U.S. Department of Transportation
Federal Aviation Administration

FAA Unmanned Aircraft Systems Integration Pilot Program

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Executive Summary

The Unmanned Aircraft Systems (UAS) Integration Pilot Program (IPP) was launched to accelerate UAS integration into the National Airspace System (NAS).[1] The Federal Aviation Administration (FAA) announced the launch of the IPP to address technical, regulatory, and policy challenges and to advance complex UAS operations that facilitate UAS integration. In May 2018, state, local, and tribal governments were selected to participate in the IPP through public private partnerships. Ultimately, nine lead participants (LPs)[2] took part in the program, representing 36 geographically and economically diverse operating environments (Figure 1).

Beginning in March 2020, the coronavirus disease 2019 (COVID 19) public health emergency significantly impacted IPP operations. While some operations slowed due to COVID 19, other teams conducted UAS missions in response to the emergency.

Figure 1: The 10 Selected Lead Participants

[1] The IPP was initiated via a Presidential Memorandum issued October 25, 2017.

[2] Lee County (FL) Mosquito Control District was originally selected to participate in the IPP, but later withdrew from the program due to funding constraints.

I. IPP SUCCESS AREAS

A Federal Register Notice, dated November 8, 2017, established program objectives for the UAS IPP.[3] Congress codified the program in the FAA Reauthorization Act of 2018.[4] Based on these governing documents, along with insights from the selection process and initial operational analysis, the FAA developed three Success Areas to measure the program's success, seen in Figure 2:

Figure 2: IPP Success Areas

1. **Safely Integrate UAS into the NAS:**
   Advancing the development and demonstration of complex UAS operations in the U.S. by gathering experience, effective practices, and lessons learned.
2. **Societal and Community Considerations:**
   Understanding societal and economic benefits of UAS operations, effective community engagement techniques, public perception of UAS, and how to address concerns.
3. **Inform FAA Policy and Decision Making:**
   Informing FAA policy and decision making recommendations to enable safe, scalable UAS operations in the NAS.

II. SUMMARY OF SUCCESSES AND FINDINGS

Through the IPP, state, local, and tribal (SLT) government partners made significant progress in the three Success Areas, substantially advancing current and future UAS operations. Table 1 summarizes the achievements and findings of the IPP. With the exception of the framework for small UAS operating within visual line of sight, the existing regulatory framework for aviation was built over the course of decades and designed specifically to manage aircraft with onboard pilots. In order to integrate UAS into the NAS in an expeditious manner and maintain an optimal level of safety, the FAA is taking an "operations first" approach. This requires selectively leveraging exemptions and waivers to enable the operations today to gain early insights that will inform future policy and regulations. The IPP and other UAS programs and research avenues serve as "building blocks" for more advanced operational capabilities. Waivers and exemptions to existing rules, with proper safety risk mitigations in place, are necessary in the near term to enable operators to test new and innovative approaches to flying UAS for various applications. These operations provide valuable data on technical capabilities, and other vital lessons learned and best practices. Over time, this information informs rulemaking and other policy activities, and more complex UAS operations will eventually be normalized in the regulatory framework.

III. THE PATH AHEAD

Through the IPP, the FAA, LPs, and their partners made substantial progress advancing the safe integration of UAS into the NAS, demonstrated complex UAS operations, developed approaches to engage the community effectively, and gained insights on societal benefits. This progress accelerated UAS integration under the existing regulatory framework and highlighted the following future priorities:

[3] Federal Register Notice included in Appendix B.
[4] Mapping of IPP accomplishments to program objectives from these documents included in Appendix C.

Future Priorities:

- **Support safe, repeatable, and scalable Beyond Visual Line of Sight (BVLOS) operations** by facilitating enabling technology and developing related policy.
- **Quantify societal and economic benefits** of UAS operations and engage the community for advanced BVLOS operations.
- **Modernize and advance policy and decision-making frameworks** to more efficiently integrate UAS operations into the NAS while maintaining rigorous safety standards.

The IPP highlighted the need for a transition away from waivers and exemptions to more permanent solutions like certifications and revised regulations. As the FAA is able to gather the necessary data through today's operations, it will be able to develop the more informed policy, rules, and regulations to fully integrate UAS into the NAS. Normalizing these lessons in the regulatory framework will significantly decrease or eliminate the need to regularly use waivers and exemptions in the future. The FAA will continue to collaborate with industry and SLT governments to advance these priorities through dedicated efforts that support safe, scalable, and repeatable complex UAS operations.

Table 1: Summary of Achievements and Findings

Success Area	Achievements Summary	Findings Summary
Safely Integrate UAS into the NAS	• Conducted more than 21,000 flight operations as of October 25, 2020. • Issued the first two air carrier certificates for UAS cargo delivery operators for 14 Code of Federal Regulations (CFR) part 135 operations. • Advanced BVLOS operations.	• Operators must continuously build safety cases for the unique circumstances of each operating environment to inform rule and standard development. • FAA tends to approve waivers and exemptions more expeditiously when operators focus the scope of operational requirements on areas that will help advance policymaking. • Open communication with the FAA facilitates understanding of how operations can advance policymaking, leading to a more efficient waiver or exemption approval process. • Parachute systems mounted on UAS that meet developed standards are a viable tool to mitigate safety risks to persons on the ground during UAS missions.

Societal and Community Considerations	• Improved the provision of medical services and access to medical supplies. • Expanded access to goods and services. • Improved employee safety and security. • Improved support for disaster response. • Expanded and improved public engagement on UAS-related issues.	• Early community engagement and addressing community feedback are essential to understanding concerns and increasing the acceptance of UAS operations in local communities, furthering scalability and realizing benefits. • IPP operations demonstrated that identifying potential societal and economic impacts is important for rulemaking. • Surveys indicated respondents generally support UAS use for emergency response, infrastructure inspection, and medical package delivery, while top concerns included privacy, safety, and security.
Inform FAA Policy and Decision Making	• Progressed Type Certification and Production Certification processes for small UAS (sUAS). • Gathered data to inform policymaking pertaining to UAS Type Certification Durability and Reliability Means of Compliance. • Established UAS command-and-control (C2) link testing metrics for cellular networks. • Conducted UAS noise testing with one LP to inform future FAA noise policy and support FAA environmental review of UAS-related federal actions (COVID-19 prohibited noise testing for other Lead Participants (LPs)). • Supported the development of the UAS Safety Risk Management Policy Order 8040.6 to establish a safety risk management process specific to UAS operations and piloted the new process on IPP operations. • Through IPP collaboration, the first Tribal Government successfully met requirements to conduct UAS public aircraft operations (PAO). • Gathered data to inform policy and best practices for engaging communities.	• With increasing demand for BVLOS operations, continuing approvals through 14 CFR part 107 might not be scalable. • Companies that want to pursue package delivery with UAS can obtain an air carrier certificate or partner with a company to further enable that company's UAS operations. However, many view the process as extremely complex. The UAS industry needs clearer guidance on the path toward certification as an air carrier. • In order for the FAA to gather the necessary data to inform its policymaking efforts, it must provide clear guidance to waiver applicants that plainly defines the FAA's safety expectations. This will enable applicants to produce higher quality waiver requests that clearly define the operations and give FAA a clear understanding of how the operations will maintain safety and help advance UAS integration. • IPP lessons learned can form a basis of best practices for governments and industry to successfully engage communities and quantify societal and economic benefits.

1 Introduction

A Federal Register Notice, dated November 8, 2017, established the objectives that would be used to form a pilot program for UAS integration. On November 9, 2017, the Department of Transportation (DOT), through the Federal Aviation Administration (FAA), officially announced the formation of the UAS IPP to address technical, regulatory, and policy challenges while advancing complex UAS operations that facilitate UAS integration. Over the course of the next three years, the IPP advanced complex UAS operations while maintaining and enhancing safety oversight and cooperation between the UAS industry, the Federal government, and applicable SLT governments. Information and data gained through the IPP will inform future policy development to accelerate the safe integration of UAS into the NAS.

1.1 UAS IPP

On May 9, 2018, nine LPs were selected representing 36 different operating environments, providing for ample diversity (Table 2). The IPP provided opportunities for new and expanded commercial UAS operations. It fostered a meaningful dialogue on the balance between local and national interests related to UAS integration and provided actionable information to the DOT on expanded and universal integration of UAS into the National Airspace System (NAS). IPP achievements helped advance many of the objectives in the FY2019-2022 FAA Strategic Plan, including the development and deployment of innovative solutions while maintaining safety.

Table 2: Lead Participant Operational Focus Areas

Lead Participant	Operational Focus Areas
University of Alaska Fairbanks (Alaska)	• Pipeline inspection • Social distancing monitoring • Medical specimen delivery
Choctaw Nation of Oklahoma	• Agricultural feral hog trap rebaiting • Tornado damage assessments • Agricultural crop monitoring • Aeronautical and weather research • Power line inspections • Agricultural cattle fencing inspections
Innovation and Entrepreneurship Investment Authority (Virginia)	• Package delivery • Natural disaster assessments • Power line inspections
Kansas Department of Transportation (Kansas)	• Airport safety and runway inspections • Light tower inspections • Precision agriculture • Power line inspections

Memphis-Shelby County Airport Authority (Memphis)	• Inspection of transport category aircraft • Foreign Object Debris (FOD) detection on airport tarmac areas • Airport perimeter monitoring • Aircraft parts movement
North Carolina Department of Transportation (North Carolina)	• Medical specimen delivery • Disaster response and recovery operations • Food delivery
North Dakota Department of Transportation (North Dakota)	• Power line inspections • Joint media operations • Emergency management operations • Bridge inspections
City of Reno (Reno)	• Automatic External Defibrillator (AED) delivery to cardiac arrest patients • River rescue missions
City of San Diego (San Diego)	• Law Enforcement: Drone as a First Responder (DFR) • Medical specimen delivery • Food delivery

1.1.1 IPP Objectives

Figure 4, below, outlines the IPP's eight objectives contained in the program's governing documents: the FAA Federal Register Notice (FRN), and Section 351 of the FAA Reauthorization Act of 2018.[5] To provide a clear framework to measure progress during the IPP, the FAA consolidated the eight objectives from the governing documents and established the IPP Success Areas (Figure 3).

