MID-ATLANTIC AVIATION PARTNERSHIP

VIRGINIA TECH™

Initial Operationalization Report

Uncrewed Aircraft Systems (UAS) Traffic Management (UTM) Implementation in the United States (US)

March 18, 2025

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Executive Summary

The Unmanned Aircraft Systems (UAS) Traffic Management (UTM) Shared Airspace initiative marks a significant milestone in the integration of UAS operations within the United States. Building on over ten years of UTM testing and development, this initiative led to the first operationalization of UTM in the United States with UTM services approved by the FAA for strategic coordination.

In 2023 the Federal Aviation Administration (FAA) UAS safety risk management policy (8040.6A) was updated to include uncrewed aircraft (UA) to UA collision risk. The overall goal of this initiative was to mitigate the UA-to-UA collision risk where overlapping commercial drone operations were emerging, specifically in the North Texas area. This report summarizes the successful, nationally scalable, and globally applicable implementation of UTM, emphasizing strategic coordination among beyond visual line of sight (BVLOS) UAS operators in the initial deployment area of North Texas. This project achieved operationalization of UTM in the United States in a timely manner while maintaining high safety standards and in the process, setting a precedent for future UTM implementations globally. Initially five companies were onboarded using the newly developed industry governance structure and data sharing agreements and to date this has grown to 12+ in less than a year.

Success of Initial UTM Implementation

The initial US UTM implementation was a collaborative effort involving multiple stakeholders, including UAS operators, service providers, the FAA and the National Aeronautics and Space Administration (NASA). Key achievements include:

- **Industry Governance:** A key component of this initiative was determining and establishing how the UTM implementation would be governed. The team developed a scalable and adaptable governance agreement modeled from the Global UTM Association (GUTMA) USS Data Sharing and Governance Agreement Template, that is now public and able to support nationwide operations. (https://github.com/utmimplementationus/getstarted)

- **Operational Strategic Coordination**: The project successfully implemented strategic conflict detection and aggregated operational intent conformance monitoring services conforming to ASTM F3548-21 Standard Specification for UAS Traffic Management (UTM) UAS Service Supplier (USS) Interoperability. This enables seamless coordination among UAS operators. Additionally, different sections of the ASTM F3548-21 standard address different requirements needed and set by the regulator, therefore particular pieces of the standard will be identified and leveraged to support a method of compliance. UTM implemented during this initiative is a fully operational capability and can support complex, commercial, BVLOS UAS operations moving forward.

- **Service Approvals**: Working closely with the FAA utilizing the Near-Term Approval Process (NTAP), four companies, ANRA Technologies, DroneUp, Wing, and Zipline, received FAA letters of acceptance to utilize UTM for shared airspace, marking an industry first. Additional approvals are expected.

Key Components

The UTM implementation leverages several key components to ensure scalability and safety:

- **Standardization**: The UTM Implementation successfully integrated strategic conflict detection service conforming to ASTM F3548-21 Standard Specification for UTM USS Interoperability to ensure UTM Service Provider (USP) interoperability. In addition, the governance framework is based heavily on GUTMA guidance documentation.
- **Automated Testing**: The use of the InterUSS Platform automated testing provides seamless onboarding and validation of new service providers and the ecosystem.
- **Governance Framework**: An industry-led governance approach, supported by a comprehensive Governance Agreement and technical documentation, ensures structured consensus decision making and dispute resolution among stakeholders.

Future of UTM Implementation

The methodologies and lessons learned from this initial UTM implementation offer valuable insights for global adoption. The initial UTM implementation in the United States serves as a successful model for timely and safe integration of BVLOS UAS operations in shared airspace.

Through this work the following key elements to implement Shared Airspace were identified:

- Create and document clear, concise, repeatable frameworks and processes such as service description document, governance framework, and gating criteria
- Enable strong public-private partnerships
- Establish a strategy and architecture to facilitate a digital information exchange between other entities as necessary
- Test, validate, and simulate prior to live operations leveraging test suites and virtual operations
- Enable an evolving ecosystem for additional UTM features using a data centric approach
- Foster innovation and scalability with existing UTM implementation and applicability with a diverse set of operators and locations

Next steps include:

