FLIGHT INFORMATION EXCHANGE

VIRGINIA FLIGHT INFORMATION EXCHANGE:
A SINGLE AUTHORITATIVE UAS DATA SOURCE FOR THE COMMONWEALTH OF VIRGINIA

By: Commonwealth of Virginia
        Virginia Department of Aviation

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Executive Summary

The Virginia Department of Aviation (DOAV), together with partners in the Virginia Department of Transportation (VDOT), the Center for Innovative Technology (CIT), and Advanced Technology Applications (ATA, LLC), has developed a novel approach for information sharing. The **Virginia Flight Information Exchange (VA- FIX)** is Virginia's step toward the future of Unmanned Aircraft System (UAS) Traffic Management (UTM) by creating an authoritative Supplemental Data Service Provider (SDSP) that leverages the wealth of information in state and local government to help UAS operations and UAS Service Suppliers plan and conduct safe, effective operations. VA- FIX is part of Virginia's approach to address key policy and safety concerns at the state and local level while also maintaining a **UAS airspace that is one of the most free and open in the nation**.

The market for UAS has continued to grow and change faster than expected, creating challenging realities for state and local government. These issues were discussed at great length and depth with the DOAV UAS Work Group, including representatives from industry, UAS operators, state and local Government agencies, public safety, and the public. The VA- FIX Working Group was created out of these discussions.

The VA- FIX Working Group identified the need to provide representatives of state and local government, authorized by DOAV, the ability to collaborate and publish and share advisories with each other and the public. VA- FIX provides this ability to publish advisories to the UAS community in a manner consistent with DOAV guidance while providing an easy mechanism for UAS operators to incorporate authoritative state and local information into operational flight plans in a clear, consistent, authoritative manner for both compliance and safety purposes.

VA- FIX also leverages the bold investment the Federal Aviation Administration (FAA) is making in its UAS Unmanned Service Suppliers (USS) and UTM programs by designing the FIX to integrate with USS and UTM providers as a SDSP. The speed with which the UAS industry is developing continues to surprise and has put pressure on aviation management. The FAA boldly recognizes this in both its UTM Concept of Operations (ConOps) and through the UAS Data Exchange Low Altitude Authorization Notification Capability (LAANC) program; both of which acknowledge that existing air traffic management models do not adequately address the challenge of integrating UAS into the national airspace.

LAANC USS providers present a unique opportunity for Virginia's FIX concept: work with existing USSes that are already providing flight planning and compliance services to UAS operators and are already capable of consuming and publishing this type of data to operators if Virginia provides a single, consistent, clear, authoritative source.

This unique combination of factors provides Virginia with an opportunity to help Virginia and the nation prepare for a UTM future. State and local government and public safety agencies, which are responsible for public safety and quality of life, are empowered to provide information to the UAS community to help manage UAS operations around public safety incidents and to provide local government guidance. The DOAV goal for VA- FIX is to ensure

that guidance is consistent, clear, useful, non-burdensome, and enables the safe, effective growth of the UAS industry in the Commonwealth.

VA- FIX allows information sharing in the most transparent, open way possible while also respecting operational security and privacy requirements, especially in public safety. The system allows for multiple ways to connect and share information, including web-based and programmatic alternatives. VA- FIX is intentionally designed to leverage existing standards, open source technologies, and background intellectual property developed in the private sector that is being transferred to the Commonwealth of Virginia. Applying design principles allows the Commonwealth to develop, deploy, and maintain VA- FIX quickly and economically, to the benefit of the Nation, the UAS Industry, state and local government stakeholders, and the citizens of the Commonwealth.

What is the Virginia Flight Information Exchange?

The Virginia Flight Information Exchange (VA- FIX) is Virginia's step toward the future of UTM by creating an authoritative Supplemental Data Service Provider (SDSP) that leverages the wealth of information in state and local government to help UAS operations and UAS Service Suppliers plan and conduct safe, effective operations.

The VA- FIX is a platform for state and local public safety and other government agencies to publish and share safety and community advisory information with each other, with USSes, unmanned system operators, and the public to promote transparency and safety. The publicly available interface provides state and local public safety and government information, while a secure government operations platform gives government agencies the ability to publish advisory, operational, and emergency notifications. VA- FIX supports open, authoritative information sharing throughout Virginia as an authoritative SDSP. VA- FIX prepares Virginia for today and for the future, integrating with USSes and UTM solution providers that will manage unmanned systems traffic in Virginia.

