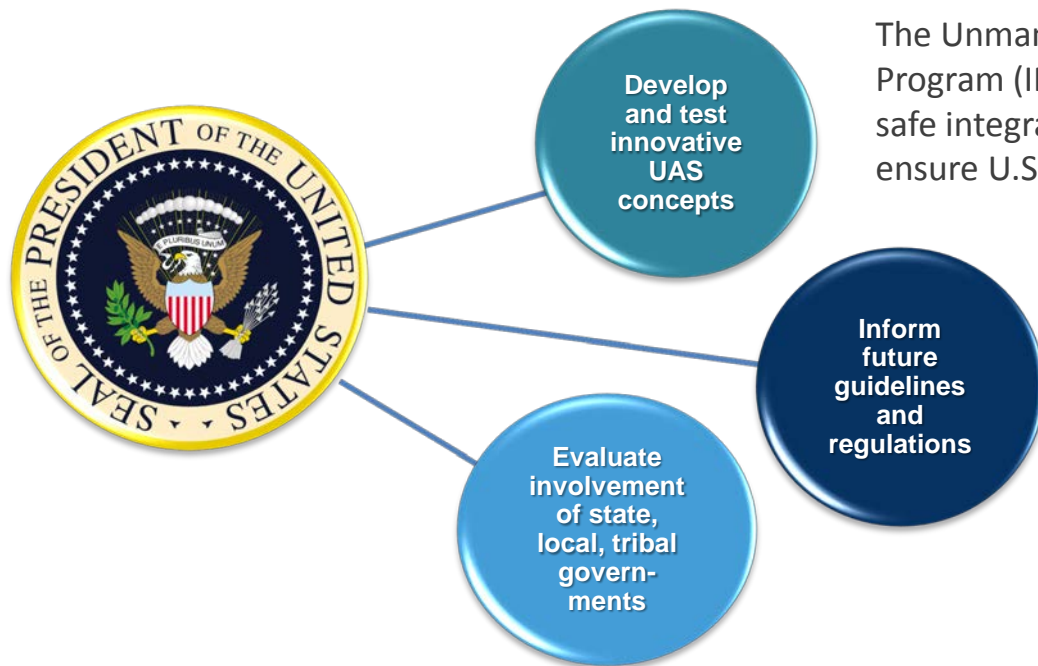
AFS-200 IPP UAS 135 Certification Team Lead



Federal Aviation
Administration



UAS Integration Pilot Program



The Unmanned Aircraft Systems (UAS) Integration Pilot Program (IPP) is designed to foster innovation, advance the safe integration of drones into our nation's airspace and to ensure U.S. global leadership in the emerging UAS industry.

The 9 Lead Participants are evaluating several advanced operational concepts, including:

- Night operations
- Flights over people
- Beyond visual line of sight
- Package delivery
- DAA technologies
- Reliability and security of data links



#UAS2019



Matternet (IPP North Carolina DOT)



- Background of Operations:

- **Project Activities:** medical specimen delivery
- **Location:** WakeMed campus in Raleigh, NC
- **Aircraft:** Matternet M2 quadcopter



- Regulations Waived:

- Part 107.39 Operations Over Human Beings
- Part 107.31 Visual Line of Sight Aircraft Operation
- Part 107.29 Daylight Operations
- Part 107.33(b) and (c)(2) Visual Observer



#UAS2019



IPP Choctaw Nation of Oklahoma



- Background of Operations:
 - **Project Activities:** Agriculture dispensing, inspection, linear infrastructure inspection, sensing/collection, post disaster
 - **Location:** Choctaw Nation property
 - **Aircraft:** 30+ UAS
- Regulations Waived:
 - Part 107.29 Daylight Operations
 - Part 107.31 Visual Line of Sight Aircraft Operation
 - Part 107.39(a) Operations Over Human Beings
 - Part 107.33(b) and (c)(2) Visual Observer
 - Part 107.35 Operation of Multiple UAS (AIRXOS)