Figure 3: IPP Success Areas

Safely Integrate UAS into the NAS	Societal and Community Impacts	Inform FAA Policy and Decision Making
Increase the number of safe complex UAS operations in the U.S. Accumulate sufficient flight experience to inform policy and enable scalable operations	Analyze public support for UAS and understanding of the safety and economic benefits of UAS Identify mitigations to the public and state, local, and tribal government concerns	Identify policy and decision-making recommendations to enable scalable operations (e.g., new policy/guidance needed and how to streamline/clarify/publicize UAS operational approvals)

[5] Congress enacted Section 351 of the 2018 FAA Reauthorization Act, which provides: "SEC. 351. UNMANNED AIRCRAFT SYSTEMS INTEGRATION PILOT PROGRAM. (a) AUTHORITY.—The Secretary of Transportation may establish a pilot program to enable enhanced drone operations as required in the October 25, 2017 Presidential Memorandum entitled 'Unmanned Aircraft Systems Integration Pilot Program' and described in 82 Federal Register 50301."

Figure 4: IPP Governing Document Objectives

Reauthorization Act, 2018	Federal Register
1. Accelerate the safe integration of UAS into the NAS by testing and validating new concepts of BVLOS operations in a controlled environment, focusing on DAA technologies, C2, navigation, weather, and human factors; 2. Address concerns regarding the security and safety risks associated with UAS operating in close proximity to human beings and critical infrastructure by ensuring that operators communicate effectively with federal, state, local, and tribal law enforcement to determine if a UAS operation poses such a risk; 3. Promote innovation in and development of the United States unmanned aviation industry, especially in sectors such as agriculture, emergency management, inspection, and transportation safety, in which there are significant public benefits to be gained from the deployment of UAS; and 4. Identify the most effective models of balancing local and national interests in UAS integration.	1. Accelerate the use and standardization of low altitude UAS operations; 2. Provide immediate opportunities to accelerate commercial-use concepts of operations; 3. Identify and help resolve operational barriers to expanded UAS operations; and 4. Foster community participation to provoke meaningful dialogue on balancing local and national interests in UAS integration.

1.1.2 Final Report Approach

This Final Report describes the IPP's background, insights from the program's three Success Areas, programmatic findings and recommendations, and a look at the path ahead. It focuses on themes that emerged throughout the program and lessons learned from operations that the FAA will use to inform policy development and regulation. The sections that follow articulate how the IPP strengthened relationships between the FAA, SLT governments, and industry to advance the integration of UAS into the NAS.

2 Program Success Areas

The FAA identified three broad Success Areas (Figure 3) aligned to the agency's objectives. These Success Areas provide a baseline for planning, documenting, and measuring success in the IPP. In this report, IPP achievements map to the respective Success Areas to demonstrate overall UAS operational progress during the program. The FAA categorized LP operations conducted during the IPP into three broad mission profiles (Table 3).

Table 3: Mission Profiles Conducted Under the IPP

Mission Profile	Examples
Package Delivery	Transportation of medical specimens, food, prescriptions, other small consumer products
Public Safety	Emergency response, natural disaster recovery, security monitoring
Infrastructure Inspection	Inspections of power lines, pipelines, agriculture monitoring

Through these mission profiles, LP activities focused on advancing and accelerating complex UAS operations in the NAS. This report summarizes the IPP's achievements for each of the mission profiles, aligned with the program Success Areas, and describes lessons learned to inform FAA policy and decision-making.

2.1 Safely integrate UAS into the NAS

The FAA encouraged LPs to develop and test innovative UAS concepts of operations (ConOps) under the IPP's framework. These operations produced lessons learned and significant new data to support safety assessments for UAS. The IPP met the objectives for this Success Area, outlined in Section 1.1.1, as a result of lessons produced by the FAA's approach for reviewing proposed operations, consideration of safety mitigations for those operations, and observation of testing and flight operations. These lessons have informed, and continue to inform, FAA policy and decision-making.

Key Takeaways:

- The IPP's model of partnership between the FAA, industry, and state, local, and Tribal governments **enabled complex operations** through the selective use of waivers and exemptions to enable testing and the gathering of data to inform future decision-making.
- The diverse IPP operations are grouped into **three successful mission profiles**: package delivery, public safety, and infrastructure inspection.
- LPs' operations produced **sufficient data** to support strong safety cases.

2.1.1 Enabling Complex Operations

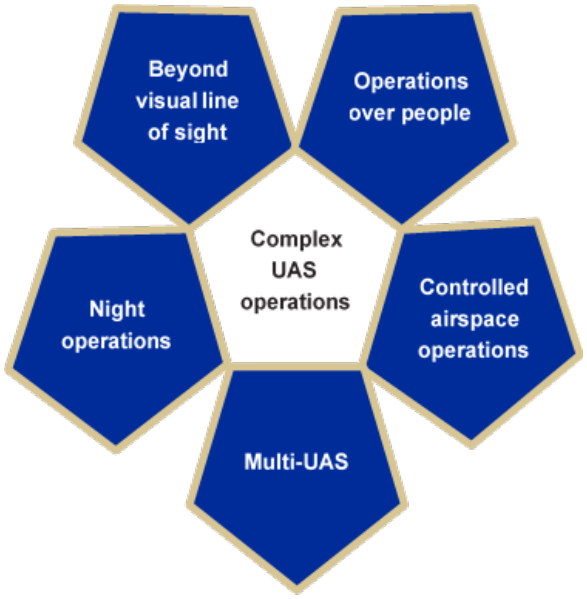
Through the IPP, the FAA applied existing regulations to enable safe, complex UAS operations in the NAS. LPs conducted their UAS operations under regulations governing sUAS operations (14 CFR part 107), air carrier operations (14 CFR parts 119 and 135), and, when applicable, the rules for general flight operations (14 CFR part 91). Small UAS are unmanned aircraft under 55 pounds. Some LPs also conducted public aircraft operations (PAO), which are operations conducted by governmental entities in the U.S. that meet the statutory definition in 49 United States Code (U.S.C.) § 40102(a)(41) and which qualify for public aircraft

status as set forth in § 40125. Section 2.3.1 includes a detailed analysis of how the IPP applied these regulations to the LPs' operations.

Working collaboratively across the FAA to tailor the current regulatory framework to their specific ConOps, LPs better understood FAA processes, including applicable authorizations and certifications to safely demonstrate the complex UAS operations shown in Figure 5. The FAA focused in particular on BVLOS operations. During BVLOS flights, the remote pilot in command, the visual observer (if one is used), and the person manipulating the flight controls of the UAS generally are not able to see the unmanned aircraft throughout the entire flight with vision that is unaided by any device.

The following sections describe the progress made by LPs, grouped by successful mission profiles, which include the complex operation types in Figure 5.

Figure 5: Complex UAS Operations



2.1.2 Successful Mission Profiles

This section highlights the IPP's operational achievements integrating UAS operations safely into the NAS for the three UAS mission profiles. With the large diversity of operators, missions, and risk levels, no UAS operations under the IPP caused any incidents that resulted in injury to people or property damage during the program. The development, testing, and successful operation of complex UAS operations enabled the FAA, LPs, and industry to ensure safe, appropriate integration of UAS operations.

A. PACKAGE DELIVERY

Package delivery was a key objective for many LPs because of its ability to cost effectively expedite and expand access to commercial goods and services for citizens without requiring those citizens to leave their homes.

Alaska, Memphis, North Carolina, Reno, San Diego, and Virginia worked with the FAA to develop ConOps for package delivery that included safety cases and operational plans (flight routes, drop locations, etc.). The FAA used these ConOps to review and approve routes for operations over people, for operations over moving vehicles, at night, or BVLOS. In every case, the FAA considered the specific characteristics of the operation (altitude, launch and drop locations, among other considerations) and environment (population density, airspace complexity, among other considerations) to assess risks and provide necessary approvals.

As air carrier operations cannot be conducted under part 107, the FAA worked with LPs and their industry partners to undertake air carrier certification under part 119, to enable commercial package delivery operations conducted under the regulations in part 135. The FAA subsequently granted part 119 air carrier certificates to Wing Aviation, LLC, in Virginia, and United Parcel Service Flight Forward (UPS FF) in North Carolina to enable commercial package delivery operations under part 135. Sections 2.2.1 and 2.3.1-B describe these achievements in more detail.

North Carolina's Part 135 Medical Specimen Delivery Operations (Figure 6)

The collaboration between the FAA and North Carolina's IPP team resulted in UPS FF receiving a part 119 air carrier certificate on September 27, 2019 and allowed them to be the first UAS package delivery operator to receive FAA authorization to transport hazardous materials. North Carolina partnered with UPS FF and Matternet to conduct commercial medical package delivery operations at the WakeMed Health and Hospitals campus in Raleigh. The BVLOS flights conducted under part 135 traversed the WakeMed campus from an outpatient surgery center over a city street to the hospital's labs. The route required active airspace coordination and deconfliction with helicopter medevac operations at the hospital.

Figure 6: Medical Package Delivery Operations in North Carolina

Through October 25, 2020, the team conducted 1,663 flights that transported medical specimens and served 6,648 patients. This reduced medical specimen delivery times on average from an hour to three minutes, cut reliance on costly ground couriers, and enabled an on demand delivery model. Patients received results more quickly than they would have received them when ground couriers were used and the WakeMed healthcare system expanded the service to out of network clients and doctors. By the end of the IPP, WakeMed's Executive Director and Medical Director of Innovation described the UAS flights as "a routine part of daily surgery center operations." Subsequently, UPS FF and Matternet's delivery efforts at WakeMed enabled them to scale these operations to other locations around the contiguous United States.

B. PUBLIC SAFETY

As a valuable tool for public safety, UAS enable emergency response operations such as: fire, police, and emergency medical services; natural disaster planning, response, and recovery; and public safety operations, including monitoring public gatherings and property perimeters. The IPP enabled the FAA to work with LPs and industry partners to develop and demonstrate a range of public safety use cases. These efforts provided essential information on requirements and mitigations needed to scale public safety related UAS operations.

Emergency response operations can pose unique challenges, such as the need to deploy quickly to the location where the emergency occurs – often over populated areas or in the vicinity of other operations in the airspace. San Diego partnered with the Chula Vista Police Department (CVPD) to establish a Drone as a First Responder (DFR) program for more rapid and flexible responses to 911 calls.

The first Certificate of Waiver or Authorization (COA) enabled multi-UAS operations under the DFR Program. The second COA enabled Close Proximity, Low Altitude (CPLA) flights which allowed officers on the ground to have better situational awareness during response activities on scene using UAS. This allowed CVPD to fly complex operations over people, with multiple UAS, at night, and BVLOS in support of 3,900 flights as of October 25, 2020. Section 2.2.1-B includes more details on these operations.