Created in direct response to needs identified at the state and local government level through dialogue and working groups, VA- FIX is part of Virginia's approach to address key policy and safety concerns while also maintaining a UAS airspace that is one of the most free and open in the nation.

Why did we create the Virginia Flight Information Exchange?

With the rapid growth in small Unmanned Aerial Systems (sUAS) the landscape is continuously changing and creating challenging realities for UAS operators, the UAS industry, and state and local government. The market for sUAS has continued to grow faster than expected, with advances in UAS deliveries, Beyond Visual Line of Sight (BVLOS), and Urban Air Mobility.

How to support these advances, address industry needs for clarity of local conditions and operational guidance, and provide means for publication and sharing of state and local information was discussed at great length and depth within the DOAV UAS Work Group.

The Virginia General Assembly recognized both the challenges and opportunities of a fast-growing, high-tech industry. With the passing of SB 307, the Department of Aviation was charged with convening a UAS Work Group to explore issues and opportunities for the Commonwealth of Virginia in the UAS market.

The Virginia DOAV UAS Work Group.

The DOAV UAS Work Group was originally convened in August 2018 and consisted of representatives from State and Local Government, Industry, Trade Associations, the FAA and the public. The objective was to advise DOAV Director Mark Flynn on recommendations for how to ensure the safe adoption of UAS in Virginia while also continuing to make Virginia the most UAS-friendly state in the nation.

The State and Local Government Sub-Group of the UAS DOAV Work Group met to discuss the unique perspective of State and Local government on UAS. State and Local Government is both an early adopter of UAS for government missions as well as regulators of UAS operations to the extent that they interact with local infrastructure and impact quality of life. Local government is the de facto first line of enforcement for violations—whether that is the FAA's intent or not. This unique mix of operator, local regulator, and enforcer gives State and Local government a unique perspective on UAS operations and their interactions.

The State and Local Government Sub-Group was able to demonstrate, through discussion and design, that information sharing is not only feasible, it is straightforward and necessary. As a result, the State and Local Government Sub-Group made several recommendations to Director Flynn. The Sub-Group recommended that DOAV:

- Provide guidance to operate, coordinate and collaborate UAS flight operations at the state and local government level;
- Promote/enable awareness and information sharing (the establishment of data standards) between state government and UAS operators;
- Develop information sharing between state and local authorities, as well as sharing advisory information from state and local government to UTM providers, USSes, and UAS operators;
- Provide a mechanism for the consistent, clear, accessible publication of local government advisories to UAS operators; and
- Provide specific support for information sharing by and between public safety agencies in Virginia.

These recommendations focus on statewide issues, but also reflect needs and concerns at the local government level.

Virginia's Needs at the Local Level.

Local Government also has specific needs that align with the Sub-Group's recommendations in the areas of public safety, emergency management, quality of life and zoning and planning. In the 2020 Session of the General Assembly, these local issues were raised in multiple bills: HB 311, HB 1227 and HB 742. Each of these bills addressed the issue of how local governments interact with the UAS operators and influence UAS operations.

These bills were consolidated and passed the House through HB 742, which states, "*a political subdivision may, by ordinance or regulation, regulate the take-off and landing of an unmanned aircraft, as defined in § 19.2-60.1, on property owned by the political subdivision. Such ordinance or regulation shall be developed and authorized in accordance with the rules and regulations promulgated by the Department of Aviation (the Department). The political subdivision shall report to the Department any ordinance or regulation adopted pursuant to this section, and the Department shall publish and update annually on its website, and any other website the Department deems appropriate, a summary of any such ordinance or regulation adopted.*"

The DOAV understands the challenges and opportunities in implementing HB 742 and is establishing a workable implementation process. The VA- FIX was built independently of the provisions of HB 742. However, it can be used by the DOAV as a platform for sharing information relevant to any local regulations adopted pursuant to HB 742 and other regulations. The VA- FIX provides a clear, central, public mechanism for UAS operators and the UAS industry to obtain authoritative state and local information rather than having to collect guidance individually from every jurisdiction in the Commonwealth.

An Opportunity to Study a National Problem.