#UAS2019



Successful Tactics for 107 Waivers



- Well developed detailed CONOPS
- Identified risks and layered mitigations to support safety case
- Understood and followed crawl, walk, run approach
- Provided detailed, quick responses to FAA's questions



#UAS2019



Matternet (IPP North Carolina DOT)



- Successful Tactics

- Leveraged experience from operations in Switzerland
- Manufactured and designed operation specific aircraft
- Selected Low Risk Operational Environment
 - Operations over limited populated areas
 - Aircraft parachute
 - Flight path mainly over rooftop buildings
 - Low altitude operations



#UAS2019



IPP Choctaw Nation of Oklahoma



- Successful Tactics
 - Knowledgeable and operationally experienced personnel and industry partners
 - Used the right aircraft for the right job
 - Purposefully selected route with low risk environment
 - Physically restricted access to non-participants
 - Rural, remotely populated areas
 - Low density air traffic



#UAS2019





FAA UAS SYMPOSIUM

Get Your Drone Business Flying: *Tips and Best Practices from FAA Insiders for Getting to YES for Your Part 107 Operational Approvals*

Paul Strande, PMP

Deputy Director, FAA UAS Research Division (AUS-300)



Federal Aviation
Administration

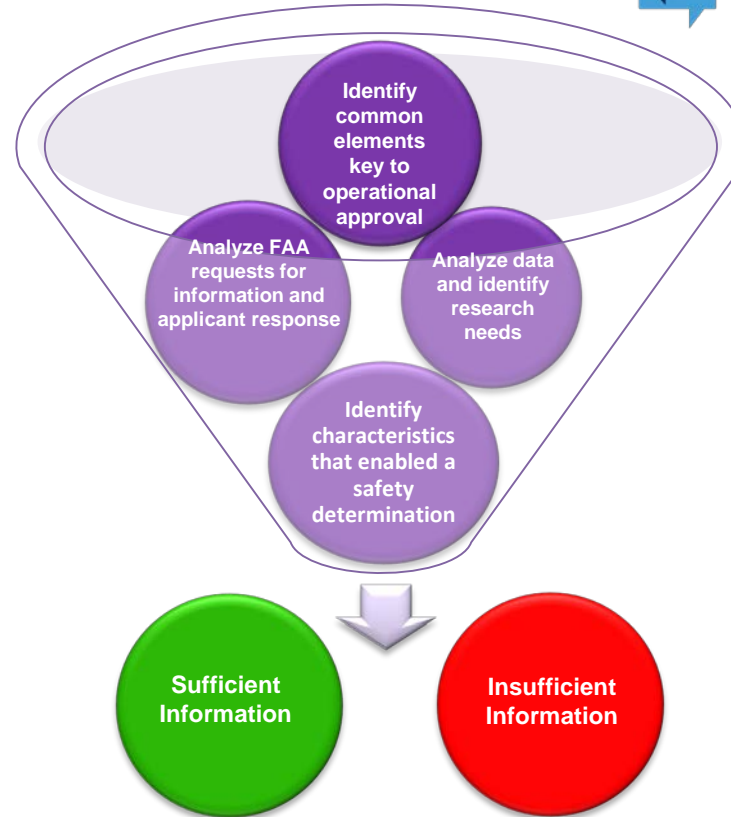


Operational Approval Trend Analysis



FAA DroneZone Waiver Database

- ✓ Concept of Operations (CONOPS)
- ✓ Operational Risk Assessment (ORA)
 - Identified Safety Risks
 - Mitigations
 - Residual Risks
- ✓ Test Data (to support the ORA mitigations)
- ✓ Operations Manual
- ✓ Vehicle Description
- ✓ Training Curriculum
- ✓ Other documentation to support the safety justification for the proposed operation



#UAS2019



Operational Approval Trend Analysis



- Beyond Visual Line of Sight (BVLOS) and Operations Over People (OOP) were chosen to be the first operations under the magnifying glass
- The vast majority of waiver applications are two sentences or less. This illustrates the need for tips and guidance to help applicants understand the qualities of sufficient waivers
- Focusing the trend analysis on waivers with FAA requests for additional information allowed the research team to more quickly analyze waivers with quality data