Similarly, the city of Reno IPP team partnered with the local fire department to test river rescue missions supported by UAS. The approaches and procedures developed under the IPP for emergency response

operations will facilitate approval of similar operations elsewhere in the country and assist in accelerating the integration of those operations into the NAS.

The Choctaw Nation of Oklahoma and the states of North Carolina, North Dakota, and Virginia demonstrated a range of disaster response and recovery UAS operations before, during, and after hurricanes, tornados, and floods. These operations provided aerial imagery to help assessment teams evaluate storm impacts, provide information about needed repair, direct emergency responders, and divert traffic away from damaged roads and bridges. The IPP demonstrated the FAA's ability to rapidly analyze safety data to approve UAS operations in support of natural disaster planning and response.

Under the IPP, LPs demonstrated the value of UAS for security and public safety operations, including inspecting property perimeters and managing crowds. These operations required specialized ConOps and related safety risk mitigations for BVLOS operations, operations over people, night operations, operations in controlled airspace, and operations with multiple UAS. Memphis and Kansas monitored airport perimeter fencing for security purposes and tarmacs for foreign objects and debris, while North Dakota used UAS with a parachute to monitor crowds at a college football event. The approaches that participants developed for these operations assisted the FAA and the broader UAS community in accelerating and scaling UAS operations that occur for public safety.

C. INSPECTION USING UAS

LPs demonstrated several UAS missions to inspect long line infrastructure, such as power lines and pipelines, other infrastructure and equipment, including light towers, aircraft surfaces, and fencing, and agriculture, such as livestock and wildlife. LPs conducted most operations under part 107 and emphasized the need to further develop and prove BVLOS capabilities, which are particularly important for infrastructure inspection operations. These operations can cover hundreds of miles of infrastructure networks where radar systems and human visual observers are not economically or logistically feasible.

The Choctaw Nation of Oklahoma and the states of Kansas, North Dakota, and Virginia used UAS to conduct power line inspections and Alaska used them for pipeline inspections. Each worked closely with the FAA to develop ConOps, robust risk assessments, and operational procedures tailored to the unique characteristics of their inspection operations. Each of these achievements was critically important to advancing the FAA's understanding of the operational and safety requirements needed to integrate scaled BVLOS operations safely into the NAS.

Alaska BVLOS Pipeline Inspections

The University of Alaska Fairbanks IPP team worked closely with the FAA to fly BVLOS using a combination of ground based radars and onboard detection capabilities to mitigate the risk of encountering other aircraft. The team conducted flights along a five mile, remote stretch of the trans Alaska pipeline near Fairbanks in the first phase of a scaled approach to fly longer distances. These precedent setting flights will continue to gather data critical to advancing complex operations in the NAS.

Kansas worked with the Air Traffic Organization and the Flight Standards Service to establish agreed-upon procedures to conduct the first UAS operations within a Class C airport runway environment. The Kansas and FAA team conducted both day and night operations at Wichita International Airport (ICT). Air Traffic Control (ATC) continued commercial air operations throughout the test, which provided effective lessons learned that other airports could utilize.

BVLOS without human visual observers is a crucial capability for linear infrastructure inspections over long distances. Through the IPP, LPs advanced BVLOS capabilities by demonstrating detect-and-avoid (DAA) collision avoidance technology and ground-based radar (GBR) systems. However, no operator found a comprehensive BVLOS solution by the program's conclusion because LPs found the current DAA and GBR technologies cost prohibitive for scaled UAS operations.

Memphis' Success with On Airport Operations

The FAA and the Memphis IPP team developed a phased approach to introduce UAS for on airport operations at Memphis International Airport (MEM). The operation required airspace authorizations for specific portions of airport property where operations would take place. Those authorizations contained terms that minimized risk to manned aircraft.

Figure 7: Aircraft Inspection at Memphis Airport

The Memphis IPP team partnered with FedEx to conduct 690 flights as of October 25, 2020, that tested aircraft inspections at MEM using UAS (Figure 7). The team utilized high resolution scans that provided vantage points impossible to achieve by human inspection. The resulting tests reduced their aircraft inspection times from three hours to 20 minutes while increasing safety for inspectors by replacing lift equipment with UAS. Additionally, Memphis utilized UAS video imagery to detect foreign object debris on tarmac areas more efficiently.

The FAA determined that FedEx's desired concept of operations, which included operation on different areas of the airport, required a Safety Risk Management Panel (SRMP) to evaluate the request from a risk mitigation perspective. The FAA expects results from the SRMP activity will facilitate the development of a checklist for airport operators and air traffic managers to use when analyzing requests for UAS operations on airports nationwide.

Kansas BVLOS Power Line Inspections (Figure 8)

The Kansas IPP team advanced the BVLOS effort by leveraging a layered approach to risk mitigation, including the use of Automatic Dependent Surveillance Broadcast (ADS B) In technology in conjunction with an onboard detect and avoid (DAA) system. The team also leveraged a novel approach to risk assessment, employing a combination of practices to mitigate risk and ultimately obtain operational approval. This enabled the team to accrue more than 150 miles of flight experience in a BVLOS environment and to gather significant data that will continue to inform FAA policy in the future.

Figure 8: Kansas's Power Line Inspection via UAS

2.1.3 Collecting UAS Flight Data

Through the IPP, the FAA collected a large amount of operational information. LPs submitted detailed data about their UAS missions that helped the FAA to develop policy, prepare an appropriate data framework, and advance scaled UAS integration. The data shown in Figures 9 and 10 illustrate how UAS integration advanced during the IPP as of October 25, 2020. Figure 9 shows the number of flights and flight hours by month during the IPP. LP flight count generally increased from the start of the IPP but fluctuated throughout the program. Varying LP operational plans, FAA certification or authorizations, and external influences like COVID-19 created this variability. Figure 10 shows the total number of flights conducted in the three major mission profile categories: package delivery, public safety, and infrastructure inspection. LPs and their industry partners conducted the majority of flights under the package delivery mission profile, but gained significant experience across all three mission profiles.

The data collected during the IPP informed both policy and decision-making and data gathering approaches for future innovation focused programs. Although the IPP helped establish the foundation for UAS data collection, the FAA identified that focused data collection processes would assist the FAA with UAS policy and decision-making. The FAA will continue to work with UAS operators to improve the collection of data and enhance data sharing between operators and the FAA to enable the continued and safe integration of UAS into the NAS.

Figure 9: Number of Flights and Flight Hours by Month

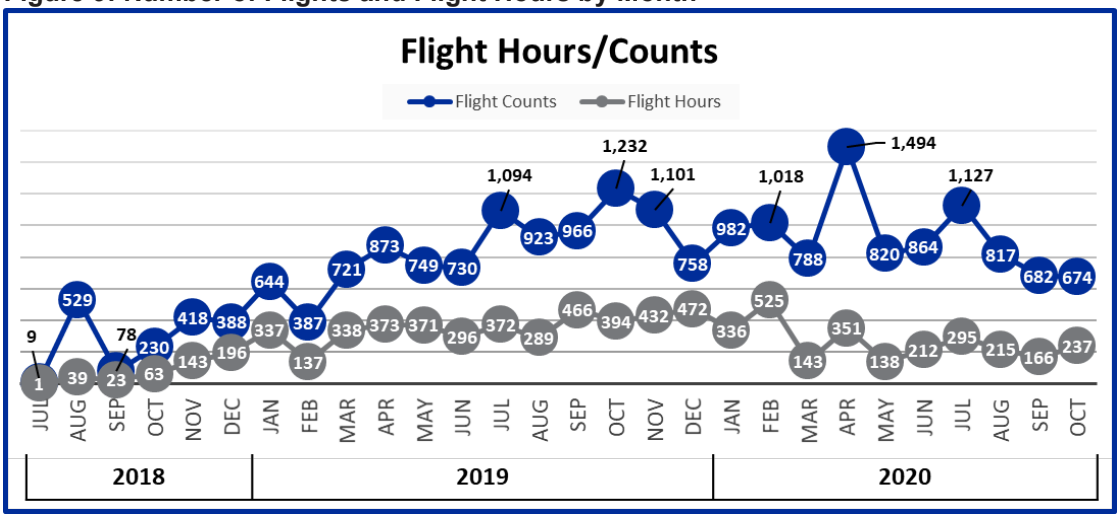


Figure 10: Flight Data as Reported

2.2 Societal and Community Considerations

Through the IPP, the FAA sought to better understand the societal and economic potential of UAS operations and community concerns. As of October 25, 2020, LP engagement with more than 12,800 community members nationwide provided useful insights on communities' perceptions of UAS operations. Knowledge of UAS benefits, combined with improved understanding of community sentiment, helped the FAA scale and accelerate UAS operations by effectively balancing local and national interests to develop well-informed policy. This knowledge and understanding also helped SLT governments and industry balance societal and economic benefits with public support.

Key Takeaways:

- LPs showed the potential for UAS operations to bring **societal and economic benefits** through package delivery, public safety, and infrastructure missions.
- The IPP demonstrated **the importance of developing community engagement strategies** to raise awareness with impacted stakeholders and to increase public support.
- Analysis of thousands of comments from the public produced an **understanding of community sentiment** towards UAS operations and best practices for addressing feedback.

2.2.1 Societal and Economic Benefits

During the IPP, LPs and their industry partners implemented UAS operations that demonstrated tremendous societal and economic potential. This section highlights examples of these benefits across each UAS mission profile (package delivery, public safety, and infrastructure inspection).

A. PACKAGE DELIVERY

LPs developed and implemented several package delivery operations during the IPP with a range of societal and economic benefits. Many of these operations showed how UAS can reduce delivery times, increase safety, add convenience, and expand access to remote areas. This was particularly critical with the delivery of crucial health care goods and services and resulted in more efficient transport of laboratory samples, reduced patient wait times, and improved overall workflows at medical laboratories leading to convenient and enhanced patient care.

For example, in addition to North Carolina's partnership with WakeMed (referenced in Section 2.1.2-A), the team worked with UPS Flight Forward and CVS to showcase prescription drug delivery to citizens in a retirement community in Cary, NC. This operation demonstrated the potential to increase access to essential goods and to deliver health care services more efficiently.

Wing, a partner under the Virginia IPP, also started a commercial UAS package delivery service. Wing's package delivery operations provided convenient, on-demand delivery from its partners: FedEx, Walgreens, and several local food and beverage merchants. The service provided over-the-counter medication, cleaning supplies, and library books to residents in the local community. Altogether, IPP operations showed that UAS brings consistent, reliable, and safe package delivery services to communities.

