Federal Aviation Administration

Version 1.0

June 30, 2022

Extensible Traffic Management (xTM) Framework Analysis

xTM Lexicon

Deliverable 01.01.00

Developed for:

Federal Aviation Administration
Advanced Concepts Branch, ANG-C2
NextGen New Entrants Division
800 Independence Avenue SW
Washington, DC 20591

Developed by:

LS Technologies, LLC
490 L'Enfant Plaza SW, #3221
Washington, DC 20024

PAGE LEFT INTENTIONALLY BLANK

Executive Summary

This document presents an initial lexicon that serves as a common frame of reference for the Federal Aviation Administration (FAA), National Aeronautics and Space Administration (NASA), industry, and other Extensible Traffic Management (xTM) stakeholders to facilitate effective and efficient communication. It is envisioned that this lexicon will be modified and expanded as future activities are undertaken to mature the xTM concept.

Version History

Date	Revision	Version
05/31/2022	Review copy	0.4
06/30/2022	Initial release	1.0

Table of Contents

List of Tables

1 Introduction

1.1 Purpose

This document serves as a repository for terms used in and defined by the Extensible Traffic Management (xTM) Framework Analysis project. It consists of common xTM terminology and other terms necessary terms to advance the objectives of the project.

This document serves as a common frame of reference for the Federal Aviation Administration (FAA), National Aeronautics and Space Administration (NASA), industry, and other xTM stakeholders to facilitate effective and efficient communication throughout ongoing activities necessary to mature the xTM concept.

1.2 Background

This xTM project investigates and analyzes xTM concepts and their associated services that are envisioned to support new entrant operations and technologies while coexisting with conventional National Airspace System (NAS) operations through an integrated and interoperable information sharing environment.

The xTM analysis highlights the common principles and tenets, as well as unique features across xTM concepts. Services that support operations in each xTM environment are also categorized. The xTM framework and analysis will ultimately help inform FAA xTM development and implementation strategies.

This lexicon aids the further development of xTM concepts by serving as a common language for stakeholders.

1.3 Scope

The xTM lexicon consists of common xTM terminology and their respective definitions. Additionally, it contains necessary terms associated with the overall principles, operations, supporting architecture, information flows and exchanges, and other elements to align the individual xTM terminology, as well as support the development of the xTM high-level concept.

2 xTM Lexicon

The xTM lexicon is provided in Table 1. The terms were developed or adapted during the xTM Framework Analysis project. Relevant terms from other sources that are used without modification are cited as such.

Table 1: xTM Lexicon

Term	Definition	Source
Air Traffic Management (ATM) System	A system that provides ATM through the collaborative integration of humans, information, technology, facilities, and services, supported by air and ground and/or space-based Communication, Navigation, and Surveillance (CNS).	GATMOC [1], xTM Project
Airspace Organization and Management	Airspace organization and management provides the first layer of conflict management. Effective airspace organization and management enhances the ability of the ATM service provider and airspace users to accomplish conflict management, and increases ATM system safety, capacity, and efficiency.	GATMOC [1]
Beyond Visual Line of Sight (BVLOS) Operations	Unmanned aircraft operations conducted beyond the visual line of sight of the operator.	xTM Project
Collision Avoidance	The third layer of conflict management, which must activate when the separation mode has been compromised. This is the safety net and is not to be used as credit in determining the performance of the separation provision regime.	GATMOC [1], xTM Project
Conflict	Any situation involving aircraft and hazards in which the applicable separation minima may be compromised.	GATMOC [1]
Conflict Horizon	The extent to which hazards along the future trajectory of an aircraft are considered for separation provision.	GATMOC [1]
Conflict Management	Conflict management limits the risk of collision between aircraft and hazards to an acceptable level. Conflict management consists of three layers: (1) strategic conflict management through airspace organization and management, demand and capacity balancing, and traffic synchronization; (2) separation provision; and (3) collision avoidance.	GATMOC [1]