- Continue to support the established UTM governance structure and extend its benefits to other operators
- Utilize the templates produced and lessons learned from this effort to expand into other geographical areas in the United States, as well as global UTM and U-space constructs
- Continue to identify specific areas for data collection to support safe and efficient airspace usage or if any other approaches are needed
- Implement additional UTM capability according to the “roadmap” developed by the Technical Committee

Version History

Version #	Revision	Date
1.0	Initial Release	03/18/2025

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1.0 Introduction

The UTM shared airspace initiative was an industry led effort to perform initial UTM implementation in the United States with an initial focus on deploying the ASTM F3548-21 strategic coordination service among BVLOS UAS operators. This report covers the initial implementation efforts spanning August 2023 to August 2024 that established the industry governance structure and successfully deployed the first FAA accepted UTM services in the United States.

This project led to an efficient and safe implementation of strategic coordination among BVLOS UAS operators in US airspace. Currently, several USP's have implemented strategic coordination, received FAA Letters of Acceptance to utilize UTM services to share the airspace, and have demonstrated these capabilities through simulations and live flights in the US National Airspace (NAS). Numerous other entrants are currently on the path to implementing services through the newly created industry governed structure.

1.1 Background

Integration of UAS operations in the National Airspace System (NAS) presents a variety of issues and novel challenges. UTM addresses some of these challenges by providing a community-based, cooperative traffic management ecosystem. UTM relies on layers of information shared between operators, USPs and others. [1]

UTM has been in development and testing for over ten years. Figure 1 shows an overview of the timeline of development, implementation and operationalization of UTM in the United States. This project is the culmination of this development and implementation of UTM.

UTM was identified early on as being crucial to safe integration of UAS into the National Airspace System (NAS). The FAA Reauthorization Act of 2018, PL 115-254, Section 377, directed the FAA to develop a process to allow the use of UTM Services to maintain the safety and efficiency of the NAS. [2] In 2023, the FAA updated the UAS Safety Risk Management (SRM) Policy (8040.6A) to include UA-to-UA collision risks, highlighting the need for mitigations to prevent collisions. [3]

The technical groundwork for the UTM system was developed through FAA and NASA testing, including the FAA UTM Field Test (UFT), FAA UTM Pilot Program (UPP) and NASA UTM Technical Capability Level tests. These tests, conducted between 2015 and 2023, explored different aspects of UTM and technical requirements and readiness. [4] Throughout this testing ASTM worked to develop the ASTM F3548-21 Standard Specification for UAS Traffic Management (UTM) UAS Service Supplier (USS) Interoperability. [5] ASTM F3548-21 was validated during the FAA UTM Field Test (UFT) in 2023.