> **"Drone technology has the potential to significantly improve the care we can deliver to our patients, both directly through improved speed and turnaround times as well as reliability and visibility of parcel delivery within our healthcare system."**
>
> *Dr. Stuart Ginn,*
> *Medical Director and surgeon*
> *WakeMed and former airline pilot*

Reno Explored Lifesaving UAS Operations

The City of Reno tested two ConOps during the IPP that, when operational, have the potential to deliver lifesaving services to their citizens: river rescue operations and AED delivery (Figure 11). Conducting river rescues with UAS offers increased speed and safety with enhanced detection capabilities from infrared camera technology. The team estimated that deploying AEDs via UAS can increase the cardiac arrest survival rate from 10% to 40%. Additionally, both missions can decrease the need for emergency vehicles to travel at high speeds through the city to reach citizens in need.[6]

Figure 11: City of Reno AED Delivery

B. PUBLIC SAFETY

During the IPP, government agencies used UAS to enhance some aspects of agency operations including responding to emergencies, preparing for and responding to disasters, and delivering routine public services. LPs demonstrated the benefits of using UAS to respond to natural disasters by quickly assessing damage and hazards across large, often inaccessible, areas. Operators can launch UAS from a wide range of locations by teams on the scene, they are less costly than manned aircraft, and they do not place pilots at risk during severe weather events. Improved situational awareness, faster response times, and improved access using UAS allow public agencies to act quickly to protect lives and property.

North Carolina conducted 260 UAS flights in the aftermath of Hurricanes Florence, Dorian, and Michael, improving the speed and effectiveness of disaster response. Virginia and its partner State Farm conducted similar missions in response to Hurricanes Florence and Michael. They also gathered flood zone characterization and mapping data under an existing nationwide waiver.

Figure 12: North Dakota Red River Flood Assessment

North Dakota also conducted flood recovery efforts by using UAS to provide imagery of roads, bridges, and other infrastructure (Figure 12). Finally, the Choctaw Nation of Oklahoma used UAS to assess tornado damage. Their analysis

[6] Flirtey Inc. provided estimated increase in cardiac arrest survival rate.

served as a tool for the National Weather Service's modeling system to more accurately rate the magnitude of events.

San Diego and the Chula Vista Police Department's Drone as a First Responder Program

San Diego's CVPD DFR program helped create safer neighborhoods by enhancing the CVPD's ability to respond appropriately in emergency situations. As of October 25, 2020, the CVPD conducted 3,900 flights and actually averted the need to dispatch patrol 986 times. The UAS provided police officers with crucial safety awareness before they arrived on the scene, allowing the CVPD to deploy units flexibly, safely follow vehicle chases through the city, and prevent tense situations from escalating unnecessarily. The program reduced 911 call response times to an average on scene response time of 110 seconds for first on the scene calls, compared to average response times without UAS of six minutes for "priority one" calls and about 17 minutes for "priority two" calls.

C. INFRASTRUCTURE INSPECTION

Under the IPP, LPs showed that UAS can reduce infrastructure inspection costs while improving inspection quality and employee safety. For example, Alaska used a waiver to conduct safe, cost effective, and environmentally friendly inspections over part of the Trans-Alaska pipeline (Figure 13). Similarly, the Choctaw Nation of Oklahoma and the states of Kansas and North Dakota used UAS to perform power line inspections quickly and efficiently while reducing exposure to hazardous working conditions such as climbing poles for employees. These inspections improved preventative maintenance and increased service reliability to customers. The IPP showed that UAS applications for infrastructure inspection can deliver important economic and safety benefits.

Figure 13: IPP Infrastructure Inspection of the Trans-Alaska Pipeline

Choctaw Nation of Oklahoma

In other cases, LPs used UAS to improve inspection effectiveness. The Choctaw Nation of Oklahoma demonstrated the benefits of UAS for routine agricultural activities. By utilizing UAS to conduct preliminary fence inspections, livestock monitoring (Figure 14), and wildlife tracking, UAS kept ranchers safe from occupational hazards. In one instance, it also provided more expansive data collection, with UAS imagery revealing pecan trees that appeared diseased at ground level but in reality had healthy crops higher up in the trees. The use of UAS saved these trees and improved crop yield by 200%, providing a direct economic benefit.

These examples show how organizations increased inspection frequency and reduced the risk of costly incidents by using UAS in their inspection operations.

D. COVID-19 RESPONSE

The IPP also provided societal benefits during the COVID-19 emergency. The use of UAS during the

emergency response demonstrated a direct public health benefit to communities. LPs showed how their operations could enable social distancing measures through contactless delivery, safe communications to citizens, and efficient monitoring of public spaces. IPP industry partners also used the foundations they built in the IPP to respond quickly and expand their operations to meet societal needs.

COVID 19 Response

The partnership between LPs and the FAA established under the IPP enabled a quick and flexible response to the COVID 19 emergency. With most governments issuing stay at home orders, closing schools, and shutting down non essential business, UAS operators were uniquely positioned to provide vital support to the American public. The following examples highlight how the IPP helped LPs utilize waivers and certificates to employ UAS as a tool to help keep their communities safe.

Alaska: Alaska conducted six flights under part 107 totaling 45 minutes on April 8, 2020, in the City of Fairbanks to capture aerial images of the streets to create a video illustrating the effectiveness of stay at home orders. In addition to these social distancing monitoring flights, the Alaska team identified a UAS benefit in delivering cargo to remote communities during COVID 19. With only 20% of Alaska accessible by roads, increased access to services like health care would be particularly beneficial to Alaska's remote communities.

North Carolina: Novant Health partnered with Zipline to conduct part 107 operations with waivers enabling operations over people and BVLOS operations with visual observers between Concord, NC, and Huntersville, NC. The 14 mile, one way route helped reduce the strain on medical supply chains by carrying Novant's personal protective equipment, testing supplies, and medication across Novant's medical campuses with 16 flights per day.

North Dakota: Industry partner Flytrex provided contactless delivery of goods and food packs under part 107 within visual line of sight from a Walmart Supercenter in Grand Forks, ND to consumers' backyards.

San Diego: The success of CVPD's Drone as a First Responder program enabled expanded UAS operations to help people in need. The city recognized that UAS could broadcast health updates to a large portion of its homeless population, located in remote and sometimes inaccessible areas. CVPD flew four missions in April 2020 utilizing UAS equipped with speakers over urban canyons to broadcast public health messaging that directed those living in the encampments to where they could receive medical supplies. This reduced the risk to officers who would have had to navigate the treacherous, overgrown terrain. CVPD covered eight square miles, reaching 26 encampments and reducing time of service from approximately two days to three hours.

Virginia: Industry partner Wing, conducting air carrier operations under part 135, provided deliveries to residential customers in Christiansburg, VA. During the state's shelter in place guidance, Wing saw more than a five fold increase in deliveries with customer sign ups increasing 350% during March and April of 2020. The value to the community extended to small businesses that benefited from partnering with Wing to deliver food, beverages, and convenience items to customers that would not have otherwise visited their establishments. Additionally, Wing partnered with Montgomery County, VA, public schools to deliver summer reading books to students' homes.

2.2.2 Community Engagement Activities

Lead participants developed effective community engagement approaches (Figure 15) to identify public perception towards UAS integration and address feedback. The FAA is interested in public opinion on UAS to the extent that it creates awareness and facilitates safe integration of UAS operations across the NAS. LPs tailored community engagement approaches to the unique characteristics of their operations and location, based on characteristics such as urban or rural areas of operation and the type of operation. Moreover, the IPP showed that community engagement is most successful when operators understand their stakeholders and proactively engage with them.[7]

Figure 15: IPP Community Engagement Techniques

- Educational Events
- Local TV Spotlights
- Online Surveys
- Print Media
- Public Demonstrations
- Public Meetings
- Public Websites
- Social Media
- Targeted Stakeholder Meetings

For example, knowing that thousands of citizens gather for the annual North Dakota State versus South Dakota State football game, the North Dakota team set up an information booth that allowed them to educate and collect feedback from a diverse, public group about their UAS program. North Carolina hosted the North Carolina Drone Summit in 2018 and 2019 and frequently attended national aviation conferences to educate the public about UAS. Similarly, Alaska recognized the importance of educating and gathering input from the general aviation community in the state about its UAS operations. As a result, the team organized town halls and public demonstrations specifically for this group.

The Choctaw Nation of Oklahoma reached a broad subset of its citizens by participating in multiple public meetings to hear from community members, and hosted a Drone Camp for Choctaw Nation of Oklahoma youth, which provided hands-on Science, Technology, Engineering, and Mathematics (STEM) learning, innovation, and education about UAS.

All participants maintained active websites to share information about their operations. Notably, Reno's website was particularly effective in engaging the community by informing the public of their participation in several concurrent FAA activities. Kansas, North Carolina, Reno, and San Diego all had success with public surveys available online to collect large quantities of community sentiment data. The surveys were helpful for determining how to communicate and address areas of concern before LPs conducted UAS activities.

North Dakota, San Diego, and Kansas found that social media was an efficient means to amplify their online community impact and reach a wide audience by using meaningful photos and videos with a clear community message. Small investments in digital platforms yielded significant returns, while more significant investments, such as videos, improved the foundation of messaging tools for ongoing community outreach.

[7] Appendix C contains a summary of community engagement best practices developed by LPs.

Virginia and Wing's Community Engagement Best Practices

Virginia and industry partner Wing Aviation, LLC, actively engaged citizens, built awareness, and garnered support within their community in Christiansburg. The Virginia team implemented a tiered strategy of community engagement that included holding individual meetings early in the process with key stakeholders that led to increased outreach to the general public. Virginia and Wing successfully identified techniques that resonated with their community and resulted in direct feedback, from knocking on doors in affected neighborhoods to setting up booths at popular community events. Facilitated by a strong relationship with partner Virginia Tech, this strategy allowed direct interaction with impacted populations. The team then educated the community about the technology and the service and listened to feedback, which it used to tailor the service to the needs of the community and to guide future outreach. Virginia and Wing maintained ongoing outreach after launch to solicit feedback and continue building relationships in the community.

Additionally, the team used tablets to survey and collect data sets that influenced their high level engagement strategy by identifying topics to better educate their community about. The team also spoke directly with individual citizens to capture their opinions and concerns, which led to the development of talking points to prepare staff for future interactions with the public.

During the IPP, Virginia's personal outreach in suburban populations proved effective, with more than 2,700 interactions with members of the public and an 86% rate of positive comments, the majority of which indicated enthusiasm for the convenience of drone delivery and the novelty of the technology.

