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Weather Forum
ASTM International Overview
Standards Supporting Safe UAS Integration
Global, Practical and Relevant

Philip M. Kenul
TriVector Services, Inc.
Chairman
F38 Unmanned Aircraft Systems
Philip.Kenul@gmail.com

www.astm.org

F38 Unmanned Aircraft Systems

Quick facts:

Formed: 2003, memorandum agreement with FAA
Current Membership: 230+ members (30 regulators)
Standards: 15 approved; 25+ in development

Subcommittees:

F38.01 Airworthiness
- Hardware oriented
- Safe design, construction, test, modification, & inspection of the individual component, aircraft, or system

F38.02 Flight Operations
- Procedure oriented
- Safe employment of the system within the aviation environment among other aircraft & systems

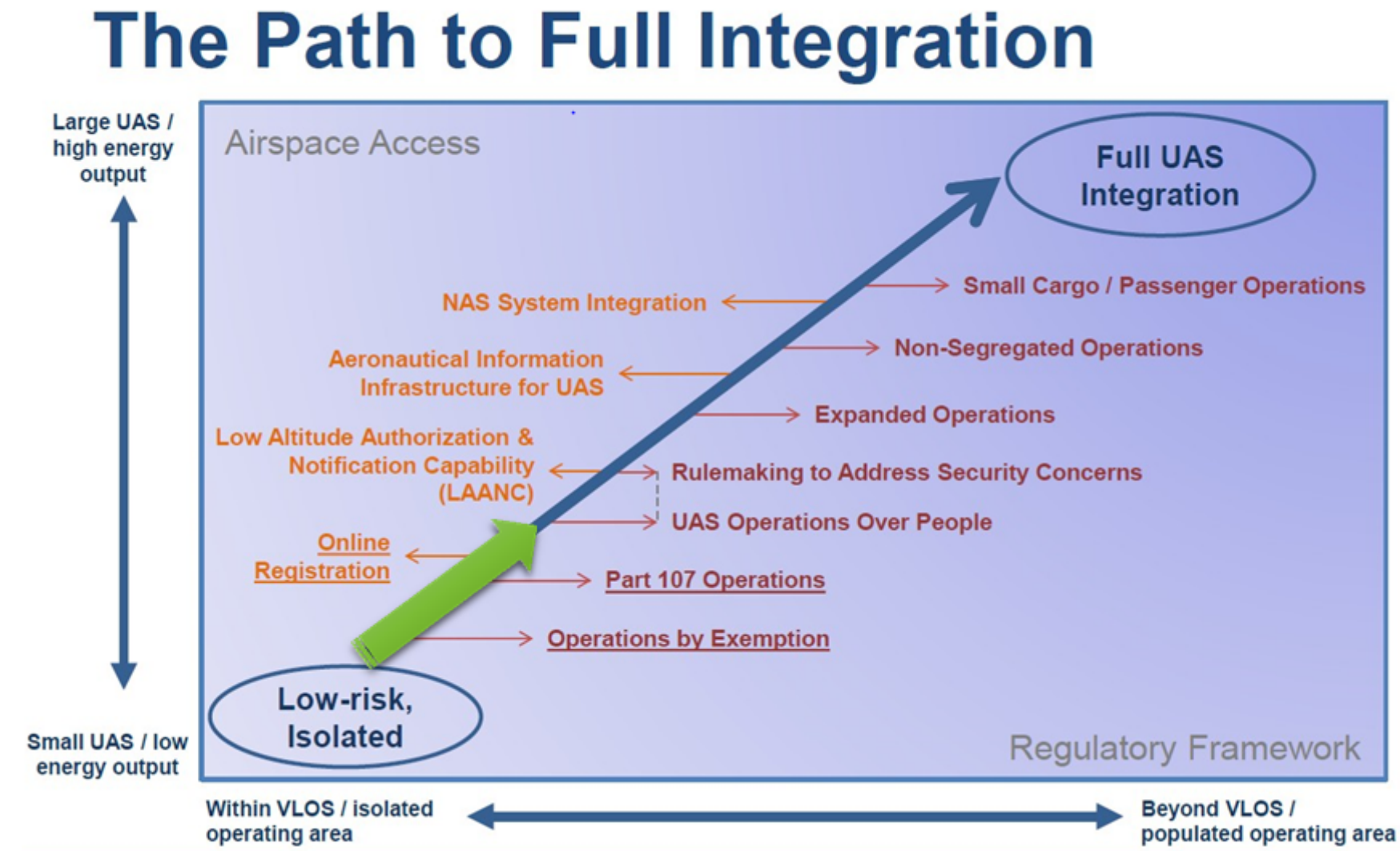
F38.03 Personnel
- Individual, Crew and Organization Oriented
- Safe practices by the individuals and teams responsible for employing the system