Non-Airspace Waivable 107 Parts	Total # Applied	Total # Appr. (Full Grant)	# Req. for Additional Info.	# Approved	# Part.Appr.	# Disappr.	# Cancelled
BVLOS Op	1813	27	39	5	1	27	6
OOP	2377	25	30	7	0	12	11
Night time Op	6019	1183	1151	657	12	216	266
Visual Observer	674	23	23	4	0	16	3
multiple sUAS Op	342	20	17	5	2	9	1
Op near a/c	426	0	4	0	0	1	3
Moving vehicle	852	1	12	0	0	8	4
Op limitations: ground speed	306	0	0	0	0	0	0
Op limitations: altitude	1055	17	66	14	1	30	21
Op limitations: minimum visibility	553	4	9	1	0	6	2
Op limitations: min dist from clouds	342	2	4	0	0	4	0

** DroneZone went live January 6, 2018. The numbers in this table and the trend analysis only reflect data for applications submitted after January 6, 2018 and before April 30, 2019. We acknowledge that many previous applications were processed.



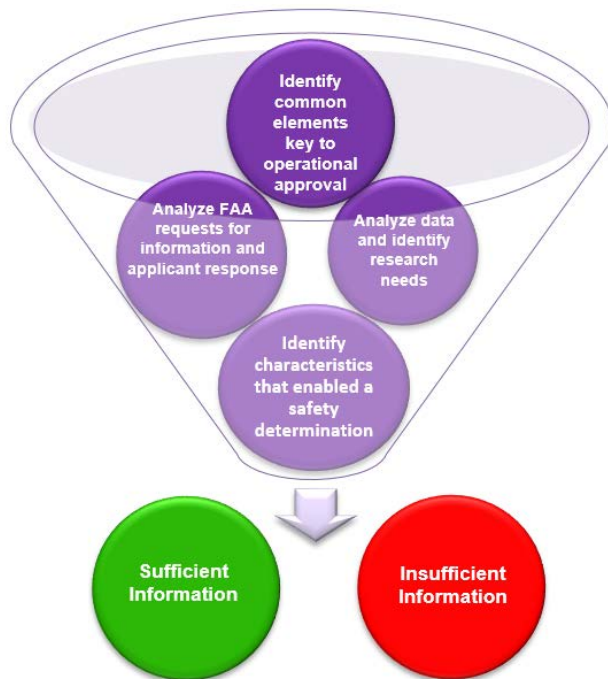
#UAS2019



Beyond Visual Line of Sight (107.31) Waiver Trend Analysis - Common Elements Key to Operational Approvals				
Waiver Application Elements	Command and Control (C2) Link and Emitters Performance Capabilities	Detect-and-Avoid (DAA) Methods	Weather Tracking and Operational Limitations	Training Requirements for Pilots and Other Participating Persons
<p>Sufficient Information</p> <p>--</p> <p>Characteristics of the Beyond Visual Line of Sight (BVLOS) applications approved after requests for additional information</p>	<p>-States and demonstrates max range and envelope that C2 can definitely operate in, taking into account geographic area, environment, and terrain</p> <p>-Provides a complete description of each emitter, including the Federal Communications Commission (FCC) grant of authorization and FCC ID number for each transmitter/emitter on the sUA and ground control station</p>	<p>-Detailed descriptions and procedures for risk mitigations to avoid collisions with aircraft (ex. Visual Observers, technology)</p>	<p>-Details when weather reports will be gathered, what will be gathered, and where they will be taken from.</p> <p>-States weather limitations, such as small unmanned aircraft system (sUAS) manufacturer's limitations or wind speed</p>	<p>-Details an employee training and testing program.</p> <p>Example:</p> <p>-Lists out courses/subjects covered</p> <p>-Tests corrected to 100% and stored for easy retrieval later</p>
<p>Insufficient Information</p> <p>--</p> <p>Characteristics of the Beyond Visual Line of Sight (BVLOS) applications after requests for additional information</p>	<p>-C2 operational capabilities not evident</p> <p>-Not demonstrating C2 can operate at stated max range or stating the envelope. i.e. lacking data</p> <p>-Lack of FCC grant of authorization or FCC identification number for each transmitter/emitter on the small unmanned aircraft system (sUAs) and ground control station</p>	<p>-Detailed methods or procedures to see and avoid non-participating aircraft and people are not evident</p> <p>-Video feed is not sufficient; limited to the direction the camera is pointing. Applicant needs to consider 360 degree awareness.</p> <p>-Automatic dependent surveillance - broadcast (ADS-B) not sufficient. ADS-B is for cooperative traffic. Uncooperative traffic needs to be addressed.</p> <p>-States 'evacuation of area', but doesn't mention how will the area will be evacuated.</p> <p>-'Will not fly over people' statement is not sufficient.</p>	<p>-Providing general, or no statements</p> <p>Examples:</p> <p>-'We only fly on clear days'</p> <p>-'Weather is to be of Visual Flight Rules in nature' is not sufficient</p> <p>- Multiple applications not addressing weather requirements</p>	<p>-Provision of a method of assuring all required persons participating in operation have knowledge in all aspects of BVLOS not evident</p> <p>-Not stating who will have the training, what the training will consist of, or a method of assuring all required persons have been successfully trained</p>