Term	Definition	Source
Conformance Monitoring	A service that determines whether an operator's vehicle is in conformance with their shared operational intent; in the event of an unexpected deviation from their intent (e.g., non-conformance, contingency), the operator, whether self-provisioned or third-party supported, shares information to support situational awareness needs of applicable stakeholders.	xTM Project [2]
Constraint	An impact to the capacity or use of a resource preferred by an operator, defined with time and geographically specified airspace information. A constraint may restrict access to airspace for operations or may be advisory in nature.	xTM Project [2]
Constraint Management	A service that supports the creation, modification, and deletion of constraints, as well as the dissemination of constraint information to applicable stakeholders.	xTM Project [2]
Cooperative Area (CA)	An airspace volume within which cooperatively managed operations can occur. Air Traffic Control (ATC) does not provide separation services to aircraft within a CA. *For Unmanned Aircraft Systems (UAS) Traffic Management (UTM) CA, this statement applies to all UAS operating exclusively under 400 feet Above Ground Level (AGL) and below facility maps in controlled airspace.	xTM Project [2]
Cooperative Control Environment (CCE)	Describes the environment where separation is maintained by using cooperative traffic management practices.	xTM Project [2]
Cooperative Operating Practice (COP)	Industry-defined, FAA-approved practices that address how operators cooperatively manage their operations within an xTM domain, including conflict management, equity of airspace usage, and demand/capacity balancing.	Initial xTM Principles v1.0.0 [3]
Cooperatively Managed Operation/ Cooperative Operation	A term used to describe an operation where the operator is cooperatively separating from other traffic within a cooperative area.	xTM Project [2]
Cooperative Separation	Separation based on shared flight intent and data exchanges between operators, stakeholders, and service providers. Cooperative separation is supported by defined	xTM Project [2]

Term	Definition	Source
	COPs as well as applicable rules, regulations, and policies. ATC does not provide separation services to cooperatively managed operations.	
Deconfliction, Strategic	The process of arranging, negotiating, and prioritizing operational intent (e.g., volumes, routes, trajectories, time assignments) of vehicles to minimize the likelihood of airborne conflicts between operations.	Adapted from ICAO UTM Common Framework Document [4]
Deconfliction, Tactical	The process of executing one or more actions to avoid an airborne conflict in a timely manner when strategic deconfliction has failed or was not executed.	BVLOS NAS Evaluation (BNE) Project
Demand Capacity Balancing (DCB)	Strategic evaluation of system-wide traffic flows and aerodrome capacities to allow airspace users to determine when, where, and how they operate, while mitigating conflicting needs for airspace and aerodrome capacity. This collaborative process allows for the efficient management of air traffic flow through the use of information on system-wide air traffic flows, weather, and assets.	GATMOC [1]
Detect and Avoid (DAA)	The ability to see, sense, or detect conflicting traffic or other hazards and take the appropriate action. DAA supports tactical deconfliction for vehicles operating beyond visual line of sight of the operator.	ICAO Annex 2 [5]
Detect and Avoid (DAA) Systems	The systems or technologies that support DAA.	xTM Project [2]
Environment, Air Traffic Control (ATCE)	Describes the environment where vehicles receive Air Traffic Services (ATS) as applicable.	BNE Project
Environment/Domain, Upper Class E Traffic Management (ETM)	Airspace above Flight Level (FL) 600, including operations conducted under cooperative traffic management practices.	xTM Project [2], ETM ConOps [6]

Term	Definition	Source
Environment/Domain, UTM	Airspace under 400 feet AGL where UAS operations are conducted under cooperative traffic management practices.	xTM Project [2]
Environment/Domain, Urban Air Mobility (UAM)	The airspace within which UAM operations are conducted under cooperative management practices.	xTM Project [2], UAM ConOps [7]
Flight Rules, Automated (AFR)	Rules that govern the use of automation to support separation between vehicles and from hazards. AFRs are a subset of Tailored Flight Rules (TaFRs).	xTM Project [2]
Flight Rules, Instrument (IFR)	Rules that govern the conduct of flight operations under instrument meteorological conditions; aircraft operating under IFR receive separation services from ATC as appropriate.	JO 7110.65 Glossary **Error! Reference source not found.**, xTM Project [2]
Flight Rules, Tailored (TaFR)	Rules that govern the conduct of flight operations that, due to unique aspects of the operation or crew complement, cannot meet IFR or VFR regulatory requirements.	xTM Project [2]
Flight Rules, Visual (VFR)	Rules that govern the conduct of flight operations under visual conditions; aircraft operating under VFR may opt to receive advisory services from ATC. Additionally, VFR aircraft receive separation services from ATC when operating in certain classes of airspace. The term “VFR” is also used in the United States to indicate weather conditions that are equal to or greater than minimum VFR requirements.	JO 7110.65 Glossary **Error! Reference source not found.**, xTM Project [2]
Flow Management, Performance-Based (PBFM)	A new generation of flow management focused on performance using agreed levels of performance that are established collaboratively and determined through evaluation of the projected (forecasted) operating environment compared to similar historical occurrences, actions taken, and outcomes achieved.	PBFM ConOps [9]
Flow Management, Traffic (TFM)	A function of ATM that continuously monitors capacity and demand, identifies imbalances, and implements Traffic Management Initiatives (TMIs) when necessary to proactively, efficiently, and safely balance capacity and demand in the NAS.	PBFM ConOps [9]

