



Summary of 2018 Plenary Meeting

Thursday, September 20, 2018, 9:00 am – 5:00 pm EDT

[AAMC Learning Center](#)

655 K Street, NW, Room LC 200 (2nd Floor)
Washington, DC 20001

The meeting was for the purpose of discussing the first draft of the UASSC standardization roadmap. Note: The order of WG discussions was out of numerical sequence to accommodate scheduling issues. The master slide deck for the meeting can be found [here UASSC 18-009](#).

Discussion Topic / Speaker

Welcome and Opening Remarks

- Staff: Jim McCabe, Senior Director, Standards Facilitation, American National Standards Institute
- Public Sector Co-Chair: Earl Lawrence, Director, UAS Integration Office, Federal Aviation Administration
- Private Sector Co-Chair: Brian Wynne, President and CEO, Association for Unmanned Vehicle Systems International

Jim McCabe welcomed participants and thanked the UASSC sponsors:

Founding Partner: Federal Aviation Administration

Premier Partners: U.S. Department of Homeland Security Science & Technology Directorate
ASTM International / National Fire Protection Association Joint Working Group

Supporting Partner: Association for Unmanned Vehicle Systems International

Associate Partner: DroneScape, PLLC

Mr. Lawrence thanked everyone for the work done to date. He noted the roadmap is tremendously helpful to the FAA to identify concerns, where we need standards, and to help us keep up with technological changes. It will give us a plan and it will be used. Identifying the standards that will maintain a safe aviation system is key.

Mr. Wynne thanked ANSI, the co-sponsors, and everyone for the work that's been done. He thanked Earl Lawrence and Art Hinaman of FAA for their leadership. Technology transition and convergence happens rapidly. More will come out of this than just a document in terms of relationship building. It's extremely important that the SDOs work together.

Mr. McCabe reviewed the agenda for the day. Each working group (WG) will go through its section of the roadmap. Ask yourself the following questions in relation to what is presented:

- 1) Is the presentation of issues, gaps, and recommendations for new or revised standards clearly stated?
A "gap" means no *published* standard exists that covers the particular issue in question.
- 2) What could be improved?
- 3) Is there any content that conflicts with or should be consolidated with another working group?
- 4) Are there any issues or gaps that have been overlooked?

A fifth question posed by Mr. Lawrence is what does a successful roadmap look like in terms of the audiences we are trying to reach whether they be industry, SDOs, research institutions, federal agencies, public safety community, legislators, etc.

Let's avoid wordsmithing the document today. There will be a 30 day comment period in October for that and thereafter the WGs will reconvene and work to resolve those comments. Let's also stay out of the weeds in terms of trying to formulate solutions to the issues we've identified.

(Secretary's Note: for the WG discussions that follow, the WG co-chairs reviewed the sections covered and accompanying recommendations. Such introductory comments are generally not included below. Rather, summary comments from the discussion are noted and are primarily focused on those suggesting possible modifications to the roadmap.)

WG3 – Critical Infrastructure and Environment (Chapter 8)

WG Co-Chairs

- Brian Daly, Assistant Vice President, Standards & Industry Alliances, AT&T
- Philip Hall, Founding Director & CEO, RelmaTech Ltd (UK)

Summary slides provided by WG3 can be found [here UASSC 18-010](#).

The American Society of Mechanical Engineers (ASME) sent over comments that they are considering work on inspections of solar and wind farms.

The American Society of Safety Professionals (ASSP) is looking at drones for construction and demolition operations.

These efforts have been noted.

Vertical Infrastructure Inspections

The Telecommunications Industry Association (TIA) submitted a comment. They are launching a new WG for drones.

Boilers & Pressure Vessels, Cranes, Building Facades, Low-Rise Residential and Commercial Buildings, Communications Towers – no comments (in terms of proposed roadmap changes)

Linear Infrastructure Inspections

Is what we need one overarching BVLOS standard and a standard operating procedure (SOP) for each of these operations? There is probably a need for an overarching standard for linear inspections that cover different scenarios. The operator may need SOPs.