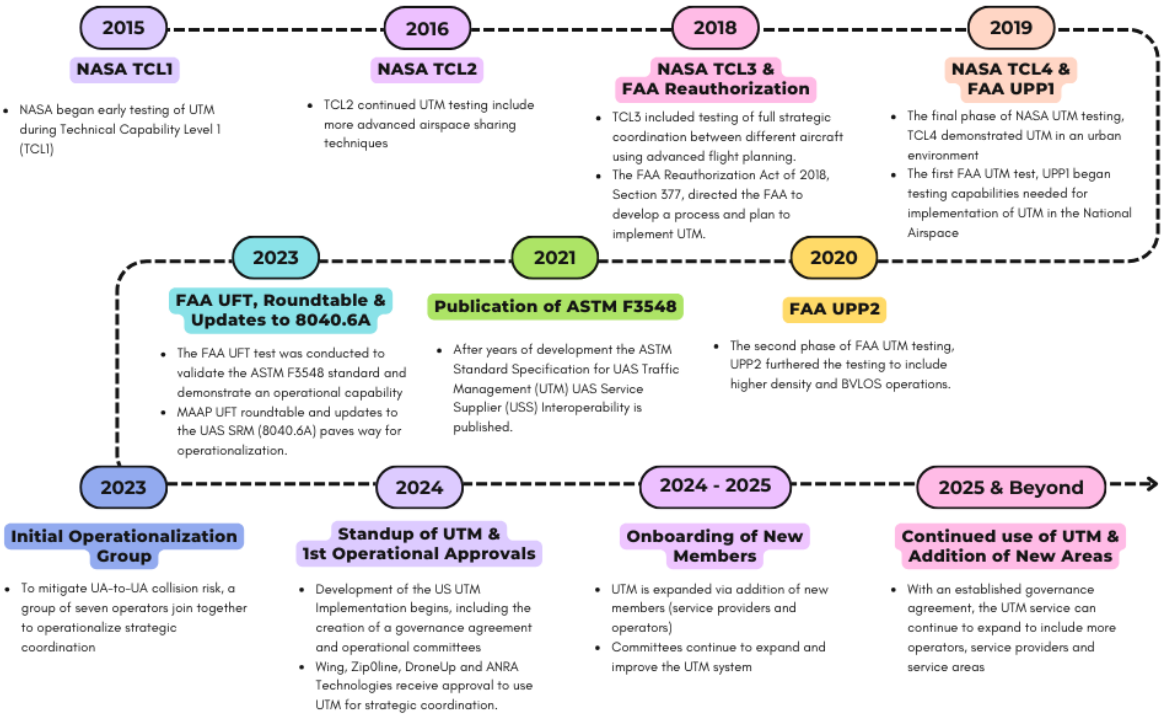

Figure 1. Timeline of development, implementation and operationalization of UTM in the United States.

In late 2023, several UAS operators noted the need for coordination due to an increasing number of UAS operations, particularly drone delivery, in the North Texas area. To address this need, it was decided to implement the most relevant UTM services defined in ASTM F3548-21. Specifically, the capabilities that needed to be implemented were strategic conflict detection and aggregate operational intent conformance monitoring services (collectively identified as strategic coordination), defined in Section 5.4 and 5.5 of ASTM F354-21.

In addition to the ASTM standard, this work leverages contributions from GUTMA and the InterUSS Platform. In all aspects, the team is striving to establish a UTM implementation that will work for all operators and all locations, on a global scale.

1.2 Objectives

The overall objective of this initial UTM shared airspace project was to build a sustainable and operational infrastructure to support strategic coordination between current and future UAS operators in the greater North Texas area. This includes the technical UTM implementation, the means to test the implementation, and the governance structure needed to sustain, grow, and foster equitable participation. It is important to note that this project was intended to be an implementation of an initial set of services on a national scale and can expanded to new service suppliers, operators, and geographical regions.

1.3 Resources

The resources for this project can be accessed at the public GitHub page (https://github.com/utmimplementationus/getstarted). Information on the InterUSS automated testing can be found on the InterUSS GitHub page (https://github.com/interuss).

2.0 Approach

2.1 Initial Demand and Current State of UTM Implementation

In August 2023, seven operators joined the project to operationalize strategic coordination: DroneUp, Flytrex, Prime Air, UPS Flight Forward, Wing, Zipline, and Manna (using ANRA Technologies as a service provider). The initial activities of the group were coordinated by Virginia Tech (VT) Mid-Atlantic Aviation Partnership (MAAP). The UTM system and governance structure were developed over the course of the project during 2024. The major milestones of the project are shown in Figure 2. As the governance setup has been established, coordination of the activities has moved to the Operational and Technical Committees.

The FAA and NASA also participated in the initial development and implementation. FAA and NASA provided expertise and guidance to ensure that the UTM is implemented in accordance with the long-term plans of the FAA and that the constructs leverage the FAA's Near-Term Approval Process (NTAP).

Figure 3 shows the overall UTM ecosystem at the time of publication, March 2025, including the current participants. Participants include service providers, operators and vertically integrated service providers that are also operators. A full list of the cohort is included in Appendix B. Many other participants are in the process of or are interested in joining.

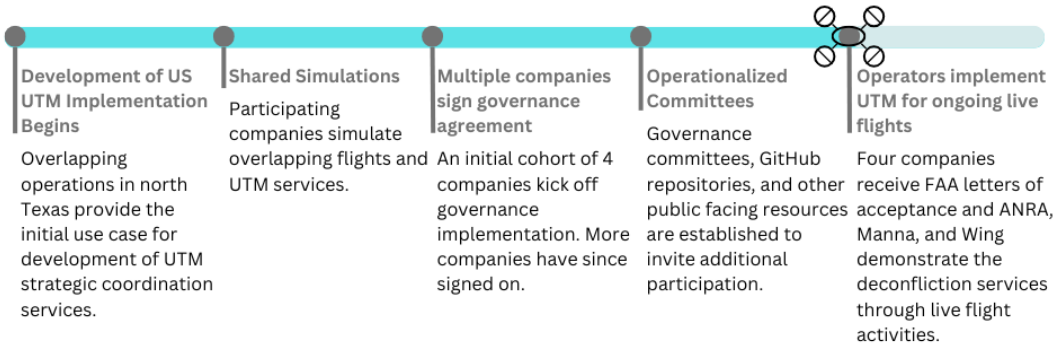

Figure 2. US UTM Implementation Milestones.

