IDAHO TRANSPORTATION DEPARTMENT

RESEARCH REPORT

Uncrewed Aircraft Systems Technology, Airspace Design, Privacy and Safety in Idaho

RP 304

By

Gloria Totoricagüena, Ph.D.

Idaho Policy and Consulting LLC

Prepared for

Idaho Transportation Department

ITD Research Program, Contracting Services

Highways Construction and Operations

June 2023

Disclaimer

This document is disseminated under the sponsorship of the Idaho Transportation Department and the United States Department of Transportation in the interest of information exchange. The State of Idaho and the United States Government assume no liability of its contents or use thereof.

The contents of this report reflect the view of the authors, who are responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the official policies of the Idaho Transportation Department or the United States Department of Transportation.

The State of Idaho and the United States Government do not endorse products or manufacturers. Trademarks or manufacturers' names appear herein only because they are considered essential to the object of this document.

This report does not constitute a standard, specification or regulation.

Technical Report Documentation Page

1. Report No. FHWA-ID-23-303	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle UAS Technology, Airspace Design, Privacy and Safety in Idaho		5. Report Date June 2023
		6. Performing Organization Code
7. Author Gloria Totoricagüena, Ph.D.		8. Performing Organization Report No. T002928
9. Performing Organization Name and Address Idaho Policy and Consulting LLC PO Box 703 Boise, Idaho 83701		10. Work Unit No. (TRAIS)
		11. Contract or Grant No.
12. Sponsoring Agency Name and Address Idaho Transportation Department (SPR) Highways Construction and Operations, Contracting Services, Research Program PO Box 7129 Boise, ID 83707-7129		13. Type of Report and Period Covered Final Report 10/01/2022 - 06/30/2023
		14. Sponsoring Agency Code RP 304
15. Supplementary Notes Project performed in cooperation with the Idaho Transportation Department and Federal Highway Administration.		

16. Abstract

This report examines existing guidelines in Idaho and in other states that lead in the implementation of UAS, in order to identify strategies to promote and regulate their use in Idaho's airspace from the surface to 400 feet AGL. UAS innovations accelerate project delivery, increase roadway safety, reduce congestion, and improve environmental sustainability. The ITD Division of Aeronautics is responsible for building a UAS Program to support ITD's strategic goals of safety, mobility, and economic opportunity. As a result of the FAA's evolving regulatory authority, state DOTs are individually addressing the challenges of UAS integration into public policy. The report summarizes best practices from leading state DOT UAS programs and develops evidence-based recommendations for strengthening ITD's UAS Program. This includes determining UAS uses to meet agency needs, establishing UAS program management practices, developing protocols for safe UAS use, procedures to effectively incorporate UAS into highway design and construction, pavement and bridge inspections, surveys, and stockpile monitoring among other uses. The report can guide statutes, policies, rules, and programs in Idaho that promote and regulate UAS use by public agencies, businesses, and the general public. This is a synthesis of information that can assist in identifying areas for improvement within Idaho's existing laws, and development of new policies for advanced air mobility. This includes jurisprudence discussions related to air space, land use and zoning, public safety, trespassing and privacy, and enforcement roles and authorities.

17. Key Words Drone, UAS, airspace requirements, aeronautics, aviation law, avigation easement, air trespass, advanced air mobility, preemption, FAA, UAS Programs, UAS use cases, UAS-aided surface transportation	18. Distribution Statement Copies available from the ITD Research Program

19. Security Classification (of this report) Unclassified	20. Security Classification (of this page) Unclassified	21. No. of Pages 100	22. Price None

Acknowledgments

The author thanks and acknowledges the dedicated professionals at the Idaho Transportation Department and their commitment to safety, innovation, efficiency, accuracy, and reducing costs for Idahoans and those traveling through Idaho. Division of Aeronautics Administrator, Jeff Marker, has led by personal and professional example in inviting and welcoming the future to his colleagues and to Idaho, and his efforts led to the establishment of Idaho's UAS Program. Jeff readily shares his knowledge of aviation policy and industry developments and encourages Idaho's public employees to engage with opportunities outside of their comfort zones. His vision prompted and sustained this research project's questions and its recommendations through to the last day of his professional employment and his retirement from ITD.

James Bennett and the ITD UAS Committee's monthly discussions were extremely valuable in gathering input from surveyors, GIS specialists, design/construction engineers, inventory and project managers, and IT specialists. Thank you, especially to those who regularly answered my calls and agreed to personal interviews, as well as email requests for information: Nick Baptista, James Bennett (committee coordinator), Vladimir Borek, Brent Brumfield, Benjamin Daley, Alex Deduck, Marvin Fenn, Flo Ghighina, Toby Griffin, Chris Higginbotham, Travis Hire, Sean Hlousek, Ryen Johnson, Jet Johnstone, Joe Jones, Nick Jorgensen, Caleb Lakey, Sharon Matthies, Tobias Mouser, Axel Quartarone, Mark Snyder, Tim Steffen, Adrienne Woods, and Tyler Zundel.

Tim Henderson provided a historical and current trajectory of Aeronautics' engagement with UAS and access to the initial UAS Program binders, files, and documents. UAS consultant Jeff Werner assisted with initial pointers to leading UAS research entities, and Kaley Wright provided expert final document formatting. Shelly Haskins, Aeronautics' Administrative Assistant, maintained communications and coordination for Technical Advisory Committee meetings and follow-up materials dissemination.

Professional time, expertise, and suggestions for clarifications and improvements were given by the Technical Advisory Committee members listed below and by external readers Eric Holdeman, Director, Center for Disaster Resilience, and Matt Morrison, CEO, Pacific NorthWest Economic Region. Amanda Laib from ITD Research Program provided detailed suggestions that improved and clarified this report.

Technical Advisory Committee

Each research project is overseen by a Technical Advisory Committee (TAC), which is led by an ITD project sponsor and project manager. The TAC is responsible for monitoring project progress, reviewing deliverables, ensuring that study objectives are met, and facilitating the implementation of research recommendations, as appropriate. ITD's Research Program Manager appreciates the work of the following TAC members in guiding this research study.

- Project Sponsor: Idaho Transportation Department (SPR) Highways Construction and Operations, Contracting Services, Research Program
- Project Manager: Jeff Marker ITD Aeronautics Division Administrator)

- TAC Members: Maureen Gresham (FHWA Idaho Division US DOT), Jeff Marker (ITD Aeronautics Division Administrator), Ned Parrish (ITD Research Program), Amanda Laib (ITD Research Program), Matthew Balderee (Idaho National Laboratory), Tim Schuh (College of Western Idaho), David Barker (Idaho Falls Police Department), Rick Hart (Deputy Attorney General at ITD), Tim Steffen (ITD Aeronautics), Shelly Haskins (ITD Aeronautics).
- FHWA-Idaho Advisor: Maureen Gresham

This document has been assessed with Turnitin's Scribbr software for accuracy in citations and documentation of sources used. Every attempt has been made to find the most recent information, technology updates, original documentation, and citations for regularly repeated information found in publications, FAA and FHWA documents, and websites that did not use citations. Similar expressions and references to federal statutes, state policies and legislation, court case rulings, and UAS use cases were found in various sources such that ideas have moved into the realm of UAS-related "common knowledge" and/or "common wording". I have searched for the earliest versions of repeated explanations and used that citation when possible. Many thanks to those mentioned above for their commitment and expertise and any mistakes in this document are solely my own.

Terminology in this field is developing. "Drones" and "unmanned aircraft system" or "unmanned aerial system" are found in the older literature but in the last three to five years are mostly replaced with "uncrewed aircraft system", "uncrewed aerial system", "uncrewed aviation system", or "remotely piloted aircraft system". Federal government agencies have issued Memoranda to correct policy and manual terminology to "uncrewed". This report uses the non-gendered "uncrewed" and "remotely piloted aircraft system" unless a direct quotation used the older gendered term "unmanned."

Table of Contents

List of Figures

List of Abbreviations and Acronyms

AAM ..... Advanced Air Mobility

AASHTO ..... Association of State Highway and Transportation Officials

ABA ..... American Bar Association

AGL ..... Above Ground Level

BVLOS ..... Beyond Visual Line of Sight

COA ..... Certificate of Authorization

DOT ..... Department of Transportation

ETS ..... Enterprise Technology Systems

eVTOL ..... Electric Vertical Takeoff and Landing

FAA ..... Federal Aviation Administration

FHWA ..... Federal Highway Administration

GAO ..... Government Accountability Office

GIS ..... Geographic Information System

IDAPA ..... Idaho Administrative Procedures Act

IPP ..... Integration Pilot Program

IR ..... Thermal Infrared Imagery

ITD ..... Idaho Transportation Department

LiDAR ..... Light Detection and Ranging

NAS ..... National Airspace System

NASA ..... National Aeronautics and Space Administration

NextGen ..... Next Generation Air Transportation System

NPIAS ..... National Plan of Integrated Airport Systems

NPMS ..... Network Pavement Management System

NTIA ..... National Telecommunications and Information Administration

PII ..... Personally Identifiable Information

RD&T ..... Research, Development, and Technology Transfer

RPAS..... Remotely Piloted Aircraft System

TAC ..... Technical Advisory Committee

UAM..... Urban Air Mobility

UAS ..... Uncrewed Aircraft System(s), Uncrewed Aerial System(s), Unmanned Aircraft System(s)

ULC ..... Uniform Law Commission

UTM ..... Urban Traffic Management

VTOL ..... Vertical Takeoff and Landing

VLOS ..... Visual Line of Sight

Executive Summary

The Idaho Transportation Department (ITD) Division of Aeronautics is responsible for building an Uncrewed Aircraft Systems (UAS) Program to support ITD's departmentwide strategic goals of safety, mobility and economic opportunity. This report examines ITD's past and current UAS use trajectory including determining UAS uses to meet agency goals and needs, establishing the UAS Program management practices, developing protocols for safe UAS use for ITD employee tasks, and the procedures to effectively incorporate UAS for increasing employee safety, and efficient highway design and construction, pavement and bridge inspections, surveys, contractor quality assurance, and in inventory control and stockpile monitoring among other uses. Project photos and videos are regularly used for public relations and communications with departmental and external media. Best practices from leading states are cited where UAS innovations accelerate project delivery, increase the safety of personnel by reducing exposure while gathering that data, increase roadway safety, reduce congestion, and improve environmental sustainability. Data collected via UAS create accurate descriptive, predictive and prescriptive data. Typically, the given examples will show that the same states leading in UAS use are also leading in advanced air mobility innovation and testing as well as in traffic management for the integration of UAS into the national airspace system.

As a result of the rapid technological developments in aviation and the Federal Aviation Administration's (FAA) evolving regulatory authority, state Departments of Transportation (DOTs) are individually addressing the challenges of UAS integration into public policy. Idaho is joining others in order to identify strategies to promote and regulate UAS use in Idaho's airspace from the surface to 400 feet above ground level. In Part 2., a chronological order of aviation law related to federal control over the US airspace and federal preemption of state control, aerial trespass, avigation easements and government takings of airspace over private property compensation, and privacy expectations produce a map of US jurisprudence related to UAS technology and its capabilities when in the hands of government employees and private-citizen pilots, law-abiding or not. Repeated statutory and ordinance recommendations from Idaho UAS stakeholders consist of addressing the UAS as simply another tool or extension of human behavior, as the UAS itself cannot commit any criminal or regulatory faults. This includes jurisprudence discussions related to air space, land use and zoning, public safety, trespassing and privacy, and enforcement roles and authorities. Existing Idaho law is often adequate to deal with trespass and privacy questions regardless of if a UAS is the device used in an illegal act. Improvements do need to be made to the Idaho code to coincide with federal constitutional court rulings, as a few of the existing references could likely be struck down by federal courts as inconsistent with existing jurisprudence. A full review with suggested improvements to Idaho statutes and specifically *Idaho Title 21 Aeronautics* section-by-section has been produced and provided to ITD separately from this Final Report document.

Risk identification, mitigation and insurance are also factors for UAS use consideration. These apply to government and private sector uses of the aircraft themselves, and also apply to how ITD will incorporate UAS multimodal transportation for passengers and cargo into its ongoing planning and

management of exiting airports, and eventually to separate vertiports, and to combined multiports. This report gives numerous use case examples of policies and actual uses in play today of UAS package delivery and air taxi planning. Commercial uses and especially “last mile delivery” are pertinent in rural Idaho, yet at least equally important is the public’s need to feel safe from failing or rogue UAS use.

The persistent questions for UAS development and integration into the national airspace assess the shades of gray regarding federal control and authority, and the simultaneous state, local, and Tribal jurisdictions’ reserved powers and positions related to low-altitude remotely piloted aircraft operations. The federal level of government preempts states from various categories of airspace decision-making, and the states preempt their respective local entities from various categories of land use, zoning and permitting ordinances and rulemaking in aviation land services. All levels of jurisdictional authority and all branches of executive, legislative and judicial powers are, and will continue to be, involved in the establishment, implementation and enforcement of advanced aviation controversy and outcomes. The progression of society’s civil rights expectations and fears or acceptance of advanced air mobility characteristics continues as noted in this report’s examples of Presidential and FAA policies, Congressional acts, state legislative codes, and federal and state court rulings.

ITD’s UAS outreach and community engagement is not yet appropriately funded or programmatic. It is mostly voluntary by ITD staff sharing examples and information with other departmental employees, other Idaho agencies, and in their own district communities where UAS is used for ITD programs. Federal Highway Administration (FHWA), FAA and leading states all consistently recommend that engaging and educating the public and elected officials about UAS use safety and efficiency is fundamental to acceptance and even positive approval of the advantages of UAS technologies today and in the future of advanced air mobility. Surveying Idaho’s UAS users from academia, business and commerce, public agencies of all levels and recreationalists gives us qualitative results stating increased and strategic outreach and public education are needed and desired. Recommendations also include a solicited annual conference/workshop coordinated by ITD Aeronautics for Idaho’s UAS users and policy decisionmakers. Vendors have responded that many would be willing sponsors and hosts for the event costs and for their own product demonstrations.

In the American Northwest, pioneers that traveled together had significantly higher rates of perseverance and odds of surviving unknown conditions and experiences. Collaboration among Idaho’s UAS trailblazers has already begun and will continue to uncover common needs, best practices and shifts toward discoveries and learning from and with each other. They welcome ITD’s leadership and coordination of their efforts. The clearest recommendation resulting from the culmination of factors reported here is for ITD to work immediately towards the establishment of a UAS Task Force of specialist stakeholders from public and private sectors, academia and research, UAS users and the general public. A consulting and advisory group for UAS and eventually advanced air mobility issues is fundamental to buttressing a nascent UAS Program and the aeronautics sector in Idaho.

Finally, terminology in this field is developing. “Drones” and “unmanned aircraft system” or “unmanned aerial system” are found in the older literature but in the last three to five years are mostly replaced

with “uncrewed aircraft system”, “uncrewed aerial system”, “uncrewed aviation system”, or “remotely piloted aircraft system”. This report uses the non-gendered “uncrewed aircraft system” and “remotely piloted aircraft system” unless a direct quotation used the older gendered term of “unmanned.”

1. Review of ITD UAS Program, Technology and Needs

Purpose

The Idaho Transportation Department (ITD) Uncrewed Aircraft Systems (UAS) program is committed to enabling ITD to safely, efficiently, transparently, and lawfully use UAS platforms to support crucial ITD functions for highway projects, infrastructure inspections, emergency response, communications, and environmental applications. To meet this goal, with funding from the Federal Highways Administration (FHWA) ITD contracted consulting services for a research project to examine UAS use in ITD's various programs and projects and a review of existing guidelines in Idaho, neighboring states, as well as other states that are leading the implementation of UAS to identify strategies to promote and regulate their use in Idaho's non-navigable airspace from the surface to 400 feet above ground level (AGL). The project began with a review of the existing ITD UAS Program and management efforts including:

- the department's goals,
- the traditional and current methods of accomplishing tasks,
- the past and current uses of UAS including the program management efforts, staffing, hardware, software, and policy,
- limitations and gaps in ITD's existing UAS program, and opportunities for future development, efficiencies, and expansion, and
- ITD concerns and opportunities for upgrading technology for efficient and effective UAS data integration and management with existing ITD data systems, storage, security, and data flows.

ITD and Division of Aeronautics Goals

ITD's Division of Aeronautics is responsible for building an Uncrewed Aircraft System (UAS) Program to support departmental strategic goals of safety, mobility, and economic opportunity through enhanced use of remotely piloted aircraft for employee safety, quality data acquisition, improved efficiencies in project management, and cost savings. Departmental policies and plans align with incorporating UAS into highway design and construction, pavement and bridge inspections, surveying, stockpile monitoring, soil and snowpack monitoring, environmental reports, mitigating traffic delays and lane closures, improving overall safety around highway construction and inspection operations, and saving resources at various opportunity points. The ITD Division of Aeronautics Mission is: "Aeronautics innovatively develops an adaptable, foresighted, and safe air transportation system promoting economic opportunity and opening gateways to adventure." The FHWA Every Day Counts program for 2023-2024 (EDC-7) includes UAS as next-generation Traffic Incident Management (NextGen TIM) technologies that increase traveler and responder safety, with the example, "The Washington State Patrol has reduced the time needed to measure, map, and photograph serious crash scenes by 70

percent with the use of UAS" (EDC-7 Next-Generation TIM: Technology for Saving Lives, Jan 4, 2023). In EDC-5, the FHWA report states, "UAS can benefit nearly all aspects of highway transportation, from inspection to construction and operations, by collecting high-quality data automatically or remotely. These relatively low-cost devices allow agencies to expedite the data collection needed for better-informed decisions while reducing the adverse impacts of temporary work zones on work crews and the traveling public" (EDC-5 Unmanned Aerial Systems (UAS), March 4, 2020). The FHWA and ITD both can expect enhanced safety and productivity, reduced costs, asset maintenance, and accelerated construction in addition to increased accuracy in data collection and use.

ITD's 2040 Long-Range Transportation Plan (IDAGO 2040) states it will, "Continue public engagement and education on technology advancements and solicit input on community impacts. This plan points out the future impacts of new technologies on transportation that are expected soon. Maintaining public awareness will ensure the public understands the benefits of such technologies and supports decisions to integrate them into the transportation network." Although some think it goes too far to suppose the public will "support" all new technologies in transportation, it is true that best practices are demonstrating increased safety, mobility, and economic opportunity. Idaho's Plan encourages innovative business practices, saving time and money, maintaining an educated workforce, and adapting to change and growth, following the fundamental pieces of ITD's vision for itself.

The departmental uses of UAS fit into each of these and make the best use of resources. The department's vision also includes, "Trust and satisfaction from the public, partners, policymakers, customers, and employees; Continued improvement in productivity, capabilities, and the ability to adapt to unexpected challenges; Employees engage in improving performance, safety, and continue to look for better ways to do their jobs." UAS technologies and the coming advanced air mobility are also connected to each of these objectives. These new technologies can interrupt the status quo or complement and improve it.

In November 2020, ITD added a new full-time position within the Aeronautics Division described as for an onboard pilot and UAS Program Coordinator. The coordinator is tasked with 1.) building a UAS Program for ITD, and 2.) providing guidance to other Idaho state agencies that want to utilize UAS technologies. The pilot/coordinator position was originally filled, and within months, that person was hired away. That position being empty since May 2022, it has been challenging to move forward with Idaho's UAS programming and planning.

The UAS operating environment is jurisdictionally complex for Idaho, and equally for all other states. Federal regulations are updated constantly, reflecting the evolution of remotely piloted aircraft technologies' uses and applicability. Airspace authority below 400 feet above ground level (AGL) is frequently in question, as states look to the FAA and the courts for guidance. Local government units such as Idaho's counties (Canyon), cities (Idaho Falls), and highway districts (Ada County Highway District) also are creating ordinances that may conflict with Idaho state and U.S. federal law.

The importance of promoting ITD objectives, nurturing advanced air mobility and future economic development possibilities, and simultaneously managing compliance with trespass and privacy laws are critical areas of concern as the political and sociological anthropology of many Idahoans' cultures puts UAS activities in the bullseye of "government infringement on my rights" attitudes. Public outreach, partnering within ITD's districts and with other state agencies, as well as with the private sector and academia regarding the above-mentioned benefits of UAS technologies need to be consistently funded and executed objectives. Current ITD UAS pilots and district communications personnel produce a commendable effort at public education and outreach. When a program Coordinator is in place, that effort will benefit from more unified messaging and synchronized work efforts. However, as will be discussed below, these responsibilities should not fall to one person, but perhaps to an Idaho UAS Task Force or advisory group. This group could assists in guiding policymaking both at the state legislative and executive branch levels, possibly county and municipal levels as well as with internal policies at ITD.

ITD's UAS Past and Current Use Trajectory

The documented use of remotely piloted aircraft for ITD projects commenced with a study in April 2014 to investigate the use of UAS in areas that could be dangerous or costly for a human inspector. In 2015, ITD district engineers authorized a Drone Pilot Project that would investigate the possibility of using UAS for ground surface data gathering, bridge inspection, construction inspection, and documentation missions. ITD's 2017 report, RP 256 "Fatigue Crack Detection Using Unmanned Aerial Systems in Under-Bridge Inspection" discusses the applications of UAS for bridge inspection, with emphasis on under-bridge inspection and fatigue crack detection. The results indicated that UAS inspections were a safe and effective way to gather data that could be used for design, construction, and ground monitoring purposes. According to district engineers, continuing research projects would test the accuracy and usability of the UAS data itself. The research team reported that the most significant barrier for these tasks was not technical, but regulatory from the FAA (Dorafshan et al FHWA-ITD-17-256 2017 p. 19).

The potential benefits and challenges of using UAS for bridge inspection were identified through an extensive literature survey. The concluding major challenges for UAS included satisfying regulations, position control in Global Positioning Systems (GPS) denied environments, private sector pilot expenses if contracting out the project work, availability of private sector pilots to contract, and the required processing of unstructured data into actionable policies and projects (*ibid*). Other considerations include difficulties with adverse weather effects on small UAS and required regulations of "arms reach" level of accesses for under-bridge inspections.

Regarding ITD Aeronautics' coordination with other Idaho state agencies and guiding UAS use, again, there is a positive foundation of past outreach and collaboration. In July of 2018, Idaho Falls Police Department initiated the Idaho Public Safety UAS Council. This Council's focus includes first responders and emergency response efficiencies; however, the Council has advocated for a statewide public agency UAS user's forum (with participation beyond that of public safety officers) for regular joint information sharing and joint training. In November 2018, ITD Aeronautics hosted a full-day discussion and an off-

site flying demonstration for any state agency interested in sending personnel. Approximately 40 people from around the Treasure Valley attended, with high-level discussions of needed coordination and joint efforts across the entire state for ongoing interagency training, conferences, and information sharing especially regarding regulatory updates. In June 2019, ITD joined the Idaho Office of Emergency Management (IOEM) and the Pacific NorthWest Economic Region (PNWER) to create the first statewide Idaho UAS Situational Awareness Symposium. This effort created an Idaho public entity UAS users contact list, a UAS inventory list of which public entities had what types of equipment, and a Summary Report of the key takeaways and recommendations from the 130 attendees from all around Idaho. The symposium was funded with grant monies and private sector sponsorships. The foundation and desire to repeat this event remain strong. In November 2022, Idaho State University (ISU) offered to host an event at their campus in 2023. The College of Western Idaho's (CWI) UAS program professors have also offered to host training and demonstration events. A new incoming UAS Program Coordinator has a strong base of accomplished planning from which to carry on as well as an eager audience for inter-agency coordination and joint efforts.

The first statewide ITD symposium in 2019 demonstrated ITD's desire for public outreach and engagement with the UAS users' community. That can be expanded to include the general media for drone events or explanations of how ITD is saving money by the use of this technology. ITD can lead state agencies by developing ongoing conferences or events with state agency UAS users and engaging with College of Western Idaho (CWI), Idaho State University (ISU), University of Idaho (UI), and Boise State University (BSU) programs so that these students know they have a pipeline of employment into Idaho public agencies. ITD's Aviation Career Exploration Academy events and participants serve as additional potential public relations and outreach regarding drones and their benefits as a tool in a myriad of uses. The 2016 Aviation Education Award was presented to ITD Aeronautics at the annual meeting of the National Association of State Aviation Officials for the 25 years of work conducted in introducing teenagers to careers in aeronautics including UAS operation. In Lewiston, the Spalding Bridge repair project won an American Association of State Highway and Transportation Officials (AASHTO) President's Award for environmental stewardship and included the UAS technology in defining and implementing this project. These are examples of the positive significance of the use of drones that should be a part of the public common knowledge.

Nationally, the types of missions and research being conducted by state DOTs vary widely. A 2019 AASHTO survey found that the top five UAS missions in order of frequency are: 1) photo and video gathering mainly for infrastructure projects; 2) surveying; 3) inspecting infrastructure including bridges, signage, light poles, and pavement; 4) responding to emergencies and natural disasters; and 5) for public education and outreach (AASHTO 2019). Similarly, the American Public Works Association's Top 5 trends for 2023 are GIS technology, UAS, asset management, field technology, and electric vehicles (APWA 2023). Studies of the country's aging infrastructure, unsafe roads and bridges, and environmental impact are all improved when conducted with UAS technology. Other high-frequency missions include observation and management of endangered species, avalanche and rockslide mitigation, and traffic monitoring. ITD's UAS users have discussed the opportunities to consistently map avalanche 'hot spots'

such as Galena Summit, with aircraft equipped with LiDAR (light detection and ranging) sensors to create detailed three-dimensional maps of the landscape. LiDAR uses laser beams to map the world in 3D, providing machines and computers with an accurate baseline representation of the surveyed environment. After significant snowfalls, those base maps can be used to measure the depth of the new snow to better mitigate avalanche probability. Traffic surveillance, mapping, construction project monitoring, bridge inspection, and image processing techniques (3D mapping or damage detection) that can detect defects are significant advantages of UAS inspections. Additional uses include detecting girder corrosion and concrete delamination using thermography. UAS are regularly used for life-saving events such as long-range inspection of rail lines to prevent derailments, inspections of power lines and cell phone towers, delivery of medicine and defibrillators to people in cardiac distress, assessment of wildfires to assist firefighters, and delivering life jackets to a boater or rafter on a lake or river.

Increased safety is a piece of nearly every flight of an ITD UAS. All six districts have used a UAS flight to measure highway guard rails instead of walking the road in person with a measuring wheel in live traffic. This use moves employees to a safe physical site for piloting the data collection mission away from the dangers of moving vehicles. Using Esri's Site Scan to acquire and process imagery ITD's asset stockpiles are regularly measured with orthomosaics for inventory updates as well as to verify contractor invoicing. Work that traditionally would involve at least two hours for a person to personally and physically measure one pile in order to get the dimension of materials, is now conducted in one flight of approximately 45 minutes and one hour to process that collected data for an entire yard of piles and the data collected includes the total volume (not only dimension) of materials. This use increases the safety of the employee not having to climb the piles, saves employee work time and productivity of perhaps ten hours for an entire yard's measurements, and produces accurate and better data for inventory records saving resources and improving the overall management of stockpiles. These uses create a baseline for the source managers and materials engineers and an after-project or regular inventory record. The maintenance crews also have access to an aerial photo map of which pile of materials to use, eliminating confusion in the field. ITD is able to improve its Request for Proposal details by knowing exactly what its materials inventory is and by measuring during and post-project quality control to confirm contractor claims of what and how much they used. This level of quality assurance in asset management must be done in-house and not contracted out.

Accurate inspection and assessment are at critical levels for bridge inspectors and transportation authorities. In concrete bridge components, detailed assessments of the subsurface cracking and delaminations are difficult to detect, and no bridge inspection is simply visual. Subsurface delaminations tend to occur within reinforced or prestressed concrete bridges or in overpasses, resulting from the corrosion of reinforcement which then develops into spalls on the bridge. This development of unseen decay emphasizes the importance of safety for the traffic moving under an overpass, and of detecting this type of deterioration early on, especially underneath the bridge and within the precast prestressed girders. While non-destructive technologies such as ground penetrating radar (GPR), ultrasound echo (UE), and impact echo (IE) can support ITD bridge inspectors in detecting subsurface anomalies, their high cost and complicated interpretation procedures limit the application of these technologies during a

routine bridge inspection. Research from Michigan Technological University demonstrates thermal infrared (IR) imagery is a non-destructive technology that helps in detecting those delaminations. Their work published in 2011 (Vaghefi et al 2011), discusses the ease of data collection and interpretation of thermal IR images distinguishing the technology especially for bridge inspections. The separation of concrete layers within the cover of the top layer of rebar occurs as a set of horizontal cracks through the depth of concrete. Those gaps are not found with visual inspections. The separating layers can then cause an interruption in sound wave transmission through the concrete. Sounding concrete with a hammer is the most economical method for detecting delaminations during a bridge inspection. Delaminated areas reveal hollow sounds when tapped with a hammer compared to intact concrete and this can indicate the defective area. These required tactile methods (chain drag, impact echo, ultrasound echo, and GPR) are the typical methods that are used for identifying delaminations.

Most of the bridge inspections conducted in Idaho are not yet UAS-assisted, but those that are do have UAS as one more tool to supplement the Bridge Inspector in the inspection. A few tasks that ITD inspectors use UAS for during bridge inspection include taking measurements, taking photos (e.g., birds eye view of water channels), 3D mapping, deck evaluation, and delamination detection. A Bridge Inspection Team Leader is always on-site to evaluate and interpret the information coming from the UAS. Infrared thermography evaluation provides inspectors with valuable detail for estimating the delamination in the deck of a structure.

For an inspector to dodge traffic and get this type of detail is extremely unsafe. The evaluation might be rushed, and areas might be missed. Performing this activity at night or on Sundays for less traffic and reduced public impact still has higher safety concerns and less visibility if conducted at night. In 2018, the Sandpoint Long Bridge inspection was conducted via boats, UAS, and “Kenny” an under-bridge inspection truck. July 2019 saw ITD’s UAS bridge inspection with crews walking the arch of the Perrine Bridge as part of a routine inspection and the aircraft was also deployed to examine portions of the structure. In bridge inspection, UAS can be used as a tool in the inspector’s “toolbox” for several tasks. UAS can supplement, not supplant qualified bridge inspectors. For example, UAS might help identify areas of concern on a bridge that require additional investigation, often using tactile methods such as the hammer sounding, which the inspector performs with other tools.

ITD’s reclamation work post-project is greatly enhanced with UAS data. The UAS preliminary mapping, followed by under-construction data collection, followed by completed-construction photos give qualitative and quantitative information regarding reclamation needs. This level of details is often fundamental to proposals for federal funding opportunities.