While the UAS DOAV Work Group identified specific needs in Virginia at the state and local level, in parallel, the FAA was identifying the need for "Supplemental Data Service Providers" in their overall UTM Concept, developed in partnership with the National Aeronautics and Space Administration (NASA).

The needs identified by the State and Local Government Sub-Group intersect perfectly with the FAA definition of a SDSP: "Operators and USSes can access SDSPs for essential or enhanced services—including terrain and obstacle data, specialized weather data, surveillance, and constraint information."[1]

The VA- FIX provides representatives of state and local government authorized by the DOAV the ability to collaborate and publish and share advisories with each other and the public. VA-FIX provides local government the ability to publish advisories to the UAS community that are consistent with DOAV guidance while providing an easy mechanism for UAS operators to incorporate authoritative state and local information into operational flight plans in a clear, consistent manner for both compliance and safety purposes.

The VA- FIX provides a unique opportunity to lead the way in studying how state and local government can contribute to UTM by leveraging their wealth of authoritative source data assets as an SDSP.

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[1] Federal Aviation Administration, Unmanned Aircraft System (UAS) Traffic Management (UTM), Concept of Operations v2.0, 3.2.2020

How does the current landscape make the Flight Information Exchange relevant?

The speed with which the UAS industry is developing continues to surprise and is putting pressure on needed changes to the fundamentals of aviation management. The FAA recognizes this in both its UTM Con Ops and through the UAS Data Exchange LAANC program; both of which acknowledge that existing air traffic management models do not adequately address the challenge of integrating UAS into the national airspace.

Traditional manned aviation has several natural rate limiters that keep the problem of managing congestion, managing separation, and accounting for external equities tractable. Manned aircraft are expensive, and they require substantial, dedicated facilities for take-off and landing. The result is that, congested as the airspace may be, these natural limiting factors serve to constrain the overall volume and scope of air traffic and provide natural "enforcement" points for ensuring that regulation and best practices for safety are followed.

By contrast, any person with means and access can readily obtain a state-of-the-art (if not particularly sophisticated) UAS incorporating software that allows an inexperienced pilot to control the vehicle with a smartphone. The result is that the growth of UAS systems in service has exploded, to the point where UAS systems in operation now dwarf the number of manned aviation systems. As of March 2020, the FAA had over 1.5 million registered UAS, more than 1 million registered owners, and over 170,000 certified remote pilots. This compares to just over 200,000 registered manned general aviation aircraft and approximately 400,000 manned pilot certificates.[2][3]

The natural laws that made the management of manned airspace feasible have been broken by these technological advancements. The result is a new class of state and local problem—now almost any horizontal surface can act as a take-off and landing area for UAS that are more accessible to owners and pilots than most automobiles. The problem is no longer simply how UAS get integrated into controlled airspace, but how do they get integrated with local communities and the public safety agencies that will be de facto responsible for interacting with them, both as operators and enforcers.

The FAA's UTM concept explicitly and clearly recognizes this new reality and envisions a "community-based" system of industry, the federal government, and state and local government cooperating to manage the anticipated heavy volumes of UAS traffic at low altitudes. The ecosystem envisioned by the FAA envisions a group of USSes that would include providers of commercial UTM services, consuming and sharing FAA and other authoritative source data. These USSes will provide services to and facilitate coordination and Detect and Avoid (DAA) capabilities for UAS operators, while also providing integration into Air Traffic Control for operations that transit controlled airspace.