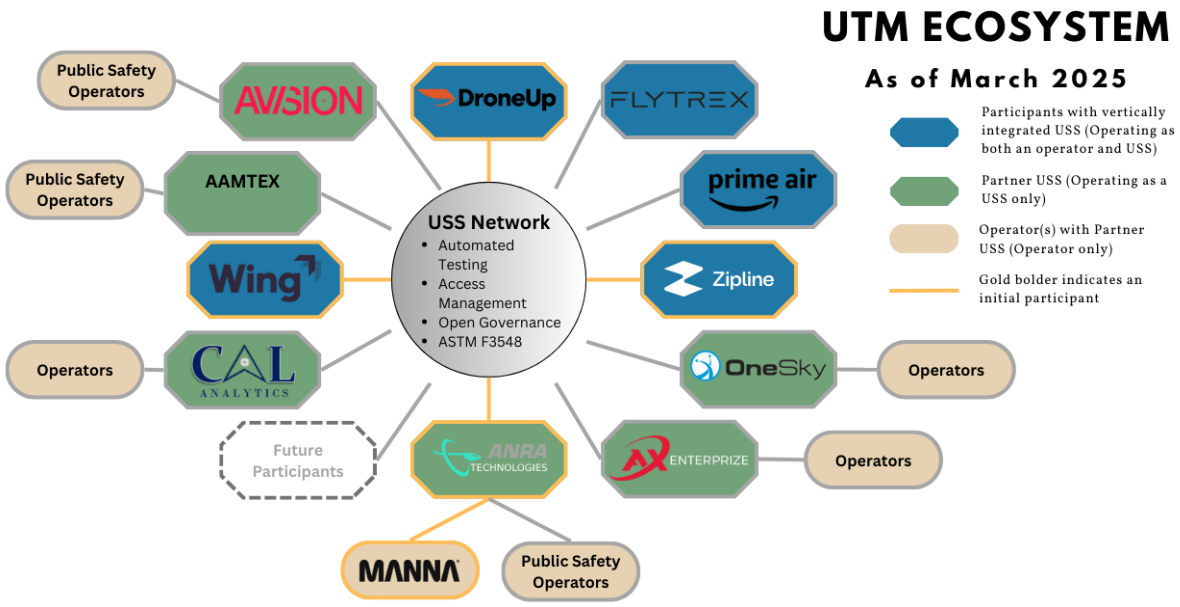

Figure 3. The current UTM ecosystem includes the initial cohort as well as numerous newer entrants to the industry governed ecosystem. Service providers are shown in green, operators are shown in tan, and vertically integrated operators are shown in blue. Gold borders indicate the initial five participants (four service providers and one operator).

2.2 Governance Approach

A unique aspect of this project is the industry-led governance which houses guidelines, processes, and structures. It was important to ensure that the UTM implementation could be supported and grown long term according to industry needs. To ensure this, the partners developed a governance framework that consists of a Governance Agreement and technical implementation details. The technical details include a Service Description Document (SDD) and a Requirements Traceability Matrix (RTM), described in more detail in Section 2.3.

2.2.1 Operator and Service Provider Roles

Both operators and service providers participate in the UTM governance. Operators are the entities that conduct the actual flights and have the need for deconfliction services. Service providers are the entities that provide the UTM services used by operators. The service provider and operator can be the same entity; however, that entity needs to fulfill each role individually.

Since the service providers are providing the UTM services, they sign and agree to the Governance Agreement. Service providers have representation on both committees. Service providers invite each operator using their service to participate in the committees.