Operations Over People (107.39a) Waiver Trend Analysis - Common Elements Key to Operational Approvals				
Waiver Application Elements	Ground Collision Severity	Laceration Injuries	Description of the Operation	Unique Remote Pilot Experience
<p>Sufficient Information</p> <p>--</p> <p>Characteristics of the Operations Over People (OOP) applications approved after requests for additional information</p>	<p>Applicants provided their own impact / injury severity tests for their requested small unmanned aircraft system (sUAS).</p> <p>--OR--</p> <p>Applicants chose a sUAS which had impact / injury severity test data readily available.</p> <p><u>Note:</u> While not seen in the approved waivers with requests for additional information, other approved operations over people (OOP) applications show that providing vehicle design and operational reliability data (with other operational mitigations, typically including minimal population size/density and/or minimal time spent over people) in place of injury severity data can be sufficient.</p>	<p>Applicants provided their own laceration tests for their requested sUAS.</p> <p>--OR--</p> <p>Applicants chose a sUAS which had laceration test data readily available.</p> <p><u>Note:</u> While not seen in the approved waivers with requests for additional information, other approved OOP applications show that providing vehicle design and operational reliability data (with other operational mitigations, typically including minimal population size/density and/or minimal time spent over people) in place of injury severity data can be sufficient.</p>	<p>Applicant proposed operational limitations:</p> <ul style="list-style-type: none"> - Altitude; Airspeed (needed to protect people on the ground) - Time flown over people; population size & density – (minimizing is a plus) - Confined area of operation (most applicants geo-fenced) - Environmental limitations: maximum wind speeds, minimum visibility, temperature range <p>Applicant described operating conditions:</p> <ul style="list-style-type: none"> - Equipment that enhances safety (i.e., prop guards, parachute) - Training taken by Remote Pilot / Visual Observers <p>Applicant described procedures:</p> <ul style="list-style-type: none"> - Contingency actions for system faults (Ex: Return to Home mode) 	<p>Applicants provided an extensive list of qualifications / experience prior to operating over people.</p> <p>Example qualifications / experience that affected approval:</p> <ul style="list-style-type: none"> - Part 107 pilot's license - Total hours operating sUAS - Total hours operating specific make and model of sUAS - Remote pilot specific Ops Over People training and testing to ensure pilot has necessary knowledge and skills. Applicant provides detailed description / curriculum for training. May include flight training and site training.
<p>Insufficient Information</p> <p>--</p> <p>Characteristics of the Operations Over People (OOP) applications after requests for additional information</p>	<p>(1) Applicants provided:</p> <ul style="list-style-type: none"> • Impact / injury severity test data for a different sUAS. • Mathematical formulas and calculations in place of test data. Ex: Impact probability <p>(2) Applicants stated a parachute will be used, but did not provide parachute test data. FAA asked if parachute met an industry standard. (i.e. ASTM F3322-18 Standard Specification for sUAS Parachutes).</p>	<p>Applicants provided:</p> <ol style="list-style-type: none"> (1) Laceration injury test data for a different sUAS (2) A statement that propeller guards will be used, and/or the motors will stop upon impact, but no supporting test data. (3) No mention of laceration injury prevention / test data at all. 	<p>Applicants did not describe enough operating limitations / conditions / procedures.</p> <p>Applicants mentioned use of return to home mode as a fail safe, but did not provide method(s) to mitigate the risk of the sUAS entering the path of another aircraft or impacting people or structures while operating in return to home mode.</p>	<p>Applicants stated RPIC has a Part 107 pilot's license, but give no other qualifications or experience to show the FAA the pilot could safely operate over people.</p>