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[2] FAA Website, UAS by the Numbers (https://www.faa.gov/uas/resources/by_the_numbers/); 10 March 2020
[3] FAA FY2020-2040 Forecast
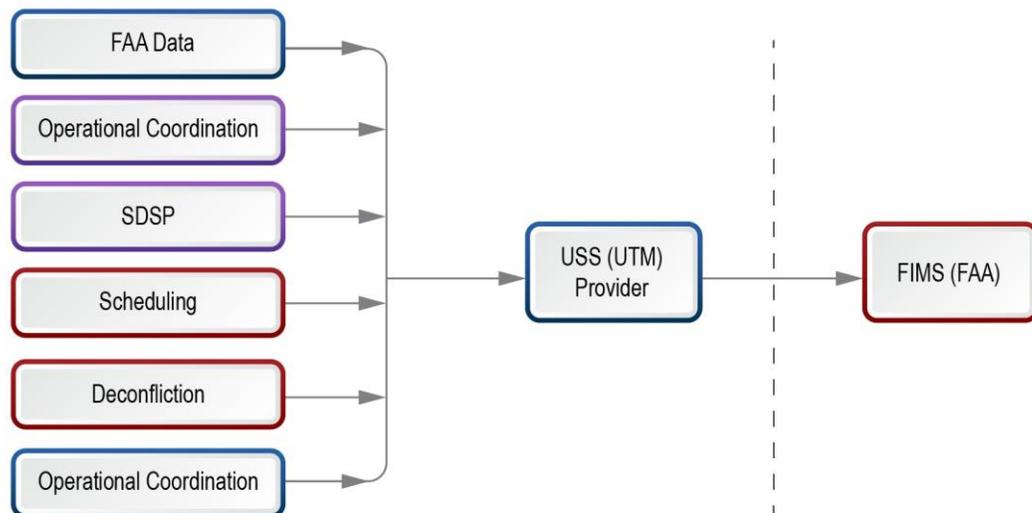
Figure 1: Simplified UTM Concept Based on the FAA UTM ConOps V2.0

The FAA UTM ConOps references one of the FAA's first functional components of the UTM ConOps: the LAANC program. Deployed as a prototype in October 2017, the program officially onboarded the first group of approved USSes in 2018. Since then, the program has grown to almost 20 approved providers.[4] The group of approved LAANC USS providers presents a unique opportunity for Virginia's FIX concept: to work with a group of existing USSes already providing flight planning and compliance services to UAS Operators and are already capable of consuming and publishing this type of data to operators. In fact, providing this type of value-added information to operators for flight planning and safety is part of many of the USS core business models, and compliance with LAANC requirements means that this community is already primed to integrate with VA- FIX.

Virginia can align with and contribute to the FAA UTM and LAANC initiatives playing out in the national airspace by functioning as an SDSP, exploring key problem statements identified by the DOAVUAS Work Group, and support the FAA vision for UTM:

- Can we improve safety and awareness through information sharing (data standards) among state and local agencies, the public, and commercial and hobbyist operators?
- Can we improve operator awareness for compliance and safety? What state and local agencies are operating in a given area? What state and local guidance, restrictions or ordinances may exist on the ground?
- Can we improve operation awareness? Can Virginia support state and local agencies and sharing information about operations? Can information sharing facilitate cooperation (such as in search and rescue or inspections)?
- Can we bridge the gap between local and industry needs? Can state and local agencies publish not just rules but also clarifying guidance and information that help UAS operators conduct safer, more efficient operations?

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[4] https://www.faa.gov/uas/programs_partnerships/data_exchange/

In October 2019 Senator Lee of Utah introduced a draft bill delegating certain airspace management functions below 400ft above ground level (AGL) to State, Tribal, and Local Government. While the general agreement was that this legislation was premature, it is consistent with the FAA's UTM vision of a "community based" approach that envisions delegation and collaboration. What is especially interesting is that Senator Lee's proposed legislation recognizes the explicitly local nature of the "immediate reaches of the [UAS] airspace" as compared to traditional manned aviation.

This unique combination of factors provides us with an opportunity to help Virginia and the nation prepare for a UTM future. We are addressing core problems raised by the DOAV UAS Work Group by leveraging Virginia's unique assets, supporting and expanding the FAA's work on UTM, and putting Virginia's data assets to work as the first authoritative State and Local SDSP.

How does the Virginia Flight Information Exchange work?

The VA- FIX is an "information hub" that supports the sharing of information by allowing state and local agencies, USSes, UTM providers, UAS operators, and the public to post and retrieve information as needed for their missions and operational requirements. VA- FIX allows information sharing in the most transparent, open way possible while also respecting operational security and privacy requirements, especially in public safety. This involves establishing a system that allows for multiple ways to connect and share information, including web-based and programmatic alternatives. VA- FIX is the first Authoritative Source SDSP per the FAA's UTM ConOps, and supports open, flexible, scalable data sharing through six key components:

- An Application Programming Interface (API) component that allows for programmatic access to post and retrieve information, either from services within VA- FIX (such as a web user interface) or approved services from without (ArcGIS or a USS Platform);
- An event-driven processer that treats information as events for additional processing allowing functions to be added in a modular way (starting with identifying intersection of advisories and operations, but could add additional adjudication or smart services);
- A scalable geospatial data store for persistently storing and rapidly querying information;
- A web-based graphical user interface that allows representatives of state and local government to interact directly with the system to publish, review, and analyze information;
- An open, public web-based graphical user interface that allows members of the public to see and review non-sensitive advisories and information; and
- An authentication boundary that ensures named access to the system is controlled and secure and sensitivity and security sharing restrictions on data are enforced.