Term	Definition	Source
Information Management	Provides accredited, quality-assured, and timely information used to support ATM operations. Information management also monitors and controls the quality of the shared information and provides information sharing mechanisms that support the ATM community.	GATMOC [1]
Intent, Flight	The future aircraft trajectory expressed as a Four-Dimensional (4D) profile until destination (taking account of aircraft performance, weather, terrain, and ATM service constraints), calculated and "owned" by the aircraft flight management system, and agreed by the pilot.	GATMOC [1]
Intent, Operational	Also referred to as operation intent, the future operational position information, consisting of spatial and temporal elements, that is exchanged between xTM operators to support cooperative traffic management.	xTM Project [2]
Operation, ETM	Operations conducted in a cooperative area in Upper Class E Airspace (i.e., above FL600) or in other contiguous designated cooperative areas where cooperative operating practices are executed.	xTM Project [2]
Operation, UAM	Operations conducted in UAM corridors where cooperative operating practices are executed.	xTM Project [2], UAM ConOps [7]
Operation, UTM	UAS operations conducted below 400 feet AGL, where cooperative traffic management practices are used. except those in the vicinity of an airport where the operator is required to coordinate with ATC.	xTM Project [2]
Operation, xTM	An operation within a CA where the operator cooperatively separates their vehicle from other traffic.	xTM Project [2]
Operator, xTM	The person or entity responsible for the overall management and execution of one or more xTM operations. The operator plans operations, shares flight information (e.g., planning and live flight), and ensures infrastructure, equipment, and services are in place to support safe execution of flight. The operator may utilize one or more Remote Pilots in Command (RPICs)/Pilots in Command (PICs) to conduct individual flights and take on the role of RPIC/PIC in addition to operator for a given flight.	xTM Project [2]

Term	Definition	Source
Operation, Priority	An operation that is given priority consideration, consistent with ATC practices, over other operations within an xTM service environment.	xTM Project [2]
Resource	The common/shared volume of airspace available to airspace users, within which they conduct their flights/missions. • May include cooperative and/or ATC managed operations, depending on the circumstances and performance requirements for the airspace. • The FAA designates the boundaries of the resource (e.g., UAM corridor, landing areas, UTM operations occur below 400 feet AGL, volumes of airspace above FL600 for cooperative traffic management, Special Activity Airspace (SAA)). • Operators define their intent for use within the shared resource.	xTM Project [2]
Separation Minima	The minimum displacements between an aircraft from other aircraft or hazards that maintain the risk of collision at an acceptable level of safety.	GATMOC [1], xTM Project [2]
Separation Provision	The tactical process of keeping aircraft away from other aircraft or hazards by, at least, the appropriate separation minima.	GATMOC [1], xTM Project [2]
Separator	The agent responsible for separation provision for a conflict; can be either the airspace user or a separation provision service provider. The role of the separator may be delegated; however, a predetermined separator must be defined prior to the commencement of separation provision.	GATMOC [1]
Service Network, Federated	A group of service providers sharing information within a federated network to support operating in a common, agreed manner consistent with the approved COPs.	xTM Project [2]
Strategic Conflict Management	The first layer of conflict management, which is achieved through the airspace organization and management, demand and capacity balancing, and traffic synchronization components.	GATMOC [1]
Traffic Management, Air (ATM)	The dynamic, integrated management of air traffic and airspace—safely, economically, and efficiently—through the provision of facilities and seamless services in collaboration with all parties.	GATMOC [1]