Bridges

Are we aware of work from DOTs or FHWA on highways? We didn't consider that a use case though it would be similar to railroads. FAA talks to NHTSA.

Requirement of sensors to be oriented upward may be something that needs to be incorporated upward.

Railroads

Have BNSF and Union Pacific bought in to the recommendations? Should we phrase them "that the railroad industry consider developing standards" or that "SDOs engage with the relevant industry to consider developing standards"? We've done outreach to BNSF. Welcome contacts if people have them and/or can help with outreach. Phil Hall may be able to help with Union Pacific.

Power Transmission Lines

Have helicopter companies been involved? HAI is.

Have we addressed proximity standards (i.e., spacing between aircraft)? We've addressed that there's a need for those. FAA sets those standards.

Wide Area Environment Infrastructure Inspections/Precision Agriculture

Environmental Monitoring – no comments

Pesticide Application

ISO has convened a WG on pesticide application using UAS. Check to note this is in roadmap. It has had two meetings. Within 3 years, there should be a standard. Aerial application of pesticides is a heavily regulated process.

There are both federal and state requirements. What is the intersection? In Virginia, you have to be regulated. Part 137 process covers this and includes preemption of state requirements. The pilot should be UAS qualified.

Have you made any distinction between remotely-piloted and autonomous flight? Not in the use-case analysis. We tried to look at the level of autonomy. We talked about whether we need a special category for low altitude aerial inspections.

We say in the definitions section, if it isn't otherwise stated, we're talking about RPAs.

FAA encourages us not to distinguish between the two in the report as those terms mean different things to different people. In the civil world, there are hardly any remotely piloted operations. Automated meaning the flight deck is automated. FAA will always find someone responsible for a given flight.

Another use case to consider might be traffic monitoring as opposed to freeway inspections.

Livestock Monitoring and Pasture Management – no comments

Commercial Package Delivery

To FAA: Are you looking at this in the context of Part 133? No. We're just looking at who's working on standards. So much is in development. 12 months from now, we'll have a completely different picture on this. The mission sets being brought to FAA are not similar to external loads for helicopters. These are secured payloads.

Should we have a broader heading for external loads? Perhaps. Aerial cranes.

Avoiding unplanned drops in urban areas.

Transmission power lines is both a linear and vertical issue. Airspace deconfliction is an issue. How to deconflict unregulated airspace. FAA handles like manned aviation.

WK60745 has been approved.

WK27055 has been moved from F38.01 to F38.02 and has a new work item number: WK65041

WG1 Airworthiness (Chapter 6)

WG Co-Chairs

- Phil Kenul, Senior Vice President, Aviation and Operations, TriVector Services, Inc.
- Mark DeAngelo, PhD, Aerospace Standards Engineer, SAE International
- (Standing in for Mr. DeAngelo who was unable to attend was Judith Ritchie, Director, Government and Industry Affairs – Aerospace, SAE International)

When we talk about sUAS, we're talking about 55 pounds or less. It may be easier to do design standards for larger platforms.

Design and Construction – no comments

Safety

The idea behind the meta-standard referred to in the recommendation is to see which standards are most applicable. Some organization needs to do an analysis of the spectrum of standards that are out there and map them to where they are most applicable. This would give manufacturers direction.

Recommendation is okay but the CAA (in this case, FAA) is the only one who will really answer this when someone applies for an airworthiness certificate. FAA added to list of organizations.

FAA goes by risk levels 1-4. It's more of a system safety analysis.
We're trying to leverage as much as we can from manned aircraft.

Can we reframe as developing a CONOP? You have to look at everything.

Quality Assurance/Quality Control

R&D needed says Yes. Elaborate? Not sure we do need it. We know how to do it on manned aircraft. It may be less on research than how we apply the safety continuum to production oversight.

Avionics and Subsystems

Weight matters in avionics.

Command and Control Link – no comments

Navigational Systems

Capability for aircraft to recover if C2 link is lost? Perhaps differentiate between ATC for high altitude (FAA ARC) and UTM for low altitude. Phil Hall raised the issue and offered to provide gap language.
Level of rigor that FAA requires you to demonstrate compliance to is commensurate with the risk level that you're in.

