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Standard Specification for UAS Traffic Management (UTM) UAS Service Supplier (USS) Interoperability¹

This standard is issued under the fixed designation F3548; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification is intended to be a global specification providing components that may be used to satisfy requirements expected to be common to many UTM-related regulations. This specification is not intended to comprehensively address all aspects of any particular UTM-related regulation or concept of operations. Similarly, because varying terminology for the same concept is frequently used across different regulations, readers should not expect an exact terminology consistency with any particular UTM-related regulation.

1.2 This version of the specification is focused on strategic aspects of UAS operations, including strategic conflict detection, aggregate conformance of operations to their operational intents, constraint awareness, and situational awareness in the event of nonconforming or contingent operations. The intention is that this specification will evolve to address increasingly complex strategic aspects of UAS operations and potentially certain tactical aspects of UAS operations.

1.3 This specification addresses the performance and interoperability requirements, including associated application programming interfaces (APIs), for a set of UTM roles performed by UAS Service Suppliers (USSs) in support of UAS operations.² Roles are groupings of one or more related UTM services. A competent authority may choose to use the roles defined in this specification in establishing the granularity of authorizations granted to a USS. The roles defined in this specification are:

(1) Strategic Coordination, comprising the Strategic Conflict Detection and Aggregate Operational Intent Conformance Monitoring services;

(2) Conformance Monitoring for Situational Awareness (CMSA);

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² Many terms describe UTM and UAS Service Suppliers. For example, UTM is referred to as U-Space, and USSs are referred to as U-Space Service Providers (USSPs) in Europe. In the United Kingdom, UTM Service Providers (UTMSP) is used. In Japan, USSs are referred to as UAS Service Providers (UASSPs). Unless otherwise stated, the terms are interchangeable in this specification.

(3) Constraint Management, comprising the Constraint Management service; and

(4) Constraint Processing, comprising the Constraint Processing service.

1.4 Section 4, Conceptual Overview, provides a description of each of the services and roles and includes further discussion on their scope.

1.5 A regulator may choose to require that a USS support a minimum or prescribed set of roles and services and may adopt terminology other than USS for a software system that provides something other than that minimum or prescribed set of roles and services. However, for purposes of this specification, a USS is a system that provides one or more of the UTM services defined in this specification.

1.6 A USS is not required by this specification to perform all roles or implement all defined services, providing business case flexibility for implementers. A typical USS that supports operators in the planning and execution of UAS operations may implement the Strategic Coordination, Constraint Processing, and CMSA roles. (Note that a USS providing CMSA for a UAS operation is required to also provide Strategic Coordination for the operation.) However, other implementations more limited in scope are possible. For example, a USS may implement only the Constraint Management role and be intended for use only by authorized constraint providers; or, a USS may implement only the Constraint Processing role to provide general airspace awareness to users independent of planning UAS flights. USSs may also provide additional, value-added capabilities and still be compliant with this specification as long as the value-added capabilities do not conflict with the services defined in this specification, and the implementation of services defined in this specification conforms to the applicable requirements.

1.7 A USS may also support other UTM roles such as Remote ID and airspace access (for example, the FAA's LAANC), specified in other documents.

1.8 This specification addresses aspects common to all roles and services, such as Discovery and Synchronization Services (DSS), security, auditing, and handling of off-nominal cases (for example, USS or DSS failures).

1.9 Additional services or enhancements to the current services will be added to subsequent versions of this specification. [Appendix X2](#), Future Work Items, identifies a set of these items.

1.10 The safety case for this version of the specification, summarized in [Appendix X4](#), is limited to strategic deconfliction, which is accomplished using the services provided by the Strategic Coordination role. This analysis does not constitute a full safety case for any particular operator or set of operations, which will have their own unique factors and variables. It does help operators understand, however, the contribution of using strategic deconfliction to their safety case and what the key variables are in increasing or decreasing the contribution. Using assumptions similar to those documented in [Appendix X4](#), strategic deconfliction reduces the probability of midair collisions by approximately two to three orders of magnitude, with the rate of off-nominal events and participation being the key variables.

1.11 Of particular note, this version of this specification does not establish requirements for fairness or equitable airspace access among UAS operations, but instead includes requirements for the logging of information that will inform future requirements in this area.

1.12 *Usage:*

1.12.1 In a region where participating UAS operators voluntarily agree to or are required by the competent authority to comply with this specification, it enables strategically deconflicted UAS operations as well as situational awareness for operations that may not be required to be strategically deconflicted. This specification is not dependent upon the use of segregated or nonsegregated airspace.

1.12.2 For regions where this specification is required by a competent authority, this specification assumes regulations established by the competent authority (or its delegate) identify any prioritization of operations and whether or not strategic conflicts are allowed between operations of the same priority. For example, it may be legal in some jurisdictions for recreational operations to share airspace and have overlapping operational intents, relying on UAS personnel to coordinate and maintain visual separation; whereas in other jurisdictions, this may not be allowed. The specification takes no position on allowed or disallowed strategic conflicts. Instead it addresses requirements for when conflicts are allowed by regulations (for example, notifications to involved USSs and UAS personnel) and for when conflicts are not allowed (for example, replanning, inability to activate an operation with nonallowed conflicts).

1.12.3 This specification is not intended to address the complete safety case for air collision risk. It provides a mechanism to address one portion of a safety case, specifically the strategic separation of participating UAS from other participating UAS. Other technologies or procedures, outside the scope of this specification, may be required to mitigate air risk with nonparticipating aircraft and to address other aspects of a complete safety case for air collision risk.