Term	Definition	Source
Traffic Management, Extensible (xTM)	The overarching term for traffic management approaches and/or associated services that address the operation of select new entrants within flexibly allocated, designated airspace.	xTM Project [2]
Traffic Management, UAS (UTM)	The management of airspace for UAS operations conducted 400 feet AGL and below in Class G and in controlled airspace below facility map altitudes when authorized.	xTM Project [2]
Traffic Management, Upper Class E (ETM)	ETM is how airspace is managed for UAS operations above FL600 or in other contiguous designated cooperative airspace.	xTM Project [2], ETM ConOps [6]
Trajectory-Based Operations (TBO)	A concept enabling globally consistent, performance-based 4D trajectory management by sharing and managing trajectory information. TBO covers ATM processes starting at the point an individual flight is being planned through flight execution to post flight activities.	ICAO TBO Concept V11 [10]
Urban Air Mobility (UAM)	A subset of Advanced Air Mobility (AAM), how airspace is managed for operations conducted within UAM designated cooperative airspace.	xTM Project [2], UAM ConOps [7]
xTM Service Supplier (xSS)	Third-party entities who provide a set of services to operators necessary to participate in cooperative operations. These services aid the operator in the planning, execution, and landing of a flight. They also support any required interactions with other stakeholders.	xTM Framework Document [2]

2.1 Lexicon Notes

The source description lists the primary source of the term definition. Terms developed as part of a past or ongoing program are so listed.

Published documents for the projects referenced in Table 1 are contained in Appendix A.

3 Conclusion

3.1 Summary

The information contained in this document and xTM lexicon will continue to be refined as the xTM concepts are further advanced.

Appendix A References

[1] International Civil Aviation Organization (ICAO), Document 9854, Global Air Traffic Management Operational Concept (GATMOC), First Edition, 2005.

[2] LS Technologies LLC, Extensible Traffic Management (xTM) Framework Analysis, xTM Framework, Deliverable 01.06.00, March 2022.

[3] LS Technologies LLC, Extensible Traffic Management (xTM) Framework Analysis, Initial xTM Principles, Deliverable 01.01.00, July 2021.

[4] ICAO, Unmanned Aircraft Systems Traffic Management (UTM) – A Common Framework with Core Principles for Global Harmonization, Edition 3.

[5] ICAO, Annex 2: Rules of the Air, Tenth Edition, 2005.

[6] FAA, Upper Class E Traffic Management (ETM) Concept of Operations (ConOps), Version 1.0, May 2020.

[7] FAA, Urban Air Mobility Concept of Operations, Version 1.0, June 2020.

[8] FAA, JO 7110.65Z, Air Traffic Control, 2021.

[9] LS Technologies LLC, Performance Based Flow Management (PBFM) Concept of Operations (ConOps), July 2020.

[10] ICAO, Trajectory Based Operation Concept, V11, October 2017.

Appendix B Acronyms

All acronyms used throughout the document are provided in Table 2.

Table 2: Acronyms

Acronym	Definition
4D	Four-Dimensional
AAM	Advanced Air Mobility
AFR	Automation Flight Rules
AGL	Above Ground Level
ATC	Air Traffic Control
ATCE	Air Traffic Control Environment
ATM	Air Traffic Management
ATS	Air Traffic Services
BNE	BVLOS NAS Evaluation
BVLOS	Beyond Visual Line of Sight
CA	Cooperative Area
CCE	Cooperative Control Environment
CNS	Communication, Navigation, and Surveillance
COP	Cooperative Operating Practice
DAA	Detect and Avoid
DCB	Demand Capacity Balancing
ETM	Upper Class E Traffic Management
FAA	Federal Aviation Administration
FL	Flight Level
GATMOC	Global Air Traffic Management Operational Concept
ICAO	International Civil Aviation Organization
IFR	Instrument Flight Rules
JO	Job Order
NAS	National Airspace System
NASA	National Aeronautics and Space Administration
PBFM	Performance-Based Flow Management

Acronym	Definition
PIC	Pilot in Command
RPIC	Remote Pilot in Command
SAA	Special Activity Airspace
TaFR	Tailored Flight Rules
TBO	Trajectory-Based Operations
TFM	Traffic Flow Management
TMI	Traffic Management Initiative
UAM	Urban Air Mobility
UAS	Unmanned Aircraft Systems
UTM	UAS Traffic Management
VFR	Visual Flight Rules
xSS	xTM Service Supplier
xTM	Extensible Traffic Management