Detect and Avoid Systems

There are standards for larger aircraft at higher altitudes. Will ground based sense and avoid (GBSAA) radar be covered in any of the standards that are out there? C2 228 Phase 2 is addressing it. ASTM sUAS is. Perhaps split this into 2 areas: on board sensors/software solutions (the system) and the level of autonomy/response time.
At what point does the system make a decision to avoid collision? We talk a little bit about it under human factors. GBSAA noted in latest comments from Ritesh to ANSI with references to RTCA documents included.
Are we assuming for DAA we're operating under part 91? Part 91 is operating rule. We also look from design approval perspective. Also addressed from maintenance angle.

Software Dependability and Approval

How do you deal with manufacturers using open source software that is not qualified? It's a gap that we should address. The ASTM standard uses DO-178 as a reference.

Crash Protected Airborne Recorder Systems

Mark Reichardt noted NASA Ames has designed crash protected data recorders for UAS.

Cybersecurity

This is a horizontal issue (UTM, Remote ID and tracking). All standards should have a cyber element in them. Taking over the aircraft is one concern but so is data interception. Let's not try to solve the problem here. The issue has been identified. How you mitigate the risk is the concern.

Electrical Systems – no comments

Power Sources and Propulsion Systems

Is this from an OEM's perspective? This is from all angles.

How about bird/wildlife hazards? Yes, that is covered elsewhere. FAA Assure has done work on this. There may be a gap getting the Assure research into the standards. They do more damage to front end than rear end engines. Not sure what standards you are talking about. The OEMs know how to design their engines. FAA is concerned with preventing midair collisions not surviving them. The Assure work will continue. As an unmanned manufacturer, it would be good to have that research data.

Two groups developing hydrogen cell and hybrid systems. Power system could be electric motor. Write-up is high level. Might need more granularity.

Noise, Emissions, and Fuel Venting

Not sure if bullet 2 in gap is phrased correctly. Should say “development of the standards that technologies would have to meet to address . . .”

Mitigation Systems for Various Hazards

Manufacturers would likely do this. (See above in re: propulsion systems.)

Parachutes for sUAS

ASTM parachute standard WK59171 is approved.

Maintenance and Inspection (M&I)

Group was not aware of M&I standards for UAS over 55 pounds. Are there standards for UAS under 55 pounds? We may not want to specify the weight. ASTM dropped weight from its maintenance technician standard. FAA doesn't do airworthiness certification for UAS under 55 pounds. By and large you just need to demonstrate the aircraft is properly maintained under the regulatory structure.

WG2 Flight Operations and Professional Qualifications (Chapters 7 and 10)

WG Co-Chairs

- Jon Gustafson, PS, CFedS, PMP, GISP, Consultant, Civil Integrated Management, Research and Innovation Solutions, Advisory Services, U.S., WSP USA
- Joe Valasquez, Founder and Chief Flight Engineer, DroneScape, LLC
- (Standing in for Mr. Valasquez who had been deployed for Hurricane Florence was Mark Reichardt, President & CEO, Open Geospatial Consortium)

Flight Operations (Chapter 7)

Privacy

Further a comment he made at the meeting, Don Shinnamon provided additional information post-meeting, the gist of which is that the Airborne Public Safety Accreditation Commission (APSAC) Standards for Public Safety Small Unmanned Aircraft System (sUAS) Programs dated 10/14/17 include brief discussions of privacy, data collection minimization, management of digital media evidence, and retention of PII. The International Association of Chiefs of Police (IACP) Aviation Committee Recommended Guidelines for the Use of Unmanned Aircraft also touch on privacy.

Operational Risk Assessment

JARUS SORA doesn't tell you how to address security and privacy concerns. ASTM F3178 is an alternative to SORA. NFPA 2400 calls for risk assessment on an operational basis. Expand to operational risk and best practice assessment? Add ARP 4754A to the list which deals with the function and operation of development assurance techniques to assure complex software and electronic hardware. An alternative means of design assurance.