Environmental studies conducted with UAS, for example, Elk Creek at Stanley Basin, created longitudinal data allowing watching the chronology of vegetative growth patterns. By using photos and orthomosaics collected from above to record and measure, the visualization of stormwater displacements, invasive species growth, precarious rock outcroppings, etc., establish a more accurate and efficient land survey. If done by a traditional method, the Elk Creek project would likely take two employees two full days to complete, and with the UAS, this was finished in less than 25% of the time, with reduced environmental

impact and improved data. Capturing topographic data with a drone is up to five times faster than with land-based methods and requires less staff. District UAS pilots are collecting data for slope monitoring, avalanche monitoring, and dangerous rock outcrop detection.

ITD's traffic congestion mitigation planning is assisted by UAS flight data recording the numbers of vehicles and movement patterns across Idaho's highways. Patterns of dangerous driving, driver error in lane changes, off-ramp mistakes, etc., can be mitigated with different signage to improve safety and this type of use case exists in all six districts. UAS video documenting construction at the north end of the Kimberly Interchange project on SH-50 documented drivers confused about appropriate lanes and appropriate directions. ITD addressed this immediately with additional signage and curve delineations, increasing traffic safety and possibly preventing an incident.

Cultural resource surveys conducted at possible future construction sites with UAS are estimated to save nearly 75% of the traditional approach time necessary to gather data according to discussions of the ITD UAS Committee (UAS Committee meeting discussion March 22, 2022). UAS software enables employees to collect, manage, and interpret the data by processing the captured images, storing them, and creating maps and 3D models that inform staff with a detailed view of the project terrain. LiDAR sensing can collect data through the existing vegetation, aiding in finding archaeological sites and wildlife passages.

ITD's UAS inventory ranges from small, specialized platforms that can operate autonomously to inspect infrastructure more safely by reducing the need to put our inspectors in high-risk places, to large, fixed-wing vertical take-off and landing (VTOL) aircraft that can survey over 700 acres in a single flight. Using UAS in the airspace above projects reduces the need to close travel lanes of traffic and subsequently increases the mobility of people. ITD UAS pilots survey pavement and structural conditions with thermal sensors, as well as environmental conditions utilizing multispectral sensors that analyze vegetation health and regeneration. The UAS captures individual images, possibly numbering in the thousands, utilizing mission plans that are capable of operating the platforms autonomously. After the flight, the images are input into advanced Geographic Information System (GIS) software that stitches together the individual images into a single mosaic. These are utilized by planners, designers, and stakeholders to provide preparation and monitoring data with one centimeter relative accuracy.

In the September 2022 FHWA Pavement Management Roadmap publication, one of the primary objectives in conducting pilot programs to demonstrate new pavement management practices was determined to be to "Demonstrate the applicability of small, unmanned aircraft systems (UAS) for pavement management" (FHWA-HIF-22-054 p. C-55). The improved pavement management data reliability can greatly improve planning for drainage conditions, pavement distress, and pavement oxidation. Cost savings to ITD employees being trained on the various UAS capabilities for pavement management and other opportunities mentioned can be substantial. In one example, a contractor was paid $4,000 per flight for a project that took approximately two hours. Using in-house expertise saves on costs, time, and the needed cybersecurity checks on the person piloting and the data collected.

UAS review flights are a simple and safe technique to check the post-project quality of work such as was done in District 4 when a new asphalt placing project was reviewed, and engineers discovered that their Site Scan comparison of pre-project and post-project photos and orthomosaics showed that a manhole had been completely paved over by the contractor. Post-project flights also document the new geometry of an intersection as well as the pavement markings. For construction inspection, ITD project teams have demonstrated the efficiencies of orthoimagery and image processing techniques for identifying pavement removal and for asphalt placing. These captured data are integrated into engineering models, documenting construction progress, and then are used for ITD's project schedules and contracting of payable milestones. In addition, novel methods of processing thermal imagery can calculate the imaged asphalt temperatures and even identify sections where thermal anomalies could likely result in recently placed asphalt.

Although currently there is no inter-agency coordination for UAS policies or project work, ITD and the Idaho Department of Fish and Game (IDFG) do conduct an annual joint meeting to discuss upcoming projects and opportunities for collaboration. They have collaborated to facilitate animal crossings, fix ravines and change culverts to passable fish passages, and monitor revegetation projects. The Idaho Department of Parks and Recreation has no official policies for their UAS use, however, they are seeing many benefits from their environmental engineers having the Part 107 Certificates and flying new sites for design and construction processes for parks. They use UAS regularly to inspect campgrounds and to document site conditions, areas of forest dead trees for logging contracts, fire hazards, and flooding conditions in other areas. Currently, there are no ongoing Memorandums of Understanding (MOU) among the departments, however, creating them has been the topic of discussion at the monthly ITD UAS Committee meetings. Inter-agency and inter-jurisdictional collaboration remain a desired goal for many public sector pilots who are waiting for someone to take the lead in creating template MOUs and template policies for exchanges. These opportunities for enhanced work will likely remain in the hands of the UAS Program Coordinator. ITD's UAS pilots agree that UAS is under-utilized and with investment in training ITD could save on departmental costs, increase safety for employees and the traveling public, increase efficiencies and productivity and greatly improve data collection and accuracy.

Sharing UAS expertise might benefit the Idaho Interagency Working Group for Public Transportation Services, created in Idaho Statute 40-514 during the 1992 legislative session. The group of representatives from the various state agencies with public transit responsibilities is specifically tasked to "advise and assist the department [ITD] in analyzing public transportation needs, identifying areas for coordination, and developing strategies for eliminating procedural and regulatory barriers to coordination at the state level." This working group could pool UAS data collection needs and resources across agencies dealing with public transit and share data regarding traffic mitigation in school areas and near bus stations.

UAS Program for ITD

In November 2020, the Idaho Transportation Department added a new position for a UAS Program Coordinator. The UAS Program is administered from within the ITD Division of Aeronautics where aircraft policy, procedures, and training take place for all districts within the state. The expectations for the program are to focus on surface transportation highway and bridge infrastructure and to create productivity efficiencies, faster turnaround of project critical data, and more efficient, archivable workflows to assist with planning, designing, building, and monitoring projects. As seen in Figure 1. below, the existing organizational chart for the UAS Program scope of work includes the initial requirements needed for best practices as compared with other state DOTs' and their UAS Programs. Each of the program columns of collaboration, testing, development, implementation, and support and expansion are necessary, and generally in the chronological order given above and here in the figure from left to right.

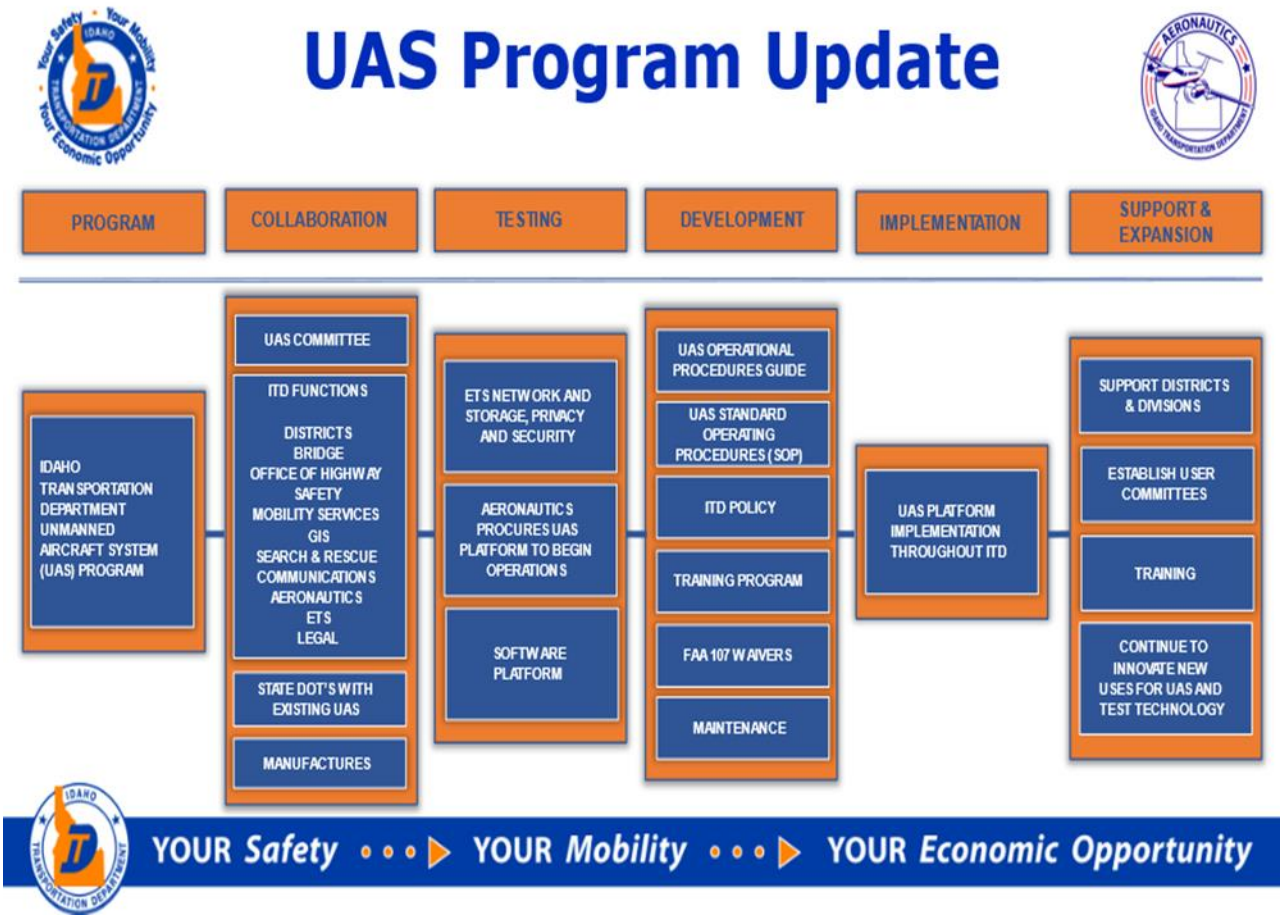

Figure 1 Diagram displaying the components of a UAS program update at ITD (created by Ben Elkins, ITD UAS Program Coordinator (2022).

Thus far, the UAS program management, staffing, policies, and technologies are in the foundational stage. Although having experienced challenges related to the Covid pandemic, and staff retention, the ITD Division of Aeronautics and the ITD Districts' Part 107 pilots have continued UAS use for safety and efficiencies. Interview information with ITD's UAS users demonstrates that every person interviewed (eight UAS district pilots) do use their own time after work and on weekends to research new equipment and software capabilities, for their own professional training and practice with YouTube videos, private sector training videos, UAS associations videos, and webinars, among other methods. These employees participate in a monthly ITD UAS Users Committee one-hour best-practices discussion, and they are eager for ongoing training and inviting other ITD employees to participate and learn about the opportunities for UAS use in departmental projects. The launch of the program was successful.

Development of ITD's UAS program to date includes the foundational draft documents to guide ITD Board policies, ITD Aeronautics Board policies, ITD Administrative Policies, and include the following:

- UAS Outreach Program
- UAS Standard Operating Procedures Policy
- UAS Flight Operations Manual
- Form 107R UAS Flight Request Form Instructions
- UAS Checklist "Before You Head Out to the Project"
- UAS Field List
- UAS Data Collection, Storage, and Management Cybersecurity Review
- UAS Project naming data protocol
- ITD UAS Flight Log
- ITD Administrative Policy for flying UAS with ITD and PPE clothing and equipment
- ITD's UAS Inventory List for federally funded equipment and other funded equipment
- UAS Billing Worksheet
- UAS Projected Program Development Gantt Chart including 2024 wishlist for purchasing
- UAS Past UAS insurance policy guidelines from ID Department of Administration

Future opportunities for the UAS Program could include developing consistent field training programs and workshop sessions covering issues such as understanding the benefits of UAS technologies and capabilities, what types of UAS software packages can create what categories of data, hands-on live field testing and practice with hardware through to data management of descriptive, predictive and prescriptive data/information literacy. The UAS Program could also coordinate workshops and training

for all state agencies together in order to pool resources and share training best practices. This would also help develop a streamlined workforce development opportunity. Separately, and if desired for all Idaho public entities including city and county employees and highway districts, the private sector could sponsor an annual educational and training event at which they are invited to share research and to demonstrate their products for Idaho's public employees.

ITD draft versions of Administrative and Board policies for UAS are dated 04-11-2022 and can easily be updated and submitted for approval. Various sections follow FAA documents and policies. They state the purpose of the policies is to establish the Idaho requirements concerning the appropriate operation of, and uses for UAS, by ITD employees, interns, and/or volunteers and by any contractor operating UAS for ITD. All users must take into consideration privacy, security, and safety issues when providing directions and/or operating UAS. Aspects of the policies are not to be construed as restricting the safe, rapid deployment of an agency-owned or -contracted UAS in response to an emergency or exigent situation. The draft explains that the Aeronautics Division has established roles, procedures, and responsibilities for the operation of UAS, and that ITD-owned equipment and trained pilots will be registered with the Division to ensure compliance with federal, state, and local laws. ITD and UAS contractors must adhere to the ITD UAS Flight Operation Manual, Standard Operating Procedures, and Procurement Process and employees are prohibited from using privately owned UAS for ITD business. Employees and UAS contractors operating UAS for ITD must meet the FAA sUAS pilot or operator certification requirements provided in 14 CFR Parts 91 and 107 and/or FAA Order 8900.1, Volume 16, Unmanned Aircraft Systems (UAS), as well as comply with all federal, state and local statutes, regulations, rules, ordinances and policies. The selection and procurement of ITD-owned UAS requires the approval of the UAS Program Coordinator, or the Aeronautics Division Administrator or designee. All new equipment is to be shipped to the UAS Program office in Boise for initial setup and then released upon completion of pilot training. UAS service providers contracting with ITD will do so per ITD consultant services policies and procedures outlined in the UAS Flight Operations Manual. In addition, districts will inform the UAS Program Coordinator, Aeronautics Division Administrator, or designee of all projects to be flown using UAS technology and/or aerial image capture. UAS platform training is required for each manufacturer's make and model of aircraft. Operations will be per the defined training requirements in the UAS Flight Operations Manual. In order to protect individual privacy and personally identifiable information, UAS operators will limit operations to the specifically approved purpose of the project and employ reasonable precautions to avoid capturing images of the public except those that pertain to the project.

ITD is considering the advantages of a hybrid model- dual sourcing with some UAS expertise in-house and the possibilities for other projects including outsourcing for long-term expertise. Knowing how and when to source each level of expertise is important to the department.

Use case testing the different strategies of in-house experts across ITD divisions should include the UAS pilots, data gathering, data storage, cybersecurity on the data collected, and data interpretation that then results in decision-making. Will administrative restructuring be necessary such as redefining that the UAS Program Coordinator must be a licensed pilot, or would it make more sense that this person be

a Part 107 pilot and work across ITD divisions to look for UAS efficiencies? A few state DOTs contract out with private sector UAS specialists for their state projects. Other states have UAS pilots across their various divisions and in their various geographical districts. At ITD, UAS work is coordinated from the Aeronautics UAS Program and districts have their own drone users collaborating and following direction from the UAS Program.

Within ITD there are many projects and processes where the UAS platform has potential for utilization. Continuing to build a successful program starts with gaining an intimate understanding of the departmental operations in order to purchase and implement the appropriate UAS hardware and software technologies that will improve or supplant existing traditional methods of accomplishing tasks. The primary goals of the UAS Program are to define the program itself and its pertinent policies, and to develop the tools needed for operators to conduct UAS operations safely and efficiently. While the program is in development, Aeronautics continues to conduct UAS missions with the intent of shifting varied operational responsibilities to the districts when the program is fully established. A second goal is to bridge the gap between the FAA Part 107 license required to fly UAS and the actual challenges that UAS operators will be faced in the field.

This is expected to be accomplished through a training program that educates participants regarding policies, operating procedures, flying, and field training with the specific UAS platforms purchased and in the ITD inventory.

The current role of the UAS Program Coordinator is established as follows:

1) Develop program requirements for operating UAS at ITD to include Operational Procedures, Standard Operating Procedures, ITD Policy, FAA 107 Waivers, Training Programs, Safety Management Systems (SMS), Maintenance Guidelines, Memorandums of Understanding (MOU), and other guiding documents necessary for an integrated program.

2) In coordination with the six Districts and other Divisions, identify UAS hardware and software which ITD recommends for specific use cases. These drones will be vetted through Aeronautics, Enterprise Technology System (ETS), and ITD legal department to ensure they meet specific FAA parameters to include, but not be limited to, operating characteristics, safety features, and data security. This list will guide districts for the acquisition of UAS technologies that will ultimately be purchased and operated by individual districts, except for higher-cost platforms that may be shared throughout the state. The list will not preclude using other UAS manufacturers, however, acquisition outside of these recommendations will require going through the UAS Program Office to ensure they meet specific operational and security requirements.

3) Identify UAS software, in conjunction with ITD's ETS, to use for fleet management, mission planning, post-processing, collaboration, and other fleet-specific needs.

4) Collaborate with ETS to develop the network infrastructure to support UAS requirements to ensure data can be utilized statewide through cloud and network infrastructure with all the

relative stakeholders to include workflows for complying with data standards for capture and retention and with privacy standards as related to aerial capture.

5) Conduct pilot and visual observer training to include ground and flight instruction. Districts will be responsible for having UAS Pilot FAA Part 107 licensing prior to ITD Training. As the program progresses, training will be dedicated to UAS instructors and lead pilots at the district levels to perform ongoing UAS workforce development.

6) Prepare an appropriate approach to adopt UAS in five designated areas with several specific goals around ITD's highway and bridge departments:

   - Survey – GIS-focused data to support highway/infrastructure projects
   - Aerial Imagery – Photogrammetry/Orthomosaics/3D Modeling/Volumetrics
   - Inspections – Bridge/Infrastructure/Buildings
   - Communications/Emergency Response – Public Education and Outreach
   - Environmental – Monitor Revegetation and Stabilized/Disturbed Areas

7) Develop Memoranda of Understanding (MOU) with other Idaho agencies in order to share assets and data in support of similar goals.

8) Support Districts and Divisions as they implement UAS into their workflow using the UAS Program developed by Aeronautics.

9) Continue to innovate, test and implement new uses and technology as our capabilities grow and new technologies evolve in the marketplace.

Through a cooperative effort with the FHWA the Division of Aeronautics acquired four different remote piloted aircraft that are capable of a wide range of missions and data capture. The UAS platforms comply with the Federal Government Guidelines and the National Defense Authorization Act Section 848 and Executive Order 13981, allowing them to be used on projects with local, state, and federal funding dollars in Idaho. The following are the UAS platforms and software that were procured for use in FY22 by Aeronautics:

- Wingtra One (Generation II) with Post Processing Kinematic (PPK) geotagging through a Topcon Hiper SR Base station. This drone will provide absolute accuracies of approximately 1cm horizontally and 2 cm vertically. Sony RX1RII 42MP, 35mm Nadir sensor for survey work, Sony A6100 24MP, 20mm Oblique sensor for 3D modeling, and a MicaSense RedEdge MX multispectral sensor for environmental analysis of vegetation. Primary use is for larger acreage projects and corridor surveys to provide high-quality data for environmental assessment, planning, design/build, project progress monitoring, slope monitoring, and source calculations. https://wingtra.com/

- RDRtwo (manufactured by Vision Aerial) Heavy Lift Hexacopter with Real Time Kinematic (RTK) mobile base station for geotagging. Sony A7R 61MP, 35mm and 50mm lens mounted on a Gremsy Gimbal 3-axis gimbal, Sony A6400 24MP, 16mm Nadir sensor, as well as a Flir Duo Pro R Thermal Sensor. Primary use is for smaller acreage survey projects, creating digital twins of bridges and critical infrastructure, stockpile and source measurements, bridge inspections, and highway surface condition analysis through the use of thermal sensing. https://visionaerial.com/product/construction-drone-system-con7/

- Skydio 2 with both Enterprise and 3D scan software. Sony 1/2.3" CMOS 12.3MP fixed sensor. Primary use is for the bridge program as unique artificial intelligence (AI) allows the aircraft to operate in GPS-denied environments less than 12" away from critical structures. The Skydio 2 will be used for stockpile and source measurements in confined spaces. https://www.skydio.com/skydio-2 (Skydio 2)

- https://www.skydio.com/3d-scan (3D scan software features)

- Autel Evo II Pro 6k. Sony 1" CMOS 20MP fixed sensor. Primary use inventory control, post-project quality assurance, environmental studies, photo and video capture for communications personnel, and initial training of UAS Part 107 Pilots. https://auteldrones.com/pages/evo-ii-collections

- ESRI SiteScan. UAS-specific software that manages mission planning, autoflight, post-flight processing, and fleet tracking through ITD's existing ESRI ArcGIS software. Currently, ITD has only several licenses for SiteScan and intends to enter into an Enterprise agreement to give access to unlimited users within the department.

- DroneLogBook UAS-specific software for managing pilots and tracking currencies of everything from aircraft and batteries to pilot currency.

Programmatic Best Practice Recommendations Compiled from State DOTs and Federal Agencies

The Division of Aeronautics personnel have been in contact with other state DOTs for approximately ten years, learning from others' UAS best practices and others' trial and error. The FAA, FHWA, and AASHTO also serve as resources with UAS information webinars, seminars, conferences, and trainings. Private sector UAS consultants are available for information sharing as are academics at Idaho State University, College of Western Idaho, Boise State University, and University of Idaho.

Idaho Falls Police Department serves as a constant resource for eastern Idaho and northwestern Utah, and the Utah DOT enthusiastically shares its best practices with Idaho ITD. Effective UAS program development and adoption of the technologies require the department's commitment to ongoing training of current Part 107 pilots as well as preparing new ones and educating general department staff about how the UAS are used (and not used) for department goals. ITD's stated mission for building the

UAS Program is to enable it to safely, efficiently, transparently, and lawfully put UAS platforms in a position to support programs, with a focus on highway functions, infrastructure inspections, emergency response, communications, public outreach, and environmental applications in order to safely generate more precise, cost-effective data.

Compiling best practice recommendations from various UAS programs at state DOTs and from federal agency UAS programs begins with the importance of maintaining a strong working relationship with the FAA for aircraft operations. A guide for working with the FAA, understanding applicable FAA rules, and obtaining a Certificate of Waiver or Authorization (COA) for operations is extremely valuable. The following is a list of recommendations to augment what has begun at ITD:

- Identify the ITD's funding source for both the initial purchases, maintenance, periodic replacement, and continued operation of UAS technology.

- Determine if the agency's aircraft have received the necessary certifications from the FAA. Perform due diligence before purchasing UAS technologies to ensure that vendors can support the technical claims they make regarding their unmanned aircraft and its sensors. Some manufacturers are leasing equipment, and this may be another option before purchasing.

- Create a Task Force or community advisory panel on the implementation of UAS and related technologies, drawing from public, private, and academic sectors. While inviting representatives from advocacy groups may help inform the panel, they should not be voting members to ensure that the views of the actual citizens are reflected. A properly assembled citizen advisory panel can gauge public suspicion and resistance and help allay community fears, especially regarding privacy and trespass. Be prepared to listen to members of the community and their concerns, and to make adjustments as necessary.

- Create an assessment and complete an annual evaluation of the UAS program to demonstrate that the UAS technology is meeting the promised capabilities and cost-effectiveness. Logs of flights, issues, costs, and benefits should be kept so that an annual study of the efficacy of the program can be conducted. The results should be disseminated to the legislature and publicly in order to promote the transparency of the program. Consistent with outreach and public information needs, publicly disseminate the report demonstrating the benefits of UAS use.

- Stay up-to-date on research and policy questions for UAS technologies and how they will be used. Implementation of the technology should correspond to a clearly defined ITD mission.

- Ensure the Department's newsletter and Aeronautics leadership have accurate economic and technical information about ITD's UAS technology and the various uses. ITD officials and spokespersons should be familiar with the costs and the use cost savings, maintenance requirements, and intended uses and how those uses increase safety, mobility, and economic opportunity, as well as increased productivity, data collection accuracy, saving resources and increasing efficiencies.

- Involve the agency's Public Information Officer in the media and public engagement process. Once a decision is made to acquire and deploy UAS technology, create media events for product demonstrations and public education.

- The staff of the UAS program should be those who have a record of safety following ITD's rules and policies and expected to follow agency rules for the operation of UAS technologies. This continues the safety of UAS operations and decreases the agency's risk of legal liability.

- Conduct recurring UAS training including simulated missions and actual flight operations, legal and policy training on UAS and aerial data collection, discussions of aerial trespass, privacy and constitutional issues, and updates on any new avigation laws, regulations, or other sources of applicable law that might affect ITD's employees' use of UAS.

- Ensure that the Department's insurance policy covers UAS equipment and operations. Follow FAA and state legal and regulatory restrictions regarding remotely piloted aircraft.

- Be prepared to defend decisions that ITD makes regarding the purchase, implementation, and operational use of UAS technology, both within Idaho government and to the general public. Detailed policies and practices in place will make it easier for an agency to defend its actions.

Importantly, ITD's contract administration could consider including that any contractor's UAS and GIS data be given to and owned by ITD. Final payment for a project should not be processed until that data is received by ITD. It is an extremely valuable piece of each project. The construction, reclamation, and/or environmental study contract management process should include turning in the data collection as is recommended in AASHTOWare or SiteManager types of AASHTO and FHWA-approved construction project management.

The ITD UAS Committee also compiled its wishlist in 2023 including; establishing consistent clarity in best practices for data collection, access and retention regarding raw data, stitched data, scrubbed data and the corresponding legal policies for these data; building a materials source database of the ITD quarries and pits, materials yards and sheds to monitor volumetrics and quality control of contractors' invoicing; having UAS aircraft and UAS trained pilots using UAS in all six districts; creating the UAS SharePoint library with organized folders and corresponding files for projects, forms, rules, checklists, data collection, etc.; and improved coordination and integration of workflow to use UAS to maximum potential and savings.

ITD's UAS Outreach and Community Engagement

Not only is UAS a newer technology, but it is also often a misunderstood capability. The aircraft can do nothing by itself, it must be piloted or programmed by a human. Popular culture movies, videos, gaming, and literature include drones being used nefariously, in criminal activity and war. This influences a general public suspicion or fear of this unknown device, or a generally negative attitude toward it. It is important for any public agency using UAS to engage the community early in the process of

implementing these technologies. Consistent with the needs of ITD programs and projects, and with law enforcement and public safety, inviting the community to understand the process of selecting and implementing UAS technology helps to promote transparency and combat the perception of government secrecy of drone use. With some public voices suspicious of the government using new surveillance technologies, the more transparent the process and explanation of ITD data collection and "scrubbing" of personally identifiable information (PII), the higher the likelihood of a successful acceptance. Especially explaining the limitations of UAS and the pilot's actions may help residents better understand the goals of the program and promote trust.

A Privacy Impact Assessment (PIA) is useful for maintaining public trust because the aircraft are equipped with technology capturing information that may be associated with individuals in ITD's data storage. While the cameras on each aircraft are not identical, they have similar performance specifications. They can employ a fixed-focus lens, providing video at any altitude and allowing operators to use software-based zooming and image enhancement. They can record small-scale aerial video images of bridges, cracking, signage, traffic patterns, and environmental developments and inadvertently include PII. Explaining to the public that data collected are assessed and PII are "scrubbed" and deleted or blacked out makes an impact on the public understanding that ITD data collection is project-based and there are protective mechanisms for accessing, sharing, and archiving useable project-related information. Other records are simply destroyed after use. The UAS technology is used in two ways- for training and for a defined project perimeter.

Idaho and other states are using President Obama's Guidelines for Voluntary Neighborly Drone Use Best Practices for programmatic outreach and public service announcements, informational sessions, DOT websites, and UAS policies and manuals. These guidelines were the result of a multi-stakeholder engagement process established in 2016 and widely recognized in public and private sector uses. The U.S. Department of Commerce's National Telecommunications Information Administration (NTIA) initiated the process, which included stakeholders from industry, civil society, academia, and other interested U.S. government agencies. Their best practices are:

- Consult the quick IMSAFE self-assessment checklist to ensure you are safe to fly. The IMSAFE checklist is a personal health assessment used to ensure the pilot is healthy before each flight. The letters stand for; Illness, Medication, Stress, Alcohol, Fatigue, Emotions. By reviewing these elements of the checklist, the pilot can conclude whether he/she is personally fit to fly.
- If you can, tell other people you'll be taking pictures or video of them before you do so.
- If you think someone has a reasonable expectation of privacy, do not violate that privacy by taking pictures, video, or otherwise gathering sensitive data, unless you have got a very good reason.
- Do not fly over private property without permission if you can easily avoid doing so.
- Do not gather personal data, and do not keep it for longer than you think you have to.

- If you keep sensitive data about other people, secure it against loss or theft.
- If someone asks you to delete personal data about him or her that you have gathered, do so, unless you have got a good reason not to.
- If anyone raises privacy, security, or safety concerns with you, try and listen to what they have to say, as long as they are polite and reasonable about it.
- Do not harass people with your drone.

Current Challenges to ITD for Policymaking

The most impactful challenge to ITD in planning for its own UAS Program development and its preparation for Idaho's UAS future continues to be the shifting landscape of regulations and standards. Federal, state, and local public entities and private entities are unclear regarding who has what authority, or who to make responsible for the control, development, enforcement of UAS policy and regulations, and the management of different heights of airspace. At the federal level, the U.S. Department of Transportation's FAA oversees "navigable" airspace (above 500 feet above ground level), the development of airports, the National Airspace System (NAS), and aircraft ownership. While the FAA oversees those aspects of aviation, it is the responsibility of state and local government jurisdictions to oversee the land an airport sits on as it relates to safety and zoning, environmental impact issues, land use compatibility, and access to Idaho airports. ITD Aeronautics provides the guidance and support for publicly owned and public-use airports in the state and now, in addition to the myriad of uses for departmental projects, will need to address UAS policies for possible vertiports sharing airport skies for economic development and other uses.