These six key components create a system that will allow Virginia state and local governments to interact programmatically with VA- FIX; allow the public to interact with the system while protecting sensitive information; and allow USSes and UTM providers to integrate programmatically with VA- FIX to integrate Virginia authoritative source information into flight planning and compliance products.
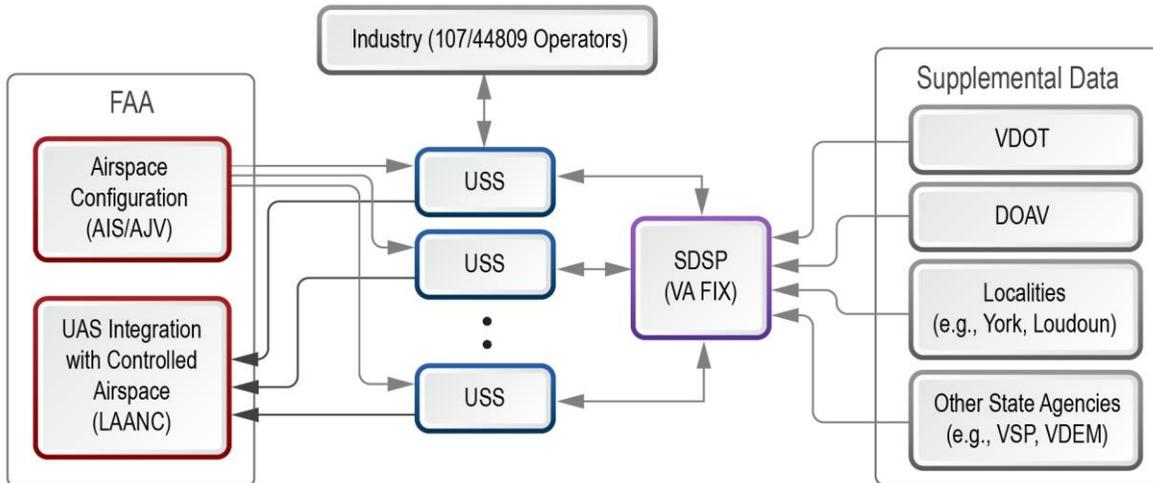
Figure 2: VA- FIX Concept of Operations

The VA- FIX architectural concept allows state and local government to share detailed supplemental information with UAS Operators in real time through FAA's existing USS program. As an example:

- A locality provides information on zoning and planning;
- A UAS operator uses its USS-provided tools to plan a site data collection operation using ground data to identify takeoff and landing areas (TOLAs) and avoid operations over people for a safe, efficient flight;
- Public Safety provides an advisory on an emerging incident;
- The USS notifies a UAS operator in real time that the operation now intersects with incident operations; and
- A UAS operator modifies/optimizes operation in real-time to avoid incident interference while maintaining safety and efficiency.
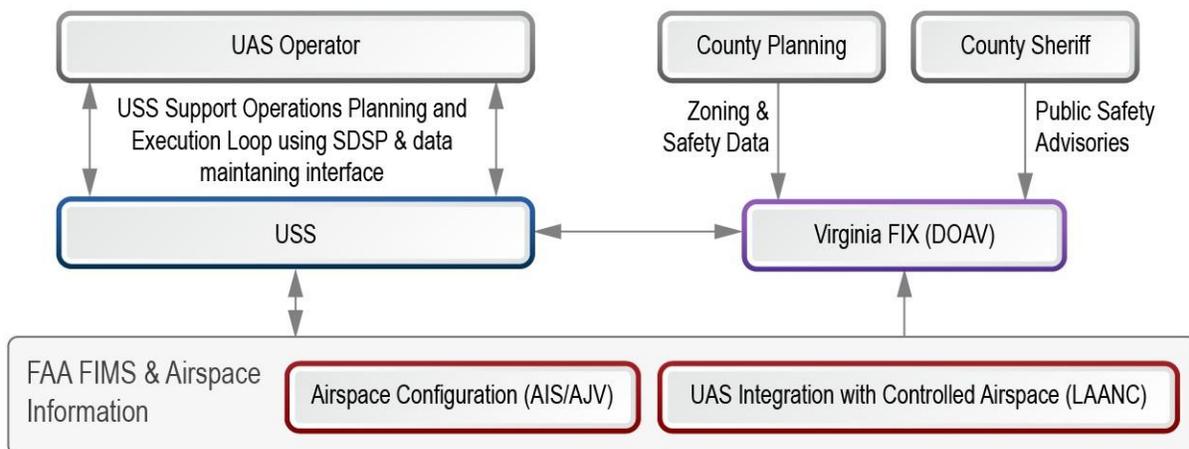
Figure 3: Example Virginia FIX Use Case