2.2.3 Community Sentiment

Understanding public sentiment towards UAS operations was a key objective of the IPP. Lead Participants chose to collect feedback from the public in a variety of ways. Some LPs administered public surveys and tracked public comments. In general, LPs found that local communities were most interested and supportive of UAS operations perceived to provide benefits to their wider community, such as for disaster response and emergency services. Concerns primarily focused on issues of security, privacy, and safety.

Figure 16: Community Sentiment

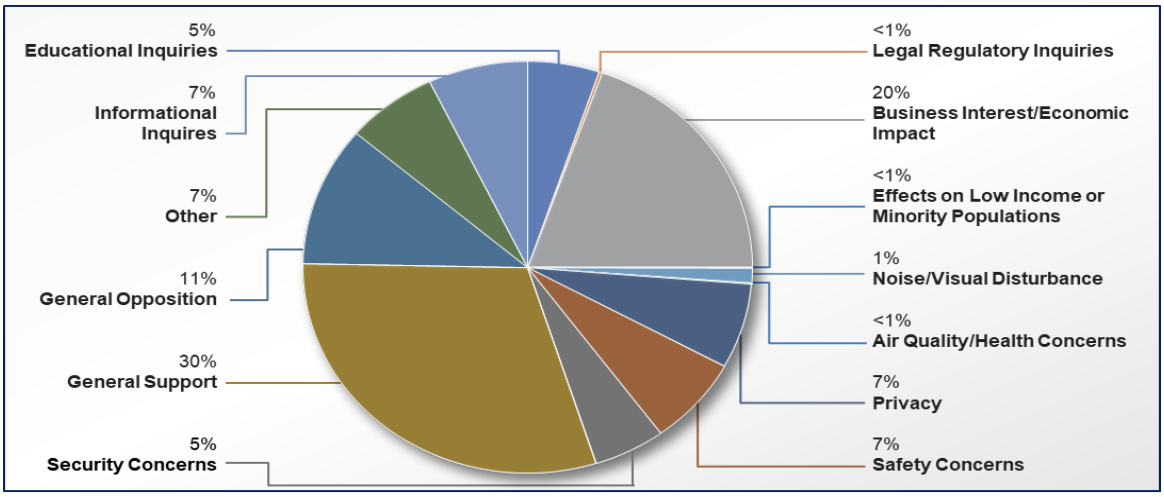


Figure 16 provides an overview of the distribution of comments some LPs received over the course of IPP flight operations through October 25, 2020. As evident from this chart, 3,912 (30%) of total public comments that LPs reported suggested general support, and 2,527 comments (20%) referenced business

interests/economic impact. Of the 12,883 comments, 1,405 (11%) from the engaged population generally opposed UAS operations. Additionally, 889 comments (7%) noted safety concerns. Another 862 comments (7%) mentioned privacy considerations while 661 comments (5%) expressed security concerns. As the FAA continues monitoring the public's receptiveness to UAS operations, it will consider facilitating its own survey efforts to ensure commonality across sentiment analysis so consistent data collection and an enhanced ability to analyze data exists among all participants.

By analyzing feedback from the community, LPs developed best practices for how to respond to public comments. Some of these observed best practices included crafting messages that reinforce the public benefits of operations, understanding environmental concerns, highlighting local partnerships, reinforcing the strong safety and security protocols in place, and providing public demonstrations.

In some cases, LPs adjusted operational plans in response to feedback received from the public. Virginia's engagement with the people of Christiansburg and North Carolina's community feedback in Holly Springs influenced their selection of new inventory for UAS delivery and influenced the addition of new partners. San Diego used their survey to ask community members about which types of operations they would be most enthusiastic; their program's operations mirrored those results.

North Dakota's Use of Social Media to Communicate Flood Status

The North Dakota IPP team found that social media was an effective tool for communicating information gathered through their flood monitoring UAS missions. These operations collected aerial imagery that provided greater situational awareness for emergency management officials. By sharing these images via social media, North Dakota kept citizens informed on water levels, road closures, and other impacts to the community in near real time. Some of the videos posted by the team received up to 500,000 views.

2.3 Inform FAA Policy and Decision-Making

The FAA developed approaches to enable complex UAS operations under the existing regulatory framework. The FAA and LPs strengthened the culture of partnership and internal lines of communication between FAA organizations, thereby accelerating safe UAS operations. As a result, the FAA explored potential policy and regulatory updates to support safe, scalable UAS integration into the NAS. This section will discuss the key takeaways from this success area as outlined below:

Key Takeaways:

- The FAA and LPs successfully **adapted and applied the current regulatory structure** to enable a wide spectrum of UAS operations conducted in the NAS
- The IPP strengthened **a culture of partnership** including developing processes and tools to support the expedited approval of complex UAS operations
- The IPP **informed FAA policy and decision concerning priorities**

2.3.1 Adaptation of the Current Regulatory Structure

Most operations during the IPP occurred under part 107, with some operations occurring under parts 91 and 135. Through the program, the FAA made notable advancements developing efficient approaches that LPs and other entities can apply broadly for future operators. The adaptation of these regulations further accelerated the integration of complex UAS operations. This section explores the progress made in each of the three regulatory frameworks.

A. PART 107, SMALL UNMANNED AIRCRAFT SYSTEMS (sUAS) REGULATIONS

Part 107 applies to small UAS operations. Under the version of part 107 in effect during the IPP, operators could fly a single UAS during the day within the remote pilot's visual line of sight and not directly over people or any moving vehicle.[8] Subject to safety analysis, the FAA could provide waivers that allow for advanced operations, such as night operations, operations over people, operations over moving vehicles, BVLOS operations, controlled airspace operations, and multi-UAS operations. These waivers enabled LPs to develop and test advanced UAS concepts. Through the IPP, the FAA enhanced its understanding of the limits of part 107. Both the FAA and LPs benefitted from the experience gained operating under part 107 during the IPP.

The FAA gained considerable experience reviewing waivers and leveraging processes that may ultimately accelerate the approval process in the future. However, the FAA understands that it needs to undertake significant policy and regulatory shifts to accelerate and scale UAS integration.

In a step towards achieving more scalable solutions, the IPP successfully facilitated a nationwide waiver for Virginia's partner State Farm to support natural disaster response. The IPP highlighted the need for a transition away from waivers and exemptions to more permanent solutions like certifications and revised regulations.

B. PART 135, AIR CARRIER OPERATIONS

The IPP successfully established a path for operators to receive a part 119 air carrier certificate that enabled package delivery operations for compensation under part 135.[9] Part 107 (sUAS rule) does not apply to air carrier operations, and neither part 119 nor part 135 contain specific provisions for UAS to conduct air transportation. Therefore, the FAA authorized commercial package delivery under the IPP using exemptions to rules for air carrier operations.

North Carolina's partner, UPS Flight Forward, and Virginia's partner, Wing (Figure 17), worked with the FAA to receive an air carrier certificate to conduct package delivery for compensation under part 135—a significant achievement under the IPP. This accomplishment provides a framework for other UAS operators to proceed through the air carrier certification process, leading to broader commercial UAS operations.

Figure 17: Wing Part 135 Deliveries

[8] On January 15, 2021, FAA issued a final a rule amending part 107 to allow operations at night and over people without the need for a waiver. Because this amendment did not take place until after the IPP had concluded, this document refers to the pre-2021 version of part 107 that did not allow for operations over people or at night without a waiver.
[9] Part 119 contains regulations that apply to persons operating civil aircraft as an air carrier or commercial operator.

While UAS operators must follow the same application processes and procedures as manned applicants to receive an air carrier certificate, the IPP provided the FAA and industry with direct experience and proven processes for approvals of certain, specific types of UAS operations under part 135 including prospective type certification requirements as described in part 21.

C. PUBLIC AIRCRAFT OPERATIONS (PAO)

LPs San Diego and the Choctaw Nation of Oklahoma both successfully obtained COAs under part 91 for public aircraft operations (PAO). For operations that fall within the scope of the definition of a public aircraft operation as set forth in 49 U.S.C. 40125, the FAA issues a COA to a governmental entity following comprehensive operational and technical review.

As a government entity conducting PAO, the Chula Vista Police Department (CVPD) (Figure 18) certified their aircraft, allowing them to take responsibility for the risk associated with the operation and enabling them to fly complex and unique operations without requiring airworthiness certification approval from the FAA. The FAA gathered data from these missions, which included operations over people and close-proximity low-altitude missions that will assist the FAA in assessing safety cases for future ConOps from private UAS operators and government entities.

Choctaw Nation of Oklahoma Achieved First Tribal UAS PAO Designation

After Congress passed the 2018 FAA Reauthorization Act, which included a provision including tribal governments under the statute for Public Aircraft Operations (PAO), the Choctaw Nation of Oklahoma IPP Lead Participant became the first tribal nation in the country to conduct PAO. The Choctaw Nation of Oklahoma successfully conducted public aircraft operations under COAs for public safety and aeronautical research.

2.3.2 Strengthened Culture of Partnership

The FAA used the IPP to facilitate an enhanced culture of transparency and open communication between the FAA, LPs, and their partners. The program brought together a large contingent of participants from multiple FAA offices, each with unique roles in facilitating UAS integration into the NAS, to support, accelerate and expand UAS activities. The FAA's commitment to a collaborative culture may continue to influence policy decisions to advance UAS integration into the NAS. This section provides an overview of how the IPP strengthened collaboration between industry, government, and the public, including both the FAA and LPs, through advancing innovative ConOps, encouraging the exchange of data, engaging the community, and increasing collaboration from all IPP stakeholders to provide guidance for FAA policy and decision-making.

A. INNOVATIVE CONOPS

The IPP fostered a collaborative culture that facilitated more robust proposals by IPP partners and more

openness to advanced proposals within the FAA when evaluating UAS waiver and certification requests. FAA acceptance of innovative ConOps enabled LP exploration of new and more complex operations. For example, the FAA waived the applicability of section 107.31 (along with section 107.33) and section 91.113 to enable BVLOS operations, which accelerated operations that occur under waiver, as the IPP provided a safe environment that fostered acceptance of innovative use cases with specific operational constraints. This environment helped rapidly inform future FAA decision-making.

During the IPP, the FAA approved operations in controlled airspace, working with the LPs and air traffic controllers to enable operations at airports. The IPP's emphasis on collaboration and coordination across the FAA created a cultural shift that will extend beyond the program. Driven by the acceptance of innovative ConOps, the creation of this environment will help to integrate UAS into the NAS efficiently.