Also Require Infrastructure capable of incorporating this technology safely in the NAS- ATM,UTM, LAANC

Global Representation

Argentina
Australia
Bahamas
Canada
China
France
Germany
Italy
Korea, Republic of
Netherlands
New Zealand
Norway
United Kingdom
United States

F38 Goal : Industry Standards Achieving Safe & Reliable UAS Operations



Mission: Coordinate/accelerate standard development and conformity assessment programs with international coordination and adaptability

- Foster coordination and collaboration on UAS standardization issues among stakeholders
- Clarify current and future UAS standardization landscape
- Help stakeholders focus standards participation resources
- Inform U.S. policy and technical input to regional and international audiences
- Support growth of the UAS market with emphasis on civil, commercial, and public safety applications

Conducted Standards Gap Analysis

Key Gap – UAS WX

UAS Operations and Weather
Safety Objectives

- No published standards for flight planning, forecasting, and operating UAS low altitude and/or boundary layer airspace.
- Lack of observations of ceiling, visibility, and winds near most low altitude UAS operational locations
- UAS CONOPS are not adequately covered by existing meteorological data acquisition, reporting, or forecasting methods.
  - Critical to the safe and efficient use of the NAS
    - ATM and UTM
  - Critical component for air traffic management, data link, and overall aircraft operations
  - Limits full capability of emerging technology
- Funding?????

Gaps: UAS Operations and Weather

Gaps in acquisition and dissemination of weather-related data:

1. Weather requirements for flight operations (ATM)
   - To operate in Class A airspace BVLOS, the aircraft must meet certain standards for weather robustness and resiliency, e.g., wind, icing, instrument meteorological conditions (IMC), etc.

2. Weather data standards themselves (UTM)
   - Published weather data standards do not have sufficient resolution (spatial and/or temporal) for low altitude and boundary layer airspaces (micro-weather detection and micro-weather predictions for wind gusts, thermal updrafts, vertical wind shear, turbulence, icing, precipitation, etc.)
   - Mesonet requirements for UTM-proper site and sensor standards

3. Standards for displays, data link, avionics, and voice protocols that involve, transmit, or display weather will need to be amended to apply to UAS (e.g., the 'cockpit display' in a UAS ground control station).

Encourage Relevant R&D

Research should be conducted to determine the following:

1)What spatial and temporal resolution is required to adequately detect weather hazards to UAS in real-time to forecast and support flight planning??

2)How to replicate a ‘flight deck display’ in UAS Command and Control systems, for meteorological information and related data link communications with ATC?

4)Can current meteorological data acquisition infrastructure (e.g., ground-based weather radar, wx stations) capture data relevant to UAS operations, particularly in low altitude airspace?

4)What weather data and data link connectivity would be required to support fully autonomous UAS operations with no human operator in the loop?

5)What is the highest temporal resolution currently possible with existing or proposed meteorological measurement infrastructure?

6)Local forecast to support BVLOS operations

ASTM Contact Information

Committee Operations Questions

Mary Mikolajewski
Manager, Technical Committee Operations
F38 Unmanned Aircraft Systems
T: +1.610.832.9678
E: mmikolajewski@astm.org

UAS Industry & Technical Questions

Phil Kenul
F38 Chairman
T: +1.301.346.5939
E: philip.kenul@gmail.com

Ajay Sehgal
F38 Vice Chair
T: +1.240.298.0570
E: ajay.sehgal@wyle.com

Membership Questions

Jonathan Daniels
Membership Secretary
T: +1.702.586.1160
E: jon.daniels@praxisaerospace.com

** This material represents the views and positions of the presenter and not those of ASTM International and/or the entire ASTM F38 Committee*

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Questions/Discussion/ Backup Slides

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Published Standards and Related Materials