While the above is a basic, simple use case, the concept of a flexible, open architecture for VA-FIX allows this use case to be repeated and scaled throughout the state. It can be applied to a variety of scenarios, stakeholders, and data.
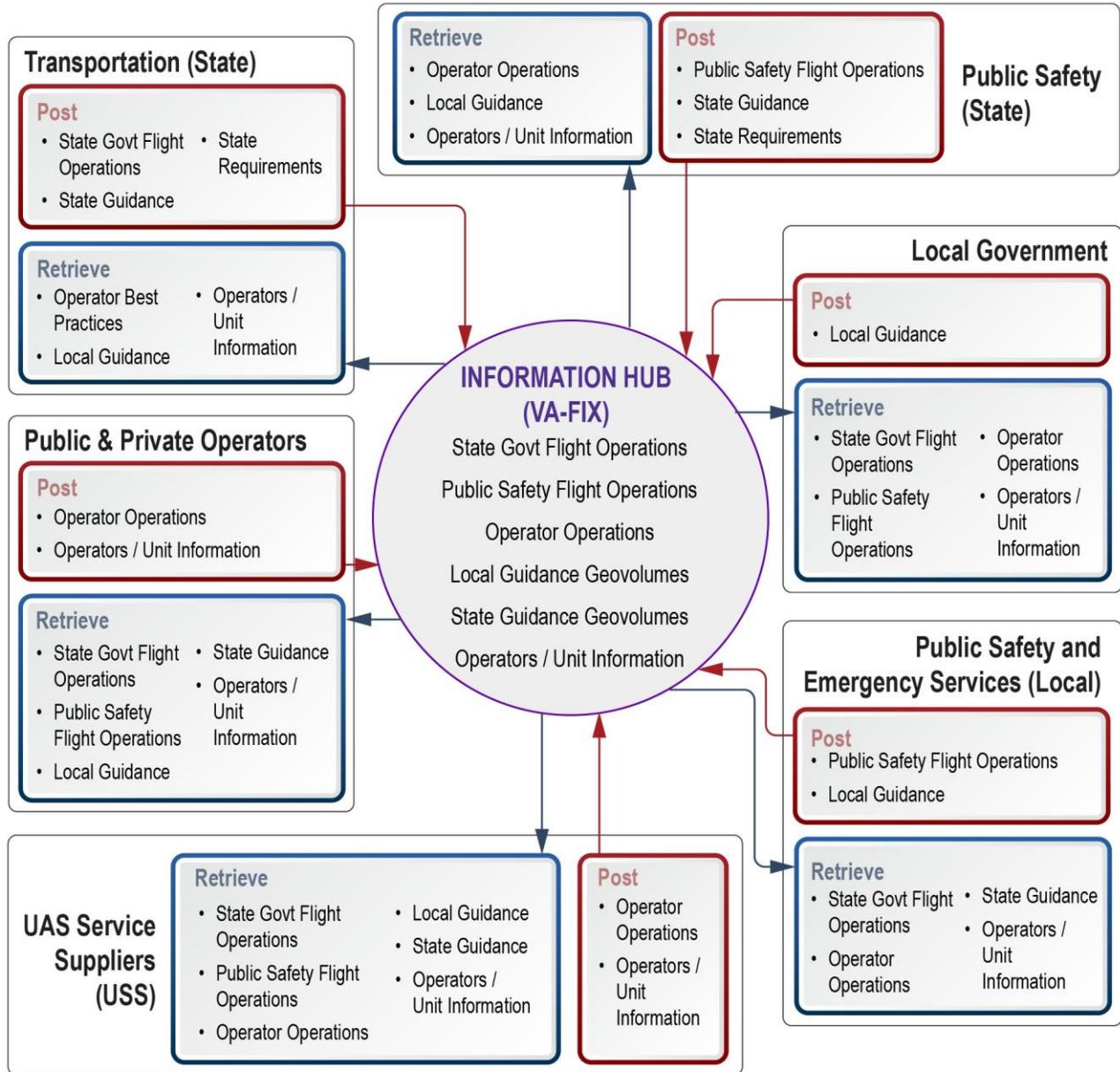
Figure 4: Information Sharing Across Stakeholders, Data, and Use Cases