B. DATA EXCHANGE TO INFORM POLICY AND DECISION-MAKING

The IPP provided the opportunity to influence UAS policy by increasing the FAA's access to data. Because much of the IPP industry partners' data is proprietary, the FAA worked closely with industry to understand the privacy concerns and establish processes that allowed for open data sharing while ensuring privacy of the information. With the aggregated data, the FAA gained valuable insight about how operators plan to use UAS in the NAS.

For example, LPs conducted most operations under part 107 without waivers, representing 62% of total flights during 2019. This illustrates how current regulations enable a majority of UAS operations, but also suggests the FAA must update regulations to normalize safe, complex UAS operations that cannot be accomplished under part 107, such as BVLOS without visual observers.

Data exchange between the FAA, LPs, and industry also provided insight into future areas of focus for the FAA, including advanced UAS operations. IPP operational data showed that 29% of flights in 2019 included advanced operations, such as operations over people and BVLOS. Analyzing the data informed the FAA of the type of information that is most critical to decision-making, which will enable the FAA to streamline and target data collection in the future. Further exchange of data will allow the FAA to make decisions on technological capabilities, safety mitigations, and other factors that inform FAA policy.[10]

C. COMMUNITY ENGAGEMENT

During the IPP, LPs used various engagement methods to gather meaningful community feedback that informed the FAA about community engagement and ways to garner support related to UAS operations. The associated lessons learned can form a basis of best practices for governments and industry to engage communities successfully and quantify societal and economic benefits. The success in gathering this data caused the FAA to add similar societal and community consideration requirements to Partnership for Safety Program (PSP) agreements that will proceed after the conclusion of the IPP. This requirement will provide the FAA with data pools to further future societal and community engagement efforts.

D. INDUSTRY INTERACTION

The UAS industry relies on innovative technologies to enable missions. For companies new to the aviation landscape, the IPP provided a safe environment to learn how to propose innovative risk mitigation measures for FAA approval. Through the IPP, UAS operators and manufacturers worked with LPs to receive direct feedback from the FAA about the safety and viability of these technologies. The collaboration between the FAA, LPs, and industry partners enabled the use of innovative technologies, like DAA or GBR,

[10] Flight Data from FAA UAS Integration Office (AUS) IPP Data Team Analysis from 1/31/2020

in UAS operations and informed future FAA policy and decision-making.

2.3.3 Priority Policy and Decision-Making Areas

Along with the accomplishments the IPP made in informing FAA policy and regulation, the program helped the FAA in identifying several priority areas for which the FAA should focus to resolve UAS integration challenges. These priority policy areas include: Type Certification (TC) for sUAS, Safety Risk Management (SRM), environmental considerations, UAS Traffic Management (UTM), and command-and-control (C2) technologies.

A. TYPE CERTIFICATION FOR sUAS

The IPP provided insight to the FAA in tailoring TC requirements to enable UAS operations effectively. When the FAA determines a product is properly designed, performs in a manner consistent with its design, and meets prescribed requirements, it issues a design approval in the form of a TC. Due to the increasing pace of innovation, the FAA is making decisions based on the level of risk of proposed operations and will propose airworthiness criteria specific to each UAS, along with a corresponding Durability and Reliability Means of Compliance (D&R MoC) to those standards.[11] The D&R MoC will be a progressive means of compliance predicated on compliance substantiation based on successful flight-testing.

Pending establishment of the TC airworthiness criteria, the FAA is testing a model D&R MoC with current applicants. The FAA will refine and expand the D&R MoC to scale approvals.

B. SAFETY RISK MANAGEMENT (SRM)

With the advancement of UAS operations and increased mission capabilities identified during the IPP, safety management and risk mitigation continue to be priorities for UAS policy and decision-making. On October 4, 2019, the FAA established its internal policy for conducting SRM specific to UAS Operations.[12] This enabled the FAA to task SRM teams with identifying potential approval paths or mitigations for related UAS challenges. The IPP revealed the need for SRM policy improvements due to the complex, innovative operations the program enabled. The FAA anticipates that lessons from the program will continue to shape SRM approaches for UAS. The FAA and LPs continued to exercise existing SRM processes to assist in properly identifying and mitigating risks for on-airport UAS operations.

For example, the Kansas DOT team worked to develop a General Operations Manual that includes a safety management system, emergency response plan, and fleet management system as the foundation for a strong state risk mitigation program. Additionally, they created a statewide UAS training program developed by Kansas State Polytechnic for state agencies, 34 IPP-team member organizations, and public safety departments. The Association of Unmanned Vehicle Systems International (AUVSI) recognized these combined efforts with the 2019 AUVSI XCELLENCE Award for Operational Safety.

C. ENVIRONMENTAL CONSIDERATIONS

The IPP provided an opportunity to collect UAS noise data in coordination with the Choctaw team and DOT's Volpe National Transportation Systems Center. Members of Volpe's Noise Research Team performed noise flight-testing of several unmanned aircraft at a site located in Choctaw Ranch Daisy near Durant, OK. These tests assisted the FAA in collecting data to begin to populate a UAS noise database for use in noise modeling and research. This informs potential approaches to reduce UAS noise impacts as

[11] https://www.faa.gov/uas/resources/events_calendar/archive/2019_uas_symposium/media/Type_Certification_for_UAS-Back_to_the_Future.pdf
[12] https://www.faa.gov/documentLibrary/media/Order/FAA_Order_8040.6.pdf

well as develop noise certification procedures, specifications, and requirements. This data is also useful during FAA environmental review of UAS-related federal actions.

D. UAS TRAFFIC MANAGEMENT (UTM)

On January 24, 2020, North Carolina collaborated with the FAA to conduct a tabletop exercise on UTM proposals that will enhance safety and inform future operations. UTM is a term for the traffic management ecosystem for uncontrolled airspace operations that "will ultimately identify services, roles and responsibilities, information architecture, data exchange protocols, software functions, infrastructure, and performance requirements for enabling the management of low-altitude uncontrolled drone operations."[13] The tabletop exercise provided a valuable forum to collaborate openly and evaluate roles and responsibilities between various stakeholders involved in a UTM environment. This coordination identified the existence of current gaps and what next steps the FAA should take to advance further UTM capabilities and policies. UTM discussions in North Carolina helped inform the FAA of statewide initiatives and considerations relevant to future UTM policy in the NAS.

The IPP also advanced Remote Identification (RID) capabilities that enable UTM. Operators can leverage these capabilities to scale the safe use of UAS across the NAS. San Diego and their partners Uber and CVPD successfully tested these technologies in a demonstration to federal agencies including the FAA, Customs and Border Protection, and the US Navy. Virginia and their partner Wing developed a RID trial in Christiansburg with 15 people testing the platform. Wing received positive feedback from law enforcement, first responders, and public safety officials and plans to use this to help shape their future RID pursuits.

E. COMMAND AND CONTROL (C2)

In 2019, the FAA developed testing metrics to support the examination of cellular networks for UAS C2 non-payload communications, as link performance (availability, continuity, integrity, and latency) is critical to operational safety. With the input from over a dozen organizations including Verizon, T-Mobile, AT&T, Intel, and Qualcomm, these metrics represent a first step towards developing guidance about how to report data that may support operational safety cases and promote the development of new standards.

In conclusion, the IPP assisted the FAA in furthering the policy and regulatory path forward for UAS. The complexity of operations, however, will require constant policy innovation by the FAA. The policies discussed above represent areas that the FAA anticipates continuing to address as UAS integration advances.

[13] https://www.faa.gov/uas/research_development/traffic_management/

3 Program Findings and Recommendations

The IPP provided the FAA with findings and recommendations that will inform future policy and decision-making. The collaboration among the FAA, LPs, and industry partners produced informative findings and recommendations in each Success Area, as summarized in this section (Table 4).

Table 4: IPP Findings and Recommendations

Safely Integrate UAS into the NAS	
Finding: While waivers and exemptions, supported by safety cases proved effective for enabling operations, regulations are critical for repeatable and scalable UAS operations.	**Recommendation for FAA:** Transition away from waivers and exemptions to more permanent solutions like certifications and revised regulations.
	Recommendation for Operators: Build safety cases and technologies that meet broad geographic profiles to support an operational approval process that is scalable.
Finding: FAA approvals accelerated when LPs focused the initial scope of their safety cases on operational areas and capabilities that were immediately viable.	**Recommendation for Operators:** Request operational concepts that begin with low risk proposals to provide reliability and safety data that leads to advanced requests and can assist in accelerating operational approval times.
Finding: Open communication between industry partners and the FAA facilitates efficient and expedited approvals for certain types of operations.	**Recommendation for FAA and Operators:** Enhance cooperation between industry partners and the FAA, through dedicated support personnel, to benefit both the safety of operations and decrease time that precedes mission execution.
	Recommendation for Operators: Bring aviation industry experience to help navigate the operational requirements and safety culture.
	Recommendation for FAA: Collaborate with industry to collect sufficient data and establish standards and regulations specific to UAS.
Finding: IPP Lead Participants incorporated	**Recommendation for FAA and Operators:**

information and partnered with UAS Original Equipment Manufacturers to develop safety cases and concepts of operations that enhance and expedite the safety case approval process.	Encourage further manufacturer communication to enable safety mitigation solutions and advanced technology.
Finding: Current BVLOS enabling technologies face scaling challenges for UAS operations.	**Recommendation for Operators:** Continue to develop scalable or easily deployed technology solutions that can detect and avoid non cooperative aircraft with a high degree of success to advance BVLOS operations.
Finding: UAS operators conduct missions across a range of environments and mission types resulting in the need for separation of manned and unmanned aircraft operations.	**Recommendation for FAA:** Adopt Detect and Avoid (DAA) industry standards that cover the entire safety continuum.