1.12.4 Through the use of constraints, this specification also provides awareness of geographically and time-limited air-

space information to USS, UAS personnel, or the operator's automation, or combinations thereof. In circumstances where a constraint is used to represent the volume within which a manned operation is planned, it provides a mechanism to address the strategic separation of participating UAS from the manned flight. However, USS responsibility is limited to providing awareness of constraints, and it is the responsibility of the UAS personnel to comply with any regulatory aspect of constraints.

1.13 *Applicability:*

1.13.1 This specification applies to operations conducted in a connected environment, meaning the UAS personnel have access to the USS (typically by means of the internet) and connectivity to the Unmanned Aircraft (UA). This specification anticipates and accommodates limited gaps in connectivity, but does not purport to address operations in locations where persistent connectivity is unavailable.

1.13.2 This specification does not purport to address tactical conflicts between UAS. Notifications and data sharing requirements in this specification associated with Strategic Conflict Detection and Conformance Monitoring for Situational Awareness may be useful in aiding some tactical conflict detection and dynamic rerouting capabilities. However, those capabilities are beyond the scope of this specification, and an implementation cannot assert compliance for tactical conflict detection or dynamic rerouting using this specification.

1.13.3 This specification does not purport to address conflicts between UAS and manned aircraft outside of instances where a manned operation is encapsulated in a constraint.

1.13.4 This specification does not purport to address authorization for UAS to operate in controlled or uncontrolled airspace.

1.13.5 This specification does not purport to address UAS that are not participating in UTM.

1.14 *Relationship to Other International UTM Standards and Specifications:*

1.14.1 It is an objective of this specification to be compatible with certain UTM specifications that address common subject matter and are developed under other standards development organizations (SDOs).

1.14.2 The existence of multiple specifications on the same subject matter can occur when the regulatory environment in a region requires that a necessary specification be developed by a particular SDO. In these cases, ASTM International seeks to establish a cooperation arrangement with the applicable SDO to ensure consistency between the related specifications.

1.14.3 This specification also seeks to support an international audience where differing regulatory requirements can exist. Where practical, this specification accommodates the differing requirements through a superset approach using a variety of techniques such as optional features and features that are configured to support a particular regulatory ruleset.

1.14.4 A summary of related specifications and the techniques used to achieve compatibility is provided in [Appendix X3](#).

1.15 The values stated in SI units are to be regarded as standard.

1.15.1 Units of measurement included in this specification:

cm	centimeters
km	kilometers
m	meters
deg, °	degrees of latitude and longitude, compass direction
s	seconds
Hz	Hertz (frequency)
time	unless otherwise specified, formatted in accordance with IETF RFC 3339

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1.17 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.18 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ASTM Standards:³

- [F3060 Terminology for Aircraft](#)
- [F3341 Terminology for Unmanned Aircraft Systems](#)
- [F3411 Specification for Remote ID and Tracking](#)

2.2 EUROCAE Standard:⁴

- [EUROCAE ED-269 Minimum Operational Performance Standard for UAS Geo-Fencing](#)

³ For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

⁴ Available from European Organisation for Civil Aviation Equipment (EUROCAE), 9-23 rue Paul Lafargue, "Le Triangle" building, 93200 Saint-Denis, France, <https://www.eurocae.net/>.

2.3 European Union (EU) Regulation:⁵

[GDPR General Data Protection Regulation](#)

2.4 IETC Standards:⁶

- [IETF RFC 3339 Date and Time on the Internet: Timestamps⁷](#)
- [IETF RFC 5905 Network Time Protocol Version 4: Protocol and Algorithms Specification⁸](#)
- [IETF RFC 7519 JSON Web Token \(JWT\)⁹](#)

2.5 ISO/IEC Standards:¹⁰

- [ISO/IEC 9001 Quality management systems — Requirements](#)

- [ISO/IEC 27001 Information technology — Security techniques — Information security management systems — Requirements](#)

2.6 OAIC Document:¹¹

- [APPs The Australian Privacy Principles](#)

3. Terminology

3.1 Unique and Common Terminology:

3.1.1 Terminology used in multiple ASTM UAS and aircraft-related standards is defined in [F3341](#), UAS Terminology Standard, and [F3060](#), Aircraft Terminology Standard. Terminology unique to this specification is defined in [3.2](#).

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *3D volume, n*—a volume of airspace defined in terms of latitude, longitude, and altitude.

3.2.2 *4D volume, n*—a 3D volume plus a start and end time for the volume.

3.2.3 *Accepted, n*—one of the operational intent states. See [4.4](#) for more details.

3.2.4 *Activated, n*—one of the operational intent states. See [4.4](#) for more details.

3.2.5 *authorized constraint provider, n*—an organization or individual that has been granted the authority to create and manage constraints in a region by a competent authority.

3.2.6 *Aggregate Operational Intent Conformance Monitoring, n*—a USS service that monitors an operator's aggregate conformance with operational intents over time to ensure the target level of safety for strategic coordination is being met. Operators could also implement their own Aggregate Operational Intent Conformance Monitoring capability.

3.2.7 *coordinated operational intent, n*—an operational intent that has been coordinated with other relevant USSs to prevent disallowed conflicts. Operational intents are required to be coordinated prior to transitioning to the Accepted state

⁵ Available from <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016R0679>.

⁶ Available from IETF Administration LLC, 1000 N West Street, Suite 1200, Wilmington, DE 19801.

⁷ Visit <https://datatracker.ietf.org/doc/html/rfc3339>.

⁸ Visit <https://tools.ietf.org/html/rfc5905>.

⁹ Visit <https://tools.ietf.org/html/rfc7519>.

¹⁰ Available from International Organization for Standardization (ISO), ISO Central Secretariat, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland, <https://www.iso.org>.

¹¹ Available from Office of the Australian Information Commissioner, 175 Pitt Street, Sydney NSW 2000, Australia, https://www.oaic.gov.au/__data/assets/pdf_file/0006/2004/the-australian-privacy-principles.pdf.