2.2.2 Governance Agreement

The governance agreement describes how the entities will manage themselves and onboard new service providers and operators. Most of the governance setup is detailed in Annex C which is based heavily on the GUTMA template [6]. This includes how the committees are setup (Section 2.2.3), how new entities are onboarded, how operational practicality is achieved, how meetings

are conducted, the rules for voting, guidance on service provider agreements, details on aggregate conformance monitoring and reporting requirements. [7]

2.2.3 Committee Structure

Under the governance agreement, two committees were established:

Operations Committee – The operations committee is responsible for general oversight, onboarding/offboarding, publishing reports, and implementing changes from the technical committee.

Technical Committee – The technical committee manages the SDD and roadmap of technical updates. The technical committee also manages the automated testing baseline.

2.3 Technical Approach

2.3.1 Service Description

The service implemented in this project consists of strategic conflict detection and aggregate operational intent conformance monitoring services (collectively identified as strategic coordination). The services are implemented in accordance with ASTM F3548-21 with a few exceptions (see Section 2.3.2).

ASTM F3548 does require compliance with ISO/IEC standards or equivalent for security, privacy and quality of service. To support implementation, these equivalent means of compliance were established for each of these items and included in the SDD.

2.3.2 Requirements Traceability and Differences from Standard

The RTM was developed to map how compliance is handled for each of the ASTM F3548 requirements. Most requirements are implemented and tested via the InterUSS automated testing. Some requirements do not require automated testing but are addressed in other documents supporting governance. Of note, the following are standard requirements that were not implemented in the current UTM implementation. These may be added later.

- USP Down (SCD0005, SCD0010 and USP0105) - In the current implementation the Discovery and Synchronization Service (DSS) is not notified when a USP is down. USPs cannot plan new flights in the areas where the down USP is managing planned and active flights. Each USP is responsible for monitoring and reporting degradation using an online notification platform per the agreement. This initial implementation approach to handling a down USP was made for efficiency and does not impact the overall safety of the UTM.
- Priority (SCD0015-SCD0030, SCD0055-SCD0070 and SCD0090-SCD0095) – All initial UTM participants have the same priority, so priority was not implemented initially. Under the initial implementation all flights are filed with a priority of 0 and no conflicts are permitted within the same priority level.

2.3.3 Onboarding and Automated Testing

A key aspect of both the governance and technical implementation is the onboarding of new service providers and operators. The onboarding process is split into steps, each with a “gate” that

must be passed to move onto the next step. The process for onboarding and the criteria for each gate is shown in Table 1.

Table 1. Onboarding gates from the UTM Service Provider Data Sharing and Governance Agreement. [7]

Gate	Gate Exit Criteria		
	Service Provider	**Operator**	**Joint**
GATE 1: Qualification Testing	• Implement the service requirements in accordance with the applicable service description document • Pass automated testing (own system only)	N/A	N/A
GATE 2: Simulation	• Pass automated testing (ecosystem)	N/A	• Integrate service provider and operator systems
GATE 3: Production Flights	• Pass automated testing (ecosystem) as a part of the software release process	• Validate operational practicality through overlapping airspace simulation	N/A

Automated testing is vital in this onboarding process as it allows new service providers to be tested and validated prior to operations. This implementation utilizes the InterUSS test suite to validate the needed functionality. Test suite updates needed during this implementation and any subsequent updates are approved by the Technical Committee who controls the automated testing baseline for the project. [8]

3.0 Live Flight Overview and Results

3.1 Flight Areas

While the work of this project is relevant and applicable to any location in the United States, initial live flights were performed in the North Texas area by Manna and Wing in late 2024. This was chosen as there was an operational need for UTM since there were multiple UAS package delivery operations occurring in the area.

3.2 Summary of Production Flights

Prior to actual flight operations, simulations were performed between the different partners. This is an important step when there are overlapping areas of operation to ensure operational

practicality. After simulations were completed, routine production operations were started using UTM to deconflict from one another.

These operations have demonstrated the practical implementation of strategic coordination services in real-world conditions. Several live flights have also been performed in the North Texas area, with ANRA providing UTM services to Manna while Wing operated with their own UTM services in overlapping airspace. As of this writing, all these flights have occurred without incident. The metrics from these flights (such as conformance, operational volume efficiency, and strategic conflict resolution success rates) are being collected by the Operations Committee on a monthly basis.

Figure 4. Example of simulation visualization (left) and live overlapping flights (right).