Societal and Community Considerations	
Finding: Public surveys conducted by LPs indicate support for emergency response, infrastructure inspections and medical package delivery. Comments indicate the top community concerns are privacy (7% of comments), safety (7% of comments), and security (5% of comments).	**Recommendation for Operators:** Develop community engagement strategies tailored to address community concerns.
Finding: Early community engagement and addressing feedback are essential for UAS integration in local communities, future scalability of UAS into the NAS, and realizing economic and societal benefits.	**Recommendation for Operators:** Use a wide variety of engagement techniques (surveys, videos, social media, door knocking, etc.) tailored to specific operations and stakeholder groups to gather public sentiment about proposed operations to reach the population broadly, build awareness, address stakeholders' unique concerns, and inform effective deployment of resources.
Finding: IPP operations demonstrated that identifying potential societal and economic impacts (including environmental impacts) is	**Recommendation for FAA:** Put a plan in place to further measure and quantify the societal and economic impacts of UAS operations.

important for safely integrating UAS that conduct package delivery, public safety, and infrastructure inspection operations in local communities.	**Recommendation for FAA:** Develop methods to improve communication of environmental requirements to UAS operators.
Inform FAA Policy and Decision Making	
Finding: With increasing demand for Beyond Visual Line of Sight (BVLOS) operations, continuing such complex operations of small UAS under part 107 waivers may not be scalable.	**Recommendation for FAA:** Consider the type of standards and regulations to broadly enable safe, secure, and routine BVLOS operations and the effects on future regulatory strategy.
Finding: Because the small UAS industry is in its infancy, the issuance of clarified guidance to waiver applicants, which plainly defines the FAA's expectations, will produce higher quality waiver requests.	**Recommendation for FAA:** Proactively disseminate clear guidance to help applicants produce high quality waiver requests and enable more expeditious approvals for safe operations.
Finding: Companies that seek to use UAS to carry the property of another for compensation or hire should work closely with the FAA to pursue an air carrier certificate under part 119.	**Recommendation for FAA:** Develop or update guidance for companies seeking to obtain an air carrier certificate to accelerate the process. **Recommendation for FAA:** Continue to leverage the FAA's certification process, exemptions, and authorizations to UAS air carrier operations. **Recommendation for Operators:** Build experience with aviation safety culture related to UAS to help accelerate operational approval and achieve safe UAS operations.
Finding: IPP lessons learned can form a basis of best practices for governments and industry to improve regulations, policy, and guidance; successfully engage communities; and quantify societal and economic benefits.	**Recommendation for FAA:** Communicate lessons learned from the IPP program and provide it to each participating FAA office for their use in development of improved regulation, policy, and guidance for UAS certification and operations.

	Recommendation for FAA and Operators: Outline and share best practices to improve outreach campaigns for new UAS programs in government or industry.
	Recommendation for FAA: Compile community engagement best practice information sheet that is available for future UAS operators.
Finding: Achieving Type Certification (TC) for UAS proved challenging for LPs. The model D&R MoC process assisted the TC process for UAS by establishing better communication and data exchange between LPs, industry partners, and UAS manufacturers.	**Recommendation for FAA:** Monitor the effectiveness of the model D&R MoC process to support appropriate rulemaking for UAS operators pursuing TC.
Finding: Issuing waivers and exemptions on a case by case basis is cumbersome for both the FAA and the applicant and limits the volume of enabled operations. However, waivers and exemptions provide a mechanism for the FAA to gain experience with novel operations.	**Recommendation for FAA:** Use lessons learned from waiver and exemption safety analyses to inform future rulemakings to enable expanded UAS operations.
	Recommendation for Operators: Submit applications, which employ an operational risk assessment, and review previously issued waivers to identify appropriate risk mitigation measures that meet the necessary level of safety to facilitate efficient FAA review.

4 Path Ahead

Throughout the IPP, the FAA, LPs, and their partners collaborated to innovate, gain experience, and enable UAS integration while solving technological, societal, and regulatory challenges. Additionally, the program identified opportunities for further advancement to address some of the challenges that stand in the way of scaled operations. This section highlights those areas the FAA will prioritize with SLT governments and industry partners beyond the IPP.

Future Priorities:

- **Advance repeatable and scalable BVLOS operations** by facilitating technology and developing related policy.
- **Quantify societal and economic benefits** of UAS operations and engage the community for advanced BVLOS operations.
- **Modernize and advance policy and decision-making frameworks** to more efficiently integrate UAS operations into the NAS while maintaining rigorous safety standards.

Advancement of Repeatable and Scalable BVLOS

To advance repeatable and scalable BVLOS operations, IPP participants had to address technological, societal, and regulatory challenges in rural, suburban, and urban environments. For example, package delivery operations in a rural area contain different challenges and potential benefits than operations in an urban area. Furthermore, air and ground risks vary for each area of operation. One of the greatest BVLOS-related challenges facing IPP LPs, their partners, and UAS operators nationwide is how to enable UAS to detect-and-avoid (DAA) manned aircraft in these varying conditions. UAS must maintain well clear of manned aircraft; however, this distance is not quantified. Although UAS operators have been testing and developing ground- and air-based systems to determine the capabilities and limitations, they have not provided suitable safety cases that would enable scalable and repeatable BVLOS operations through technical means.

The size, weight, power, and cost limitations associated with UAS prove that no single DAA system currently available will provide adequate coverage to ensure safe operations. Though ground- and air-based measures to satisfy the safety requirement exist, these measures may be cost-prohibitive to many stakeholders without a significant budget. Repeatable and scalable BVLOS operations will remain a limited enterprise requiring a case-by-case evaluation without revision of existing regulations and substantial technological development from industry.

Through this experience, the FAA has begun to shape a path forward for BVLOS technology and related policy. By identifying current gaps in technological capabilities and policy, the FAA will be prepared to anticipate and address challenges for these missions. Moving forward, the FAA will focus on specific, task-oriented aspects leading to routine, scalable, and economically viable BVLOS operations. The FAA will review associated consensus-based requirements and guidelines to continue its collaboration with industry, including the development of standards needed for enabling technologies. This will improve the repeatability and scalability of BVLOS flights that have the potential to enable safe, scaled UAS integration in the NAS for all major mission profiles.

Analyze Societal Benefits

The IPP reaffirmed the FAA's commitment to engaging communities for advanced BVLOS operations and enabling safe UAS operations that bring significant and quantifiable societal and economic benefits. The FAA and the LPs share a common mission of serving the public and evaluating acceptance of innovative technologies and missions. Moving forward, the FAA will expand its efforts to quantify the societal and economic impacts that operations have made in job safety, public health, cost savings, and service reliability. The FAA will develop specific data collection processes, requirements, and toolsets that will incorporate economic and societal data as part of future program design. This will give SLT government partners vital insights to identify the most significant and worthwhile UAS operations for their communities. The FAA will also focus on environmental considerations related to UAS operations and their impact on society. The FAA's continued collaboration with SLT governments as well as industry will build best practices for raising awareness of UAS operations and the benefits they bring to communities. Quantification of benefits may inform the development of future regulations to enable greater UAS operations.

Modernizing Policy and Decision-Making Frameworks

The IPP helped establish the foundation for UAS operations to inform, modernize, and advance FAA policy and decision-making. While the FAA made progress in using and adapting existing regulations, guidance, and processes, the FAA will need to modernize and advance policy and decision-making frameworks in order to enable repeatable and scalable solutions. This will continue to be a focus for the FAA to better address challenges faced by LPs and industry partners during the program.

5 Conclusion

The IPP enabled the FAA, LPs, and their industry partners to work together to begin to address technical, regulatory, and policy challenges while reinforcing the country's global leadership in the emerging UAS industry. The program's objectives centered on three Success Areas: (1) Safely Integrate UAS into the NAS, (2) Societal and Community Considerations, and (3) Inform FAA Policy and Decision-Making. These Success Areas guided the FAA, LPs, and their industry partners in their operations. Overall, the achievements and findings from the IPP led to significant advancement of current UAS operations and will help inform the continued integration of UAS. The following table (Table 5) contains a summary of these achievements and findings:

Table 5: Overview of Successes and Findings

Success Area	Achievements Summary	Findings Summary
Safely Integrate UAS into the NAS	• Conducted more than 21,000 flight operations as of October 25, 2020. • Issued the first two air carrier certificates for UAS cargo delivery operators for 14 CFR part 135 operations. • Advanced BVLOS operations.	• Operators must continuously build safety cases for the unique circumstances of each operating environment to inform rule and standard development. • FAA tends to approve waivers and exemptions more expeditiously when operators focus the scope of operational requirements on areas that will help advance policymaking. • Open communication with the FAA facilitates understanding of how operations can advance policymaking, leading to a more efficient and expedited waiver or exemption approval process. • Parachute systems mounted on UAS that meet developed standards are a viable tool to mitigate safety risks to persons on the ground during UAS missions.
Societal and Community Considerations	• Improved the provision of medical services and access to medical supplies. • Expanded access to goods and services. • Improved employee safety and security. • Improved support for disaster response.	• Early community engagement and addressing feedback are essential to understanding concerns and increasing the acceptance of UAS operations in local communities, furthering scalability, and realizing benefits. • IPP operations demonstrated that identifying potential societal and economic impacts is important for rulemaking. • Surveys indicated respondents generally support UAS use for emergency

	• Expanded and improved public engagement on UAS-related issues.	response, infrastructure inspection, and medical package delivery, while top concerns included privacy, safety, and security.
Inform FAA Policy and Decision Making	• Progressed Type Certification and Production Certification processes for small UAS (sUAS). • Gathered data to inform policymaking pertaining to UAS Type Certification Durability and Reliability Means of Compliance. • Established UAS command-and-control (C2) link testing metrics for cellular networks. Conducted UAS noise testing with one LP to inform future FAA noise policy and support FAA environmental review of UAS-related federal actions (COVID-19 prohibited noise testing for other Lead Participants (LPs)). • Supported the development of the UAS Safety Risk Management Policy Order 8040.6 to establish a safety risk management process specific to UAS operations and piloted the new process on IPP operations. • Through IPP collaboration, the first Tribal Government successfully met requirements to conduct UAS public aircraft operations (PAO). • Gathered data to inform policy and best practices for engaging communities.	• With increasing demand for BVLOS operations, continuing approvals through 14 CFR part 107 might not be scalable. • Companies that want to pursue package delivery with UAS can obtain an air carrier certificate or partner with a company to further enable that company's UAS operations. However, many view the process as extremely complex. The UAS industry needs clearer guidance on the path toward certification as an air carrier. • In order for the FAA to gather the necessary data to inform its policymaking efforts, it must provide clear guidance to waiver applicants that plainly defines the FAA's safety expectations. This will enable applicants to produce higher quality waiver requests that clearly define the operations and give FAA a clear understanding of how the operations will maintain safety and help advance UAS integration. • IPP lessons learned can form a basis of best practices for governments and industry to successfully engage communities and quantify societal and economic benefits.

With the opportunity to conduct safe UAS operations in the NAS under FAA oversight, LPs conducted thousands of UAS flights covering package delivery, public safety, and infrastructure inspection operations, and realized many benefits (Figure 19).

Figure 19: Benefits Realized by the IPP's Operations

Some of the benefits realized by the IPP's operations included:

- Decreasing patients' wait times through the use of UAS for medical specimen deliveries.
- Expanding access to goods through package delivery operations.
- Enhancing public safety and reducing emergency response times for law enforcement agencies.
- Responding quickly to natural disaster events.
- Improving inspection capabilities for longline linear infrastructure, such as power lines and pipelines.