Using the Lessons Learned



Approach

- ✓ Well Defined Business Vision
- ✓ Concept of Operations (CONOPS)
- ✓ Operational Risk Assessment (ORA)
 - Identified Safety Risks
 - Mitigations
 - Residual Risks
- ✓ Test Data (to support the ORA mitigations)
- ✓ Operations Manual
- ✓ Vehicle Description
- ✓ Training Curriculum
- ✓ Other documentation to support the safety justification for the proposed operation

Lessons Learned from past approvals can inform your approach





FAA UAS SYMPOSIUM

Getting to Yes with Part 107 Waivers

John Page

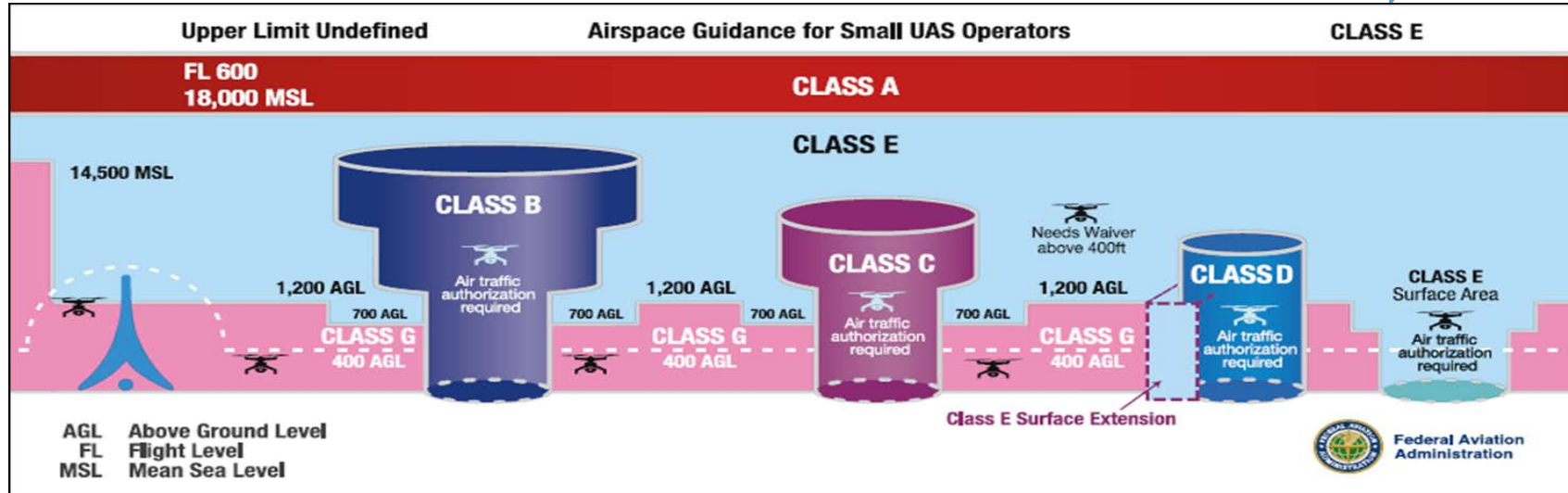
Air Traffic Specialist



Federal Aviation
Administration



Part 107 Airspace Requirements



- Operations in Class G and Class E non-surface do not require ATC authorization
- Operations in Class B, C, D & Class E surface areas designated for an airport require ATC authorization
- Online portal available at the FAA DroneZone and through LAANC.