None specifically related to UAS

- SAE ARP 5740, Cockpit Display of Data Linked Weather Information (2015)
- Advisory Circular AC 00-45H, Aviation Weather Services (2016)
- Advisory Circular AC 00-24C, Thunderstorms (2013)
- FMH-1, Surface Weather Observations and Reporting (2005)
- Advisory Circular 23.1419-2D, Certification of Part 23 Airplanes for Flight in Icing Conditions (2007)
- FAA Order JO 7930.2N, Notice to Airmen (2013)
- National Weather Service Policy Directive 10-8 (2016)
- FAA Order JO 7110.0Z, Flight Services (2018)
- ICAO Annex 3, Meteorological Services for International Air Navigation Part I and II (2016)
- World Meteorological Organization (WMO), GRIB-2
- RTCA DO-369, Guidance for the Usage of Data Linked Forecast and Current Wind Information in Air Traffic Management (ATM) Operations
- RTCA DC-364, Minimum Aviation System Performance Standards (MASPS) for Aeronautical Information/Meteorological Data Link Services
- RTCA DO-358, Minimum Operations Performance Standards (MOPS) for Flight Information Services Broadcast (FIS-B) with Universal Access Transceiver (UAT)

Remote ID Guiding Principles

- Compatible with Handheld Devices (Smartphones/Tablets)
- Designed to be tolerant of missed / dropped messages
- Low Cost and Low SWaP
- Enable public to participate/identify improving acceptance
- Open Protocols & Interoperable
- Harmonize Globally
- Create transparency and accountability while protecting customer and operator privacy

UTM USS-USS Standard

F38.02 WG WK63418 Standards and Methods for UTM USS-USS functionality

- Focus on UTM technical standards needed to support the commercial deployment of UTM Service Suppliers (USS)
  - Scope was set to be the required interoperability and performance characteristics needed for USS to USS communications. Standard indexes on low-altitude UAS but does not constrain to that criteria alone in our current writing efforts.
  - ANSP and other authority communications are also within scope (modeled as USS network participants)
- Broad participation in the working group from industry across multiple continents (US, Europe and Asia) as well as regulators from multiple geographies as well (FAA, Transport Canada, EASA)
- Communication Services
- Navigation Services
- Weather Services
- Mapping Services

Members include (not an exhaustive list):

Amazon Prime Air
Google Wing
GE AiRXOS
ANRA
Thales
Unifly
Intel
AGI
KittyHawk
Mitre
PrecisionHawk
AirMap
Uber
AT&T
TMobile
Airbus
NASA

ASTM F38 Published Standards

F2849-10 Standard Practice for Handling of Unmanned Aircraft Systems at Divert Airfields

F2851-10(2018) Standard Practice for UAS Registration and Marking (Excluding Small Unmanned Aircraft Systems)

F2908-16 Standard Specification for Aircraft Flight Manual (AFM) for a Small Unmanned Aircraft System (sUAS)

F2909-14 Standard Practice for Maintenance and Continued Airworthiness of Small Unmanned Aircraft Systems (sUAS)

F2910-14 Standard Specification for Design and Construction of a Small Unmanned Aircraft System (sUAS)

F2911-14e1 Standard Practice for Production Acceptance of Small Unmanned Aircraft System (sUAS)

F3002-14a Standard Specification for Design of the Command and Control System for Small Unmanned Aircraft Systems (sUAS)

ASTM F38 Published Standards

F3003-14 Standard Specification for Quality Assurance of a Small Unmanned Aircraft System (sUAS)

F3005-14a Standard Specification for Batteries for Use in Small Unmanned Aircraft Systems (sUAS)

F3178-16 Standard Practice for Operational Risk Assessment of Small Unmanned Aircraft Systems (sUAS)

F3196-17 Standard Practice for Seeking Approval for Extended Visual Line of Sight (EVLOS) or Beyond Visual Line of Sight (BVLOS) Small Unmanned Aircraft System (sUAS) Operations

F3201-16 Standard Practice for Ensuring Dependability of Software Used in Unmanned Aircraft Systems (UAS)

F3266-18 Standard Guide for Training for Remote Pilot in Command of Unmanned Aircraft Systems (UAS) Endorsement

F3269-17 Standard Practice for Methods to Safely Bound Flight Behavior of Unmanned Aircraft Systems Containing Complex Functions

F3298-18 Standard Specification for Design, Construction, and Verification of Fixed-Wing Unmanned Aircraft Systems (UAS)