VA- FIX is intentionally designed to leverage existing standards, open source technologies, and background intellectual property developed in the private sector that is being transferred to the Commonwealth of Virginia. Applying design principles allows the Commonwealth to develop, deploy, and maintain VA- FIX quickly and economically, to the benefit of the UAS Industry,

state and local government stakeholders, and the citizens of the Commonwealth. The VA- FIX explicitly relies on several key design principles:

- Leverage existing state and local UAS programs, operational needs, and existing geospatial data to operationalize the existing wealth of authoritative source data that the Commonwealth already has;
- Leverage open-source technology and an unlimited grant of existing intellectual property by an existing USS capability developer in Virginia (provided by ATA) to support the base capability quickly and inexpensively;
- Leverage existing data and information standards promulgated by the FAA for sharing geospatial information in the context of UAS as a SDSP; and
- Open the pilot to USSes and agency software providers to connect to the VA- FIX interfaces to share data and extend the capability by partnering with existing providers.

In the development of VA- FIX, the Flight Information Exchange Pilot Working Group has been careful to manage the scope of the project. The Commonwealth of Virginia wants to foster and enable UTM, not provide a competing solution. From the beginning, this working group has maintained a set of clear scoping principles, as described in Figure 5 below.

VA- FIX Is Not	VA- FIX Is
- A UAS Traffic Management (UTM) solution. Industry and the FAA are already working on this. VA- FIX is an effort to create an additional data source for integration into a UTM. - A new regulation. There are already existing authorities, laws, and models for regulation. VA- FIX is an experiment in publishing and sharing information in a way that agencies and UAS operators can understand and use. - A flight planning or fleet management solution. VA- FIX is intended to provide a means and a source for sharing data, while allowing state and local government to interface with VA- FIX through any tool that can send and receive geospatial data in an open manner.	- An experiment in the value, opportunity, and challenges of information sharing by, and between, state and local agencies, industry, and the public. - An open and public asset, owned by the Commonwealth of Virginia, with no licensing or intellectual property restrictions and open interfaces (combined with an authentication mechanism) to allow agencies and industry to share information through preferred tools and vendors. - A SDSP as described in the FAA UTM ConOps providing value-added information to industry participants in support of safety and efficiency that fosters the DOAV mandate to manage the governance of authoritative supplemental data throughout the Commonwealth. - A catalyst for collaboration among state and local agencies and industry by creating an open, public information hub that everyone can use—provide focused initial use cases and then allow others to create their own demonstration projects leveraging the VA- FIX infrastructure.

Figure 5: Maintaining clear scope for the VA- FIX is critical to maximizing value

Serving Virginia Stakeholders.

The DOAV UAS Work Group and the VA- FIX Working Group include representatives from industry, UAS operators, state and local government agencies, public safety, and the public. The groups have had robust discussions about specific areas where the VA- FIX can demonstrate the value of information sharing and a single authoritative source. As a result of these discussions, stakeholders identified five key use cases to assist in design, development, and evaluation:

- *Local Government Advisory*: Provide local government a voice for local preferences (e.g., safety in operations over people, privacy, environmental concerns) while providing guidance to industry in a consistent, harmonized manner managed through DOAV.
- *State or Local Agency Site Data Collection*: Make the public and UAS operators aware of operations so that we can reduce operational interference which improves safety while also reducing public concerns about the use of the UAS through transparency.
- *Public Safety Large Audience Events*: Provide needed data to UAS operators and USS providers to assist in compliance with Federal Rules about operations over people.
- *Public Safety Hazmat*: Inform operators and the public about an area of personal hazard or aircraft contamination risk— manage flight in the air and deconfliction on the ground.
- *Public Safety Emergency Incident and Disaster Management (e.g., Fire, Police Operations, Wildfire, Hurricane)*: Inform operators and the public about an area of personal hazard, aircraft contamination risk, or risk of catastrophic damage to UAS— manage flight in the air, deconfliction on the ground, and help with creating a temporary flight restriction (TFR).