There is significant federal-level discussion regarding UAS statutory responsibilities and the states' DOTs. As a result of this evolving regulatory authority, state DOTs are individually addressing the challenges of UAS integration into their own state public policies. States preparing for full commercial applications with separate task forces designated for commercial drone issues include Alaska, Arizona, Kansas, Louisiana, Michigan, Minnesota, Montana, Nevada, New Jersey, North Carolina, North Dakota, Ohio, Oklahoma, Pennsylvania, Texas, Utah, Virginia, Washington, and West Virginia. These task forces include public and private sector participants, the legislative, executive, and judicial branches of government, and large and small businesses and academic centers researching, creating, and using remotely piloted aircraft systems. They have created state-appropriate statutes, policies, and commerce plans for economic development. They are working with higher education for their own workforce pipeline in this UAS industry sector and are sharing research data and best practices. For state and local authorities, widespread commercial UAS services will raise issues such as public safety, zoning rules, noise limits, time-of-day restrictions, job training and education, and insurance. Most of these issues will require extensive exploration by regulators, residents, researchers, and operators. According to the Mercatus Center state rankings conducted by researchers Skorup and Haaland, states that do have a statewide committee, task force, or department of transportation team dedicated to drones do merit a higher

score in their ranking report of which geographies in the US will be the leaders in economic development and innovation in the UAS future (Skorup and Haaland 2020).

Regulatory harmonization and increased public outreach are needed in Idaho to expand the ideas of safe air mobility, instant logistics, and transportation options in order to prevent local backlash and misunderstandings of exactly what UAS technologies capabilities are, and are not, and what the operator may legally do, and not do. The aircraft and systems themselves are just tools, and are not the illegal actor; it is the operator of the device that is responsible for its legal and safe use. In Idaho, the enforcement mechanisms for UAS regulations are unclear or nonexistent, and it will be helpful and useful to improve communications with the public in general and with UAS operators in order to clarify, define, train, and fund the enforcement actors. Federal and state UAS regulations may be unclear, however, many of the UAS use issues regarding trespass and privacy are completely predictable and should be anticipated by ITD and the Idaho Legislature.

Idaho statutes and administrative rules will have to consider economic development opportunities in addition to the hierarchy of land uses (hospitals, critical infrastructure, schools, etc.). For example, the permitting and siting of vertiports based on their impact on the surrounding community, identifying suitable sites for the future of air mobility-focused infrastructure, and continuing development in the delivery of needed services and products. These are integration and coordination issues that will evolve with new technologies and uses in the National Airspace System, with consistent public education and outreach, and with the population's acceptance (or not) of air corridors in our daily lives. The likely best such efforts will be those that leverage existing law to the extent possible, draw meaningful distinctions between air-based and land-based conduct, avoid direct or inadvertent regulation of airspace or aviation safety, and maximize consistency across the state.

UAS Traffic Management, Air Mobility, Instant Logistics, and Economic Opportunity

Many states have existing statutes that authorize local jurisdictions (cities, highway districts, etc.) to lease air rights above public roads, bestow property owners with air rights, and establish avigation easements. These states are already prepared to facilitate private sector UAS operations in the 400 feet AGL airspace while Congress and the Federal Aviation Administration (FAA) are developing national UAS policies. States can create UAS aerial corridors above public roads and public rights of way, eliminating trespass questions and having to purchase rights from private land or private building owners. Even if UAS delivery companies must work within the patchwork of state laws and designated or undesignated airspace rights above state and local roads, securing the airspace rights above interstate highways could significantly assist in developing a long-term super skyway following the interstate highway system of established connections and direct routes to the most populated areas in the US. Such sky lanes can facilitate transformational opportunities for cities. Yet the road to integrated drone operation poses a host of security, regulatory, and public acceptance challenges (Thompson 2020, pp. 16-18).

What remains after excluding trespassing in private airspace and the national FAA authority over navigable airspace encompasses a substantial unregulated and undefined area. Congress authorized states "to use or permit the use of the airspace above and below . . . [interstate] highway pavement," via statute in 1958, and courts have rarely interpreted this provision. Commercial drone delivery companies have yet to test whether states could convey that airspace to them for a UAS highway infrastructure. Assuming that this statute would permit states to transfer the airspace above interstate highways to commercial UAS delivery companies, drone deliveries in America could happen sooner rather than later *(ibid* p. 8).

Creating a clear and coherent framework at the state and local level, such as a system of aerial corridors, will make parcel delivery faster, improve the distribution of medical supplies, and create jobs in the technology and logistics sectors (Skorup and Haaland 2020).

In Skorup's determined six factors for the 100 points system for ranking states' "Drone Readiness", he uses the following to score and rank the 50 states' preparedness for commercial services including:

- Airspace lease law (30 points): More than one-third of states currently allow state or local authorities to lease airspace above public roads and private property.
- Avigation easement law (25 points): These laws allow drone flights if they are high enough to avoid being a noise nuisance to landowners and passersby.
- Taskforce or program office (20 points): States that have a UAS program office within their department of transportation or a statewide task force will be ahead of the curve and can anticipate future issues before they become problems for operators and residents.
- Law vesting landowners with air rights (10 points): These laws clarify property rights, thereby reducing litigation risk for drone operators and homeowners alike.
- Sandbox (10 points): The term "sandbox" refers to a designated place to test new technologies under liberal rules for a predetermined duration. A sandbox allows early-stage companies to show proof of concept to investors and regulators.
- Jobs estimate (5 points): The number of drone jobs in a state signals future growth in drone commerce.
- Skorup's Drone Readiness score gives the top positions to Oklahoma, North Dakota, Arkansas, Arizona, and Minnesota. Idaho is ranked 26th with a score of 37/100. Idaho's points earned are in the following categories:
- Airspace Lease Law: 0/30. Idaho law does not allow public authorities to lease low-altitude airspace above state and local roads. An airspace lease law would allow state or local officials to create drone highways above these roadways.

- Avigation Easement Law: 25/25. Idaho law creates an avigation easement, which means drone operators are protected from nuisance and trespass laws as long as their drones do not disturb people on the ground. Idaho Code § 21-204 (2019).
- Task Force or Program Office: 0/20
- Law Vesting Landowners with Air Rights: 10/10. Idaho law expressly provides air rights to landowners, which reduces litigation risk for drone operators because landowners know the extent of their property rights. Idaho Code § 21-203 (2016).
- Sandbox: 0/10
- Jobs Estimate: 2/5 (Skorup and Haaland 2020).

The FAA's webpage on package delivery by drone (Part 135 air carrier certification) states that during 2017 through 2020, the FAA's UAS Integration Pilot Program (IPP) focused on testing and evaluating the integration of UAS operations into the national airspace system. This work continues under the UAS BEYOND program which focuses on the remaining challenges of UAS integration, including beyond visual line of sight (BVLOS) operations, societal and economic benefits of UAS operations, and community engagement. Through the UAS IPP, the FAA is issuing air carrier certificates to qualifying commercial applications. Participants in these programs are among the first to prove their concepts, including package delivery by UAS through the Part 135 Air Carrier Certification. Part 135 certification is currently the only path for small UAS to deliver for compensation beyond visual line of sight.

United Parcel Service (UPS) Flight Forward was the first company to earn this air carrier certificate. UPS Flight Forward began by focusing on delivery in healthcare operations and is now working on general package delivery. Google's Wing Aviation has also received FAA approval to operate, and is currently offering UAS deliveries in Christiansburg, VA. Amazon is piloting its own air traffic control system with the use of artificial intelligence to manage the traffic of its aircraft. Amazon's Prime Air expects to deliver packages up to 5 pounds in 30 minutes or less using small UAS. Other companies such as Walmart, Domino's, and FedEx are working on approaches to drone-based package delivery. UAS registration data, collected from FAA-mandated registrations for remotely piloted aircraft exceeding a certain weight, indicate that there is an increase in their use for commercial purposes, though they extend beyond package delivery, to include surveying crops, and delivering medical samples among many other applications (Federal Highway Administration 2020 Trends Report).

Advanced air mobility (AAM) efforts in other states are significantly further developed than Idaho's. Several states are piloting and assisting the emergence of AAM to specific local areas. Neighboring Utah DOT has created working groups to better understand the opportunities and challenges associated with the deployment of AAM. They are conducting studies and evaluating the potential benefits of advanced regional air mobility for their local economy and communities. Many states are exploring options such as defined skyways and leasing highway airspace for their state policies that could facilitate the

development and integration of AAM planning into their statewide transportation system implementation.

“Highway airspace” is generally accepted as the open area above and below the highway’s established grade line. This includes the areas beneath an elevated overpass and adjacent to the roadway. Airspace must also be located within the state or municipality defined right-of-way boundary. This airspace is considered a legal interest in land providing an “exclusive right to possession and use of [that] land” for public travel. Generally, the highway airspace also includes the surface of the land. Right-of-way easements can extend to sidewalks and parking areas. Once the right-of-way boundaries are determined, the highway airspace occupies the vertical space above that defined area. However, precisely where highway airspace ends and navigable airspace begins is unclear, although one certainty remains: the FAA maintains regulatory jurisdiction over any navigable airspace (Thompson 2020, pp 17-18). Following are several examples of states and cities engaging with the opportunities in these airspaces as reported in Utah’s 2022 Advanced Air Mobility Infrastructure and Regulatory Study presented to the Utah Legislature by Utah’s DOT Division of Aeronautics:

Arkansas, with a developed aviation and aerospace sector, announced the creation of the Arkansas Council on Future Mobility, an advisory board tasked with helping the state move forward as a center for next-generation mobility and AAM. This Council reviews pending legislation, designs programs to efficiently adopt particular technologies, secures federal grant funding, and establishes education and workforce initiatives that can create aviation jobs in the state. Engagement includes the non-profit sector, such as the University of Arkansas’ smart-mobility innovation programs receiving a $412,000 planning grant in 2022 from a charitable foundation to support the college’s efforts and pilot research studies in uncrewed aerial mobility.

Because Idaho does not have large urban centers, California’s planning seems as though it is far in the future. However, in 2022, the California Department of Transportation’s (Caltrans) Division of Research, Innovation, and System Information (DRISI) began research on Air Digitization with a primary focus on digitizing corridor airspace for UAS and advanced air mobility. The research hopes to develop and implement the necessary guidelines and best practices for California and its local jurisdictions for all that is needed for the creation of defined airspace corridors. They expect to identify corridor impacts on the pilot communities in regards to safety, equity, and environmental changes. The research outcomes will summarize the factors required for determining and defining the critical roles and responsibilities of stakeholders involved in the implementation of AAM. Caltrans’ Division of Aeronautics expects to use the information to create a simulation able to analyze proposed siting and development of vertiports and airspace corridors.

The San Francisco Bay Area is home to several alternative mobility eVTOL and UAM companies, including air taxi startups, manufacturers, and rideshare and passenger companies at the forefront of short-haul research since the 1980s. BLADE, a short-distance aviation company, has tested on-demand flights in the Bay Area, connecting San Francisco International Airport to the Oakland International Airport, Palo Alto Airport (PAO), Norman Y. Mineta San Jose International Airport (SJC), Monterey

Regional Airport (MRY), and Napa Valley. The Los Angeles Department of Transportation (LADOT), the Los Angeles Department of City Planning and the Mayor's Office are collaborating to develop policies and procedures for the regulation of urban air mobility (UAM) operations in the city, starting with a report on the UAM Policy Framework Considerations. LADOT expects to enable industry and public safety stakeholders to analyze and evaluate the UAM pilot projects. Per the LADOT UAM Policy Framework Considerations report, this approach best informs the construction and scaling of new infrastructure and helps the community benefit through access to multimodal transportation and its land use (LADOT 2021). In 2021, eVTOL developer Archer announced its plans to create an air taxi network in Los Angeles using its four-seat air taxi, due to be certified for commercial operations by 2024. Stakeholders are working to facilitate collaboration among public agencies, mobility technology companies, and community members to test various mobility solutions. California's Overair aerospace company plans to introduce air taxi service by 2026 with an onboard pilot and five passengers traveling up to 100 miles with highest speeds at 200 mph. They also have aircraft designs that can carry approximately 1,000 pounds of cargo. In 2022, Helinet, joined this airspace network with experience in organ delivery, parcel delivery, aerial firefighting, chartered passenger services, and filming. Helinet will help inform future policy and regulatory decisions related to aerial operations and ground-based infrastructure needs.

The City of Orlando, Florida is one of five government entities (and the only municipality) selected to participate in NASA's AAM aero-research partnership, an initiative that allows NASA's aeronautical innovators to work with participating governments to determine what it means to be a sustainable, resilient community with AAM as a significant mode of public transportation. In 2020, Lilium announced its plans to develop a 2,000-mile air mobility network across the most populated areas of central and southern Florida. Orlando is also a founding member of the World Economic Forum's Advanced and Urban Aerial Mobility Cities and Regions Coalition, established in 2022. This international group collaborates to share expertise and develop best practices that cities and regions can adopt based on their respective circumstances. In 2022, Eve Air Mobility created a consortium of advanced air mobility companies to develop a Concept of Operations to explore the needed services that will connect the Miami International Airport with the Miami Beach Convention Center, nine miles away. Orlando's Lake Nona community will be the first site for one of 10 or more vertiports expected to initiate services in 2025. For reference, the Lake Nona vertiport is expected to cost $25 million and encompass 56,000 square feet. The State of Florida continues its planning for the development of a network of vertiports, and most of Florida's population (22 million people) will live within 30 minutes of a projected vertiport, and further demand for flights is expected from the over 125 million visitors to the state. The Orlando AAM Transportation Plan will evaluate projected transportation, economic, environmental, and community impacts associated with AAM through a regional connectivity plan.

Michigan's legislature created the Michigan UAS Task Force in 2016, members were appointed and it became effective in 2017, and it continues to lead UAS and AAM, working across the border with Ontario, Canada in collaboration for air mobility corridor research and planning for their nearly $45 Billion annual two-way trade. Governor Gretchen Whitmer initiated a study in 2022 to determine the

feasibility of three different commercial skyways in the Grand Traverse Region, the Michigan Central Impact Area of Corktown Detroit, and between Michigan and Ontario. A public-private partnership includes Detroit-based Airspace Link, Northern Plains UAS Test Site, Thales USA, CityFi, Grand Sky Development Co., and Aviation Innovations LLC leading the support of the project with the State of Michigan and the Government of Ontario.

North Carolina has led in UAS and AAM research and practice for more than 10 years. They have consistently participated in FAA UAS Programs, maintained a well-funded public outreach commitment and adopted an early statewide UAS traffic management concept. The North Carolina Department of Transportation (NCDOT) is one of the few teams selected by the FAA to be a part of the BEYOND initiative, which started in October 2022. This initiative seeks to address the challenges faced with UAS:

- "Beyond Visual Line of Sight (BVLOS) operations that are repeatable, scalable, and economically viable with attention given to infrastructure inspection, public operations, and small package delivery;
- Industry operations that better analyze and quantify the societal and economic benefits of UAS operations; and
- Community engagement that collects, analyzes, and addresses community concerns" (https://www.ncdot.gov/divisions/aviation/uas/Pages/beyond.aspx).

The NCDOT Integration Pilot Program (IPP) team (part of the BEYOND initiative) focuses on UAS package delivery of medical and food supplies in rural, suburban, and urban areas. Under the IPP, the team conducted nearly 13,000 flights with UPS Flight Forward, Flytrex, Matternet, Volansi, and Zipline. The testing included the delivery of medical supplies across the Atrium Health Wake Forest Baptist Medical Center campus. They also used UAS for transportation infrastructure inspection and their program received the first waiver for full BVLOS UAS operations to be used in bridge inspections. Another NCDOT initiative was the funding of the North Carolina Transportation Center of Excellence regarding Connected and Autonomous Vehicle Technology in 2020. One Center goal combines researchers from North Carolina A&T State University, North Carolina State University, and University of North Carolina at Charlotte, developing flexible and adaptive coordination and control algorithms for urban air mobility.

In 2021, the North Carolina General Assembly awarded a $5 million grant to the nonprofit organization AeroX, focused on promoting the safe and efficient commercialization of UAS technologies, for the design and development of an urban AAM system for Winston-Salem. The legislative appropriation helps AeroX continue building the air traffic management system that will allow uncrewed and crewed aircraft to fly safely in the low-altitude air space. The same year, the legislature appropriated funds to create a grant program offering AAM startup companies $50,000 grants to launch Winston-Salem-based ventures for AAM. North Carolina is strategically planning for UAS integration and has incorporated UAS as part of the innovative future transportation needs in its NC Moves 2050 Plan, the state's 30-year transportation plan. There are over 30,000 recreational use UAS owners and 5,000 permitted commercial and government operations UAS. These thousands of users enjoy state programs for public

education and outreach to expand safe use via public workshops, social media outreach, pilot programs to inform residents, businesses, and agencies of the benefits of adopting UAS.

North Dakota is home to one of the FAA's seven UAS test sites. Since 2019, the Northern Plains UAS Test Site program has received more than $50 million in funding and supports UAS applications in oil and gas, public safety and law enforcement, among other areas. In 2021, Vantis, a network to facilitate UAS growth in North Dakota, selected Thales Group USA as its system integrator to build the first statewide system to allow UAS to operate BVLOS. The program installed three radar systems, four ADS-B ground stations, and a command and communications network. It also supported the development of a statewide cloud solution, serving as a backup for the mission-network operation capability, and a missions and operations center. This program is one of the first deployments of this kind in the world. Leveraging the Vantis network, uAvionix, an avionics company specializing in UAS, received approval from the FAA in January 2023 to conduct BVLOS small UAS flights in North Dakota. uAvionix, with support from the Northern Plains UAS Test Site, demonstrated to the FAA that it established adequate risk mitigations to satisfy the required safety standards for the specified BVLOS operation within the national airspace system (Northern Plains UAS Test Site 2023).

Ohio also benefits from strong relationships with the FAA and NASA. The FlyOhio Initiative (a voluntary, cooperative umbrella organization that coordinates AAM development efforts with stakeholders and other industry partners in the state), is led by the Ohio Department of Transportation (ODOT), and is partnering with the US Air Force, NASA, JobsOhio, the Ohio Federal Research Network, the Dayton Development Coalition, the City of Springfield, and corporate partners from across the state. Ohio estimates $13 billion in economic impact over 25 years through investing in AAM, including 15,000 new jobs, $2.5 billion in local, state, and federal tax revenues, and 1.6% GDP growth through 2045 (Ohio AAM Economic Impact Report) . To initiate AAM efforts, a $6 million grant was awarded to the City of Springfield to create the National Advanced Air Mobility Center of Excellence (NAAMCE) at Springfield-Beckley Municipal Airport. Ohio has conducted four separate research efforts with NASA focusing on (1) community integration; (2) air traffic; (3) command and control; and (4) safety. Ohio also published the Ohio AAM Framework in August of 2022. This framework delves deeper into implementation and integration guidance for AAM.

In 2020, FlyOhio and the Ohio DOT commissioned an in-depth study of AAM focused on connecting the metropolitan areas of Akron, Cincinnati, Cleveland, Columbus, Dayton, and Toledo passenger transportation, cargo delivery, and an economic impact forecast through 2045. The jobs, tax revenues, and overall economic productivity forecast has gained public interest, and Springfield-Beckley Municipal Airport near Dayton has become an AAM epicenter. The airport has also attracted several companies developing AAM capabilities, and in 2019, it won FAA designation to test UAS flights BVLOS. FlyOhio worked to achieve a higher level of economic activity, with an investment of $1.4 billion needed for ground and infrastructure investment for multiports – vertiports serving multiple types of aircraft, potentially in different configurations, all at once.

These are exemplary programs from which ITD can learn and develop without needing to "reinvent wheels". How can UAS be leveraged and how can ITD plan for their system-wide presence and integration internal to departmental functions, and eventually advanced air mobility, rural air mobility, urban air mobility in commerce delivery, and personal use of air taxis? If the future of ITD also includes managing the airspace above highways, ITD may position UAS use as positive, innovative, and useful for increased employee safety and departmental cost savings as well as for developments in commercial and passenger AAM. State laws need to accommodate remotely piloted flights from large and small operators and clarify whether state, local, or federal officials have authority over low-altitude airspace. Simultaneously, the enforcement responsibility and authority of regulations regarding negligent, reckless, or malicious use of UAS must be clarified. UAS will eventually provide on-demand services that can be combined with ground transportation to create door-to-door, smartphone-based mobility as a delivery and transportation service. Efficient, safe and equitable integration depends on engaging with and responding to all stakeholders—the general public, regulatory agencies (at all governmental levels), city planning organizations, and economic development agencies. In October 2022 Congress passed, and the President signed, the "Advanced Air Mobility Coordination and Leadership Act" ("the Act"), which requires the Department of Transportation to form an interagency working group (IWG) to develop a national AAM strategy by 2024. "The purpose of the strategy is to ensure the Federal government, in partnership with State, local, and Tribal entities, is ready to work with and oversee the AAM industry, including developing new transportation options, amplifying economic activity and jobs, advancing environmental sustainability and new technologies, and supporting emergency preparedness and American competitiveness so that the United States continues to lead the world in aviation into the 21st century" (Advanced Air Mobility Coordination and Leadership Act, Request for Information May 16, 2023. Pub. L. 117-203). The Request for Information on Advanced Air Mobility released in May 2023 includes a request for subcommittee information for Infrastructure Development, to be led by the Federal Communications Commission and the FAA, "focused on understanding the aviation facilities needed to support AAM operations, including ground infrastructure; services, including emergency services; accessibility and competition; telecommunications; weather observation and prediction; utility resources; maintenance of vertiports; sensory systems needed for communications, navigation, and surveillance; and multimodal compatibility." (US Department of Transportation. Docket No. DOT-OST-2023-0079).

ITD and Airports and Vertiports

Agricultural aviation, first responder search and rescue, and wildland fire fighting that traditionally have involved Idaho's airports now could include remotely piloted aircraft and automated aircraft operations and these activities will remain in the realm of state regulations. UAS use within Idaho falls under state and local control; however, interstate commerce with UAS as the delivery vehicle will likely be regulated similarly to an interstate truck or rail delivery under the US Constitution's Commerce Clause. Thirty Idaho airports have been designated by the FAA as part of its National Plan of Integrated Airport Systems (NPIAS). This designation makes them eligible to receive federal funding for airport infrastructure development and improvements, which could in the future also include vertiports for UAS

and advanced air mobility. An additional thirty-eight Idaho airports are eligible to receive state funding via the Idaho Airport Aid Program (IAAP).

Idaho's urban, suburban, and rural communities will likely have aerial services to new areas often excluded from commercial aviation because of cost. Many of the local airports that are underused can serve as strategic centers for rural air mobility operations, extending economic development and customer service to areas currently not served at all, or are underserved, by traditional runway-dependent aviation. These airports can provide convenient options for UAS commerce, such as last-mile package delivery and delivery of critical supplies using the airport infrastructure already in place.

For commercial package delivery, zoning specifications and definitions for UAS delivery will need to address highly distributed infrastructure and very different land-use needs from the traditional airport needs known to ITD. Land use capability and suitability for a vertiport for VTOL vehicles will need clarification of whether this is state or local government jurisdiction and if and how privately owned property can be regulated regarding vertiport siting. Preliminary guidance for vertiports was released by the FAA in the form of an Engineering Brief #105 in February 2022 which provides vertiport planning and design standards. This is a living document, last edited in March 2023, and a full advisory circular for vertiports is expected in 2024.

Following the FAA and other leading states, Idaho and its counties and cities can leverage these recommendations to inform land use planning, establish rulemaking for permitting vertiports, and establish criteria for operational policies. Infrastructure criteria for siting and operating a vertiport among other things will include:

- Determining ownership as a public entity or private entity.
- Access near residential areas or not, and what visual and sound impacts of vertiports on private residential land uses will Idaho regulate?
- Zoning, Height, and Noise Restrictions.
- Adjacent Airport/Vertiport: How close should vertiports be zoned to adjacent vertiports or airports?
- How will air traffic and vertiport ground traffic be managed?
- Will there be both scheduled and unscheduled service for flights?
- International border issues for international deliveries and/or passenger processing, especially for transportation between North Idaho and Canada.
- Public Safety if there is an incident? Will there be first responders on-site?
- Will vertiports be connected to other modes of transportation such as bus and rail stations, and bike share?

- What sizes of UAS and fuel types will be allowed for which land uses?
- Will aircraft staying on-sight through the night be required to fly off-site for maintenance and storage?
- What types of Weather Observing Instrumentation are needed for each vertiport?
- What will be the UAS traffic management structure for the vertiport? Will it follow existing air traffic control technology or its own separate system?

The 2020 ITD Airport System Update Plan stated, "For Idaho and other states with significant agricultural activity, the increasing use of UAS is also being realized, potentially changing airport usage for these activities. Similarly, aerial wildland firefighting is also being looked at for potential UAS applications. As UAS operations increase over time for activities such as these, they may become a notable safety hazard to Idaho's low-altitude operators and may affect the airport facility needs and use" (ITD 2020, pp 7-13). For over 30 years the ITD Division of Aeronautics has actively managed its airfield pavement infrastructure through the use of a Network Pavement Management System (NPMS). It is responsible for maintaining 48 airports of which 29 are recognized as part of the FAA's National Plan of Integrated Airport System (NPIAS); the remaining 19 are non-NPIAS airports. The Update Plan included an interactive exercise with Idaho's 75 airport managers to obtain additional input on specific issues facing the Idaho aviation system. Participants identified trends that were important to the Idaho system, that they were experiencing now, or that they thought were reasonably likely to occur in the future and should be considered during this 2020 Update. Based on the group's consensus on how likely each issue would be to affect airports in Idaho, and how much of an impact each issue would have, the UAS use and technology were rated in the highest impact category. Airports of all sizes should prepare for the entry of UAS package delivery and uncrewed passenger vehicles into the National Airspace System.

This future of Urban Air Mobility (UAM) is envisioned as an on-demand system for air passenger and cargo transportation within an urban area. The development of the needed peripheral service industry is growing. These transportation systems are anticipated to be used by a combination of UAS, VTOL, and electric VTOL (eVTOL). NASA together with other agencies are developing a concept of operations for an expected air taxi system. The proposed system identifies the necessary step-by-step flow of operations for a singular flying taxi trip starting from the passenger requesting the flight to the aircraft undergoing service and maintenance, with recognition that a substantial regulatory framework and involvement from the FAA, the state DOTs, and local jurisdictions are needed. The US DOT's May 2023 request for information for advanced air mobility asks for local stakeholder input regarding the following categories: expected customer experience; scheduling and ticketing a flight; arrival at a vertiport; passenger and baggage screening; flights boarding security; assistance available for passengers (either on board the aircraft or on the ground); how passengers communicate problems in the cabin; expected levels of comfort in terms of vibration and transition phases (in/out of hover); cabin noise; heat ventilation and air conditioning and air quality; how stowage of cargo is achieved including essential items such as wheelchairs; and divisions of responsibility between vertiport and operations personnel (US Department of Transportation. Docket No. DOT-OST-2023-0079. Request for Information on Advanced Air Mobility).

Planning for future vertiports in Idaho needs serious consideration regarding necessary legislation, and the expected role of ITD, local governments, and private industries at all levels for regulations, operations, and funding. Vertiports will need specialty boarding, take-off, and landing areas. There could be single-operation vertiports for either cargo or people, vertiports that are integrated into existing airports and heliports, or multi-purpose multi-modal transportation options vertiports that act as commercial hubs. The FAA's working group on AAM is seeking information during 2023 and 2024 on whether system planning similar to the National Plan of Integrated Airport Systems should exist for vertiports, and what level of coordination is required for effective vertiport planning and use.

There are a variety of components related to AAM vertiports that need to be considered in the planning. Not necessarily in any chronological order, considerations include siting, design, regulations, safety, environmental impact, social acceptance, equity, and air space operational integration factors. Over 450 considerations were compiled from subject matter experts participating in NASA's AAM Ecosystem Working Groups during 2021 (https://nari.arc.nasa.gov/aam-portal/). These considerations can be used to conduct demand and network analysis, for local transportation planners to develop AAM networks for their community, and for the AAM ecosystem members to identify policy, standards, and research gaps as seen below (Mendonca et al 2021):

Federal planning and regulatory considerations

- Federal funding
- Public vs Private
- Airspace impact evaluation
- Design Circular(s)
- Maturing taxonomy
- Grant restrictions
- Occupational Safety and Health Administration (OSHA) and Americans with Disabilities Act (ADA) requirements
- Future climate requirements
- Leadership in Environmental and Energy Design (LEED) Goals/requirements
- Physical security (passenger and cargo) regulations
- Applicable existing regulations
- Regulations developed for AAM
- Environmental requirements i.e., National Environmental Protection Act (NEPA), FAA 1050.1

- Cros-border operations
- Governing regulations i.e., Part 135
- FAA Regulatory Roles & Responsibilities (CAA)
- FAA Operational Roles and Regulations (ANSP)
- Federal and Local Roles and Responsibilities
- Species protection regulations
- Registration in National Registry of Airports
- Airport Master Record 5010-1 forms
- Mitigation programs i.e., noise abatement
- Interstate commerce regulations
- Part 157 Forms 7480 & 7460 Notice of Construction
- 49 USC 5501 National Intermodal Transportation
- Data collection, retention and disposal policies and procedures (for audit and safety trends analysis)
- Federally provided vs commercial provided service
- Engage early with the FAA (Mendonca et al 2021. p.3)

State, Local, and Tribal planning and regulatory considerations:

- Zoning of site
- Zoning of surrounding area
- Local/state funding
- Noise ordinances
- Operating hours
- Economic development plan
- Building, plumbing code(s)
- Lack of building codes
- Local data requirements

- Adopted fire codes
- Incorporate & adhere to local master and transportation plans
- Support local planning goals
- Current or future land use plans
- Environmental requirements i.e., Special purpose state/local laws
- Long term local goals and plans
- Long term transportation integration planning
- Stakeholder groups assembled
- Process in place to obtain stakeholder input
- Understanding public opinion
- Federal vs Local roles and responsibilities
- Digital policy (flexible & rapid policy implementation tools)
- Information Technology (IT) system requirements for publicly funded infrastructure
- Local mandate of publicly funded vertiport requirements on private vertiports
- Differences in state vs local regulations
- Local airport land use plans
- State Aviation System and other aviation Plans (Mendonca et al 2021 p. 6)

Risk Identification, Mitigation, and Insurance

ITD's Vision Statement starts with, "Provide the Safest Possible Transportation System and Work Environment". Success is measured by continued partnerships that reinforce the importance of safety in the Department's culture, education, and day-to-day lives. The Vision Statement also includes, "We will stay vigilant about employee safety and renew efforts to maintaining a safe work environment because we want everyone to return home to their families every day." According to the UAS pilots, these values are practiced on every single UAS flight for ITD. Pilots set up signage and traffic cones, wear ITD safety vests, and head and eye protection, and follow all flight preparation and flight checklists, manuals, SOPs, etc. The UAS Committee monthly discussions consistently call out the physical safety of the pilot and observer, the improved safety for the public while operating the UAS in airspace instead of disrupting land traffic, and the safety and cybersecurity of data collection. UAS are making definable differences in increased safety, decreased need for lengthy and dangerous visual inspections, and can identify

anomalies with precision and sensor data. Although most state programs mention saved time and funding in the use of UAS, the number one focus is on increased safety in transportation construction and maintenance projects. The preventive aspect of keeping people out of harm's way is a more significant and unquantifiable factor than a return on investment, and that includes the safe use of the drone itself.