#UAS2019



Methods of Authorization



- Under 14 CFR Part 107 there are 2 methods to receive an airspace authorization
 - Manual Process
 - Statistics (as of April 30, 2019)
 - Began issuing manual airspace authorizations October 24, 2016
 - Over 37,000 approved operations
 - Automated Process
 - Statistics (as of April 30, 2019)
 - LAANC roll out began April 30, 2018
 - LAANC is available at nearly 300 air traffic facilities covering approximately 500 airports.
 - Over 87,000 approved operations



#UAS2019



Methods of Authorization



- Manual Process

- Applications submitted through the FAA UAS Portal called DroneZone (Note: LAANC message)
- Manually checked against UASFM's to determine if the requested altitudes are in compliance with UASFM's
- If not in compliance with the UASFM's the request must be coordinated directly with the impacted air traffic control facility
- Requester receives notification of decision through DroneZone
- Approved requests are valid only for the day and time period requested with a period requested, unless associated with an operational waiver and/or the facility is not in LAANC



#UAS2019



Methods of Authorization



- Automated Process

- LAANC checks request against the Unmanned Aircraft System Facility Maps (UASFMs) as well as multiple other airspace data sources such as temporary flight restrictions and NOTAMS (NOTE: does not relieve pilot of responsibility of checking on day of flight)
- Approved requests are valid only for the day and time period requested with a period requested
- Upon approval a copy of the authorization is sent to the proponent and ATC facility
- **LAANC can't be used**
 - in conjunction with an operational waiver
 - for operations in airspace managed by the DOD
 - at some federally contracted facilities
 - a few FAA managed facilities
 - overlapping airspace



#UAS2019

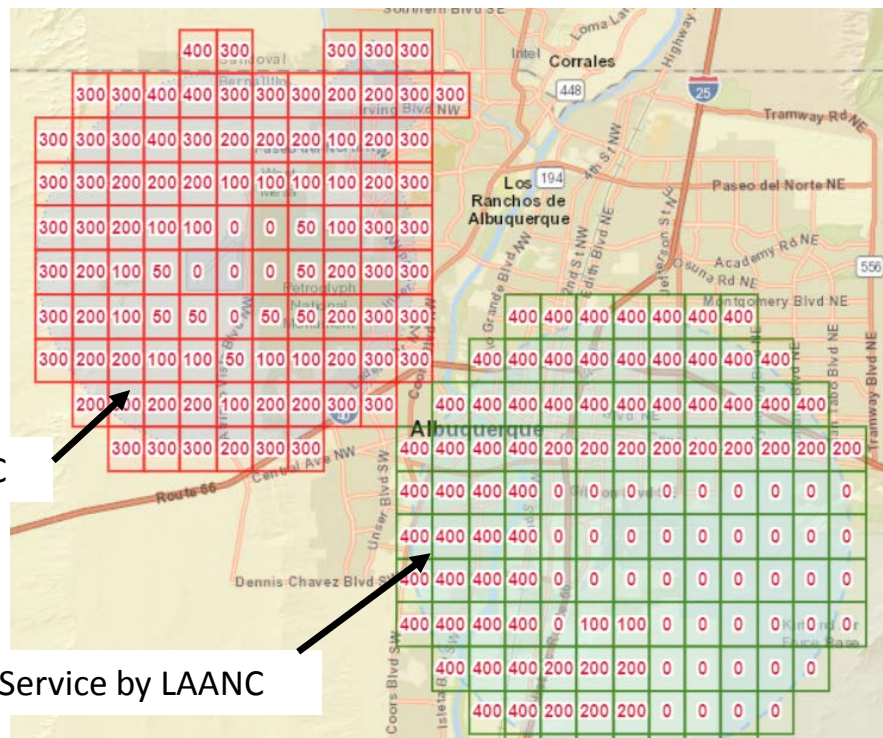


Examples “Visualize it” Website



Red – Not serviced by LAANC

Green – Service by LAANC



<https://faa.maps.arcgis.com/apps/webappviewer/index.html?id=9c2e4406710048e19806ebf6a06754ad>