These use cases specifically identify and serve the needs of key stakeholders in the Commonwealth of Virginia who participate in the UAS DOAV Work Group and the VA- FIX Working Group. The following is a list of state and local public safety agencies and other key stakeholders that are participating in the FIX Working Group and contributing to the design and deployment of this capability:

- Virginia Department of Aviation
- Virginia Department of Transportation
- Virginia Center for Innovative Technology
- Virginia Department of Emergency Management
- Virginia Department of Forestry
- York County Fire Department
- Loudoun County Sheriff's Department
- Stafford County Sheriff's Department
- Fairfax County UAS Coordinator
- Loudoun County UAS Coordinator
- DRONERESPONDERS

In addition, DOAV has sought input and guidance from the DOAV UAS Work Group, VA- FIX Users Group, UTM and USS Providers (to be offered programmatic access to VA- FIX) and UAS Operators (including recreational flyers) who will consume advisories through UTM and USS providers.

State and local government and public safety agencies that are responsible for public safety and quality of life, are empowered to provide information to the UAS community to manage UAS operations around public safety incidents and to provide local government guidance.

How Can You Participate?

This capability is not solely for the VA- FIX Working Group, or even just for Virginia, for that matter. With a commitment to open and transparent information sharing, DOAV and the VA- FIX Working Group are seeking to expand collaboration. There are multiple ways to join the VA- FIX effort.

You Are a Virginia Stakeholder.

If you are a Virginia stakeholder (state or local agency, USS or UTM operating in Virginia, UAS operator or stakeholder) DOAV wants you to have access to the VA- FIX. State and local agencies can contact DOAV to have accounts provisioned for their authorized users. USS and UTM providers, if FAA approved, will be provided free programmatic access to the VA- FIX through an authenticated API by application to DOAV. UAS operators and stakeholders can review information through USS and UTM providers connected to the VA- FIX or directly through the VA- FIX public website.

You are a National Stakeholder.

If you are a national industry stakeholder, such as a federal agency, USS or UTM provider not currently active in Virginia, we welcome you to the Commonwealth! DOAV can also onboard approved, appropriate stakeholders to VA- FIX for sharing (publication and consumption) of information.

You are Another State.

The Commonwealth of Virginia believes that the VA- FIX model is applicable to jurisdictions across the country. In conversations with other states, DOAV has learned that many other states have the same challenge of how to prepare for UTM while also ensuring that they keep an open playing field and avoid getting drawn into becoming a UTM provider. Having information exchange as a general-purpose base capability allows you to work with any and all USS and UTM providers, keeping your state open to all of the UAS industry and preserving competition and freedom of choice for state and local industry, UAS operators, and industry.

You are a Local Jurisdiction Outside of Virginia.

The Commonwealth of Virginia is also willing to make the VA- FIX infrastructure available to other jurisdictions that are seeking to evaluate the VA- FIX concept of open information sharing as a SDSP. Because the VA- FIX uses national standards and interfaces, and interfaces with USS and UTM providers on a national basis, to the extent that a non-Virginia entity would like to "experiment" with information sharing through the VA- FIX, DOAV has the ability to provide a non-privileged account to an external jurisdiction and that jurisdiction will be able to publish data to the public and USS/UTM providers anywhere in the United States.

Resources

Federal Aviation Administration, Unmanned Aircraft System (UAS) Traffic Management (UTM), Concept of Operations v2.0, 3.2.2020.

Federal Aviation Administration Website, UAS by the Numbers (https://www.faa.gov/uas/resources/by_the_numbers/); 10 March 2020.

Federal Aviation Administration FY2020-2040 Forecast.

Federal Aviation Administration, UAS Data Exchange LAANC, https://www.faa.gov/uas/programs_partnerships/data_exchange/