Communications with Idaho's Department of Administration, Risk Management, reveal the total number of state agency-owned remotely piloted aircraft insured as of 12/21/2022 is 161. These UAS are owned separately by the Idaho Military Division, Idaho Office of Species Conservation, Idaho Potato Commission, Idaho Department of Fish and Game, Idaho Department of Lands, Idaho State Police, Idaho Department of Parks and Recreation, Lewis Clark State College, Boise State University, Idaho State University, University of Idaho and Idaho Public Television. The Department of Administration provides a stand-alone policy for ITD's UAS that gives coverage for both liability and property damage. All other state agencies' UAS are covered only for liability to third parties. ITD's stand-alone policy for UAS is provided by USAIG with a $1Million/3Million per occurrence/aggregate limit. Coverage applies to scheduled ITD UAS flights only. There are no specific requirements indicated in the policy beyond those of the FAA in terms of aircraft type, pilot, or usage. There may be exclusions that apply to usage as a covered peril but not in a regulatory manner. For the non-state level public entities, the Idaho Counties Risk Management Program (ICRMP) was created in 1985 by Idaho local governments searching for a stable, Idaho source of insurance and risk management services for inter-local government collaboration. UAS are specifically now written into the ICRMP "liability" coverage for governmental use.

Risk management also includes data protection in the collection, storage, access, and sharing mechanisms. Data security protocols must follow ITD's ETS team and have regular training and reminders for UAS operators. Effective and streamlined data management is a core task in information management and planning for ITD projects and programs. The internal use of UAS for data collection may be on a project-by-project basis, as well as for ongoing and longitudinal maintenance information; however, processes and protocols should be homogenous. As such, ITD Aeronautics must maintain the proper mechanisms to input, organize, and monitor data relevant to statewide aviation management and coordination. Furthermore, monitoring and updating data continually would help track systemwide performance over time. Various types of software platforms are available in the market to assist in this process. Based on conversations with ITD Aeronautics, the selected software platform should have the ability to minimally handle the following elements or activities: facility data collection and maintenance; data collection including (but not limited to) operational activity, state and 5010 airport inspections; Information Security and Critical Infrastructure Protection development and management; Idaho Airport Aid Program funding, reimbursements, and payments; asset management; and an airport directory with contact information.

There is a need to work closely with ITD's IT support to ensure that databases can handle the large amounts of data that are generated by UAS sensors in formats that may not be standard for data management platforms. It is important that databases are appropriately flexible and supported.

While some insurance coverage focuses on traffic and mobility incidents, other coverage may include private UAS operators using their aircraft above state agency-controlled public spaces. The Idaho Department of Parks and Recreation (IDPR) is using UAS administratively for photographing development project progress and gathering promotional video within Idaho's parks. However, Idaho Administrative Code, Idaho Administrative Procedures Act (IDAPA) 26.01.20.175 Administration of Department of Parks and Recreation Park & Recreation Areas & Facilities states, "15. Non-traditional Recreational Activities. Non-traditional recreational activities such as model airplane and glider operations, geo-caching, gold panning, drone operation, and metal detecting may be authorized by the park or program manager if such activities do not interfere with traditional uses of the park and are consistent with preservation of park resources."

According to IDPR Operations Division Administrator, "The policy is primarily targeted at recreational use by visitors, and discretion is given to park managers. It varies from park to park as to where and what is allowed. For instance, IDPR has a designated area for drone use at Bruneau Dunes State Park. Any other airspace is closed to drone use. Unfortunately, most people would like to get drone footage of the dunes, but we've determined that as a direct conflict with those seeking solitude while hiking the dunes." State-level, as well as county and municipal-level administrative rules and ordinances, have been passed with safety in mind for the public below a UAS flight.

The FHWA UAS Fact Sheet discusses safety and risk mitigation as major benefits of using UAS in transportation projects. Generally, bridge inspection requires stopping or detouring traffic and creating single-lane temporary work zones, and/or using special access equipment such as buckets or even climbing a structure. UAS technology "can speed up data collection while reducing risk to work crews and the traveling public. It can accelerate the rate of data collection operations, such as survey or aerial photography, and facilitate exact quantity calculation. It can be used for routine inspections, such as flying a programmed path over silt fencing after a rain event to check for sediment buildup, and high-risk inspections, such as crane or temporary falsework construction. Consistently mapping terrain and monitoring conditions offer the potential for isolating problem areas before an accident or emergency occurs, which can both save lives and reduce asset maintenance costs. During an emergency event, UAS technology can quickly and inexpensively survey the damage, allowing for better-informed and efficient recovery operations".

National Groups Provide Support for Proposed UAS Legislation

The nationwide backlog for critical infrastructure inspections often demonstrates that traditional methods are more time consuming, more expensive, and can be more dangerous than work accomplished with UAS. ITD's Vision Statement, "Employees are essential to delivering transportation systems and services, so attracting and retaining quality employees are critical to our success." The department wants employees to actively engage in their work, contribute to programs, and feel valued. These employees, however, need the proper tools and training to stay and to continue developing their quality skills. Several national organizations, including AASHTO, are supporting a bill passed by the US

House of Representatives in 2022 that would broaden the use of UAS for infrastructure inspection purposes and provide funding exactly for UAS operator training. The Drone Infrastructure Inspection Grant or "DIIG" Act would authorize the U.S. Department of Transportation to create a $200 million competitive grant program to help state, tribal, and local governments in UAS education and trainings and to deploy drones to perform inspections of bridges and other critical infrastructure. This bill H.R.5315 directs the US Secretary of Transportation to establish in the Department of Transportation a UAS infrastructure inspection grant program, and a UAS education and training grant program. As of June 27, 2023 there is no action in the US Senate on this bill.

The appropriation would also allow USDOT to provide UAS education and workforce training grants at universities and community colleges. This would prepare current and future students and employees for the UAS economy and help cultivate a diverse workforce. Over 90 institutions have been approved by the FAA as UAS-Collegiate Training Initiative Schools, including Idaho State University. A governmental agency may use a federal 80% pay grant to purchase or lease any eligible small UAS and/or to support its operational capabilities, privately contract for services performed with UAS, or support the UAS program management capability of the agency itself to use any eligible small UAS. The bill says the selection priority would go to critical infrastructure projects in historically disadvantaged communities, or to those "projects that address a safety risk in the inspection, operation, maintenance, repair, modernization, or construction of an element of critical infrastructure."

Limitations in ITD's Existing UAS Program, and Opportunities for Future Development, Efficiencies, and Expansion

As described above, ITD's UAS Program has a sound foundation for internal departmental continued success and development. Accomplishments are largely a result of employee dedication to train themselves and to subsequently teach others. The decentralized district work teams (including IT and ETS), regardless of highway, inventory, traffic or bridge project, have managed to integrate cost savings and productivity using UAS. While ITD allocates its staff and aircraft in a manner that reflects the departmental priorities, it reviews and considers all requests for assistance within the department and from other public agencies. UAS use is enhancing situational awareness and increasing ITD employee safety by providing aerial support to employees on a bridge or on the ground monitoring a fixed location of construction or inspection. Reviewing other state DOTs has shown that there is no one best chronological order for creating and implementing an UAS program within a state's transportation department. Idaho has started very recently, with comparatively very little funding, during a worldwide pandemic, with a program coordinator that left within the first year, yet the commitment of employees and leadership have already demonstrated quantifiable and qualitative successes. The departmental missions are driving the UAS technology use- as should be.

A strong recommendation is to establish an Idaho UAS Task Force, with which the dependency on one person (the ITD UAS Coordinator) would be eliminated, and the continued progress of UAS use would not stall. As discussed above, in addition to coordinating and managing ITD's UAS use projects for all six

districts in Idaho, this new and quickly developing technology and the novel mobility and economic opportunities are too great a responsibility for one person. Those states that have a specific statewide UAS task force, commission, or committee of diverse stakeholders designated for this topic are the states that are leading in use and all of the subsequent benefits, innovation and productivity. Idaho could benefit from such a gubernatorial or legislatively established UAS task force. As addressed in this report, an advisory body could assist with numerous high-level recommendations such as:

- Consistent review of current federal and Idaho laws, regulations and court cases that could impact departmental UAS use and future advanced air mobility and recommend necessary revisions. Identify potential laws and IDAPA rules that will create jurisdictional harmonization and parameters for UAS pilots, vertiports and AAM operations throughout Idaho.

- Use task force members and their representative industries and sectors to fortify a public acceptance and awareness outreach campaign to educate the general public and lawmakers about UAS and AAM capabilities, technology and benefits.

- Coordinate an annual conference/workshop for UAS users in Idaho to promote interjurisdictional and interagency collaboration, best practice sharing and private sector input among other topics.

- Collaborate with local governments through Idaho Association of Counties and Association of Idaho Cities to identify opportunities for mutually beneficial practices to integrate UAS into transportation plans, and address local preemption and changes to the Aeronautics Code Title 21 as necessary.

- Submit the task force recommendations to the UAS Program Coordinator, the Division of Aeronautics Administrator and the Aeronautics Advisory Board for administrative or legislative action to the Governor and legislative leadership.

A possible Idaho UAS/Advanced Air Mobility Task Force could be created via legislation or a Governor's Executive Order and specify that ITD is the state entity responsible for aeronautical activity in the state which also has the authority to develop the rules, regulations, policies, and procedures for the use and integration of UAS into Idaho airspace below 400 AGL. The Task Force objectives could include a full consideration of public outreach and education, concerns, barriers and opportunities for advanced air mobility and UAS use in transportation logistics and economic development. Task Force members could be led by ITD Division of Aeronautics and ITD's Deputy Attorney General and could include representatives from each state agency using UAS, Information Technology Services, Chairs of the House and Senate Transportation Committees, ID Association of Counties, Association of Idaho Cities, FAA Regional Office, ID Public Safety UAS Council, UAS programs at College of Western Idaho and Idaho State University, Idaho National Laboratory, ITD Aero Advisory Board in addition to several members of the private sector with experience in this field such as consultants WSP, JR Simplot Company, and those already using UAS package delivery such as DroneUP and Zipline. Sub committees for specific categories could include additional specialists from whom to gather input.

Task Force meetings could include an aspect of public comment from Idaho residents, public and private sector entities, non-profit organizations, such as the Idaho Aviation Association, for example at every other meeting, or taken online or through the postal mail. Having an advisory body such as a task force would likely create a more consistent voice for simultaneously promoting and regulating a safe environment for UAS in Idaho and a coordinated ongoing public information campaign regarding advanced air mobility and economic development. It could also serve as an entity to facilitate the collaboration of UAS programs in Idaho higher education at BSU, CWI, ISU and UI. This advisory group could address workforce development in aeronautics and ITD Division of Aeronautics programs development with professors and students as well as employment agencies. It could remind local public jurisdictions that airspace questions belong to national entities, and land use questions of zoning and easements can be granted as joint powers from the state (or not).

Statutory recommendations for improvements and clarifications to Idaho Title 21 Aeronautics could come from this and future Task Force works, including Idaho law defining prohibited and protected UAS airspace areas, prohibited UAS uses such as interfering with first responders, public safety officials and disaster management, establishing the extension-of-self principle and technology-neutral law which means that personal actions which are currently allowed or prohibited by persons would equally apply to persons using an UAS, and a framework that allows ongoing safe operation of commercial and passenger use of airspace.

Today's future-looking questions for ITD's UAS and advanced air mobility responsibilities and authority include: Where are private sector and public sector attitudes, understanding and objectives in, or out, of alignment with each other? What are the benefits, challenges, and unintended outcomes of UAS operated transportation services? How are the direct and indirect costs of UAS use for and of public infrastructure measured and accounted for? What are the UAS interoperability and integration priorities for the U.S. and Idaho's transportation system and its parts across jurisdictions, roadways, and modes? What are the known current and future barriers in regional and multimodal coordination of transportation information, operation, and performance? Policy tools, such as regulations and standards, as well as engagement with other DOTs and private sector operators may help answer these questions through risk sharing, innovative services, data sharing, and a willingness to try new approaches to solving mobility problems.

2. Review of Statutes, Regulations, and Jurisprudence Regarding the General Operation of UAS at the Federal and State Levels of Government

Purpose

The second objective of this project is to gather information about federal and state statutes, rules, and programs in Idaho and other states that promote and regulate the use of UAS by public agencies, private and commercial organizations, and the general public. The goal is to synthesize useful information that assists in identifying areas for improvement within Idaho's existing laws and the development of new policies concerning the use of drones. This includes a discussion of existing jurisprudence and requirements related to air space, land use and zoning, public safety, trespass and privacy, and enforcement roles and authorities.

Introduction

The Federal Aviation Administration (FAA) has communicated over the decades that it has the authority to create a comprehensive regulatory system governing the safe and efficient management of UAS operations, including non-commercial operations at ground-level altitudes, above private property, and within state boundaries following the laws Congress has passed under its Constitutional Commerce Clause powers. In addition, following the Constitution's Supremacy Clause, the state and local laws affecting the field of aviation safety and the efficient use of airspace are federally preempted, (FAA Office of the Chief Counsel, State and Local Regulation of Unmanned Aircraft Systems UAS Fact Sheet), although non-federal government entities may still issue specific laws pertaining to UAS that do not touch this federally preempted field. ITD recognizes that a higher level of harmonization, uniformity, and consistency is needed for safety, mobility, and economic opportunity in UAS use and technology advancement as well as for the integration of drones into the national airspace and uniform traffic management.

The intent of the FAA to have a uniform and flexible system in place, where states work together to integrate uncrewed aircraft into the national airspace, is filled with ambiguity and confusion subsequent to our system of federalism and separation of powers plus the succession of FAA fact sheets, FAA directives, federal and state court decisions, and a patchwork of state statutes, and municipal and county ordinances. The law is still unsettled regarding under what circumstances a landowner has standing to bring suit for an unconstitutional taking of airspace property rights based on UAS-related actions. The FAA's incremental approach to safe UAS integration allows the agency to more carefully consider training requirements, operational specifications, and technology considerations. However, its exclusive authority over US "navigable airspace" has maintained that traditional aviation activities are generally carried out in an interstate (federal authority) context, yet UAS now provide the first series of

cases in the field of aviation law where the majority of activities occur in an intrastate (10th Amendment Reserved Powers for states) jurisdiction. There remains a lack of consensus on fundamental UAS jurisdiction and privacy issues among stakeholders from the federal, state, local, and tribal governments, the UAS industry, property and privacy advocates, academic experts, and others.

This policy guidance is intended only to improve the internal management of the UAS Program specifically and UAS use principals for ITD department-wide and when it supports other agencies. Ensuring an appropriate level of safety, accountability, transparency, and innovation that follows federal executive and judicial branch guidance as well as consideration of other states' best practices.

Federal Authority

Integration of small UAS operations into the national airspace system begins with determining which level of government- the federal government, or the state, local, and tribal governments, or all of them- has/have the legal authority to make these decisions. Successful integration involves balancing safety, social and economic benefits anticipated from UAS operations with constitutionally protected property and privacy rights. It may also involve balancing the federal government's constitutional rights and responsibilities to regulate interstate commerce, with the states' constitutionally reserved police powers. The FAA and federal court cases maintain that it has the authority to create a comprehensive regulatory system governing the safe and efficient management of UAS operations. This includes non-commercial operations at ground level, above private property, and solely within state boundaries following the laws Congress has enacted under the Commerce Clause powers.

The US DOT has communicated it is the agency's "long-held position that . . . [FAA] has the responsibility to regulate aviation safety and the efficiency of the airspace within the navigable airspace, which may extend down to the ground." This authority and responsibility to regulate all aircraft operations down to the ground are based in part on 49 U.S.C. § 40103(b)(1), from Congress's Air Commerce Act of 1926 legislation enacted in the context of crewed aircraft. As currently codified, that provision authorizes the FAA to regulate "the use of the navigable airspace . . . to ensure the safety of aircraft and the efficient use of [that] airspace," and "navigable airspace" is defined as the airspace above minimum safe flight altitudes prescribed by FAA regulations.

Although the FAA has not issued regulations prescribing minimum safe flight altitudes for UAS, DOT officials have told the Government Accountability Office in interviews, "It is the Department's stance that, for purposes of the definition of the term navigable airspace, zero feet ('the blades of grass') is the minimum altitude of flight for UAS." (Government Accountability Office, 2020.) UAS operations at ground level also are supported by 49 U.S.C. § 44701(a)(5) which directs the FAA to issue "air commerce" safety regulations. The officials noted that because "air commerce," in contrast to "navigable airspace," is not defined by a minimum altitude, FAA may regulate UAS and other "aircraft" in the stream of interstate commerce even when they are on the ground. Support also comes from 49 U.S.C. § 40103(b)(2), which among other things directs FAA to issue air traffic regulations for "protecting individuals and property on the ground." How are these conclusions derived?

The FAA points to the Constitution's Supremacy Clause, to rule that state and local laws affecting the field of aviation safety and the efficient use of airspace are federally preempted although non-federal government entities may still issue laws and ordinances pertaining to UAS that are not in this preempted category. In particular, according to FAA, it is responsible for air safety "from the ground up," including for UAS operations. In addition, "navigable airspace," "air commerce," and "national airspace system" statutes and rules are cited by FAA as supporting its regulation of UAS operations from the ground up. The agency refers throughout the preamble to one of its most recent UAS rulemakings to the regulation of UAS operations now as in the general "airspace of the United States" (Fed. Reg. 72438 (Dec. 31, 2019).

Does the National Airspace System (NAS) include the facilities in the system? Airports, vertiports, airstrips, etc.? May air commerce and interstate commerce also be regulated by FAA even when on the ground? Is federal preemption absolute for all airspace? There is a myriad of unresolved UAS legal jurisdictional and privacy issues and aviation industry legal specialists such as Mark McKinnon are asking:

- Whether Congress may use its power under the U.S. Constitution's Commerce Clause to regulate all UAS operations, including non-commercial, non-interstate, low-altitude operations over private property, and if so, whether Congress has authorized FAA to regulate all such operations in the FAA Modernization and Reform Act or other legislation?

- What impact possible Fifth Amendment protected property rights landowners have in the airspace within the "immediate reaches" above their property, as recognized by the U.S. Supreme Court in *United States v. Causby* and other legal precedents, and do these include federal, state, local, and tribal authority over low-altitude UAS operations including "down to the blades of grass" flights?

- Was and is it Congress's intent, in the FAA Modernization and Reform Act of 2012 or other following legislation, to preempt the states, localities, and tribes from regulating any or all UAS operations below 400 feet AGL?

- What liability do UAS operators and the federal, state, local, and tribal governments have to landowners under state aerial trespass and constitutional takings law for conducting, regulating, or preempting state regulation of UAS operations in low-altitude airspace, and can landowners exclude drones from their property's overlying airspace?

- Do existing federal and state privacy laws adequately protect against invasions of physical privacy and personal data privacy involving UAS operations, and what authority do the federal, state, local, and tribal governments have to enact additional measures that may be needed?

- Will property rights, nuisance claims, and local police powers be impacted differently by UAS and advanced air mobility traffic management or is it just a different technology with similar expectations applied to it?

- What is the scope of civil and criminal trespass authority in low-altitude airspace?

- What authority do federal, state, local, and tribal governments have to protect against invasions of physical privacy and personal data privacy involving UAS operations?

Integration of UAS into the National Airspace System

In §333 of the FAA Modernization and Reform Act of 2012 (Public Law No. 112-95), Congress directed the Secretary of the US DOT to determine whether UAS operations, posing the least amount of public risk, and no threat to national security, could be operated safely in the national airspace system (NAS) and if so, to establish requirements preparing for this. In 2015, the FAA proposed a framework of regulations that would allow routine commercial use of certain tested UAS in the aviation system, while maintaining safety and the flexibility to accommodate future technological innovations. This 2015 "Fact Sheet for State and Local Jurisdictional Regulation of UAS" from the Administration's Office of the Chief Counsel provides information for states and municipalities considering laws, rules, and/or ordinances for UAS use. State and local restrictions consistency with the extensive federal statutory and regulatory framework pertaining to control of the airspace, flight management and efficiency, air traffic control, aviation safety, navigational facilities, and the regulation of aircraft noise at its source are suggested. The Fact Sheet outlines the FAA's justification for federal level oversight of aviation, airspace, and explains its responsibilities in these areas.

Congress has given the FAA the above powers in 49 U.S.C. §§ 40103, 44502, and 44701-44735. It directed the FAA to "develop plans and policy for the use of the navigable airspace and assign by regulation or order the use of the airspace necessary to ensure the safety of aircraft and the efficient use of airspace" in 49 U.S.C. § 40103(b)(1). Congress has further directed the FAA to "prescribe air traffic regulations on the flight of aircraft (including regulations on safe altitudes)" for navigating, protecting, and identifying aircraft; protecting individuals and property on the ground; using the navigable airspace efficiently; and preventing collision between aircraft, between aircraft and land or water vehicles, and between aircraft and airborne objects in 49 U.S. Code § 40103(b)(2).

Because federal registration is mandatory for purposes of operating an aircraft in the national airspace, states and local governments may not mandate an additional registration requirement on the operation of UAS in national airspace without first obtaining FAA approval. Also, no state or local UAS registration relieves a UAS owner or pilot from complying with the current federal UAS registration requirements. The Fact Sheet points out that a 'patchwork quilt' of state and local entity restrictions confuses the consistency and simultaneously the flexibility of the FAA in controlling the airspace, safety and an efficient air traffic management. "A navigable airspace free from inconsistent state and local restrictions is essential to the maintenance of a safe and sound air transportation system." (See *Montalvo v. Spirit Airlines*, 508 F.3d 464 (9th Cir. 2007), and *French v. Pan Am Express, Inc*., 869 F.2d 1 (1st Cir. 1989); see also *Arizona v. U.S.* 2012). Proponents argue that where Congress occupies an entire field, even a complementary state regulation is not allowed. Field preemption reflects a congressional decision to prohibit any state regulation in the subject, even if it is thought to be parallel to the federal standards.

The 2015 Fact Sheet gives examples of UAS laws that are generally recognized as state and local government authority, such as requirements (or not) for police to obtain a warrant prior to using UAS for surveillance; prohibitions on the use of UAS (or any other technologies such as smart phones) for voyeurism; exclusions on using UAS for assisting in hunting or fishing (as does Idaho), and prohibitions on attaching weapons to a UAS. Examples are given of state and local laws affecting UAS for which consultation with the FAA is recommended (and they invite states, counties, and municipalities to consult with the FAA's Office of the Chief Counsel before implementing measures regulating aspects of the usage and operations), such as restrictions on flight altitude or flight paths, regulation of the navigable airspace, and mandating UAS-specific technology, equipment, or training. Mandating specific equipment or training for UAS that is related to aviation safety (such as geo-fencing) is likely to be preempted. Courts have found that state regulation of mandatory training and equipment requirements related to aviation safety is not consistent with the federal regulatory framework (*Med-Trans Corp. v. Benton*, 581 F. Supp. 2d 721, 740 (E.D.N.C. 2008); *Air Evac EMS, Inc. v. Robinson*, 486 F. Supp. 2d 713, 722 (M.D. Tenn. 2007).

Federal courts have also stricken down state and local regulation of overflight such as operational restrictions on UAS flight altitudes and paths, operational bans, and any regulation of the navigable airspace. A city ordinance prohibiting flying UAS within the city limits, within the airspace of the city, or within certain distances of landmarks will not be upheld. (*City of Burbank v. Lockheed Air Terminal*, 411 U.S. 624 (1973); *Skysign International, Inc. v. City and County of Honolulu*, 276 F.3d 1109, 1117 (9th Cir. 2002); *American Airlines v. Town of Hempstead*, 398 F.2d 369 (2d Cir. 1968); *American Airlines v. City of Audubon Park*, 407 F.2d 1306 (6th Cir. 1969). State and local entities may enact and administer their own regulatory programs for their own needs, but these must be within the limits established by the FAA's federal minimum standards.

Judicial Branch Support for Federal Preemption

Article VI of the US Constitution, referred to as the Supremacy Clause, declares that the "Constitution, and the laws of the United States which shall be made in pursuance thereof; and all treaties made, or which shall be made, under the authority of the United States, shall be the supreme law of the land; and the judges in every state shall be bound thereby, anything in the Constitution or laws of any State to the contrary notwithstanding." The 10th Amendment to the US Constitution states that "the powers not delegated to the United States by the Constitution, nor prohibited by it to the States, are reserved to the States respectively, or to the people." When questions arise as to whether federal law or state law controls a given situation, court cases analyze whether the Supremacy Clause requires that federal law preempts state law, or whether the 10th Amendment limits the federal government and preserves powers reserved to the states. Following is a chronology of these jurisprudence developments for UAS.

- 1926. Air Commerce Act. The first federal legislation governing air commerce authorized the federal government to regulate the use of the "navigable airspace" and declared a public right of transit through that airspace.

- 1944. *Northwest Airlines v. State of Minnesota*, 322 U.S. 292, 303 (1944). “Congress recognized the national responsibility for regulating air commerce. Federal control is intensive and exclusive. Planes do not wander about in the sky like vagrant clouds. They move only by federal permission, subject to federal inspection, in the hands of federally certified personnel, and under an intricate system of federal commands. The moment a ship taxies onto a runway it is caught up in an elaborate and detailed system of controls. It takes off only by instruction from the control tower, it travels on prescribed beams, it may be diverted from its intended landing, and it obeys signals and orders. Its privileges, rights, and protection, so far as transit is concerned, it owes to the Federal Government alone and not to any state government.”

- 1946. *United States v. Causby*, 328 U.S. 256 (1946). First US Supreme Court case to consider avigation easements. A poultry farmer sued the federal government for consistently flying military planes at low altitudes above his property. The aircraft noise scared the chickens into flying into the barn walls and then dying. In its ruling, the Supreme Court confirmed that the federal government took an easement of flight (later called avigation easement) under the meaning of the Fifth Amendment and stated that “the landowner owns at least as much of the space above the ground as he can occupy or use in connection with the land.” The Court determined that the dividing line between the portion of the airspace in the public domain and the portion protected subsequent to land ownership against invasions by aircraft was the line delineated by the Civil Aeronautics Authority (now the Federal Aviation Administration) as the minimum safe altitude of flight. This ruling has served as the foundation for future cases arguing air rights, but the ruling was not broad. Does a property owner who planted tall trees in their yard own more air space than a property owner who owns flat rangeland? Neither case law nor federal regulations provide definite answers. First, if a UAS flies over (or through) property, could this be a trespass claim at a specific height? What is the exact height of one’s property rights in the air? The law concept of *ad coelum et ad inferos* (which translates to “from heaven to hell”) established that every inch of space above and below the land belonged to the owner. However, with advancements in aviation and space technologies, *ad coelum et ad inferos* has lost its legal potency and application. The Court explained that “[t]he superadjacent airspace at this low altitude is so close to the land that continuous invasions of it affect the use of the surface of the land itself. We think that the landowner, as an incident to his ownership, has a claim to it and that invasions of it are in the same category as invasions of the surface.”

- 1958. The Federal Aviation Act of 1958. Established that “the FAA, was passed by Congress for the purpose of centralizing in a single authority the power to frame rules for the safe and efficient use of the nation's air space.”

- Federal code 49 U.S.C. 44701(a)(5) allows the FAA to prescribe regulations and minimum standards necessary for safety in air commerce and national security,” and this allowance leaves “some room for state and local UAS laws, albeit recommending that state authorities first consult federal aviation authorities in such matters.” Jurisprudence on the Federal Aviation Act shows that where there are pervasive regulations in an area, the Federal Aviation Act preempts all state claims in that area, particularly air safety.

- 1962, *Griggs v. Allegheny County,* 369 U.S. 84 (1962). The Court found that what it called "air easements" and "navigation easements" were constitutionally protected "private property" (Griggs, 369 U.S. at 90). Allegheny County owned and maintained the Greater Pittsburgh Airport at a site it had acquired to provide airport facilities under the Federal Airport Act. The pattern of flight established by the Civil Aeronautics Administrator for airplane takeoff and landing from the airport required aircraft to fly regularly at low altitudes over Griggs' residential property. The resulting noise, vibrations, and danger forced the Griggs family to move from their home. The Supreme Court held that the county had taken an air easement over Griggs' property for which it must pay just compensation as required by the Fourteenth Amendment. Traditional common law provides that there is a trespass when a person or "thing", such as tree branches or a telephone wire, enters onto another person's land or into the airspace above the property. The mere intrusion is generally considered a trespass per se, without harm being proven. By 1965, common law trespass involving "aircraft" generally required both flight into the "immediate reaches" of a landowner's airspace and a "substantial interference" with the "use and enjoyment of his land." This aircraft trespass rule, still in use today, is said to be based on *Causby*. As between the common law trespass rules for airborne objects and aircraft, UAS industry stakeholders have generally taken the position that flights by drones should be governed by the trespass rule for aircraft, noting Congress has defined UAS as "aircraft" for purposes of federal aviation safety regulation. They also believe the aircraft trespass rule's "substantial interference" requirement appropriately balances the rights of landowners and UAS operators. Other stakeholders and legal commentators, however, believe drone flights should be governed by the traditional trespass per se rule for airborne "things." They state that small UAS flying through and hovering near the ground are more akin to small airborne objects covered by the traditional rule than larger crewed aircraft covered by the "aircraft" rule. They also state that requiring substantial interference for trespass by drones effectively replaces aerial trespass with a new tort of "aerial nuisance" and that landowners should be able to maintain their right to the exclusive use of their low-altitude airspace without having to prove the same high level of interference required by *Causby* for an unconstitutional taking.

- 1963. *Aaron v. United States*, 311 F.2d 798, 801 (Ct. Cl. 1963). 500 feet public airspace / private property demarcation line is maintained, even if future cases might arise where flights above 500 feet could constitute a government taking. The court ruled that owners of property over which planes flew at an elevation of fewer than 500 feet were indeed entitled to compensation, but they were not entitled to compensation for the flights above 500 feet although they may have been "inconvenienced to some extent by these flights".