3.3 Operational Approvals

The UTM implemented by this project is already being integrated towards safety mitigation within advanced operational approvals from the FAA. This is a testament to the benefits of having the FAA involved in the process and the hard work from the entire team to address the many requirements. In late summer of 2024, the FAA approved Wing, Zipline, DroneUp, and ANRA Technologies to use their UTM services for strategic coordination. This is an industry first and was done via the FAA Near-Term Approval Process (NTAP).

4.0 Challenges, Lessons Learned and Recommendations

4.1 Challenges and Lessons Learned

4.1.1 Governance

The governance approach utilized for this effort leveraged previous work by GUTMA and others, however there were many new aspects added and lessons learned during the process. Coordination of a complex team like this requires defined structure in order to maintain equity and access. While all the partners are committed to the safety of the airspace, many have different constraints, objectives, and concepts of operation. The robust governance committee structure established here provides a mechanism to handle disputes, implement new concepts and features, onboard new participants, and scale operations to new geographies.

As of this writing, these legal agreements are well established, but as more parties are added there may be changes needed to address additional concerns. The Governance Committee structure inherently addresses the need to adapt and update the structure over time.

Another area that was considered was how to ensure efficient use of the airspace. The ASTM F3548 has minimum conformance metrics to ensure operators do not violate their volumes routinely. In the SDD the minimum conformance is set at 95%. This ensures operators are filing volumes that are sufficiently large to contain the planned flight, but the question the team had to consider was how to ensure operators do not utilize unnecessarily large volumes of airspace. Several methods were considered including adding additional metrics. The decided approach was to use the same aggregate conformance metric as a flag for inefficient use of airspace. If an operator's aggregate conformance is in excess of 99.5% within a rolling 4-week period, then a review will be made by the Operations Committee to ensure the fair and efficient use of the airspace.

4.1.2 Technical

The timely implementation achieved during this project was partially enabled by prioritizing an initial, limited set of core UTM services. The ASTM standard covers many functions of UTM, many of which are important and vital to long term implementations. However, for this initial implementation the team decided to focus on strategic coordination. Things such as priority, constraints, etc. were put onto the roadmap for future implementation.

Automated checkout tools are vital for an operational UTM. Large scale integration using primarily manual validation methods were used in previous UTM testing (such as UPP and UFT) and are not viable in a commercial setting where various operators and new software are onboarding routinely. This project leveraged InterUSS which were updated during the project to ensure new service providers could be evaluated properly. It is important to keep these tools up to date as the UTM system changes or new features are added.

One area that needed specific attention during the UTM implementation was the ability to support entities in different phases of UTM development. This is an ongoing need past the initial phases as new operators/service providers will be onboarded routinely. To support this the team implemented multiple environments:

- Pre-qualification – The pre-qualification environment is where USPs perform their own individual testing during development. Many USPs set up their own pre-qualification environment, but one is also provided by Wing for USPs that don't yet have their own internal environment(s) set up.
- Qualification – This environment is used to conduct automated interoperability tests between different USPs. These tests are required before moving to simulation or production.
- Simulation & Production – Currently one environment is used for both simulation and production. In future enhancements to the architecture new partitions and environments will be created.

4.2 Recommendations and Next Steps

The initial implementation of UTM in the United States was effective in addressing additional safety layers to UAS operations and can be leveraged as 1) the foundation for additional UTM services in the United States, and 2) a template for globally harmonized UTM operations at scale. Below is a summary of the recommendations that are detailed in the following section:

- Continue to support the existing UTM implementation as it scales to new geographic locations and onboards new participants
- Utilize the templates produced and lessons learned from this project to advance further operationalization of UTM services in the United States and globally
- Continue to collect data on efficient and equitable airspace usage to identify if other metrics or approaches are needed
- Implement additional UTM features according to the "roadmap" developed by the Technical Committee
- Explore how UTM data can be shared with other entities, such as traditional aviation and/or the FAA

Through this work the following key elements to implement Shared Airspace were identified:

- Create and document clear, concise, repeatable frameworks and processes such as service description document, governance framework, and gating criteria
- Enable strong public-private partnerships
- Establish a strategy and architecture to facilitate a digital information exchange between other entities as necessary
- Test, validate, and simulate prior to live operations leveraging test suites and virtual operations
- Enable an evolving ecosystem for additional UTM features using a data centric approach
- Foster innovation and scalability with existing UTM implementation and applicability with a diverse set of operators and locations

4.2.1 Support of Existing UTM and Expanding to Include Other Operators and Locations

The team plans to continue support of the existing UTM implementation and work towards onboarding more operators. Since the initial implementation there have been several operators that have reached out and joined the team. This is expected to increase over time. As new operators are onboarded, the Operations Committee should work to identify and address any new requirements or capabilities needed. One example of this would be if public operators need priority for relevant operations.