As the IPP concludes, the FAA will apply the newly acquired knowledge and experience to address common challenges LPs identified during the program and future policy, as well as new issues. The IPP's ideas and collaboration will set the precedent for future UAS programs. The FAA expects that the safe integration of UAS into the NAS will continue to benefit from the program's outcomes.

Appendix A: Acronym List

ADS-B In	Automatic Dependent Surveillance-Broadcast (input)
AED	Automated External Defibrillator
AT&T	American Telephone & Telegraph
ATC	Air Traffic Control
AUVSI	Association of Unmanned Vehicle Systems International
BVLOS	Beyond Visual Line of Sight
C2	Command-and-Control
CFR	Code of Federal Regulations
COA	Certificate of Waiver or Authorization
ConOps	Concepts of Operations
CPLA	Close Proximity, Low Altitude
CVPD	Chula Vista Police Department
D&R	Durability and Reliability
DAA	Detect-and-Avoid
DFR	Drone as a First Responder
DOT	Department of Transportation
FAA	Federal Aviation Administration
FedEx	Federal Express
FOD	Foreign Object Debris
FRN	Federal Register Notice
GBR	Ground-Based Radar
ICT	Wichita International Airport
IPP	Integration Pilot Program
LCMCD	Lee County Mosquito Control District
LLC	Limited Liability Company
LP	Lead Participant
MEM	Memphis International Airport
MoC	Means of Compliance
NAS	National Airspace System
NC	North Carolina
ND	North Dakota
OK	Oklahoma
PAO	Public Aircraft Operations
PSP	Partnership for Safety Program
RID	Remote Identification
SLT	State, Local, and Tribal
SRM	Safety Risk Management
SRMP	Safety Risk Management Panel
STEM	Science, Technology, Engineering, and Mathematics
sUAS	Small Unmanned Aircraft Systems
TC	Type Certification
UAS	Unmanned Aircraft Systems
UPS	United Parcel Service

UPS FF	UPS Flight Forward
UTM	UAS Traffic Management
VA	Virginia
VLOS	Visual Line of Sight

Appendix B: IPP Governing Documents

Federal Registry Notice 2018 FAA

FAA Reauthorization Act of 2018

Reauthorization Act, 2018	Federal Register
1. Accelerate the safe integration of UAS into the NAS by testing and validating new concepts of BVLOS operations in a controlled environment, focusing on DAA technologies, C2, navigation, weather, and human factors; 2. Address concerns regarding the security and safety risks associated with UAS operating in close proximity to human beings and critical infrastructure by ensuring that operators communicate effectively with federal, state, local, and Tribal law enforcement to determine if a UAS operation poses such a risk; 3. Promote innovation in and development of the United States unmanned aviation industry, especially in sectors such as agriculture, emergency management, inspection, and transportation safety, in which there are significant public benefits to be gained from the deployment of UAS; and 4. Identify the most effective models of balancing local and national interests in UAS integration.	1. Accelerate the use and standardization of low altitude UAS operations; 2. Provide immediate opportunities to accelerate commercial-use concepts of operations; 3. Identify and help resolve operational barriers to expanded UAS operations; and 4. Foster community participation to provoke meaningful dialogue on balancing local and national interests in UAS integration.

Appendix C: Mapping of IPP Accomplishments to Program Objectives

2018 FAA Reauthorization Act Requirements	IPP Achievements
Accelerate the safe integration of UAS into the NAS by testing and validating new concepts of BVLOS operations in a controlled environment, focusing on DAA technologies, C2, navigation, weather, and human factors	• Established first UAS C2 link testing and performance metrics • Conducted more than 21,000 flight operations as of October 25, 2020 across IPP lead participants, gathering vital data to inform integration efforts; 5% of these flights supported advanced BVLOS operations • Executed lost link testing to improve C2 link reliability • Tested various ground-based and on-board optical and acoustic DAA solutions as a means to enable viable and scalable BVLOS operations • Enabled nationwide BVLOS and operations over people waivers • Facilitated first operations without visual observers • Authorized the first PAO to a tribal government • Tested limited BVLOS operations where the airspace is monitored utilizing technical means • Developed guidance for operations on and around airports, informing decision-making for future similar operations

2018 FAA Reauthorization Act Requirements	IPP Achievements
Address concerns regarding the security and safety risks associated with UAS operating in close proximity to human beings and critical infrastructure by ensuring that operators communicate effectively with federal, state, local, and Tribal law enforcement to determine if a UAS operation poses such a risk	• Partnered with nine lead participants, including five state and three local governments and one tribal entity • Developed an Unmanned Aircraft Systems Safety Risk Management Policy Order 8040.6 • Informed policymaking pertaining to an Unmanned Aircraft Systems Safety Risk Management Policy Order 8040.6 • Conducted traffic assessments for operations over moving vehicles • Researched UAS-human impact risk for various UAS platforms • Determined safety risks for close proximity, low altitude operations under part 91 • Enabled nationwide BVLOS and operations over people waivers • Developed safety cases for infrastructure inspection • Explored longline linear infrastructure inspection operations around pipelines and power lines • Facilitated collaboration between federal, state, local, and Tribal governments to enable safe, secure UAS operations • Accelerated the Type and Production Certification processes related to UAS, which enable operations over people and low altitude operations

2018 FAA Reauthorization Act Requirements	IPP Achievements
Promote innovation in and development of the United States unmanned aviation industry, especially in sectors such as agriculture, emergency management, inspection, and transportation safety, in which there are significant public benefits to be gained from the deployment of UAS	• Enabled routine public safety operations using drones as a first responder • Enabled rapid response to emergencies and natural disasters through accelerated waiver approvals • Enabled routine public safety operations using drones as a first responder • Improved benefits to the agriculture industry including crop output and farmer/rancher safety • Explored long-line-linear infrastructure inspection operations around pipelines and power lines • Created innovative methods for agricultural purposes including feral hog trap re-baiting, fence inspection, and cattle counting using UAS
Identify the most effective models of balancing local and national interests in UAS integration	• Facilitated collaboration between federal, state, local, and Tribal governments to enable safe, secure UAS operations • Executed UTM tabletop to explore state and local roles and responsibilities and identify potential deterrents to the state or locally run UTM operations

Federal Register Notice Requirements	IPP Achievements
Accelerate the use and standardization of low altitude UAS operations	• As of October 25, 2020, conducted more than 21,000 flight operations across IPP Lead Participants • Issued waivers and certificates to allow routine UAS operations • Addressed safety concerns with low-altitude airspace UAS utilization in by developing strong safety cases • Accelerated the Type and Production Certification processes related to UAS, which enable operations over people and low altitude operations
Provide immediate opportunities to accelerate commercial-use concepts of operations such as commerce, photography, emergency management, agricultural support, infrastructure inspections, package delivery, and others	• Enabled rapid response to emergencies and natural disasters through accelerated waiver approvals • Enabled routine public safety operations using drones as a first responder • Leveraged existing regulations to enable UAS operations such as medical specimen deliveries and package deliveries for compensation • Conducted safety case analysis to enable medical specimen and prescription delivery to provide expanded access • Demonstrated the potential of routine package delivery of food and other goods • Enabled improved aircraft inspection via UAS that increases efficiency in airport operations • Developed policy like the D&R MoC TC to provide immediate enabling frameworks • Issued the first two Part 119 air carrier certificates to UAS operators via unprecedented use of the Special Authority for Certain Unmanned Systems (49 U.S.C. § 44807), enabling routine commercial operations

Federal Register Notice Requirements	IPP Achievements
Identify and help resolve operational barriers to expanded UAS operations	• Acknowledged limitations with current regulatory policies originally designed for manned aircraft systems • Tested various enabling technologies such as C2 and DAA to support BVLOS operations that would greatly expand UAS operations • Conducted first UAS noise-testing to inform part 36 decision-making • Streamlined the UAS Type Certification process using D&R MoC • Informed policymaking pertaining to D&R MoC • Increased waiver approval experience allowed the FAA to more rapidly issue waivers
Foster community participation to provoke meaningful dialogue on balancing local and national interests in UAS integration	• Received feedback from more than 12,700 citizens nationwide through outreach programs • Promoted online surveys to garner feedback on UAS operations • Hosted various industry conferences to facilitate UAS discussion • Engaged with targeted stakeholders to address concerns and foster community satisfaction • Utilized social media to magnify other engagement methods and connect with diverse populations • Executed UTM tabletop to explore state and local roles and responsibilities • Engaged with more than 12,800 community members nationwide as of October 25, 2020, helped to demonstrate that community engagement is critical to UAS acceptance, scalability, and realizing economic and societal benefits

Appendix D: Community Engagement Best Practices

UAS Community Engagement Best Practices

The FAA identified three strategies that were the most successful for IPP LPs:

Reaching Different Populations	LPs were most successful when they **understood the populations** they served and the ways in which they could reach those individuals. **Targeted meetings** played an essential role in communicating with highly impacted stakeholders for several LPs. Such meetings yielded successful dialogue and support across the community.
Storytelling Across Operational Characteristics	Understanding the **positive impacts** of operations and sharing that with the public has had a constructive outcome on public perception. **Tailoring engagement** approaches to the unique characteristics of operations, such as urban versus rural, population density, or operation type, helped maximize population outreach.
Feedback Solicitation	Collecting public sentiments towards UAS operations allowed operators to **address public concerns** and garner support for UAS integration in the community. Feedback collection occurred in a variety of forums including surveys, meetings, websites, public events, etc. In general, LPs found that local communities were interested in and supportive of UAS operations perceived to provide benefits to their wider community, such as for disaster response and emergency services.

Other effective community engagement strategies include:

- Identify all **impacted populations** prior to initial operations
- Determine topics around which community members may be concerned (e.g. noise, privacy) and **proactively communicate** mitigation actions
- Inform local populations of activities and provide a forum for **open communication** (e.g. public meetings, surveys)
- Attempt a **variety of techniques** that have proved successful for other operators, then narrow activities based on successes
- Work with **traditional media** outlets (local and national) to inform the public of operations
- Use multiple **social media** pages (LPs', partners', DOT's, etc.) to educate and inform the public of UAS operations
- Speak at or attend **conferences and events**
- Understand your **constituency**, what they care about, and what engagement techniques/messaging resonate with them

These strategies align with the good practices and effective techniques identified within FAA's Community Involvement Manual.


FAA Unmanned Aircraft Systems
Integration Pilot Program