- 1973. *City of Burbank v. Lockheed Air Terminal*. The US Supreme Court held that "[t]he Federal Aviation Act requires a delicate balance between safety and efficiency… and the protection of persons on the ground...[t]he interdependence of these factors requires a uniform and exclusive system of federal regulation if the congressional objectives underlying the Federal Aviation Act are to be fulfilled" (*City of Burbank v. Lockheed Air Terminal Inc*., 411 U.S. 624, 638–39 (1973). "If we were to uphold the Burbank ordinance [which placed an 11 p.m. to 7 a.m. curfew on jet flights from the Burbank Airport] and a significant number of municipalities followed suit, it is obvious that fractionalized control of the timing of takeoffs and landings would severely limit

the flexibility of FAA in controlling air traffic flow. The difficulties of scheduling flights to avoid congestion and the concomitant decrease in safety would be compounded" (*Burbank v. Lockheed Air Terminal Inc*., 411 U.S. pp. 624, 639 (1973). "The paramount substantive concerns of Congress [in enacting the FAA Act] were to regulate federally all aspects of air safety…and, once aircraft were in 'flight,' airspace management…." (*Burbank* at p. 644).

- 1989 *French v. Pan Am Express, Inc*., 869 F.2d 1, 6 (1st Cir. 1989). "[W]e remark the Supreme Court's reasoning regarding the need for uniformity [concerning] the regulation of aviation noise, see *City of Burbank v. Lockheed Air Terminal*, 411 U.S. 624 (1973), and suggest that the same rationale applies here. In Burbank, the Court struck down a municipal anti-noise ordinance placing a curfew on jet flights from a regional airport. Citing the 'pervasive nature of the scheme of federal regulation,' the majority ruled that aircraft noise was wholly subject to federal hegemony, thereby preempting state or local enactments in the field. In our view, the pervasiveness of the federal web is as apparent in the matter of pilot qualification as in the matter of aircraft noise. If we upheld the Rhode Island statute as applied to airline pilots, 'and a significant number of [states] followed suit, it is obvious that fractionalized control … would severely limit the flexibility of the F.A.A ….' [citing *Burbank*] Moreover, a patchwork of state laws in this airspace, some in conflict with each other, would create a crazy quilt effect … The regulation of interstate flight and flyers must of necessity be monolithic. Its very nature permits no other conclusion. In the area of pilot fitness as in the area of aviation noise, the [FAA] Act as we read it 'leave[s] no room for … local controls' (citing *Burbank*)."

- 1996. *Gustafson v. City of Lake Angeles*, 76 F.3d 778, 792-793 (6th Cir. 1996). "Air traffic must be regulated at the national level. Without uniform equipment specifications, takeoff and landing rules, and safety standards, it would be impossible to operate a national air transportation system."

- 1996. *Brown v United States* 73 F.3d I100 (Fed. Cir. 1996). The case addressed whether noise and other effects from overflights interfered with the property owner's rights in such a way as to constitute a taking of an avigation easement and hence require compensation. The planes flew directly over Brown's land, the flights were low and frequent, and the flights directly and immediately interfered with his enjoyment and use of the land. Case law following *Causby* added a specification on the third factor, requiring that the interference with land enjoyment and usage be "substantial." *Brown's* contribution to the status of avigation easements is significant to avoid property holders from being caught between an absence of diminishment of current actual use of the property, and the creation of a six-year statute of limitations. If the court would have decided for the US government, finding that there must be an impairment of the current actual use of the property, the property holder who is not immediately suffering from the overflights would not have an action until after changes to the nature of the property actually impair the use of the property. The six-year statute of limitations for avigation easement claims start from either the time of the first overflights which cause the government taking, or from the time of substantially increased use and a new taking arises. If the landowner does not suffer an actual loss within this six-year period, she is forever precluded by the statute of limitations from seeking compensation for the taking. The highest value owed is not only the

current value but a proposed possible use value. The *Brown* decision is that when accepting a market value compensation, the potential future uses must also be included. This is the first case in the realm of avigation easements to define the term "enjoyment and use" to include damages resulting from a decrease in the fair market value of the land for other uses to which the land could be converted. The implications of this decision are far-reaching. Because of the *Brown* decision, aircraft overflights do not have to cause immediate diminishment of the current actual use of the property.

- 1999. *Abdullah v. American Airlines*. "Congress's intent to regulate interstate and international air safety to be unambiguous" and held "state and territorial standards of care in aviation safety are federally preempted."

- 2002. *Skysign International, Inc. v. City and County of Honolulu*, 276 F.3d 1109, 1115 (9th Cir. 2002). The Court ruled that laws traditionally related to state and local police powers – including land use, zoning, privacy, trespass, and law enforcement operations, generally are not subject to federal regulation. "We similarly hold that federal law occupies the entire field of aviation safety. Congress' intent to displace state law is implicit in the pervasiveness of the federal regulations, the dominance of the federal interest in this area, and the legislative goal of establishing a single, uniform system of control over air safety. This holding is fully consistent with our decision where we considered whether federal law preempted state regulation of aerial advertising that was distracting and potentially dangerous to persons on the ground. In upholding the state regulations, we held that federal law has not 'preempt[ed] altogether any state regulation purporting to reach into the navigable airspace' (*Skysign* at 1116.)

- 2004. *Witty v. Delta Airlines*. "… federal regulatory requirements for passenger safety warnings and instructions are exclusive and preempt all state standards and requirements."

- 2005. *Greene v. B.F. Goodrich Avionics Systems, Inc*. 409 F.3d 784, 795. "… federal law establishes the standards of care in the field of aviation safety and thus preempts the field from state regulation."

- 2007. *Montalvo v. Spirit Airlines,* 508 F.3d 464, 473. "…federal law occupies the entire field of aviation safety." "The purpose, history, and language of the FAA [Act] lead us to conclude that Congress intended to have a single, uniform system for regulating aviation safety. The catalytic events leading to the enactment of the FAA [Act] helped generate this intent. The FAA [Act] was drafted in response to a series of fatal air crashes between civil and military aircraft operating under separate flight rules…In discussing the impetus for the FAA [Act], the Supreme Court has also noted that regulating the aviation industry requires a delicate balance between safety and efficiency. It is precisely because of 'the interdependence of these factors' that Congress enacted 'a uniform and exclusive system of federal regulation'" (*Montalvo v. Spirit Airlines*, 508 F.3d 464, 471 (9th Cir. 2007), citing *City of Burbank v. Lockheed Air Terminal Inc.*, 411 U.S. pp. 624, 638-39 (1973). "[W]hen we look to the historical impetus for the FAA, its legislative history, and the language of the [FAA] Act, it is clear that Congress intended to invest the Administrator of the Federal Aviation Administration with the authority to enact exclusive air safety standards. Moreover, the Administrator has chosen to exercise this authority by issuing such pervasive

regulations that we can infer a preemptive intent to displace all state law on the subject of air safety" (*Montalvo* at 472). "While Congress may not have acted to occupy exclusively all of air commerce, it has clearly indicated its intent to be the sole regulator of aviation safety. The FAA, together with federal air safety regulations, establish complete and thorough safety standards for interstate and international air transportation that are not subject to supplementation by, or variation among, states" (*Montalvo* pp. 473-474.)

- 2010. *US Airways, Inc. v. O'Donnell,* 627 F.3d 1318, 1326. "… federal regulation occupies the field of aviation safety to the exclusion of state regulations."

- 2011. *Goodspeed Airport LLC v. E. Haddam Inland Wetlands & Watercourses Comm'n,* 634 F.3d pp. 206, 210. "Congress intended to occupy the field of air safety." The 2nd Circuit highlights that "[i]n occupying the field of air safety, Congress did not intend to preempt the operation of state statutes and regulations like the ones at issue here." The Court ruled that "[a]lthough ... Congress has indicated its intent to occupy the entire field of aviation safety, the generally applicable state laws and regulations imposing permit requirements on land use challenged here do not, on the facts before us, invade that preempted field. This ruling shows that permit requirements related to land use do not necessarily touch aviation safety, and therefore could fall outside of the field of Congressional preemption. *Goodspeed* is important because it provides states with the persuasive authority to make a case that there are powers available to them to oversee the regulations of uncrewed aircraft, notwithstanding implied preemption under the Federal Aviation Act.

- 2012. FAA Modernization and Reform Act of 2012, Special Rule for Model Aircraft which stated that the FAA may not promulgate any rule or regulation regarding a model aircraft.

- 2014. *Huerta v. Pirker* WL 8095629, at p. 5. The National Transportation Safety Board (NTSB) upheld an FAA order designating UAS as definitionally the same as crewed aircraft, stating that "[w]e must look no further than the clear, unambiguous plain language of 49 U.S.C. § 40102(a)(6) and 14 C.F.R. § 1.1: an 'aircraft' is any 'device' 'used for flight in the air.' This definition includes any aircraft, crewed or uncrewed, large or small."

- 2014. FAA published the Code of Federal Regulations, Title 14, Part 107 Small Unmanned Aircraft Systems, introducing regulations including general provisions, operating rules, remote pilot certification requirements, and waivers available to uncrewed aircraft pilots.

- 2015. Registration and Marking Requirements for Small Unmanned Aircraft. The US DOT and FAA released a final rule that "provide[d] an alternative, streamlined and simple, web-based aircraft registration process for the registration of small unmanned aircraft, including small unmanned aircraft operated as model aircraft, to facilitate compliance with the statutory requirement that all aircraft register prior to operation." (Registration and Marking Requirements for Small Unmanned Aircraft, 80 Fed. Reg. 78594, 78594 (Dec. 16, 2015) (to be codified at 14 C.F.R. pt. 1, 45, 47, 48, 91, and 375).

- 2016. *Huerta v. Haughwout*, 2016 WL 3919799 D. Conn. 2016. The court questioned both the FAA's and Congress's authority to regulate all low-altitude UAS operations, particularly in the airspace over private property.

- 2017. National Defense Authorization Act of 2017. Mandatory drone registration provision was included in this Act, and the resulting framework included 14 Code of Federal Regulation § 48.1189 and 49 U.S.C.A. § 44103190 which outlined the regulatory and statutory registration and marking requirements for small UAS.

- 2017. *Taylor v Huerta* 856 F.3d 1089 (D.C. Cir. 2017) addressed the FAA's authority over uncrewed aircraft and how state laws and local ordinances are affected by federal preemption. The Court held that the Registration Rule was unlawful as applied to model aircraft.

- 2017. *Boggs v. Merideth*, 2017 WL 1088093 (W.D. Ky. 2017). Federal court held it lacked the authority to rule on what it said were state law issues of UAS-related privacy and property rights in low-altitude airspace.

- 2017. *Singer v. City of Newton*. In the District Court of Massachusetts, Singer sued the city to challenge its ordinance sections which "require[d] all owners of pilotless aircraft [to] register their pilotless aircraft with Newton, and also prohibit operation of pilotless aircraft out of the operator's line of sight or in certain areas without a permit or express permission." In the court's review of the Newton Ordinances § 20–64(b), it points out that the FAA indicated its intent to be the exclusive regulatory authority for the registration of pilotless aircraft…citing the 2015 FAA Fact Sheet that says no state or local government may impose an additional registration requirement on the operation of UAS in navigable airspace without first obtaining FAA approval (*City of Newton*, 284 F. Supp. 3d 125. 148 Id. at p. 127). The city ordinance stated in part: "Purpose: The use of pilotless aircraft is an increasingly popular pastime as well as a learning tool. It is important to allow beneficial uses of these devices while also protecting the privacy of residents throughout the City. In order to prevent nuisances and other disturbances to the enjoyment of both public and private space, regulation of pilotless aircraft is required. The following section is intended to promote the public safety and welfare of the City and its residents. In furtherance of its stated purpose, this section is intended to be read and interpreted in harmony with all relevant rules and regulations of the Federal Aviation Administration, and any other federal, state, and local laws and regulations (*City of Newton*, 284 F. Supp. 3d at 131), Newton Massachusetts Revised Ordinances ch. 20, § 64(B) (Section (b) states: "Owners of all pilotless aircraft shall register their pilotless aircraft with the City Clerk's Office, either individually or as a member of a club . . ."). The court highlighted that "Congress [gave] the FAA the responsibility of regulating the use of airspace for aircraft navigation and to protect individuals and property on the ground . . ..and specifically directed the FAA to integrate drones into the national airspace system" (*City of Newton,* 284 F. Supp. 3d at 132). It explained that the FAA used this power to require that a remote pilot must command the flight of the uncrewed aircraft, or, a visual observer must see the uncrewed aircraft through the duration of the flight, and "allow waiver of the visual observer rule." Because of this, the Court held that the subsection was preempted under the reasoning that "the Ordinance limits the methods of

piloting a drone beyond which the FAA has already designated, while also reaching into navigable space . . . intervening in the FAA's careful regulation of aircraft safety cannot stand" (*City of Newton*, 284 F. Supp. 3d at p. 133).

- 2018. FAA Reauthorization Act Of 2018. This legislation addressed aircraft noise, the integration of UAS into the national airspace, and the financing of airport capital projects.

- 2019. External Marking Requirement for Small Unmanned Aircraft, 84 Fed. Reg. 3669, 3669 (Feb. 13, 2019, to be codified at 14 C.F.R. Part 48). The FAA and DOT ruling requires "small unmanned aircraft owners to display the unique identifier assigned by the FAA upon completion of the registration process (registration number) on an external surface of the aircraft." This rule is important to the registration of small UAS because it allows law enforcement to access the identifier number and from that be able to request the identity of the pilot from FAA registration.

- 2019. Remote Identification of Unmanned Aircraft Systems, 84 Federal Regulations 72438, 72439 (Dec. 31, 2019) to be codified at 14 C.F.R. pt. 1, 47, 48, 89, 91, and 107). The FAA gave notice of a proposed rulemaking on the remote identification of UAS in the US.

- 2020. *Michigan Coalition of Drone Operators v. Genesee County*. 19-113058-CZ (Mich. Cir. Ct. 2020). Upheld in appellate court 2022, this affirmed a lower court's ruling that Ottawa County exceeded its authority when it tried to ban the use of drones in county parks. Michigan state law preempts local governments from enacting policies regulating drone usage, essentially allowing drone pilots to fly as long as they are compliant with federal law. By limiting the conditions in which pilots could operate their drones, Ottawa County violated Michigan's Unmanned Aircraft Systems Act.

- 2022. *RaceDayQuads LLC v. FAA*. This suit challenged the Drone Remote Identification Regulations as infringing upon the Fourth Amendment expectation of privacy, and government surveillance of the operator's use, but was denied by the DC Circuit (July 29, 2022.) Remote identification is described as the "digital license plate" for remotely piloted aircraft, compliance mandate starting September 16, 2023. The final rule established a new Part 89 in Title 14 of the Code of Federal Regulations requiring broadcasting of location. Remote ID has been determined to be necessary to maintain aviation safety and security issues regarding operations in the NAS. Broadcasts are mandatory for remote ID messages directly from the UA via radio frequency broadcast (likely Wi-Fi or Bluetooth technology) connecting the UAS serial number or session ID with the registration database will be limited to the FAA and can be made available to authorized law enforcement and national security personnel upon request. Most aircraft must be produced as Standard Remote ID Unmanned Aircraft and have either an internal signal broadcasting the pilot's location, plus the drone's latitude, longitude, and heading, or an attached broadcast module sending the same data. Anyone with a smartphone in the vicinity of the launch point will be able to know the pilot's location while flying. Remote ID is expected to increase safety, transparency and responsibility of pilots because a drone's speed, heading, and altitude will be accessible at all times while it is in the air and will enable more complex

operations, including Operations Over People and Beyond-Visual-Line-of-Sight, to be made without the pilot having to secure a waiver.

As cited above, law related to remotely piloted aircraft is a developing field with circumstances where crewed aircraft precedence will apply, and other cases where it will not.

Needed and desired harmonization for UAS regulated use is not yet close to fruition, though not from a lack of trying. Initiatives carried out from 2017-2020, separately convened by the FAA and the Uniform Law Commission (ULC) to address UAS jurisdiction issues (and in the ULC's case, also UAS privacy issues), failed to produce even simple recommendations in key areas, and the courts have not provided a consistent roadmap either.

Other areas of the law such as criminal behavior, tortious activity, and legal interests relating to the rights of property owners, generally fall within a state's authority to regulate remote piloted aircraft operation. The scope may be narrow, but powers do remain for states to regulate operations that are not preempted by the Federal Aviation Act, or expressly preempted by the Airline Deregulation Act. The American Bar Association (ABA) Section of Real Property, Trust, and Estate Law released a draft resolution and report in 2020 outlining their recommendations to the federal government, state governments, and other political subdivisions of the states. The proposed resolution urges the federal, state, local, territorial, and tribal governments, and their respective agencies and departments, to protect real property interests, including common law trespass and privacy rights, with respect to any statute, ordinance, regulation, administrative rule, order, or guidance pertaining to the development and usage of unmanned aircraft systems over private property (Reynolds 2020). A consistent legal framework would help protect the interests of property owners as "[e]merging technologies such as UAS do not fit squarely within existing trespass and privacy rights laws." To protect these interests, the report advised government entities to consider existing frameworks of common law trespass and privacy rights as a foundation for governing uncrewed aircraft over real property but to keep in mind that "a 'one-size fits all' approach to rules governing the operation of drones is not appropriate" (*ibid*).

The Impact of UAS and Property Rights in Airspace on Federal and State Authority

A key unresolved issue in determining the scope of federal and Idaho state jurisdiction over UAS operations is the modern-day status and impact of property rights in airspace. The continued recognition of these historic rights could affect the extent to which Congress is deemed to have intended to preempt states' police power protections of those rights, for example, or might influence how Congress may decide to clarify its preemption intentions in the future. The possibility that federal UAS regulatory action might diminish airspace property rights to a point that it becomes an unconstitutional taking to fly UAS for advanced air mobility planning requiring just compensation to all landowners also might affect the scope of regulatory authority Congress is deemed to have assigned to FAA or how FAA exercises that authority.

The Court ruled that the flights at issue in *Causby*, (U.S. military aircraft continuously taking off and landing directly above a landowner's home and business) had taken the landowner's property, a flight easement in that airspace. The Court did not specify the "precise limits" of "immediate reaches" of airspace, but said a taking occurs when flights over private land are "so low and so frequent as to be a direct and immediate interference with the enjoyment and use of the land." In the UAS context, aircraft are generally restricted to low-altitude airspace. The fact that the FAA has not set an explicit UAS minimum flight altitude while setting a general maximum flight altitude of 400 feet, necessarily places UAS relatively close to people and structures on the ground. Thus low-altitude UAS operations have revived questions about whether landowners have property rights in the low-altitude airspace above their land, a question many believe was resolved in the context of manned flight decades ago. The different legal positions in the UAS context largely reflect different interpretations of the Supreme Court's landmark decision in *Causby* and subsequent cases, and court statements that a landowner "owns" and has "exclusive control" of one's "immediate reaches" airspace.

The jurisprudence above shows that the FAA's authority is broad, however, are there areas that would not be included in federal authority and would be within Idaho's state authority? The FAA Modernization and Reform Act of 2012, the resulting FAA regulations, and the *Taylor v. Huerta* and *Singer v. City of Newton* cases provide guidance on this question. Legal cases after *Causby* have not clarified the exact limits of vertical (airspace) property rights, but Robert Heverly's extensive research indicates that the holding in *Causby* would "allow states to step in and set navigable airspace for drones below that limit set by the FAA for other aircraft. . . [s]o long as the height set by a state meets the *Causby* overflight test…" (Heverly 2015). If a court rejects a state government's attempt to set the limits of useful airspace, an alternative would be for the states auction of airspace, where the federal government could auction particular geographic and exclusive assignments of airspace to the states. The American Bar Association's proposal was a step in the direction to harmonize airspace property laws. Daniel Thompson's research argues that "[h]armonizing federal, state, and local airspace property laws will be one of the most frustrating obstacles for this integrated drone infrastructure above highways," (Thompson 2020).

Current law recognizes two basic types of private airspace rights claims: state tort claims for traditional and aerial trespass, and federal constitutional claims for a government "taking" of property. When considering avigation easements, a primary question for states is how much (and in which directions?) of the airspace actually constitutes private property. In *Causby*, flights above a landowner's home and business had "taken" the landowner's property and were deemed a flight easement in that airspace. The federal government, therefore, was ordered to pay the landowner just compensation following the Constitution's Fifth Amendment power of eminent domain. The Court did not specify the "precise limits" or "immediate reaches" airspace, but said a taking occurs when flights over private land are "so low and so frequent as to be a direct and immediate interference with the enjoyment and use of the land." With *Causby* and subsequent Supreme Court rulings protecting "immediate reaches" airspace property rights, the courts recognized a balance of authority between the federal government and the states. In the aviation context, the courts held that the federal government has dominant authority to

regulate flight operations in navigable airspace to ensure aviation safety and efficient airspace management, and most but not all state and local aviation laws are preempted. However, the federal government's authority remains subject to landowners' constitutionally protected airspace, property rights, and the state's police powers to protect such rights (*Griggs v. Allegheny County*, 369 U.S. 84 (1962); *Penn Central Transp. Co. v. City of New York*, 438 U.S. (1978); *Loretto v. Teleprompter Manhattan CATV Corp.,* 458 U.S. 419 (1982). *City of Burbank v. Lockheed Air Terminal Inc.*, 411 U.S. 624 (1973)*; Montalvo v. Spirit Airlines*, 508 F. 3d 364 (9th Cir. 2007); *Braniff Airways v. Nebraska State Board of Equalization and Assessment*, 347 U.S. 590 (1954)*; Skysign International, Inc. v. City and County of Honolulu*, 276 F.3d 1109 (9th Cir. 2002).

State, Local, and Tribal Governments' Positions on Their Authority over Low-Altitude UAS Operations

State legislatures may need to pass legislation that differentiates a state government's powers to control low-altitude intrastate airspace from the FAA's right to control navigable interstate airspace. While the FAA maintains that it has the authority to create a comprehensive regulatory system for UAS operations at ground level as a part of ensuring aviation safety and the efficient use of airspace, a few state and local governments and federal district courts have questioned its authority to regulate UAS operations at these low altitudes, in particular those intrastate flights and low flights over private property. For example, state legal authorities have noted that since 1926, Congress has distinguished between "navigable airspace" -which the FAA may regulate for aircraft safety and efficient management and which as noted is defined as the airspace above safe altitudes of flight- and "airspace of the United States", an undefined broader term over which the U.S. Government has sovereignty. They also challenge the FAA's position that 49 U.S.C. § 40103(b)(2)(B), authorizing the agency to regulate "navigable airspace" by issuing "air traffic regulations" for "protecting individuals and property on the ground", actually provides authority to regulate activities below navigable airspace flight activity down to the ground.

Even if the FAA has such authority, many states, localities, and Tribal governments believe they are not preempted from regulating at least some parts of UAS operations in the same low-altitude airspace in which FAA has asserted preemptive authority. States and localities, citing their inherent police powers over public health, safety, and welfare reserved under the Constitution's Tenth Amendment, and tribes, citing their inherent sovereign powers, have sought to address UAS operations in a manner that protects property and privacy rights and provides for appropriate land use regulation, zoning, and law enforcement. As discussed, property rights are significant in the UAS context because they have been recognized in low-altitude airspace, both in the context of unconstitutional takings of property and in state-law aerial trespass claims. Privacy rights also are significant in the UAS context because of their virtually universal use of cameras and other sensors and their ability to fly at low altitudes and be piloted remotely. Several states and localities have sought to address UAS concerns using their general trespass, reckless endangerment, privacy, and other police power laws, and/or have enacted UAS-

specific laws to create "reasonable time, place, and manner" restrictions. These have included restrictions to ensure UAS do not intrude on personal privacy (one of the most common types of UAS-specific state laws), prohibitions on the use of UAS for certain types of activities, and restrictions or bans on UAS operations in certain locations or below certain altitudes.

If state legislatures do not provide guidelines for pilots and operators, the city and county governments are likely to continue passing ordinances until state governments establish a set framework. Several states and local jurisdictions assert that they have, or want to obtain, authority to use "counter" UAS measures to respond to reckless or criminal pilots that are flying either in an unsafe manner or where pilots are not permitted to fly aircraft. Although many states have enacted measures to address concerns raised by UAS operations, other states are seeking to encourage UAS operations within their borders, particularly for commercial purposes. There are considerations opposed to harmonization by state law such as Lauren Phillips' research showing that "[s]tates are increasingly restricting the power of local governments, and, in doing so, impeding innovation and experimentation" (Phillips 2017). Among other things, these states have passed resolutions highlighting the benefits of UAS to their citizens and to economic development, and have enacted laws preempting localities from impeding or restricting operations.

However, the regulatory uncertainty of different federal and state codes hurts innovation and investment in commercial drone use and impedes progress toward the federal goal of UAS integration.

Privacy Laws and UAS

Privacy rights, like property rights, have historically been governed by state law rather than federal law, under states' general police powers. As summarized below, some states and localities have sought to use their general privacy laws or common law causes of action to protect against UAS-related privacy harms, while others have enacted UAS-specific privacy laws.

Fourth Amendment concepts of when and where there are reasonable expectations of privacy from government intrusion are not directly applicable to intrusions by the private commercial sector nor recreational UAS operations. What, if any, additional legal protections can and should be enacted to address these privacy rights in Idaho, and whether those protections should come from the federal government or the states, is also subject to debate. Such protections may be constrained by First Amendment rights of UAS operators to gather or at least to report information, for example. Questions also have been raised about which types of UAS privacy interests the federal versus state governments have authority to address, and which level of government is better positioned to address concerns about these interests. Regarding privacy questions, many stakeholders believe UAS operations present novel privacy concerns, while others say it is simply a new technology raising similar concerns of human behavior as earlier technologies.

Following the history of jurisprudence thus far, individuals do not have an absolute right to exclude drones from the airspace above their property. As *Causby* and its subsequent cases make clear,

landowners do not have a property right in the airspace itself. The airspace is a public good that is managed by the federal government. It is the FAA, and not individual property owners, that decide where and when aircraft can fly. This centralized federal control means not only that property owners cannot unilaterally declare the airspace above their land a "No Drone Zone," but also that they cannot take matters into their own hands should they dislike that a drone is operating in that airspace. To that end, federal law unequivocally makes it a felony to shoot down an aircraft, including UAS, regardless of where it is operating. However, landowners do have a right in the use of the surface, and UAS flights can affect that right. Landowners are not powerless to stop aerial intrusions. While property owners do not own the airspace and cannot simply exclude aircraft, they do own the surface. With that ownership comes a protected right to use that property as the owner sees fit. While UAS operators have no ability to prevent a landowner from building on their property, *Causby* suggested that low-altitude UAS operations could disrupt the landowner's use of the property so as to permit legal relief (Baxenburg 2023 p. 26). As technology continues to evolve, so will the application of the legal paradigms.

There is no comprehensive federal law protecting the privacy of personal data collected by private actors (versus by the government), including data collected via UAS. (GAO 2019). Nor is there a single federal agency with statutory responsibility to regulate UAS privacy matters for the entire federal government. (GAO-12-981). The agency lacks any official authority to regulate UAS operations regarding privacy concerns. In issuing the Part 107 rules in 2016, the FAA explained that privacy concerns are beyond their scope, and are an "overreach," of its mission to ensure aviation safety. Congress did not require it to consider privacy issues in its 2012 FMRA mandate to integrate UAS into the national airspace system either (Federal Regulation 42064, 42190-92. June 28, 2016. Part 107 rules). Congress does not require regulation of UAS privacy in its 2016 or 2018 FAA Reauthorization Acts either (the next expected reauthorization is 2023). The FAA's rulemaking powers neither mandate nor permit it to create or enforce regulations that specifically protect privacy interests between private parties. The FAA did note in issuing Part 107, that our state and local governments may address UAS privacy concerns involving private parties using a state's police power authority.

As mentioned earlier, voluntary UAS privacy protections supported by both public and private sectors were developed in 2016 as the "Voluntary Best Practices for UAS Privacy, Transparency, and Accountability: Consensus, Stakeholder-Drafted Best Practices Created in the NTIA-Convened Multistakeholder Process" (UAS Voluntary Best Practices). The UAS Voluntary Best Practices, which apply to both commercial and recreational UAS, address the collection and protection of UAS-gathered personal data and were developed through the presidentially directed, multi-stakeholder engagement process convened over two years by the NTIA, known as the "Presidential Memorandum from President Barack Obama to Heads of Executive Departments and Agencies, Promoting Economic Competitiveness While Safeguarding Privacy, Civil Rights, and Civil Liberties in Domestic Use of Unmanned Aircraft Systems". With many exceptions, the UAS Voluntary Best Practices create measures to enhance privacy, for example, restricting the intentional collection of personal data where the UAS operator knows the potentially affected person(s) "has a reasonable expectation of privacy" as well as transparency and

accountability for example, ITD providing advance notice to potentially affected individuals when and where UAS operations will be flying and unintentionally collecting data that may include PII.

The Federal Trade Commission (FTC) does have certain authority to protect personal privacy related to UAS operations. Section 5(a)(1) of the Federal Trade Commission Act authorizes the FTC to protect consumers from "unfair or deceptive acts or practices in or affecting commerce," and section 375 of the 2018 FAA Reauthorization Act confirms that these prohibited acts or practices include failing to comply with privacy commitments made in connection with commercial UAS operations: "violation of a privacy policy by a person that uses a UAS for compensation or hire, or in furtherance of a business enterprise, in the national airspace system shall be an unfair and deceptive practice in violation of section 5(a) of the Federal Trade Commission Act…"

One type of general privacy law that some states and localities have employed to try to address UAS privacy concerns is a criminal "Peeping Tom" or "video voyeurism" statute. As of 2023, nearly all states have enacted some version of this type of law, but some reportedly have encountered challenges in using them to address UAS concerns because their existing laws' requirements do not always correspond to UAS's technical capabilities. Another type of general privacy law that might protect against surveillance by UAS, and that individuals might be able to use to obtain recourse for harm, are common law privacy torts. In intrusion upon seclusion cases, because the surveilled person must be in a setting where they have a "reasonable expectation of privacy," this tort would likely afford little protection to those surveilled during an ITD flight mission. In addition, in both intrusion upon seclusion and "public disclosure of private facts" cases, if the UAS operator is an ITD employee collecting legitimate data on traffic patterns or crash site details, this might limit an individual's privacy protection from a UAS flight in some cases. These types of court cases are highly fact dependent.