F38 New Standards Under Development

WK65041 Practice for UAS Remote ID and Tracking

WK52089 New Specification for Operation over People

WK56338 Safety of Unmanned Aircraft Systems for Flying Over People

WK59171 SUAS parachutes

WK59317 Vertiport Design

WK60659 UAS Maintenance Technician Qualification

WK60937 Design of Fuel Cells for Use in Unmanned Aircraft Systems (UAS)

WK61763 Training for Remote Pilot Instructor (RPI) of Unmanned Aircraft Systems (UAS) Endorsement

WK61764 Training for Public Safety Remote Pilot of Unmanned Aircraft Systems (UAS) Endorsement

WK62416 Terminology Unmanned Aircraft Systems

WK62668 Detect and Avoid Performance Requirements

WK62669 Detect and Avoid – Test Method

F38 New Standards Under Development

WK62670 Large UAS Design and Construction

WK62730 Practice for UAS Operator Audit Programs

WK62731 Practice for UAS Operator Compliance Audits

WK62733 Training and the Development of Training Manuals for the Unmanned Aircraft Systems (UAS) Operator

WK62734 Specification for the Development of Maintenance Manual for Lightweight UAS

WK62741 Training UAS Visual Observers

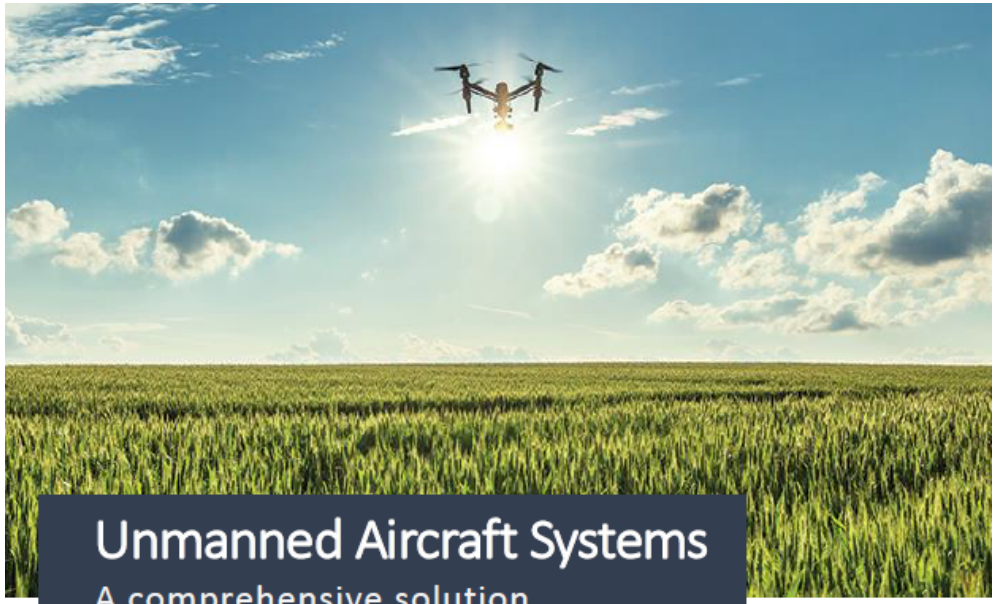
WK62743 Development of Maintenance Manual for Small UAS

WK62744 General Operations Manual for Professional Operator of Light Unmanned Aircraft Systems (UAS)

WK63407 Required Product Information to be Provided with a Small Unmanned Aircraft System

WK63418 Service provided under UAS Traffic Management (UTM)

ASTM UAS Roadmap



Unmanned Aircraft Systems

A comprehensive solution

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Our leadership in international standards development is driven by the contributions of our members: more than 30,000 of the world's top technical experts and business professionals representing 140 countries. Working in an open and transparent process and using ASTM's advanced IT infrastructure, our members create the tools that support industries and governments worldwide.

Through our 150 technical standards-writing committees, we serve a broad range of industries: aerospace, infrastructure, public safety personnel, consumer products and many more. When new industries — like nanotechnology, additive manufacturing and robotics — look to advance the growth of cutting-edge technologies through standardization, many of them come to ASTM International.

Beyond standards development, ASTM offers certification and declaration through our subsidiary, the Safety Equipment Institute, as well as technical training programs and proficiency testing. All our programs complement our standards development activities and provide enterprise solutions for companies, government agencies, researchers and laboratories worldwide.

**Available and updated on ASTM website URL:*

https://www.astm.org/COMMIT/ASTM%20UAS%20Roadmap-1.pdf