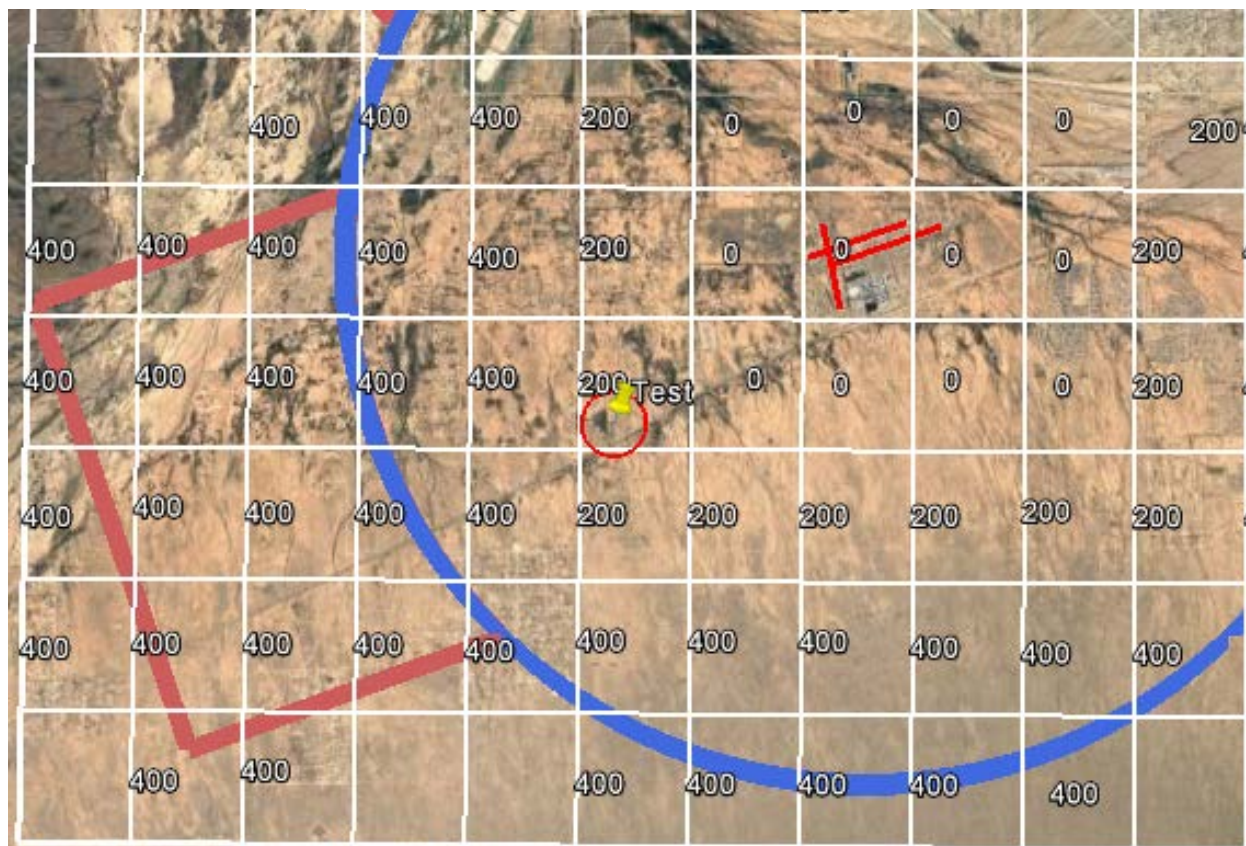
#UAS2019



Example Part 107 Application

- Name: UAS Flyer 1
- Location: 32° 7'11.48"N 111°12'41.48"W
- Operational Area: ¼ mile radius
- Altitude Requested: 125' Above Ground Level (AGL)
- Closest Airport: Ryan Field (RYN), Arizona
- Operations Description: Conduct aerial photography above a construction site.