The main concerns with commercial or recreational UAS use have to do with public safety and privacy. Two approaches help, such as technology-neutral laws which prohibit criminal behavior itself rather than the method used to conduct it, and by imposing similar penalties on voyeurism or harassment whether accomplished in person, with a smartphone or UAS. These laws can be created locally and socialized to assure the public that its safety and privacy are legally protected, regardless of the constantly changing technological capabilities. These types of state and local laws require no consultation with the FAA. Secondly, technology-specific laws curtail or prohibit the use of remotely piloted aircraft in certain locales or for certain purposes. Examples include laws prohibiting the use of UAS over public monuments and buildings, places of worship, and schools. These laws are less flexible than their technology-neutral counterparts and may need to be changed as technological advances see an increasing reliance on UAS for private uses (Zickurh et al 2016).

In the opposite vein, there are UAS pilots who believe that they are being unfairly surveilled because of the mandatory remote identification requirements for aircraft and registration. Remote ID is the ability of a UAS in flight to provide identification and location information that can be received by other parties. The final rule was published in the Federal Register and effective date to April 21, 2021. All UAS pilots are required to register their aircraft and must operate it per the final rule on remote ID beginning

September 16, 2023. There are three ways UAS pilots can meet the identification requirements of the remote ID rule:

1) Operate a Standard Remote ID Drone that broadcasts identification and location information of the aircraft itself and the control station. A standard remote ID drone is produced with built-in remote ID broadcast capabilities.

2) Operate a UAS with a remote ID broadcast module giving the aircraft's identification, location, and take-off information. A broadcast module is a device that can be attached to the aircraft, or a feature (such as a software upgrade) integrated with the UAS. Pilots flying a drone with a remote ID broadcast module must be able to see their aircraft at all times during a flight.

3) Operate (without remote ID equipment) at FAA-recognized identification areas (FRIAs) sponsored by community-based organizations or schools. FRIAs are the only locations where uncrewed aircraft may operate without broadcasting remote ID message elements.

Remote ID was developed in part to help address privacy concerns from the general public, regarding suspicious cameras in the sky. Now that UAS operators are worried about their own privacy, clarification is needed for them. The only way to identify the pilot and the pilot's exact location is to have the remote identification app on one's phone, and the average person is not likely to have this. Plus, the app only gives the serial number from the FAA registration. Only law enforcement can contact the FAA, have a warrant or show cause, and give them the serial number in order to get the registered pilot's name and location.

UAS use and the accompanying data collection technologies do present general privacy concerns for ITD. The National Institute of Justice 2016 Report giving recommendations for UAS Programs across the country addresses the collection and use of data from aerial surveillance, which remains within the scope of ITD's authority, obligations, and mission. To the extent that ITD's UAS fly in support of program operations and overfly private residences, there is a minimal risk that a person's privacy might be unintentionally violated. However, the captured images do not generally include PII without further software manipulation, and the cameras deployed on ITD's UAS (or manned aircraft) do not have the capability to collect information regarding what occurs in the interior of a building, nor is that their purpose.

A second privacy concern, specific to UAS, is that they present a perceived risk to privacy because they are able to conduct surveillance undetected. However, ITD policies suggest public information outreach, physical signs at the data collection site, and notifications to the public that ITD is flying drones on a specific date(s). There is no hiding, quite the opposite, there is a concerted effort to announce UAS use coming and/or in progress and enhance the public understanding of UAS uses for safety, efficiency, and effectiveness. ITD UAS may only be used in support of an authorized mission, inspection or project investigation, the video or other data collected from ITD aircraft may only be accessed by authorized ITD personnel with an authorized need to know, and the ITD-held video or other data is controlled through chains of custody and stored in secure locations until it is destroyed.

The Privacy Act of 1974 specifies how the federal government should treat individuals and their information, and it mandates the responsibilities for federal agencies regarding the collection, use, dissemination, and maintenance of any personally identifiable information. Section 222(2) of the Homeland Security Act of 2002 states that the Chief Privacy Officer shall assure that information is handled in full compliance with the fair information practices as set out in the Privacy Act of 1974.

In response to this obligation, the Department of Homeland Security Privacy Office developed a set of Fair Information Practice Principles from the underlying concepts of the Privacy Act to encompass the full breadth and diversity of the information and interactions of their department. In the future, ITD may need to conduct privacy impact assessments on specific projects if for some reason there will be significant data collected that could include PII.

ITD should be transparent and provide notice to an area via signage regarding its collection, use, dissemination, and maintenance of visual data, including educating people as to how scrubbing is conducted. Outreach serves as notice to the public that information captured by ITD UAS is subject to governmental privacy laws, and the data saved is not associated with any individuals. ITD already does provide a level of transparency to the public about the current UAS programs. The video or images information collected are not high resolution, and one cannot usually clearly identify individuals and are not sufficiently precise to permit actual identification when it becomes a department record. Individuals do not have legal standing to restrict ITD's ability to collect information in the public space. ITD could specifically articulate its authority which permits the collection of data (list and include links to state statutes and rules) and communicate the corresponding project and purpose of the UAS-assisted information being collected.

Video, still images, and data collected during ITD's UAS operations are a part of increased safety, reduced costs, and improved accuracy, speed, and productivity. Flights are discussed, authorized, and recorded in the flight log. These data correspond with the project or program record file that they support, and their retention, sharing, and access are managed by ITD's ETS team and/or by the Idaho Office of Information Technology. Following a principle of data minimization, ITD is working on collecting and keeping only that data directly relevant and necessary for the department's mission. Extraneous video and images should be disposed of following Idaho's records retention schedules as approved by the Idaho State Historical Society's Archival policies and rules. For example, at the national level, the US Department of Homeland Security keeps digital recordings for approximately 30 days to five years. However, ITD may need to archive data for the entire lifetime of an asset, which in some cases could be 30 years or more.

ITD pilots can maintain the steps they are taking to protect live traffic video feeds, signals information, recorded video, and still pictures captured by its aircraft. The closed system with restricted access and approval process requiring clearance from system administrators ensures that only authorized users with a need to know have access to the data collected. ITD is accountable for providing training regarding privacy issues and chain of custody of data to all of its employees and contractors who use

UAS and could audit the actual use to demonstrate to the public its compliance with federal and state law and all applicable privacy protection requirements.

The US Department of Justice report mentioned above also points out that discussions about UAS and the right to privacy usually position how to best protect the rights of individuals from unwarranted intrusions by government agencies which are seeking to gather, maintain, use, and disclose imagery obtained through their official uses of UAS. In these discussions, it is important to remember that the U.S. Supreme Court, since 1967, has held that areas and activities already exposed to the public are not protected under the Fourth Amendment, as it is not reasonable to expect actions to be private when conducted in view of the public. With respect to aerial surveillance, the U.S. Supreme Court has repeatedly ruled that law enforcement is not required to obtain a search warrant, as individuals do not have a Fourth Amendment right to be free from warrantless aerial surveillance (*California v. Ciralo*, 476 U.S. 207, 215 (1986). "The Fourth Amendment simply does not require the police traveling in the public airways... to obtain a warrant in order to observe what is visible to the naked eye" (*Dow Chemical Co. v. United States*, 476 U.S. 227, 239 (1986) holding that the taking of aerial photographs of private property by government officials from navigable airspace is not a search under the Fourth Amendment).

Public safety agencies should regularly review and update state statutes, departmental policies and administrative rules that govern the use of new technologies and any potential privacy concerns. Working collaboratively with Idaho communities will maintain trust with residents. Privacy advocacy groups tend to believe that there is reason to be suspicious of governmental use of UAS technology, whether at the local, state, or federal level, and are afraid of excessive use of UAS technology and want stronger protections via statutes and regulations. Simultaneously, public agencies oppose unnecessary controls that inhibit their abilities to conduct their public missions safely and efficiently.

State Preemption, Registration, and Permitting of UAS

It might seem obvious, but a necessary start to states harmonizing their UAS planning includes simply agreeing on the definition of "aircraft". The definition of "unmanned aircraft" provided by the Federal Aviation Administration (9 14 C.F.R. § 107.3, 2020) and used in Arizona, California, Georgia, Kansas, Kentucky, Montana, New Jersey, North Carolina, North Dakota, Pennsylvania, South Dakota, Utah, Wisconsin, and West Virginia is: "an aircraft that is constructed or operated without the possibility of direct human intervention from within or on the aircraft, including every object that is on board or otherwise attached to the aircraft, or carried or operated during flight, regardless of weight. For the purposes of this act, this term is synonymous with the term 'drone.'" From there, the checkerboard begins.

The University of Mississippi's School of Law has a specific Center for Air and Space Law which produced a Journal of Drone Law & Policy in 2020, publishing one edition. This one edition produced a detailed survey of the states' and territories' statutes and policies, regulations, and conflicting jurisprudence thus far and giving us several of the following conclusions. Currently, twenty states have passed legislation that preempts municipal or county rules, regulations, codes, or ordinances that seek to regulate aspects

of the operation of UAS in their jurisdictions, including the registration requirements. Arizona, Connecticut, Delaware, Florida, Louisiana, Maryland, Michigan, New Jersey, Oregon, Pennsylvania, Rhode Island, and Virginia have all passed express preemption-with-no-exceptions provisions for uncrewed aircraft. Alaska has preempted its municipalities from passing ordinances permitting the release of images captured by UAS. Georgia has passed an express preemption provision that allows existing ordinances to stay in place, and for their municipalities to pass ordinances that reinforce FAA regulations and/or that regulate remotely piloted aircraft use on public property. Illinois has passed an express preemption statute that excludes the city of Chicago from the state requirements and allows the political subdivisions within Chicago's jurisdiction to implement their own measures regulating UAS. Texas has preempted political subdivisions from passing measures regulating uncrewed aircraft unless the measure is related to special events, public use of an uncrewed aircraft, or use of an uncrewed aircraft near public property. Utah preempted political subdivisions from passing measures regulating uncrewed aircraft unless the political subdivision is an airport operator.

Despite the directive from the FAA to consult with them before enacting a registration system, a number of states, counties, and municipalities have established registry-like systems that have yet to be disputed in courts. California, Louisiana, Minnesota, Nevada, North Carolina, Oregon, and West Virginia have enacted legislation that establishes a state registry or licensing system for uncrewed aircraft operators. Much like the registration data sets that states use for automobile license plates, UAS registration provides state authorities the ability to associate an operator with their specific aircraft. In California, a business or person planning to operate a UAS for pest control must follow requirements from the FAA as well as obtain a specific license from the state. In Louisiana, "[e]ach person operating an unmanned aerial system in the course of an agricultural commercial operation shall obtain a license from the [agriculture] department" and "[e]ach unmanned aerial system operated in the course of an agricultural commercial operation shall be registered with the [agriculture] department." (Louisiana Statutes Annual § 3:43. 2020). Licenses are issued after applicants submit a written application to the department and then pass an agricultural education and safety training course administered by the Louisiana Cooperative Extension Service or the Southern University Agricultural Research and Extension Center. In Minnesota, commercial operators are required to register and license their aircraft with the Minnesota DOT and to maintain UAS policy insurance with the requirements outlined in the statute. Nevada has codified that the Department of Public Safety shall create and maintain a registry of uncrewed aircraft operated by public agencies within the state of Nevada (Nevada Revised Statutes Annual § 493.118. 2020). In 2015, the North Carolina DOT created a permitting system for commercial use UAS. Recreational operators are not affected by the permitting requirements; however, any operator flying for commercial or governmental purposes must pass a knowledge test and register with the DOT. While this state statute is a permit and not a registry, it shows that field preemption is not as broad as some think, and express preemption might not apply to future UAS rates, routes, or services.

In Oregon, the Oregon Administrative Code directs the Oregon Department of Aviation to establish a registry of uncrewed aircraft systems operated by public bodies other than educational institutions, and violators can be fined up to $10,000. The implementation of this registry is highlighted in subsections

(2)(a) and (2)(b) which state "[a] public body, other than an educational institution, may not operate an unmanned aircraft system in the airspace over this state without registering the unmanned aircraft system with the Oregon Department of Aviation" (Oregon Revised Statutes Annual§ 837.360(2)(A)). In West Virginia, "[p]ersons who intend to operate an unmanned aircraft system shall register at the area superintendent's office prior to engaging or participating in the operation of any unmanned aircraft system and specify where the activity will take place." This registry is only in place for West Virginia UAS operators who wish to fly in the airspace of state parks, forests, and rail trails. The language of the statute gives West Virginia's state park superintendents broad discretion to "prohibit, issue directives, or implement time and place restrictions on unmanned aircraft system use" in their jurisdiction (West Virginia Code Annual § 20-5-2).

The FAA has been careful when communicating what categories of state and local laws would be preempted. The first two sections of the 2015 FAA Fact Sheet, "Why the Federal Framework" and "Regulating UAS Operations," expressly communicate that states do have latitude. Just as states are laboratories for innovation and regulations that sometimes guide federal choices, there is good reason to think that parks, cities, or counties within states can be tests for innovation that guide state governments; however, UAS planning affects the state in its entirety, thus the need for statewide harmonization. UAS regulation poses an issue of subsidiarity and local control within a state. Large urban areas may have the resources to address policy issues, but rural areas, though poorer, could be better equipped for different types of innovation. While there is a federal-state balance to be struck, states are demonstrating that they have the authority to regulate under their traditional police powers, and the patchwork effect can still be mitigated by states preempting local authorities. State governments may be the jurisdictions that are the best positioned to simultaneously protect residents and to create safe environments that will nurture the AAM industry.

The greatest concern that remains is the National Defense Authorization Act language that resulted from and overruled *Taylor*. (National Defense Authorization Act §143). Some cases using the Federal Aviation Act found no preemption because the legal question at issue was outside of the preempted field. The FAA needs to clarify what those boundaries are and whether or not the National Defense Authorization Act overruling *Taylor* and the FAA's subsequent registry does indeed preempt a state from mandating a state registration of UAS. The FAA must delineate which aspects of the operation of UAS are federally preempted. States do have specified powers in regulation, but a registry, unless narrowly tailored for a specific purpose other than just cataloging or identifying could be preempted in a court.

States may regulate due to real property interests generally falling under the recognized police powers of a state. However, states must retain flexibility when regulating emerging technologies that affect their own airspace. In addition to the Uniform Law Commission's efforts over the past several years to draft a model UAS aerial trespass law for all states to consider, the ULC's Uniform Tort Law Relating to Drones Act Drafting Committee has worked to prepare a template UAS privacy law. Ultimately, because of wide differences in the privacy interests that states protect and how they protect them, the Committee decided to draft a model law that simply affirmed that a state's existing privacy laws whatever they might be also apply to actions taken by a pilot using UAS. The model law thus would be

technology-neutral and avoid conflicting with existing state laws (https://instituteforlegalreform.com/wp-content/uploads/2022/01/1323_ILR_Drones_Report_V6_Pages_Digital.pdf).

Commercial Interests and Last Mile Delivery

Opening markets, reducing barriers, clarifying regulations, and injecting more certainty and predictability into the aeronautics marketplace are key catalysts for the innovation progress that drives Idaho's, the United States', and the global economies and markets. However, as the above chronology of jurisprudence shows, Idaho and most of the United States are far from that type of marketplace, and aeronautic interests are questioning past rulings and their appropriateness in today's world. UAS industry stakeholders have questioned whether the court's decisions in *Causby* regarding low-altitude airspace property rights are part of binding Supreme Court precedent, or, whether *Causby's* ruling was limited to property rights in land. There are legal stakeholders who believe *Causby's* "vague framework" of airspace property rights is ripe to be challenged and suggest these rights should be reconsidered to allow society to achieve the safety, social, and economic benefits of new technologies. UAS industry stakeholders also have taken the position that states are preempted from regulating or at least prohibiting UAS operations in low-altitude airspace, asserting that Congress intended such preemption for the federal government in order to streamline and ensure the safety and efficiency of the NAS.

Federal policymakers repeat that the FAA maintains the sole authority to regulate and manage airspace use for efficiency, air traffic control, overall safety, navigation facilities, and aircraft noise. Congress has repeatedly directed, and funded, the FAA to develop the necessary policies and plans for the use of navigable airspace and to assign the use of the airspace necessary to ensure the safety of aircraft and the efficient use of airspace. Congress has also directed the FAA to prescribe air traffic regulations on the flight of aircraft for navigating, protecting, and identifying aircraft, protecting individuals and property on the ground, using navigable airspace efficiently, and preventing collision of aircraft, between aircraft and land or water vehicles, and between aircraft and airborne objects. In Section 333 of the FAA Modernization and Reform Act of 2012 (Public Law No 112-95), Congress directed the Secretary of Transportation to determine whether UAS operations posing the least amount of public risk and no threat to national security could safely be operating in the National Airspace System and if so, to establish requirements for the safe operation of these systems.

UAS stakeholders argue that federal preemption is critical to fixing the dangerous confusion of differing state UAS laws that they believe stifle technological progress and innovation for remotely piloted aircraft and all of the vertiports and peripheral services needed for this industry. The FAA's directives governing its Airport Improvement Program (AIP) have long required airport sponsor-grantees to acquire "title" to all "real property interests" needed for the construction and operation of the grant-assisted airport. FAA explicitly states that these property interests include avigation easements which it defines as "a conveyance of airspace over another property for use by the airport." As mentioned above, *Griggs* found that air easements were constitutionally protected private property and a taking

must be reimbursed (*Griggs,* 369 U.S. at 90). How will this apply to takeoffs and landings from vertiports?

In 2013, the US DOT and the FAA released the first annual "Integration of Civil UAS in the National Airspace System Roadmap" outlining efforts needed to safely integrate remotely piloted aircraft. The Roadmap addressed current and future policies, regulations, technologies, and procedures that will be required as demand moves from today's limited accommodation of UAS operations to the extensive commercial integration into the NextGen aviation system. The US DOT also released a Comprehensive Plan that supplements the Roadmap. This Comprehensive Plan details the multi-agency approach necessary to harmonize standards, policies, procedures, and regulatory requirements for safe and timely integration. In 2015, and in response to the 2012 mandate from Congress, the FAA proposed a framework of regulations allowing routine commercial use of specific small UAS. Under the Notice of Proposed Rulemaking, the FAA proposed a set of regulations with permissible hours of flight, line-of-sight observation, allowed altitudes, operator certification, optional use of visual observers, aircraft registration and identification marking, and other operational limits. This initial framework is referred to as a "Section 333 exemption request" because commercial operators sought specific exemption from these Federal Aviation Regulations for items such as the aircraft airworthiness certification, which was traditionally required of manned aircraft. In 2016, the FAA's subsequent permanent rulemaking, Federal Aviation Regulations Part 107, became effective. This set of regulations outlined the requirements for commercial operations of UAS in the National Airspace System. Part 107 mostly replaced the previous Part 333 exemption process with a set of standardized pilot certification requirements and operational restrictions, but it also kept an opportunity for a small portion of those operational restrictions to be waived following an FAA review. The FAA maintains its legal authority for the federal regulatory development for UAS and has the sole control over and access to airspace down to the "blades of grass".

As the demand for commercial UAS use below 400 feet increases, the FAA, NASA, and industry partners are developing a UAS traffic management (UTM) infrastructure to accommodate these operations safely and efficiently. The UAS Traffic Management Pilot Program began on March 31, 2020, and has identified "services, roles and responsibilities, information architecture, data exchange protocols, software functions, and performance requirements for managing low-altitude drone operations without intervention by air traffic control facilities." UTM utilizes the industry's ability to supply services under the FAA's regulatory authority where these capabilities do not currently exist. It is a community-based, cooperative traffic management system, where the operators and entities providing operation support services are responsible for the coordination, execution, and management of operations, with rules of the skies established by the FAA (https://cms.faa.gov/newsroom/uas-traffic-management-pilot-program).

The objectives of the program include testing Remote Identification technologies and operations with increasing volumes and density to test safe Beyond Visual Line of Sight UAS operations. Remote identification systems are becoming a viable security asset for governments of all sizes, providing a means to identify and track UAS near critical infrastructure or in restricted airspace. In May 2023, El Paso, Texas implemented a fully networked Remote ID system to detect unmanned aerial vehicles flying

within and beyond 500 square miles of the El Paso International Airport's airspace. It will provide real-time information about UAS flights to prevent unauthorized operations and reduce the risk of accidents; allow for the expansion of commercial operations, including package delivery, infrastructure inspection, and emergency response services; and adhere to strict privacy guidelines that protect the personal information of the operators. All of these expectations need access to the radiofrequency spectrum.

In the U.S., the Federal Communications Commission (FCC) grants the use of spectrum. More spectrum is needed for UAS to use command and control technologies at higher altitudes, detect-and-avoid systems, transmit payload data, and strengthen the safe operations of UAS in the NAS. As the FCC issued proposed rulemakings in 2023 on the use of specific bands, such as 5Ghz and 6Ghz, it needs to consider future UAS operations and rely on industry-conducted research, testing, and analysis of UAS spectrum use taking place (FCC 2023).

In February 2023, U.S. Senators introduced the "Increasing Competitiveness for American Drones Act of 2023" comprehensive legislation streamlining the approvals process for BVLOS flights and clearing the way for UAS to be used for commercial transport of goods across the country. Specifically, the bill requires the FAA to establish a "risk methodology," which will be used to determine the level(s) of regulatory scrutiny for different flights including:

- Operators of small UAS under 55lbs simply have to declare that they conducted a risk assessment and meet the standard, subject to audit compliance by the FAA.
- Operators of UAS between 55lbs and 1320lbs must submit materials based on the risk assessment to the FAA to seek a "Special Airworthiness Certificate." UAS in this category may be limited to operating no more than 400 feet above ground level.
- Operators of UAS over 1320lbs must undergo the full "type certification" process—the standard approval process for crewed aircraft.

In addition, the "Increasing Competitiveness for American Drones Act" would create the position of "Associate Administrator of UAS Integration" as well as a UAS Certification Unit that would have the sole authority to issue all rulemakings, certifications, and waivers. This new organizational structure would create a central rulemaking body for UAS, allowing for a more uniform process.

Integration and interoperability in multi-modal transportation facilitate seamless transitions between air, land, and water and among jurisdictions, yet with many challenges, especially given the current governance compartmentalization across the modes and jurisdictions. Troy Rule argues that it is possible to respect existing property rights while also encouraging the commercial drone industry. Digital airspace-sharing platforms could open up much of the nation's non-navigable airspace by enabling landowners to license their airspace to drone users for pay. These platforms would align the interests of landowners and drone companies, maintain long-standing property rights, and allow landowners to generate income by licensing their above-property airspace for drones (Rule 2022.)

How will current property rights and privacy rights affect commercial package delivery planning?

One of the most difficult and expensive aspects of the supply chain is the "last mile" and home delivery. This commercial interest involves larger UAS with more robust capabilities. Uncrewed aircraft weighing 55 pounds, or more are considered "large UAS". Title 14 CFR Part 107 does not apply to large UAS. Large UAS are subject to the requirements of Title 14 CFR Part 91, as well as other operating requirements that may apply depending on the specific details of its operation. The number of large UAS flights in the NAS is increasing, and as this industry continues to mature, so will the commercial demand in Idaho. The FAA's existing UAS integration focuses on repeatable, scalable operations in order of operational risk and complexity, not by the size of UAS. This regulatory approach uses performance-based standards to ensure that safety objectives help innovation and technology adoption while maintaining a consistent level of safety. The desire to accelerate the integration of large UAS for last-mile delivery requires different regulations and updates to existing regulations. The lowest-risk operations are those conducted within visual line-of-sight (VLOS). Many commercial VLOS operations using small UAS have been integrated into the NAS as a result of the FAA's recent rulemaking. Such rulemakings include the promulgation of 14 CFR part 107, and the recent expansion of part 107 under the Operations of Small Unmanned Aircraft Systems Over People rule, which permits small UAS operations at night or over people under certain conditions, as well as the Remote Identification of Unmanned Aircraft Rule, which paves the way for future operations beyond visual line-of-sight (BVLOS). The FAA considers BVLOS operations to be higher risk than VLOS operations and will need to adjust existing regulations before BVLOS operations can occur routinely (/https://cms.faa.gov/sites/faa.gov/files/2022-08/PL_116-6_2019_Appropriations_Large_UAS.pdf).

Autonomous last-mile deliveries are part of the e-commerce boom that the US is experiencing, though this use of UAS is still challenging because of unclear FAA regulations, public perception having strong suspicion of UAS, and the evolving technology itself. Bringing down the cost of deliveries while speeding up and improving customer service are the goals for business planning. Chris Cunnane and Steve Banker give current examples in a 2022 Forbes Magazine article (https://www.forbes.com/sites/stevebanker/2022/08/16/the-race-for-last-mile-drones/?sh=149af9b5546f) including:

- Wing, a subsidiary of Alphabet, the holding company for Google and Waymo, has developed a fleet of last mile UAS for small package delivery in the US, Australia, and Finland, ranging from small pill bottles to items weighing as much as 7 pounds. Wing has made hundreds of thousands of deliveries in Dallas suburbs, Virginia, Australia, and Finland.

- In Amazon's case, Prime Service members living in Lockeford, California were invited to opt in to free UAS delivery. Once a customer enrolls, an Amazon employee visits to make sure their yard has enough clear space to accept drone deliveries.

- The UPS Flight Forward is a wholly owned subsidiary of UPS and focused on last-mile drones. Launched in 2019, it became the first company to receive the FAA's full Part 135 Standard Certification, allowing the company to operate an unlimited remote-controlled aircraft delivery network in the United States. In June 2020, UPS partnered with CVS to use drones to deliver prescriptions to residents of The Villages in Florida, one of the country's biggest retirement communities. The deliveries came from a CVS store about a half mile away and were delivered via Flight Forward. The drones dropped the prescriptions at a central location, where a Flight Forward employee delivered them by golf cart to homes.

- Matternet, founded in 2011, offers an end-to-end UAS delivery solution around the world that uses its proprietary M2 Drone, Cloud Platform, and Station. The company has partnered with UPS to use its last-mile drones for the delivery of medicines and blood from Wake Forest Baptist Health. Matternet goes beyond last-mile delivery as its proprietary software platform receives requests from customers, creates delivery routes, and monitors, commands, and controls all operating assets of the company. In November 2019, a Matternet M2 drone completed the first commercial medical prescription drone delivery in the US under an FAA-approved program. The prescriptions were lowered to their destinations via a cable while the aircraft hovered about 20 feet above each delivery point.

- Flytrex customers download the Flytrex app and register their front and back yard locations. They can place orders from a partner network of restaurants and the aircraft are able to fly five miles roundtrip, reaching the destination in about five to ten minutes. Unilever's partnership with Flytrex and The Ice Cream Shop drone deliveries include all of Flytrex's US locations. Drone orders from The Ice Cream Shop are delivered to the front or back yards of local residents with a promised flight time of fewer than three minutes and lowered safely by wire into their yards.

- Zipline focuses on deliveries in the health sector. The San Francisco-based company began using delivery UAS in Rwanda, for moving medical supplies to health clinics, then later partnered with Novant Health to deliver personal protective equipment and medical equipment in North Carolina. Zipline's aircraft make 32-mile flights on two routes between Novant Health's emergency drone fulfillment center in Kannapolis to the company's medical center in Huntersville, NC to help front-line workers. Zipline also collaborates with Cardinal Health in North Carolina for air delivery of pharmaceutical products and medical supplies. Zipline and Magellan Rx Management, a Phoenix-based national pharmacy benefits manager, deliver prescription medications directly to patients at home via UAS.

For the members of the National League of Cities, the main concerns over commercial UAS use have to do with property and privacy rights, legal liability, public safety, visual and noise pollution, and disturbing plant and animal life. While commercial usage may present new economic opportunities for cities, local leaders should begin to think about how and when they want to see widespread commercial UAS use. Zoning-specific laws can use zoning to restrict and direct the commercial use of drones. An example may be allowing commercial UAS flights in a residential zone only between restricted hours of the day. They could require additional or commercial permits and insurance. These types of laws require consultation with the FAA, as they are complementary to existing FAA requirements.

City managers understand that their local airspace will become more crowded, and more technologically automated. UAS of all sizes will provide emergency medical response, commercial package delivery, and private security services to households. While the FAA is expected to set national standards for all entities operating in navigable airspace, local governments will likely still be responsible for the bulk of enforcement. Cities have a significant role to play in developing their own regulations. The FAA's Fact Sheet for local and state regulation of drones is a helpful resource in determining how best to craft legislation. Ultimately, local governments should be aware that the terrain in this arena is always shifting, and that federal policy surrounding drones is also likely to develop. To best engage and influence the development of UAS-related statutes and policies, cities should consistently coordinate with state and federal policymakers. Local leaders should stay updated on UAS and airspace traffic management technological developments and also set clear expectations regarding the approved commercial usages and limitations in their own communities.

Civil Rights and UAS Best Practices

Nationwide, UAS programs are encouraged to incorporate principles of transparency and accountability and to conduct threshold reviews of potential privacy, civil rights, and civil liberties concerns. Privacy assessments are beneficial in evaluating ITD's compliance with applicable legal, regulatory, and policy requirements. The US Department of Homeland Security suggests that best practices for UAS leave the decision as to how often such an assessment is appropriate to the agencies to make based on their own needs, expertise, and the facts and circumstances involved. Any privacy assessment should identify potential risks and the steps needed to mitigate those potential risks.

Various agencies conduct privacy threshold reviews before a project flight to determine whether any PII could inadvertently be collected, and how to prevent it or protect it, once gathered. Knowing the laws to decide if any public notice is required for UAS flights and data collection is an easy preventive measure. Requests for UAS data from commercial entities, civil litigants, or Freedom of Information Act requesters should be reviewed by ITD's legal counsel to determine if data sharing is appropriate and permissible under applicable federal and Idaho laws or regulations. DHS suggests a detailed and streamlined redress process is necessary for permitting challenges to the alleged inappropriate capture of PII. ITD staff should ensure that adequate procedures are in place to receive, investigate, and address privacy, civil rights, and civil liberties complaints, with information on how an individual can request redress being readily available to the public with easy-to-follow instructions. ITD should comply with Idaho's approved records retention schedule that systematically eliminates stored data after they are no longer legally required or operationally useful, determine whether there is a need for additional data sharing agreements, and establish appropriate record management policies before sharing data with other agencies with authenticated chain-of-custody that preserves the data integrity.

ITD personnel should receive regularly updated training regarding privacy and civil liberties policies. Individuals with access to stored data should receive training designed for the specific software and hardware employed by the UAS Program, and that personnel responsible for handling UAS support

requests from other agencies should receive additional training on the agency's standard operating procedures for handling such requests. Staff should be reminded not to use any UAS-acquired data for personal use. ITD personnel and contractors should comply with UAS program training requirements, rules of behavior, and procedures for reporting suspected cases of misuse or abuse of UAS technologies.