The implementation of UTM in the United States can also be used as a template as UTM services are set up in more locations, including other nations. The GUTMA templates were used heavily in this implementation and the lessons learned should be incorporated back into the GUTMA templates for use on a global scale.

4.2.2 Efficient and Equitable use of the Airspace

The method implemented during this project to ensure the efficient and equitable use of the airspace was to have the Operations Committee review if an Operator's aggregate conformance is

more than 99.5% within a rolling 4-week period. This is a simple approach as it does not require the collection of additional metrics, but it may have limitations. It is recommended that the Operations Committee monitors and logs conformance metrics and documents any case where the aggregate conformance exceeds this 99.5% threshold. Depending on how often a review is needed, other metrics may be required to ensure efficient and equitable airspace usage.

4.2.3 Technical Roadmap

As the current UTM is an initial implementation there are functionalities that have not been implemented but are on the roadmap. The Technical Committee maintains the roadmap and it is recommended to include input from all stakeholders in determining the implementation plan for the roadmap items. As of the writing of this report, the technical roadmap, as determined by the Technical Committee includes:

1. USS network performance, interoperability, and reliability. Includes DSS interoperability / pooling and USS down.
2. Identify gaps and update the Service Description Document as needed to align with the Operations Committee DSS Pooling Policy
3. Prioritization task force. Task force with FAA participation and policy guidance to define approach for priority flights and address public UAS operator integration.
4. Residual USS network security. Includes non-repudiation (message signing or otherwise).
5. Assess residual UA to UA risk and develop mitigations.
6. Residual crewed aircraft risk. Includes non-cooperative crewed aircraft participation.

5.0 References

[1] Federal Aviation Administration, "Unmanned Aircraft Systems (UAS) Traffic Management (UTM) Field Test (UFT) Concept of Use (ConUse)," 2022.

[2] PUBLIC LAW 115–254, *FAA REAUTHORIZATION ACT OF 2018*, 115th Congress, 2018.

[3] Federal Aviation Administration, *Unmanned Aircraft Systems (UAS) Safety Risk Management (SRM) Policy*, 2023.

[4] Federal Aviation Administration, "UTM Field Test (UFT) Final Report," FAA, Washington, DC, 2023.

[5] ASTM Standard F3548-21, "Standard Specification for UAS Traffic Management (UTM) UAS Service Supplier (USS) Interoperability," 2021.

[6] Global UTM Association, "GUTMA USS Data Sharing and Governance Agreement Template," GUTMA, Lausanne, Switzerland, 2024.

[7] *UTM Service Provider Data Sharing and Governance Agreement in the United States*, 2024.

[8] InterUSS, "InterUSS Platform," [Online]. Available: https://interussplatform.org/.

Appendix A: Acronym List

DSS	Discovery and Synchronization Service
FAA	Federal Aviation Administration
GUTMA	Global UTM Association
ISO	International Organization for Standardization
MAAP	Mid-Atlantic Aviation Partnership
NASA	National Aeronautics and Space Administration
NTAP	Near-Term Approvals Process
RTM	Requirements Traceability Matrix
SDD	Service Description Document
UAS	Unmanned Aircraft System
UFT	UTM Field Test
UPP	UTM Pilot Program
USP	UAS Service Provider
USS	UAS Service Supplier
UTM	UAS Traffic Management
VT	Virginia Tech

Appendix B: Current Participants

The table below shows the participants as of the writing of this report.

Company	Type
AAMTEX	Service Provider
Amazon	Service Provider and Operator
ANRA	Service Provider
Arlington PD	Operator
AVISION	Service Provider
AX Enterprize	Service Provider
Cal Analytics	Service Provider
Dallas PD	Operator
DroneUp	Service Provider and Operator
Flytrex	Service Provider (Partnered with Causey as the operator)
Irving PD	Operator
Manna	Operator
OneSky	Service Provider
Wing	Service Provider and Operator
Zipline	Service Provider and Operator