SAMPLE – Not for navigation purposes



#UAS2019



14 CFR Part 107.41 Waiver



New Part 107 Waiver/Authorization Application

Please select one of the following to start your Application.

- ☐ **OPERATIONAL WAIVER:** Use this to request a waiver to the provisions of Part 107 waivable under 14 C.F.R. 107.200 (e.g. operations at night, operations from a moving vehicle, operation beyond line of sight, operation over people, operation requiring a visual observer, operations of multiple UA by one pilot, operation near aircraft, or waivers from operating limitations on ground speed, altitude, minimum visibility, or minimum distance from clouds).
- ☒ **AIRSPACE AUTHORIZATION:** Use this to request access to controlled airspace. An airspace authorization is the mechanism by which an operator may seek Air Traffic Control (ATC) approval to operate in controlled airspace. Authorizations can be for a specific location or for broad areas governed by a single ATC jurisdiction.
- ☐ **AIRSPACE WAIVER:** Use this to request a waiver from 14 C.F.R. § 107.41. Airspace Waivers may be issued where the applicant can demonstrate safety mitigations through equipment that their UAS can safely operate in controlled airspace without seeking ATC authorization prior to each operation. Processing times for airspace waivers are significantly longer than processing times for airspace authorizations.

Cancel

Start Application

gle day

you need
ed for

ne in the



#UAS2019



Tips and shared lessons learned you can use in your waiver application to get to YES



Jeremy Grogan
Part 107 Waiver Team Lead



Why is the waiver approval rate so low

- 70-80% of waivers are disapproved for incomplete information
- The majority of these applications are 1-2 sentences long
- Applicants write their applications from a standpoint the FAA knows about their specific proposed operation and sUAS

Lessons Learned from Issued IPP Waivers



- Crawl/Walk/Run approach to incremental operations
 - Started small with a plan to gather the data, operational experience, and exercise safety systems to expand operations
- Operational environment used as an initial risk mitigation
 - Restricted access locations
 - Low traffic volume airspace



#UAS2019



Lessons Learned from Issued IPP Waivers



- Worked together to get to yes rather than a solo effort
 - Used other industry experts experience and systems and formed partnerships
- Aircraft appropriate for the operation
 - Identified sUAS which met their needs
 - In some cases the sUAS choice was used as a risk mitigation
 - Sometimes sUAS were used only to test concepts or validate risk mitigations
- Understood how airspace can impact the initial risk of the operation and complexity of the review and approval process



#UAS2019



107.31 Lessons Learned

- Operations proposed were within the technology limits of today
- Leveraged previous research projects
 - Identified and described differences in the research referenced and their specific operation and operational environment
 - Addressed those differences in the application
- Validated proposed methods to comply with 107.37 and 107.39 during sUAS operations

107.39 Lessons Learned

- Provided data obtained through testing identifying the severity and likelihood of injuries their specific sUAS may cause in a human impact
- Leveraged and built on previously performed research
- Injuries caused and likelihoods were within the ANPRM parameters

Getting to yes common themes

- Waiver applications with data, detailed information, descriptions and documentation commensurate with the initial unmitigated risk of the proposed operation resulted in higher approval rates
 - Example- My sUAS operation uses an Ops Manual
 - For a low risk operation statement may be all that is needed
 - For medium and high risk operations-
 - Include the Ops Manual in the application

Do I have to take part in a special FAA partnership program to get a 107.31 or 107.39 waiver



- You don't have to be part of a special program
- An acceptable safety cases does not all require exorbitant amounts of money
- Many non-FAA partnership sUAS operators have been issued BVLOS and OPS over person waivers
 - These waivers can be located on the waivers granted website

Questions?

20 Minute Break

Next in this room...

Unraveling Risk



#UAS2019