Enforcement

Who has the authority and the capabilities to enforce the UAS statutes, regulations, and rules? If the violation is a criminal act using UAS as the tool to commit the crime, the crime is the focus of the incident, and law enforcement will respond to and enforce that law, regardless of the tool used. If the violation is a violation of FAA regulations, then the FAA should be notified, and they have the authority to enforce their regulations. UAS operator identification and the enforcement of restricted airspace ordinances are identified as the most critical existing problems in the regulation of operations. Between the promulgation of 14 CFR part 107 in August 2016, and the FAA's 2020 Roadmap report, it sought civil penalties in 42 cases - 21 cases involving controlled airspace violations (Class B, Class C, etc.), seven cases involving prohibited or restricted airspace violations, and eight cases involving notices to airman violations (https://www.tamucc.edu/lone-star-uas/assets/documents/2019-uas-civil-integration-roadmap-third-edition.pdf). In 2016, Congress increased the civil penalty for anyone who recklessly interferes with wildfire suppression, law enforcement, or emergency response efforts. The FAA continues to work with law enforcement partners on identifying pilots who violate the law with UAS. Local authorities have various options in response to persons operating UAS in an unsafe manner in their jurisdictions. Localities can prohibit UAS activities in and around public gatherings. The FAA strongly recommends proactive local public communication, education, and outreach. There is a wide range of resources available on the FAA.gov/UAS website to support the use of UAS and to response to unauthorized activity. Currently, local law enforcement apply their existing authorities to interview and detain pilots who conduct prohibited UAS operations. The Law Enforcement Assistance Program, run by FAA, takes regulatory enforcement actions and, as appropriate, provides aviation-related support to law enforcement agencies seeking criminal prosecution or in some cases those conducting airborne drug interdiction.

While the FAA has developed resources for law enforcement and communicated the pivotal role local law enforcement can play, it has not necessarily communicated this information directly to its law enforcement partners in the states. Law enforcement offices are likely to ask if a crime has been committed with the UAS. If not, then enforcement of FAA regulations is not in their scope of responsibility. Without a clear approach to collaborating with the thousands of state and local law enforcement agencies across the country, the FAA does not have any assurance that these agencies have the knowledge they need to help identify and respond to unsafe UAS operations, or even know about the state-granted authority to get involved. Subsequently, the Government Accountability Office has recommended that the FAA Administrator should develop a plan to more effectively communicate key information to local law enforcement agencies regarding their expected role in small UAS safety oversight. Going forward, the FAA plans to provide UAS information to the law enforcement community

via each state's Fusion Center. The Fusion Centers are state-owned and operated centers that serve as focal points for receiving, analyzing, gathering and sharing of threat-related information among state, local, Tribal and territorial, federal and private sector partners.

Are additional laws needed, or just the enforcement of existing laws? Who has enforcement authority for the illegal use of UAS and the photos and data acquired during an illegal flight? Is it as simple as applying existing trespass, privacy, and motor vehicle laws to UAS? Some law enforcement officers think so. While the US government has a federal architecture for airspace regulation, the states demonstrate a variety of political and institutional objectives, implementation methods, and models for the enforcement of the policy. For example, trespass questions and the separation of land use issues (take-off from ground or buildings) from air space use issues are unclear in Idaho law and regulations. Idaho's university campuses have claimed they control UAS flights on their campuses because they control the copyright on the UAS filming permits of their campuses. The FAA and ITD may regulate the airspace and some land zoning use, but the University of Idaho has its own copyright on the use of aerial photos and film of its entire campus. Whatever the laws and regulations are, consistent outreach to law enforcement at all jurisdictions is necessary by ITD Aeronautics and possibly the Idaho Attorney General's office. Safety and nuisance calls generally go first to the local police or the Sheriff's office. Public safety agencies are in the best position to educate, deter, detect, and investigate unauthorized or unsafe UAS operations if those operations are part of criminal conduct.

For practical and legal reasons, state and city authorities will eventually play increasingly significant roles in determining UAS flight corridors, as well as in creating the time, place, and manner restrictions, such as time-of-day rules and noise maximums. To jump-start this new industry and bring remotely piloted services to Idaho residents, the state and local leaders should continue coordinating with the FAA to build the ground-based infrastructure for those airspace skyways, which operators will use for parcel delivery, inspections, search and rescue, and other public safety, multi-modal transportation, and commercial services. By designating skyways above existing public roads, regulators can avoid nuisance, trespass, and government takings costs and lawsuits from landowners. Leasing the aerial corridors above public roads would allow state and local authorities to manage low-altitude skyways for safe and efficient services. Exercising this power would also allow many authorities to receive passive income through the leasing or auction of a currently unused public resource (Skorup 2022). This conveyance can be a transfer of a property right (airspace) for a limited amount of time for use.

For purposes of transferring highway-related airspace, defining the area to be conveyed needs to be precise, however, there are currently no technologies to accurately survey airspace and mark the specific boundaries. Harmonizing routes above inter-state highways, state highways, county and independent districts highways, city streets, etc., will require significant collaboration and cooperation. No matter how airspace is described in a conveyance, maintaining the boundaries set in that conveyance will prove to be complex. Developing technologies will assist autonomous UAS to navigate these routes. Once skyway airspace has been identified, the next issue is determining who may lease this airspace. Interstates, state highways, and municipal roads are each leased by their respective right-of-way interest holders. As the Federal Aid Highway Act (1958) stands today, agreements between a

state and the Secretary of Transportation may authorize states to "permit the use of" the airspace above highways by "other commercial establishment[s]," so long as such use does not "impair the full use and safety of the highway," or "interfere...with the free flow of traffic" (23 U.S.C. § 111(a) (2012) and Thompson 2020 p. 19). Falling packages and malfunctioning UAS would interfere with the free and safe flow of traffic; however, traditional delivery methods already pose certain driving safety risks directly on the roads. UAS air travel avoids the cost of constructing and maintaining physical roads and bridges. UAS package delivery takes trucks off the roads making them safer for drivers and decreasing the carbon footprint.

States that do statutorily address highway airspace typically allow that airspace to be leased for up to ninety-nine years such as California, Minnesota, and Nebraska. Georgia authorizes its Department of Transportation to lease air rights above limited-access highways "for development as commercial enterprises or activities" (Georgia Code Annual § 32-6-117).

The state of California Streets and Highway Code § 104.12 Section 104.12 details the leasing of areas above or below state highways:

(a) "The department may lease to public agencies or private entities for any term not to exceed 99 years the use of areas above or below state highways, subject to any reservations, restrictions, and conditions that it deems necessary to ensure adequate protection to the safety and the adequacy of highway facilities and to abutting or adjacent land uses. Authorized emergency vehicles, as defined in Section 165 of the Vehicle Code, which are on active duty and are not merely being stored, shall be given preference in the use of these areas, and no payment of consideration shall be required for this use of the areas by these vehicles. Prior to entering into any lease, the department shall determine that the proposed use is not in conflict with the zoning regulations of the local government concerned. The leases shall be made in accordance with procedures to be prescribed by the commission, except that, in the case of leases with private entities, the leases shall only be made after competitive bidding unless the commission finds, by unanimous vote, that in certain cases competitive bidding would not be in the best interests of the state. The possibilities of entering into the leases, and the consequent benefits to be derived therefrom, may be considered by the department in designing and constructing the highways.

Revenues from the leases shall be deposited in the State Highway Account. If the leased property was provided to the department for state highway purposes through donation or at less than fair market value, the lease revenues shall be shared with the donor or seller if so provided by contract when the property was acquired. If the donor or seller was a local agency that no longer exists at the time the department enters into the lease, the local agency's share of lease revenues shall be paid to the county or counties within which the local agency was situated.

(b) Notwithstanding subdivision (a), in any case where sufficient land or airspace exists within the right-of-way of any highway, constructed in whole or in part with federal-aid highway funds, to accommodate needed passenger, commuter, or high-speed rail, magnetic levitation systems, and highway and nonhighway public mass transit facilities, the department may make the land or airspace available, with

or without charge, to a public entity for those purposes, subject to any reservations, restrictions, or conditions that it determines necessary to ensure adequate protection to the safety and adequacy of highway facilities and to abutting or adjacent land uses.

(c) The department shall consider the future lease potential of areas above or below state highway projects when planning new state highway projects. This consideration shall be accomplished by intradepartmental consultation between offices concerned with project development and airspace lease development (California Statutes and Highway Code § 104.12 2001).

Minnesota: "The commissioner of transportation may lease or otherwise permit the use of the airspace above and subsurface area below the surface of the right-of-way of any trunk highway, including the surface of the right-of-way above and below the airspace or subsurface areas, where the land is owned in fee by the state for trunk highway purposes when the use will not impair or interfere with the use and safety of the highway. The lease, permit, or other agreement may contain such restrictive clauses as the commissioner deems necessary in the interest of the safety and convenience of public travel and other highway purposes. No lease, permit, or other agreement shall be for a period in excess of 99 years. Vehicular access to such airspace, subsurface, or surface areas shall not be allowed directly from the highway where such access would violate the provisions of United States Code, title 23, or would interfere in any way with the free flow of traffic on the highway. Any lease, permit, or other agreement shall have the approval of the appropriate federal agency when required" (Minnesota Statutes §161.433).

Nebraska: "(1) Each city of the metropolitan class shall have the power to lease, upon such terms as the city deems appropriate for a term not to exceed ninety-nine years, air space above any street, alley, major traffic street, connecting link, controlled-access facility, main thoroughfare, boulevard, or other property owned by such city, to one or more of the owners of the fee title adjoining such air space on either or both sides of such street, alley, major traffic street, connecting link, controlled-access facility, main thoroughfare, boulevard, or other city property, but only if the air space to be so leased is not needed for and does not materially interfere with the use of such street, alley, major traffic street, connecting link, controlled-access facility, main thoroughfare, boulevard, or other city property.

(2) All leases of such air space shall provide (a) the minimum clearances to be maintained at various points over the street, alley, major traffic street, connecting link, controlled-access facility, main thoroughfare, boulevard, or other city property, (b) the area of the air space to be leased, (c) the location of supports, columns, pillars, foundations or other similar or supporting structures within or on such street, alley, major traffic street, connecting link, controlled-access facility, main thoroughfare, boulevard, or other city property, and (d) that such supporting structures shall be so located as not to materially interfere with the use of the street, alley, major traffic street, connecting link, controlled-access facility, main thoroughfare, boulevard, or other city property. Such leases may contain such other terms and conditions as shall be deemed appropriate by the city.

(3) In determining rental under any such lease, the city may take into account the public purpose or use, if any, to be served by the lessee." (Nebraska Revised Statutes § 14-1730)

Nationally, without a uniform law designed to facilitate skyway leases, advanced air mobility remains a patchwork of airspace leasing statutes.

3. Idaho UAS Users Speak

Purpose

Conducting surveying and interviewing a sampling of public and private entities in Idaho that are using or interested in using UAS is important in order to learn about their successes, needs, and concerns relative to their UAS experiences in Idaho. Part III of this Final Report demonstrates that Idaho's UAS users, whether recreational, commercial/private sector, or public agency pilots are all asking for increased coordination among users, for ongoing outreach and education, networking and learning from others, and opportunities to stay up to date regarding federal and state UAS law, regulations and rules. Interviewing and surveying UAS users in Idaho's private sector utilities, mining, forestry, agriculture, construction, real estate, and public sector academics, transportation, fire-fighting, law enforcement, disaster resilience and emergency management, parks and recreation, invasive weed control and state forestry and lands have given the suggestions and attitudes summarized below.

Idaho's Public and Private Sector Stakeholders Need Similar Help

The Idaho Office of Emergency Management's top threats are from wildfires and flooding, and both are the types of disaster management that need UAS technology for a comprehensive response and recovery. Similarly, for emergencies, the Idaho State Police want advanced UAS coordination and information sharing among public entities, which are critical components to granting clearance and to keeping proper communications channels open. Law enforcement say they spend much of their time educating others about the regulations and rules of flying UAS. The Idaho Falls Police Department is regularly asked to give tutorials and trainings about UAS procedures. The Idaho State Fusion Center receives many "unrealistic requests" for situational awareness flights due to people not understanding what UAS can and cannot do. They would like all agencies to have the minimum understanding of the UAS capabilities and especially what their own departments already have available. Many interviewees agreed that any public agency or entity flying UAS needs to have a person with the designated responsibility to stay up to date on federal, tribal, state, and local regulations and ordinances. All of these necessities take dedicated professional time allotted to training, certification, and constant reading by specific employees. Interviewees suggested that agencies should create standard operating procedures for handling requests during both emergency and non-emergency circumstances.

Several rural fire departments (Post Falls, Rupert, Eagle, Grangeville) are interested in starting their own UAS programs but do not know how to get started. It seems overwhelming to them because they think they need to have someone who is already a specialist and experienced UAS pilot. Two have purchased UAS equipment and those devices are still in the boxes. Several expert recreationalists and private sector UAS firms asked how they can be incorporated into emergency response without negatively impacting the safety of the professional first responders. They would be happy to be a part of a team of volunteer emergency responders but do not know where or with whom to engage in order to offer their

services. Participants asked, “Are Idaho public-private partnerships available to collaborate and outsource when necessary? Are there template agreements that can be used for those groups that wish to start a new partnership?”

The agricultural sector in Idaho is using UAS over large and small tracts of land, surveying fields, signs of drought or over watering, signs of crop or forest damage, needed additional nutrients, and with seeders and pesticide sprayers attached to UAS. Cattle and sheep ranchers use UAS for their herd counts and to find lost grazing animals. Private sector discussions revealed that generally, expensive equipment or programs are not as important as how an aircraft is being flown and how the data is being captured. In general, in Idaho, these agricultural users were not as concerned with trespass or privacy questions because they are most likely flying over their own private property. Pilots flying for the JR Simplot Company, T-O Engineers, and Great Basin Aerial though, are concerned about flying over state highways and interstate highways for their projects. They asked, “What exactly are the rules? When and where do they apply? Who is enforcing them?”

Rail companies doing business in Idaho are using UAS to inspect structures, railcars, lines, and land for burglary, derailments, accidents, trespass, and facility audits among other uses which often do include using UAS for human safety. Utility companies in Idaho also use video and photos from UAS flights to improve human safety but are inundated with data collection and its assessment. Idaho Power, for example, conducts tower, transmission lines, dams, and structural inspections with UAS and it hopes to use artificial intelligence and machine learning to help them detect anomalies from the massive amounts of data they gather. The UAS increases safety and saves time during physical inspections. Utilities want to and need to know how emergency incident command works and should know who their local emergency managers are and their contact numbers if they want to ask permission to enter a site to fly their UAS to assess damage during an emergency.

Idaho lags behind most other states in aeronautics workforce development, and current UAS higher education professors, instructors, and students surveyed want more consistent engagement between ITD and Idaho’s colleges and universities for increased collaboration. They also want increased engagement with Idaho’s private sector using UAS to offer internships or collaborative projects on which higher education students can gain field experience. Idaho State University, the University of Idaho, Boise State University, and the College of Western Idaho all offer UAS courses and training for an in-state workforce, and believe they are underutilized. Those professors and their students are interested in Idaho’s public agencies offering specific internships to Idaho UAS students, and or creating MOUs for specific projects for which an Idaho public entity needs UAS work. Creating talent pipelines of UAS professionals from Idaho’s higher education institutions to Idaho’s public agencies is essential to keeping this workforce in our state.

Discussions with current UAS pilots in Idaho revealed that every respondent would like to have a robust updated UAS webpage on ITD’s Aeronautics website with links to all sorts of pertinent information. They would like to have templates for starting a UAS program, model operations manuals and SOPs, template checklists before flying, and the types of documents needed in order to not have to “reinvent wheels”

for creating and administering a UAS program. They want increased outreach and updates, possibly a quarterly digital newsletter with links to new regulations, available trainings, webinars, upcoming demonstrations, and new apps. The web page could even include Idaho-specific job listings for UAS and information about Idaho higher education programs and short workshops available.

Respondents from state agencies want to collaborate on some sort of inter-agency agreement to share training and equipment and possibly to contract out employees at agreed-upon rates among the agencies. For example, Boise Fire Department has a specific ongoing agreement with the Idaho Department of Lands to exchange resources if needed at a contracted amount of payment for use. Many respondents believe their UAS are under-utilized in their agency or their business, with aircraft "sitting on the shelves". They say it would be beneficial to have a template memorandum of understanding or a similar written agreement that identifies each agency's role and responsibilities in fulfilling a request. This agreement may include identifying which agency will exercise ownership, retention, and dissemination rights over any collected data.

Interviewees also asked for a significant increase in availability and access to the FAA representative for Idaho. They would like to engage with ITD and the FAA for consistent updates to legislation, rules, developing technology, and research. They are requesting that information be curated and prepared for them. All survey and discussion participants responded that data exchange and sharing among agencies is desirable, but they do proceed with much caution due to not knowing exactly the rules and a lack of a standard protocol across agencies. A "one-stop shop" website with federal laws and requirements, Idaho state UAS law, and a list of any local jurisdictions with specific UAS ordinances would be "ideal".

Informal conversations with elected Idaho legislators serving on the House Transportation and Defense Committee (17 committee members) or the Senate Transportation Committee (9 committee members) during the 2023 legislative session demonstrate a significant lack of information and /or understanding of the current and future technological capabilities and economic opportunities of UAS and airspace development. Several of the legislators interviewed began their comments by referring to "shooting those things right out of the sky" or something very similar. Security was also a consideration from senior legislators who had witnessed a counter-drone demonstration from Black Sage Technologies in Boise at the Capitol Building. They were worried especially about highly sensitive facilities as well as an increased risk of terrorism from autonomous air vehicles. Not one believed Idaho's general public is currently excited or even positive about the economic opportunities of "advanced air mobility", and only a handful are familiar with that phrase and to what it refers. All of those interviewed did agree that it would be extremely valuable for them to attend demonstrations when ITD employees are flying a project and to witness for themselves exactly what the UAS can and cannot do, and the increased safety, productivity, accuracy, efficiency, and reduced costs. Flying taxis, home delivery of medicines, and vertiport integration into Idaho's airspace systems all received negative feedback as too far-fetched. Because Idaho's elected legislators all have a short two-year term, and there is regularly at least 20% turnover with newly elected members, ITD will be wise to consistently engage and invite legislators to field demonstrations to witness for themselves the positives of the technology. Educating and updating legislative committees during hearings and also during the session interim is highly likely an ongoing

necessary task. Engaging with statewide, or various, Idaho UAS user groups to help reinforce the positive messages to elected officials and decision-makers will be useful and mutually beneficial, as well as enhance the Department's ability to fulfill its missions. A thorough public relations plan, including elements such as community outreach and education, and a method for addressing privacy and trespass concerns needs to include the Idaho state legislators.

The Idaho Public Safety UAS Council members' survey includes law enforcement, fire protection, search and rescue, and other first responders from city and county agencies. In this group of stakeholders participating in this UAS Council, 75% have an established UAS program, 13% are interested and are developing a program and the remaining 12% are interested in UAS use but have not taken any action yet to establish any sort of program in their agency. The DJI Phantom Series or the DJI Mavic Series are used by 71% of them. The funding for these public agencies' purchases has come from internal funding 56%, federal and state grants 22%, asset forfeiture 11%, and corporate or private donations 11%. Those entities with a UAS program indicate that the calls or functions to which they deploy are for situational awareness at 85%, crime scenes, traffic crashes, and missing persons calls each at 57%, and patrol and SWAT responses at 42%. There is reported interagency support from 63% of respondents and 58% rate the use of UAS to be very effective for completing tasks and another 14% rate UAS as extremely effective. Regarding policies and operational procedures and standards for UAS use only 28% have written standards and procedures for their operators, and 20% have encountered legal arguments regarding the application of their UAS.

The top categories that UAS users in Idaho encounter when discussing with friends that they are a UAS pilot are privacy, trespass, safety, noise, negative visual impacts, and "You mean the Jetsons"? Working toward the necessary social transformation to accept and embrace advanced air mobility is not only about adding education, outreach, and giving more information, it is also necessary to subtract psychological friction, reluctance, and fear of change. The integration of civil and public UAS operations into our national airspace system and the realization of the benefits of remotely piloted technology in our economy are significant. Public education about what UAS is, and is not, is essential to gaining a positive status among the general public. A significant ongoing effort for outreach is necessary by all public and private sector UAS users to educate the general public.

Just as important as the technology and infrastructure ongoing development are the community engagement and work that is being done at the local, state, and city levels, because it is those local communities that will be managing the advanced air mobility infrastructure. The infrastructure planning and construction activities will require detailed planning, and zoning that will need synchronization across Idaho communities. The Idaho public has valid concerns regarding UAS operations with respect to safety. If people do not feel safe when remotely piloted aircraft are operating around them, or they have persistent fears of drones intruding in their private lives, then UAS commercial opportunities will likely be very limited.

Successful UAS programs in other state DOTs, businesses, and UAS programs within Idaho public entities agreed with the National Cooperative Highway Research Program Domestic Scan 17-01 that the

following are fundamental: 1.) Executive Support, 2.) Organizational Structure, 3.) Clear Policy and Regulation, 4.) Addressing Safety and Risk Management, 4.) Training and Crew Qualifications, 5.) Constant Public Relations, 6.) Application and Operations protocols.

Idaho UAS Users' Recommendations

- Create an expert UAS task force for Idaho with strategic planning for future policies, interagency MOUs, collaborative trainings, and resource and risk sharing. Constantly make public announcements that residents are protected from trespass and invasion of privacy.
- Create an Idaho UAS users' group that includes both public and private sector experts and beginners that can network and share best practices, via social media and in-person events. Those recreational users interviewed are willing to pay a small fee for a Saturday morning demonstration and update class. Professionals using UAS in their employment are asking for a full one or two-day conference and training annually. The state should develop mutual aid MOUs for the sharing of UAVs, equipment, and related resources (certified pilots, cameras, sensors, etc.).
- Continue to share UAS best practices from other states' and countries' use cases.
- Engage elected officials and educate them on current rules and regulations to ensure that they make informed state policies related to UAS.
- Strengthen a collective effort for outreach and communications from FAA and ITD Aeronautics to educate current and potential UAS users. The FAA has existing public engagement programs designed to increase awareness of UAS capabilities, activities, guidelines, rules, and best practices.
- Hold an annual conference with regulation updates, additional information sharing, networking, education, and UAS demonstrations.
- Private sector has many resources for consulting and helping establish UAS programs. More outreach from the private sector UAS companies themselves would be helpful.

Annual UAS Conferences Possible Agenda Items:

- FAA, legislative, jurisprudence, and insurance issues updates.
- Breakout sessions with different categories of content specialty and/or by level of expertise. There are many different uses for UAS and at least three categories of user experience (expert, intermediate, beginner).
- A joint effort with the private and public sectors to address the Idaho Legislature regarding changes to the code for both the public and private sectors.

- Standardize advantages and disadvantages for UAS operations among different Idaho state departments and Tribal, county, city highway districts, and other jurisdictions.
- Public safety and UAS use, and how airspace priority is determined and managed.
- Vendor demonstrations and exhibits
- UAS use cases for public and private sectors integration.
- Panels for the private sector on how to find the local emergency planner and learn about incident command for disaster resilience and working together with public safety.
- What is new in the UAS technology world, and real-life case studies that address increasing the public acceptance of UAS, drone inspection data bottlenecks, law enforcement counter-drone strategies and permissions, UAS data rules, and governance, integrating drone data with established workflow, and vendor exhibits and demonstrations and showing what a "complete drone solution" means.
- Understand how to obtain airspace authorization and work with local airports.
- Issues specific to UAS benefits for rural Idaho land access and rural communities which often lack access to economic opportunities due to transportation seclusion. AAM can help reduce these barriers and improve rural/urban equity as access to employment and business opportunities are enhanced.
- Outreach efforts should include persons with limited English proficiency and persons with intellectual and physical disabilities.
- Learning about flight route planning considerations and initial lists of restrictions, such as 1.) FAA restrictions and airspace classifications, prohibited and restricted airspace, stadiums, and federal UAS flight restrictions; 2.) environmental restrictions such as National Park Service lands and U.S. Fish and Wildlife Service Refuge Lands; 3.) local zoning restrictions that could be identified, including state and local prisons, and 4.) physical obstacles such as tall electric transmission towers that could create a hazard for aircraft navigation (Ohio DOT 2022).
- Safety is essential to UAS and AAM operations during the flight and while on the ground (vertiport) considerations. The locations of vertiports will be an important safety consideration as their proximity to densely populated spaces increases the access but also the risk to people and property. Local authorities should participate in these annual conferences.
- Ideas for dealing with UAS noise and noise ordinances for UAS time and place uses and/or nuisance accusations.

4. Summary and Recommendations

UAS technologies and the coming advanced air mobility are connected to each of ITD's mission objectives. ITD staff have demonstrated their abilities to use UAS for their own increased safety and that of the traveling public, preserved mobility, and expanded economic opportunity, while encouraging innovative business practices, saving time and money on numerous surface transportation projects, self-teaching and sharing their know-how for an educated workforce, evading collection of personally identifiable information, and adapting to change and growth in the Department's responsibilities. Part One's review of the trajectory of UAS use and creation of the UAS Program itself details the excitement and commitment of ITD's UAS-using personnel for integrating this technology whenever appropriate.

There is a documented 10-year history of ITD employees using or researching UAS uses without having a specific UAS Program. The uses include reclamation and environmental studies work, surveying, 3D mapping, thermal imagery and LiDAR surveying, stockpile volumetrics, traffic confusion and congestion mitigation, cultural studies, slope and avalanche detection, quality assurance of checking contractor work and materials invoicing, and road surface inspections for deck evaluation, delamination, and defective concrete work. Interviews and highway project reports demonstrate ITD staff using these technologies for all of the above. A next step could include documenting the quantitative comparisons of UAS use and traditional methods use for specific tasks in order to build a business plan demonstrating return on investment of UAS training and use.

FHWA and FAA are consistently researching and developing new use cases for UAS platforms with stringently tested surface transportation applications. Many state DOTs, including Idaho's, are demonstrating quantitative and qualitative enhanced safety for employees and the traveling public, increased productivity, especially in bridge and culvert inspections, reduced costs to the departments via saved time for employee hours and less need for traditional heavy or invasive machinery uses and public impact, longitudinal asset management comparing digital data to digital data rather than to human input reports, accelerated construction subsequent to speedy, easy and efficient use of UAS, in addition to increased accuracy in data collection and use. The use cases examples from various states and municipalities are convincing for expanding UAS use.

The nascent ITD UAS Program has a sound foundation for continuing with administrative, policy and protocol document drafts prepared and easily updated for approval and implementation. As listed on page 23 of this report, the existing draft documents are already being shared and used as suggested checklists for ITD UAS pilots. These documents are available at the ITD Aeronautics Main Office in Boise in paper format, and in the departmental internal UAS Program SharePoint folder.

Idaho is not a wealthy state and many Idahoans do not exhibit great excitement for the opportunities of regular UAS use nor for the aspects of advanced air mobility. The state need not pretend to become a leader in either field and instead can leverage other states' experiences and best practices in order to accept the most appropriate technologies and aviation advancements. Those advancements are somewhat tied to social acceptance. Idaho's known anti-government voices continue to assume that

use of UAS is generally connected to government surveillance, an abuse of civil rights, trespass and/or an invasion of privacy, and/or criminal behavior. This report highlights constant community outreach and establishing a task force as two components in leading states. UAS-advanced states such as Utah, have implemented a robust and consistent public outreach campaign which has been shown to positively impact the socialization of uncrewed air package delivery. Those states with established UAS advisory committees or task forces have leveraged multi-sector approaches to education and awareness of UAS advantages.

The 2020 ITD Airport System Update Plan survey of 75 Idaho airport managers showed UAS use and technology were rated in the highest impact category for future planning. Federal and state planning for vertiports and multiports that combine crewed and uncrewed aviation for passengers and cargo should be on every meeting agenda of the ITD Aeronautics Advisory Board for at least a simple update on new technologies and which states are testing what applications.

The return on investment of UAS use is significant for Idaho but is not yet being tracked systematically. Anecdotal details of using UAS for this or that project is unlikely to change many votes of the Idaho Legislature in favor of increased appropriations for the UAS Program. A specific business plan demonstrating increased safety, past and current investments, costs and savings, and return on investment is needed to help educate elected officials (and the general public) regarding the benefits of funding and capitalizing on UAS use.

As reported in detail above, the quickly- developing regulatory foundation for airspace and advanced air mobility law creates a situation of needed constant awareness and updating one's knowledge of the current legislation, FAA regulations and waivers, and jurisprudence. The intent of the FAA to maintain a uniform and flexible system in order to integrate UAS into the national airspace system is strong on "flexible" and weaker on "uniform". Pages 50-64 give a chronologically ordered explanation of how airspace law has developed and what factors have gained US Supreme Court attention and rulings, and which have failed thus far to be considered in the federal scope of authority under the Supremacy Clause of the US Constitution.

Recommendations:

1) Establish a UAS Task Force advisory group to facilitate and further the UAS Program. One person alone, or even a near future UAS Program staff of several full-time employees, cannot keep apprised of the US DOT, FAA, technological, use case, legal, and data management developments and simultaneously complete the necessary tasks of creating and managing a UAS Program for Idaho. A selected and/or appointed commission of experts could give ongoing input and function as a sounding board for potential policy and statutory updates. It could assist with consistent review of current federal and Idaho laws, regulations and court cases that could impact departmental UAS use and future advanced air mobility and recommend necessary revisions. A subcommittee could identify potential laws and IDAPA rules that will create jurisdictional harmonization and parameters for UAS pilots, vertiports and AAM operations

throughout Idaho. A task force could also include a mechanism to receive regular public input before submitting recommendations to the UAS Program Coordinator, the Division of Aeronautics Administrator and the Aeronautics Advisory Board for administrative or legislative action to the Governor and legislative leadership.

2) Fund public engagement and outreach activities that highlight the safety, uses, advantages, and future opportunities for UAS and advanced air mobility. Consistent and constant messaging, demonstrations of hardware and software and invitations for public events and comment may reduce suspicion and friction from opponents to aviation developments. Increasing quantity and access to positive information will influence some, and reducing fear and opposition to governments acquiring data by demonstrating the existing trespass and privacy protections will affect others. ITD's 2040 Long-Range Transportation Plan includes promoting public engagement and soliciting input. Use task force members and their representative industries and specialties to fortify a public engagement and awareness outreach campaign to educate the public and lawmakers about UAS and AAM capabilities, technology, and benefits. Task Force work should demonstrate transparency and have an aspect of open public comment.

3) Separate the UAS Program Coordinator scope of work from a requirement for a crewed-aircraft pilot. This position needs significantly more expertise and time in Idaho airspace policy planning, federal aviation awareness and FAA relationship-building, administration of data and information flow, and advanced air mobility legal updates. Preparing regional and statewide conferences and training events is high on the request list from the Idaho UAS users and the ITD UAS Program Coordinator is well-positioned to plan and prepare these events.

4) Coordinate an annual conference/workshop for UAS users in Idaho to promote interjurisdictional and interagency collaboration, best practice sharing and private sector input among other topics. Partial funding could come from private sector sponsorships for these events.

5) Maintain a consistently funded and mandatory training cycle for ITD UAS users. A best-case scenario would include joint trainings with other state and public agencies in Idaho in order to capitalize on efficiencies of collaboration for trainings, MOUs and joint projects.

6) Create ongoing MOUs with Idaho National Laboratory's UAS testing and training programs, and Idaho's higher education institutions for their UAS instructors, trainers, and students to engage around the state as collaborators or interns on ITD projects. This brings the latest knowledge and input to existing ITD employees and projects, and builds an in-state workforce pipeline to stay in Idaho with established relationships through internships. UAS instruction, certifications and degrees are currently available at BSU, CWI, ISU and UI.

7) Collaborate with local governments through the Association of Highway Districts, Idaho Association of Counties and Association of Idaho Cities to identify opportunities for mutually beneficial practices to integrate UAS into transportation plans, land use planning, emergency management, environmental preservation, and airport land management. Address questions of state preemption of local authority, and changes to the Aeronautics Code Title 21 as necessary.

8) Request regular interaction with the FAA Representative for Idaho to participate and give any updates to ITD UAS Committee.

9) Heed the wishlist created by the ITD UAS users themselves including consistent communications and updates regarding UAS regulatory developments and ITD data management policies, provide regular training and skills building, maintain access to a digital library of curated information, and improve coordination and integration of workflow to use UAS to maximum potential and savings.

10) Create a business plan to demonstrate the cost savings, needs and efficiencies of hiring 3-5 people into the UAS Program. Demonstrate that 3-5 FTEs for the UAS Program will actually save money in several areas and increase non-quantifiable categories such as safety for employees and the traveling public.

5. Cited Works

Ada County Highway District Board of Commissioners. 2019. Ada County Highway District Ordinance. "Ordinance Number 241."

American Association of State Highway and Transportation Officials. 2019. "2019 AASHTO UAS/Drone Survey of all 50 State DOTs." *Mission Control*. Accessed June 21, 2023. https://www.transportation.org/wp-content/uploads/2019/05/MissionControl_Drones3.pdf

--- 2022. "Uncrewed Aerial Systems & Advanced Air Mobility. State of Play for State DOTs." Information Sheet. April 2022. Accessed June 21, 2023. https://transportation.org/mobility/wp-content/uploads/sites/34/2023/01/UAS-AAM-Information-Sheet_April-2022.pdf

American Public Works Association. 2018. *APWA Top Tech Unmanned Aircraft Systems (UAS).* Accessed June 21, 2023. https://www.apwa.net/Library/TB_UAS.pdf

Banker, Steve, and Chris Cunnane. 2022. "The Race for the Last Mile Drones." *Forbes Magazine*. August 16, 2022. Accessed June 21, 2023. https://www.forbes.com/sites/stevebanker/2022/08/16/the-race-for-last-mile-drones/?sh=16afc8e6546f.

Baxenburg, Sarah and Josh Turner. 2023. "As the Drone Flies: How to Think About Property Ownership, Federal Preemption, and Airspace Control in the Era of Remotely Piloted Aircraft." *Journal of Robotics, Artificial Intelligence & Law* Vol. 6, No. 3. February 21, 2023. Accessed June 23, 2023. https://www.mondaq.com/unitedstates/aviation/1284806/as-the-drone-flies-how-to-think-about-property-ownership-federal-preemption-and-airspace-control-in-the-era-of-remotely-piloted-aircraft

Ben Dor, Lavi M. and Jonathan M. Hoffman. 2022. "The Emerging Airspace Economy: A Framework for Airspace Rights in the Age of Drones." *Wisconsin Law Review* Volume 2022 Issue 4, Pp 953-996. Accessed June 23, 2023. https://wlr.law.wisc.edu/wp-content/uploads/sites/1263/2022/11/16-3rd_Ben-Dor-Hoffman-Camera-Ready-953%E2%80%9396.pdf

Bentley, Jennifer M. 2018. "Policing the Police: Balancing the Right to Privacy Against the Beneficial Use of Drone Technology." *Hastings Law Journal* Volume 70, Issue 1. Pp 249-289. Accessed June 23, 2023. https://www.hastingslawjournal.org/policing-the-police-balancing-the-right-to-privacy-against-the-beneficial-use-of-drone-technology-2/

Busby, Jamie. 2019. "Drone Delivery: The Danger of Opening the Air As A Commercial Highway." *Loyola Maritime Law Journal* Volume 18, Issue 2. Pp. 288-311.

Butterworth-Hayes, Philip. 2022. "The Market for UAV Traffic Management Services. 2022-2026." Edition 5.1. *Unmanned Airspace.* July 2022. www.unmannedairspace.info

Carr, Nanci K. 2019. "Look! It's A Bird! It's A Plane! No, It's A Trespassing Drone." *Journal of Technology Law & Policy* Volume 23. Pp 147-152.

Delgado, Nestor. 2020. "The State of Drones: What Room is Left for States to Establish an Uncrewed Aircraft Regulatory Scheme." *Journal of Drone Law & Policy* Volume I. Pp. 91-146. Accessed June 23, 2023. https://airandspacelaw.olemiss.edu/wp-content/uploads/2020/12/1-J.-Drone-L.-Poly.pdf

Donohue, Laura K. 2021. “Who Owns the Skies? Ad Coleum, Property Rights, and State Sovereignty.” *Eyes to the Sky: Privacy and Commerce in the Age of the Drone*. Matthew Feeney ed., Cato Institute.

Eddy, Nathan. 2020. “Building the drone highways of the sky.” *Smart Cities Dive*. December 22, 2020. Accessed June 23, 2023. https://www.smartcitiesdive.com/news/building-drone-highways-smart-city-sky/592581/#:~:text=Building%20the%20drone%20highways%20of%20the%20sky

Federal Aviation Administration. 2012. *Modernization and Reform Act of 2012, Public Law No. 112-95. Subtitle B, Unmanned Aircraft Systems.* Federal Regulations. February 14, 2012. Accessed June 23, 2023. https://www.congress.gov/112/plaws/publ95/PLAW-112publ95.pdf

--- 2015. *State and Local Regulation of Unmanned Aircraft Systems (UAS) Fact Sheet*. Federal Aviation Administration Office of the Chief Counsel. December 17, 2015. Accessed June 23, 2023. https://www.faa.gov/sites/faa.gov/files/uas/public_safety_gov/public_safety_toolkit/UAS_Fact_Sheet_Final.pdf

--- 2016. *Federal Regulation 42064, 42190-92. Part 107 Rules.* June 28, 2016. Accessed June 23, 2023. https://www.federalregister.gov/documents/2016/06/28/2016-15079/operation-and-certification-of-small-unmanned-aircraft-systems

--- 2019. *Report to Congress: Large Unmanned Aircraft Systems*. House Appropriations (Report 115-750). Accessed June 23, 2023. https://www.congress.gov/congressional-report/115th-congress/house-report/750/1

--- 2020. *Integration of Civil Unmanned Aircraft Systems (UAS) in the National Airspace System (NAS) Roadmap. 2020.* 3rd Edition, Volume 1. AUS-200807-002. https://www.tamucc.edu/lone-star-uas/assets/documents/2019-uas-civil-integration-roadmap-third-edition.pdf

--- 2022. Beyond Visual Line of Sight Aviation Rulemaking Committee. *Unmanned Aircraft Systems Final Report*. March 10, 2022. Accessed June 23, 2023. https://www.faa.gov/regulations_policies/rulemaking/committees/documents/media/UAS_BVLOS_ARC_FINAL_REPORT_03102022.pdf

--- 2022. *Engineering Brief No. 105, Vertiport Design.* Memorandum September 21, 2022. Accessed June 23, 2023. https://www.faa.gov/sites/faa.gov/files/eb-105-vertiports.pdf

--- 2022. *FAA Releases Vertiport Design Standards to Support the Safe Integration of Advanced Air Mobility Aircraft.* September 26, 2022. Accessed June 23, 2023. https://www.faa.gov/newsroom/faa-releases-vertiport-design-standards-support-safe-integration-advanced-air-mobility

Federal Communications Commission. 2023. *FCC Starts Rulemaking to Make Available Licensed Spectrum for Unmanned Aircraft Use.* January 24, 2023. Accessed June 23, 2023. https://www.fcc.gov/document/fcc-starts-rulemaking-licensed-spectrum-unmanned-aircraft-use-

Federal Highway Administration. US Department of Transportation. 2019-2020. *Unmanned Aerial Systems (UAS). On-Ramp to Innovation, Every Day Counts (EDC-5).* Accessed June 23, 2023. https://www.fhwa.dot.gov/innovation/everydaycounts/edc_5/docs/uas-factsheet.pdf

--- 2019. *Use of Small Unmanned Aerial Systems for Bridge Inspection.* Tech Brief. FHWA-HIF-19-056. October 2019. Accessed June 23, 2023. https://www.fhwa.dot.gov/uas/resources/hif19056.pdf

--- 2019. *Use of Small Unmanned Aerial Systems for Construction Inspection*. Tech Brief. FHWA-HIF-19-096. October 2019. Accessed June 23, 2023. https://www.fhwa.dot.gov/uas/resources/hif19096.pdf

--- 2019. *Use of Small Unmanned Aerial Systems for Land Surveying*. Tech Brief. FHWA-HIF-20-034. December 2019. Accessed June 23, 2023. https://www.fhwa.dot.gov/uas/resources/hif20034.pdf

--- 2020. *Global Benchmarking Program Study on Unmanned Aerial Systems (UAS) for Surface Transportation.* Domestic Desk Review. Office of Infrastructure FHWA-HIF-20-091. August 2020. Accessed June 23, 2023. https://www.fhwa.dot.gov/uas/hif20091.pdf

--- 2021. *The Transportation Future: Trends, Transportation and Travel.* Transportation Policy Studies, Topics. November 2021. Accessed June 23, 2023. https://www.fhwa.dot.gov/policy/otps/TPS_2020_Trends_Report.pdf

--- 2022. *UAS Improve Environmental Data Collection*. Innovator Volume 15. Issue 90. May/June 2022. https://www.fhwa.dot.gov/innovation/innovator/issue90/page_01.html

--- 2022. *Pavement Management Roadmap*. FHWA-HIF-22-054. September 2022. https://www.fhwa.dot.gov/pavement/pubs/hif22054.pdf

Goodwin, William, and Tyler Finn. 2018. "The Local Future of the Low-Altitude Airspace." *The Air and Space Lawyer,* Volume 31, Issue 4. December 2018.

Hamilton, J. Scott and Sarah Nilsson. 2020. *Practical Aviation & Aerospace Law*. 7th Edition. Aviation Supplies & Academics Inc. Newcastle, Washington.

Heverly, Robert A. 2015. "The State of Drones: State Authority to Regulate Drones," Albany Law School. *Albany Government and Law Review*. Volume 8, Number 1. Pp 29-46.

Horikawa, Michael S., and David W. Wright. 2020. "A Drone's Eye View of Rights and Legal Remedies." *Internet and Social Media.* Pillsbury Winthrop Shaw Pittman LLP. July 23, 2020. Accessed June 23, 2023. https://www.internetandtechnologylaw.com/drones-rights-legal-remedies/

Idaho National Laboratory. 2022. *UAS Testing and Training Capabilities*. 20-50443_021_R1. Accessed June 23, 2023. https://factsheets.inl.gov/FactSheets/Unmanned%20Aerial%20Systems.pdf

Idaho National Laboratory Communications and Outreach. 2022. "*Send in the Drones: INL Unmanned Aerial Program Offers Independent Testing and Prototyping."* September 16, 2022. Accessed June 23, 2023. https://inl.gov/article/send-in-the-drones-inl-unmanned-aerial-program-offers-independent-testing-and-prototyping/

Idaho Transportation Department. 2017. *Fatigue Crack Detection Using Unmanned Aerial Systems in Under-Bridge Inspection.* Dorafshan, Sattar and Marc Maguire, Nathan V. Hoffer, Calvin Coopmans. FHWA-ITD-17-256." August 2017. Accessed June 23, 2023. http://apps.itd.idaho.gov/apps/research/Completed/RP256.pdf

--- 2020. *Long Range Transportation Plan 2040*. https://itd.idaho.gov/wp-content/uploads/2020/12/2040-LR_TransPlan_Summary.pdf

--- 2020. Division of Aeronautics. *Idaho Airport System Plan Update & Airport Economic Impact Analysis Update*. *Final Technical Report.* Kimley Horn, July 2020. Accessed June 23, 2023. https://apps.itd.idaho.gov/Apps/info/ITD-Aero_IASP_Report.pdf

--- 2022. *2022 Interagency Working Group Annual Program, Usage, and Funding Report for Transportation.* Miller, Shauna. Accessed June 23, 2023. https://apps.itd.idaho.gov/apps/pt/iwg/2022IWGReport.pdf

--- 2022. *Idaho's Statewide Transportation Improvement Program (STIP) FY22 to FY28 Submittal*. Accessed June 23, 2023.https://apps.itd.idaho.gov/Apps/Fund/stip2022/STIP-Publish.pdf

Kapnik, Benjamin. 2019. "Unmanned but Accelerating: Navigating the Regulatory and Privacy Challenges of Introducing Unmanned Aircraft into the National Airspace System." *Journal of Air Law and Commerce.* Volume 84, Issue 4. Pp. 439-448. Accessed June 23, 2023. https://scholar.smu.edu/jalc/vol84/iss4/4/?utm_source=scholar.smu.edu%2Fjalc%2Fvol84%2Fiss4%2F4&utm_medium=PDF&utm_campaign=PDFCoverPages

Karpowicz, Jeremiah. Executive Editor. 2019. "5 Things to Know About How Drones are Being Used for Construction in North America." *Commercial UAV News*. October 28-30, 2019.

Keifer, Scott P. 1996. "Aircraft Overflights as a Fifth Amendment Taking: The Extension of Damages for the Loss of Potential Future Uses to Aviation Easements. Brown v. United States." *Missouri Journal of Environmental and Sustainability Law.* Volume 4, Issue 2. Accessed June 23, 2023. https://scholarship.law.missouri.edu/jesl/vol4/iss2/3.

Kolarich, Brook C. 2018. "Playing with Fire: Drone Incursions into Wildfire Suppression Operations and the Regulatory Challenges to Reducing Their Risks," *Texas Tech Administrative Law Journal* Volume 19 Pp. 301-304. Accessed June 23, 2023. https://digitalcommons.mainelaw.maine.edu/student-impact-summit/27/

Los Angeles Department of Transportation. 2021. *Urban Air Mobility Policy Framework Considerations*. September 13, 2021. Accessed June 23, 2023. https://ladot.lacity.org/sites/default/files/documents/ladot-uam-policy-framework-considerations.pdf

McKinnon, Mark. 2020. "GAO Weighs in on Drones." Fox Rothchild LLP. September 17, 2020. Accessed June 23, 2023. https://plane-lyspoken.foxrothschild.com/2020/09/17/gao-weighs-in-on-drones/

Mendonca, Nancy, and James Murphy, Michael D. Patterson, Rex Alexander, Gabriela Juarez, and Clint Harper. 2022. "Advanced Air Mobility Vertiport Considerations: A List and Overview." *American Institute of Aeronautics and Astronautics Aviation 2022 Forum.* Chicago, Illinois, June 27- July 1, 2022. Published Online: June 20, 2022. Accessed June 23, 2023. https://ntrs.nasa.gov/api/citations/20220007100/downloads/Vertiport%20Considerations%20Paper%20Final%20v2.pdf

Michigan Department of Transportation. 2017. *Unmanned Aircraft Systems Task Force. Final Report 2017.* Accessed June 23, 2023. https://www.michigan.gov/-/media/Project/Websites/aero/UAS/UASTF_Final_Report_v2_Full.pdf?rev=a52514c3b84d45fd8cfe89a4bb8230fc

--- 2022. Michigan Research Institute. *Integration of Unmanned Aerial Systems Data Collection into Day-to-Day Usage for Transportation Infrastructure – A Phase III Project*. Brooks, C., and C. Cook, R. Dobson, T. Oommen, K. Zhang, A., Mukherjee, R. Samsami, A. Semenchuk, B. Lovelace, V. Hung, Y. Tan, Y. Yang, A. Jenkins, J. Graham, V.C. Lekha, M. Billmire, V. Barber. Final Report, No. SPR-1713. June 11, 2022. Accessed June 23, 2023. https://www.michigan.gov/mdot/-

/media/Project/Websites/MDOT/Programs/Research-Administration/Final-Reports/SPR-1713-Report.pdf

Migala, Stephen J. 2017. "UAS: Understanding the Airspace of States." *Journal of Air Law and Commerce* Volume 82. Pp. 3-12.

Murphy, Kara. 2020. "US Judge Rules Against County Seeking to Ban Drone Flights in Their Parks." *Digital Photography Review*. February 17, 2020. Accessed June 23, 2023. https://www.dpreview.com/news/1042631835/judge-rules-against-county-seeking-to-ban-drone-flights-intheir-parks#:~:text=On%20February%2010th%2C%20the%20Honorable,battle%20was%20ignited%20after%20R

National Cooperative Highway Research Program. 2018. *Successful Approaches for the Use of Unmanned Aerial System by Surface Transportation Agencies*. Snyder, Paul, and Zachary Waller, Paul Wheeler, Amy Tootle, Jeff Milton, Troy Larue, James Gray, Shayne Gill, Gregg Frederick, Steven Cook, and Emanuel Banks. Scan Team Report Project 20-68A, Scan 17-01. July 2018. Accessed June 23, 2023. https://onlinepubs.trb.org/onlinepubs/nchrp/docs/NCHRP20-68A_17-01.pdf

--- 2022. *Implementing the Results of NCHRP Project 20-68A, Domestic Scan 17-01: Successful Approaches for the Use of Unmanned Aerial Systems by Surface Transportation Agencies.* O'Neil-Dunne, Jarlath. NCHRP Project 20-44(17). 2022. https://onlinepubs.trb.org/onlinepubs/nchrp/docs/NCHRP20-44(17)ProjectReportFinal.pdf

National Telecommunications and Information Administration (NTIA). 2016. *Voluntary Best Practices for UAS Privacy, Transparency, and Accountability: Consensus, Stakeholder-Drafted Best Practices Created in the NTIA-Convened Multistakeholder Process* (UAS Voluntary Best Practices). May 18, 2016. Accessed June 23, 2023. https://www.ntia.doc.gov/files/ntia/publications/voluntary_best_practices_for_uas_privacy_transparency_and_accountability_0.pdf

--- 2015. *Presidential Memorandum from President Barack Obama to Heads of Executive Departments and Agencies, Promoting Economic Competitiveness While Safeguarding Privacy, Civil Rights, and Civil Liberties in Domestic Use of Unmanned Aircraft Systems.* 80 Fed. Reg. 9355, 9355. February 20, 2015. NTIA, Multistakeholder Process: Unmanned Aircraft Systems. Accessed June 23, 2023. https://www.govinfo.gov/content/pkg/DCPD-201500103/pdf/DCPD-201500103.pdf

North Carolina Department of Transportation. *Unmanned Aircraft Systems.* Accessed June 23, 2023. https://www.ncdot.gov/divisions/aviation/uas/Pages/default.aspx.

--- Website pages. https://www.ncdot.gov/divisions/aviation/uas/Pages/default.aspx , https://www.ncdot.gov/divisions/aviation/uas/Pages/beyond.aspx , https://www.ncdot.gov/divisions/aviation/advance-mobility/Pages/default.aspx (Accessed May 8, 2023)

Northeast UAS Airspace Integration Research Alliance. 2021. "High-Density Automated Vertiport Concept of Operations." Accessed June 23, 2023. https://ntrs.nasa.gov/api/citations/20210016168/downloads/20210016168_MJohnson_VertiportAtmtnConOpsRprt_final_corrected.pdf

Northern Plains UAS Test Site. “FAA Grants Initial Approval Allowing BVLOS Drone Flights on North Dakota Drone System”. January 9, 2023. Accessed June 23, 2023. https://www.npuasts.com/news/article?id=140

Norton, Bryan V. 2018. “Drone 101: A Survey of the Overlapping Laws, Rules and Regulations in Idaho and the National Airspace.” *Idaho State Bar, Advocate.* Volume 61, Pp. 31- 32.

Office of Management and Budget. 2007. *M-07-16, Safeguarding Against and Responding to the Breach of Personally Identifiable Information.* May 22, 2007. Accessed June 23, 2023. https://www.whitehouse.gov/sites/default/files/omb/memoranda/fy2007/m07-16.pdf

Ohio Department of Transportation, Office of Statewide Planning and Research. 2021. *Infrastructure to Support Advanced Autonomous Aircraft Technologies in Ohio*. Rosario, Rúben del. Project ID Number 111453. June 2021. Accessed June 23, 2023. https://www.dot.state.oh.us/Divisions/Planning/SPR/Research/reportsandplans/Reports/Final%20Reports/136144%20Final%20Report.pdf

--- 2021. *Economic Impact Report for Advanced Autonomous Aircraft Technologies in Ohio*. Research Project Fact Sheet. June 2021. https://www.dot.state.oh.us/Divisions/Planning/SPR/Research/reportsandplans/Reports/Final%20Reports/136144%20Final%20Fact%20Sheet.pdf

--- 2022. *Ohio Advanced Air Mobility Framework*. August 2022. Accessed June 23, 2023. https://uas.ohio.gov/wps/wcm/connect/gov/ad6a839a-13fa-4266-b0ee-e9590d82d3e2/Aug2022_AAM+Planning+Framework_Sm.pdf?MOD=AJPERES&CONVERT_TO=url&CACHEID=ROOTWORKSPACE.Z18_K9I401S01H7F40QBNJU3SO1F56-ad6a839a-13fa-4266-b0ee-e9590d82d3e2-oa8-beJ

Pennsylvania Department of Transportation. 2020. “Unmanned Aircraft Systems/Drones.” Accessed June 23, 2023. https://www.penndot.gov/Doing-Business/Aviation/Licensing%20and%20Safety/Pages/Unmanned-Aircraft-Systems-(Drone)-Information.aspx

Phillips, Lauren E. 2017. “Impeding Innovation: State Preemption of Progressive Local Regulations.” *Columbia Law Review* Volume 117, Number 8, December 2017. Pp. 2225-2262.

Reynolds, Matt. “ABA House of Delegates Passes Resolution on Drones; Delegate Calls it ‘a Hot Topic.’” *American Bar Association* ABAJOURNAL.COM Feb. 17, 2020. Accessed June 23, 2023. https://www.abajournal.com/news/article/resolution-111

Rule, Troy A. 2022. “Drones, Airspace, and the Sharing Economy, Mercatus Working Paper.” *Mercatus Center at George Mason University*. Arlington, VA, May 2022. Accessed June 23, 2023. https://www.mercatus.org/system/files/rule_drones_airspace_and_the_sharing_economy_wp_mercatus_v1_1.pdf

Shalby, Colleen. 2019. “Illegal Drones Ground Water-dropping Helicopters at Critical Moment in Maria Fire Battle.” *Los Angeles Times.* November 2, 2019. Accessed June 23, 2023. https://www.latimes.com/california/story/2019-11-01/maria-fire-drone-hinders-firefighting-efforts-as-blaze-doubles-insize-overnight;

Shammas, Brittany. 2020. “Drones Are Swarming over Colorado and Nebraska at Night: Authorities Say They Have No Idea Why.” *Washington Post.* January 2, 2020. Accessed June 23, 2023. https://www.washingtonpost.com/transportation/2020/01/02/drones-are-swarming-overcolorado-nebraska-night-authorities-say-they-have-no-idea-why/

Simonsen, Rina Valeur and Malene Hartung, Kirstine Clemens Brejndal-Hansen, Stig Yding Sørensen, Kristian Oluf Sylvester-Hvid, David Klein. 2019. *Global Trends of Unmanned Aerial Systems.* Danish Technological Institute. Accessed June 23, 2023. https://02f09e7.netsolhost.com/AUVSIDocs/Global%20Trends%20for%20UAS.pdf

Skorup, Brent and Connor Haaland. 2021. “Which States Are Prepared for the Drone Industry? A Fifty State Report Card, Release 2.0 Mercatus Research Paper.” *Mercatus Center at George Mason University, Fairfax, VA.* Accessed June 23, 2023. https://www.mercatus.org/publications/technology-and-innovation/whichstates-are-prepared-drone-industry

Texas Department of Public Safety. 2019. *Unmanned Aircraft System (UAS) Standard Operating Procedure.* September 1, 2019. Accessed June 23, 2023. https://www.dps.texas.gov/docs/prCh4Anx11.pdf

Thompson, Daniel. 2020. “Rethinking the Highway: Integrating Delivery Drones into Airspace Above Highways.” *Indiana Law Journal* Volume 95, Issue 5, Pp 8-27. 2020. Accessed June 23, 2023. http://ilj.law.indiana.edu/articles/Thompson-Rethinking-the-Highway.pdf

U.S. Chamber of Commerce Institute for Legal Reform. 2022. *Torts of the Future: Drones*. Joshua Turner, Sara Braxenburg, Scott Bouboulis, Kyle Gutierrez, and Wiley Rein LLP. Accessed June 23, 2023. https://instituteforlegalreform.com/wp-content/uploads/2022/01/1323_ILR_Drones_Report_V6_Pages_Digital.pdf

U.S. Department of Homeland Security. *The Privacy Act of 1974*, 5 U.S.C. § 552a. Accessed June 23, 2023. http://www.dhs.gov/privacy-compliance

--- 2015. *The Fair Information Practice Principles*. August 10, 2015. Accessed June 23, 2023. https://www.dhs.gov/publication/privacy-policy-guidance-memorandum-2008-01-fair-information-practice-principles

--- 2015. *Best Practices for Protecting Privacy, Civil Rights & Civil Liberties in Unmanned Aircraft Systems Programs.* December 18, 2015. Accessed June 23, 2023. https://www.dhs.gov/sites/default/files/publications/UAS%20Best%20Practices.pdf

--- 2018. *Privacy Impact Assessment for the Aircraft Systems.* DHS/CBP/PIA-018(a). April 6, 2018. Accessed June 23, 2023. https://www.dhs.gov/sites/default/files/publications/privacy-pia-cbp018a-aircraftsystems-april2018.pdf

U.S. Department of the Interior. 2022. *DOI Operational Procedures Memorandum 11. Update to Voluntary Best Practices for UAS Privacy, Transparency, and Accountability: Consensus, Stakeholder-Drafted Best Practices Created in the NTIA-Convened Multistakeholder Process.* Office of Aviation Services. December 2, 2022. Accessed June 23, 2023. https://www.doi.gov/sites/doi.gov/files/opm-11.pdf

US Department of Justice. 2016. *National Institute of Justice Report. Considerations and Recommendations for Implementing an Unmanned Aircraft Systems (UAS) Program*. December 2016. Accessed June 23, 2023. https://nij.ojp.gov/library/publications/considerations-and-recommendations-implementing-unmanned-aircraft-systems-uas

U.S. Department of Transportation. 2023. [Docket No. DOT-OST-2023-0079]. Request for Information on Advanced Air Mobility. Accessed June 23, 2023. https://www.transportation.gov/sites/dot.gov/files/2023-05/AAM%20IWG%20RFI_WEBSITE.pdf

U.S. Department of Transportation, Federal Highway Administration. 2022. Pavement Management Roadmap, FHWA-HIF -22-054. September, 2022. Zimmermann, Kathryn and Max Grogg, Prashant Ram, Omar Smadi, David Peshkin, Brad Allen, Linda Pierce, Margot Yapp. Accessed June 23,2023. https://www.fhwa.dot.gov/pavement/pubs/hif22054.pdf

U.S. Government Accountability Office. 2012. *Unmanned Aircraft Systems: Measuring Progress and Addressing Potential Privacy Concerns Would Facilitate Integration into the National Airspace System*. September 18, 2012. Accessed June 23, 2023. https://www.gao.gov/products/gao-12-981

--- 2019. *Internet Privacy: Additional Federal Authority Could Enhance Consumer Protection and Provide Flexibility*, GAO-19-52 (Washington, DC). (GAO-12-981, supra note 4 at 35.) Jan. 15, 2019. Accessed June 23, 2023. https://www.gao.gov/products/gao-19-52

--- 2020. *Unmanned Aircraft Systems: Current Jurisdictional, Property, and Privacy Legal Issues Regarding the Commercial and Recreational Use of Drones.* B-330570. September 16, 2020. Accessed June 23, 2023. https://www.gao.gov/products/b-330570

--- 2020. *Unmanned Aircraft Systems: Current Jurisdictional, Property, and Privacy Legal Issues Regarding the Commercial and Recreational Use of drones. Appendices I-VI*. B-330570. September 16, 2020. Accessed June 23, 2023. https://www.gao.gov/assets/B330570_Appendices.pdf

Utah Department of Transportation. 2022. *Utah Advanced Air Mobility Infrastructure and Regulatory Study. Advanced Air Mobility Legislative Report.* Division of Aeronautics. Accessed June 23, 2023. https://udot.utah.gov/connect/wp-content/uploads/sites/50/2022/11/AAMLegislativeReport-LW-Edits-Final-1.pdf

--- 2022. *Long-Range Urban Air Mobility Land-Use Planning for Vertiports.* Katelynn Hall, Tayli Hillyard, Keunhyun Park, Brent Chamberlain. Draft Final Report. Report No. UT-22.09.

Vaghefi, Khatereh, and Henrique A. de Melo e Silva, Devin. K Harris, Theresa (Tess) M. Ahlborn. 2011. "Application of Thermal IR Imagery for Concrete Bridge Inspection." Presented at PCI National Bridge Conference. Salt Lake City, Utah. October 2011. Accessed June 23, 2023. https://www.researchgate.net/publication/265061456_Application_of_Thermal_IR_Imagery_for_Concrete_Bridge_Inspection

Zickuhr, Kathryn, and Elias Stahl, Nicole DuPuis. "Cities and Drones: What Cities Need to Know About Unmanned Aerial Vehicles (UAVs)." *National League of Cities, Center for City Solutions and Applied Research*. 2018. Accessed June 23, 2023. http://interfaith.issuelab.org/resources/25430/25430.pdf