Beyond/Extended VLOS

Mid-large is not defined. Say “larger than small.” ASTM BVLOS appendix will be discussed at meeting in November then likely be finalized and go out for ballot. Phil Hall sure of accuracy of last sentence in opening paragraph. Should BVLOS/EVLOS be dealt with separately?

Operations Over People

OOP is a risk factor as part of the overall risk consideration depending on the operation, e.g., NFPA 2400. You do need an overarching OOP standard that looks at the issue overall (technical mitigations, how you operate the aircraft, and impact studies). Folks using it for specific use cases can draw on the information in that standard.

There are two types of OOP missions: 1) where people are willing participants in the mission (e.g., a film crew) and 2) people who are unaware of the drone (e.g., at a sporting event). We need to address the two groups in whatever standard. There may be no difference but those situations should be considered, i.e., cooperative versus non-cooperative operations.

Weather

OGC's meteorological offices around the world generally agree with gap statement but feel the recommendation could perhaps be more focused on UAS performance or operator needs (training). Existing standards may be adequate, but the observational capability within the infrastructure is probably not suitable for micro-climates. More comments will likely be forthcoming.

Data Handling & Processing

Recommendation is to put together architectural best practices. Cybersecurity becomes important, data on the aircraft and data transmission must be secure. A large degree of commercial IP is at stake.

UAS Traffic Management

The gap is for a performance standard, not an interoperability standard. What data will FAA provide (e.g., TFR, rules of the air)? Not sure.

Is this where we would get into standards for swarming? Multi-advisory research panel at Assure held last two days and swarming was discussed so the SARP will likely make a recommendation. So, stay tuned. Andy Thurling can provide a sentence or two for the roadmap.

ASTM is working on an architecture standard for UTM that is well underway. Phil Kenul can provide the number. Is this the federated model of providing a UTM services? How the service providers interact? Yes. Performance requirements for USS are needed and have not been discussed. That is the gap. The interactions between USS is being dealt with in the current research.

Remote ID & Tracking

Two recommendations: direct broadcast and network publishing. ASTM WK27055 has a new number. Demonstration at VA Tech in November on what's been done thus far. Comment came in earlier from Ryan Hodgens of WhiteFox of how ASTM F38 is addressing security. They have a subgroup working on security issues.

Geo-fencing

Two recommendations: a conceptual model and a best practices document. Different zones of geo-fencing in terms of what it would mean to an operator? This would be part of the geo-fence so an operator could understand it. Javier (DJI): The Unmanned Aircraft Safety Team has a working group dealing with this topic though it won't produce a standard. Tracy (AUVSI) leads that team and would like to collaborate. They are looking at developing safety enhancements.

Geo-fence can be stationary or mobile. A temporary mobile (temporal) geo-fence could be placed over a moving target. Consideration given to dynamic boundaries around bad weather? That could be an application.

Personnel Training, Qualifications and Certification Standards (Chapter 10)

Terminology

A few published standards coming out of RTCA 203 and 228 have terminology sections in them. DO-362 and DO-365 should be listed. "Unmanned aircraft systems" is how we refer to them now.

Manuals

Are there standards for the development of CONOPS? JARUS SORA Annex A addresses that. NFPA 2400 has specific job performance requirements for public safety operators.

UAS Flight Crew

We should reference work in progress on qualification/certification standards for pilots at ICAO under the SARPS. TOP is in its beta phase. Two organization have undergone certification. Public launch will be in

November. For certification, it takes account of many standards (RTCA, Airborne Public Safety Standards, NFPA, ASTM, ICAO) that are out there today.

Additional Crew Members

You could list others that are use case specific, e.g., NFPA 2400. Does weight matter when it comes to training? FAA commented that it is looking at mission specific competency, not weight. FAA defines UAS by what part you are operating under. One commenter liked the description of UAS over 55 pounds as being large.

Maintenance Technicians – no comments

Compliance/Audit Programs

How does self-assessment work? Add NFPA 2400. Audit programs cover both operations and people. Next phase for TOP program will be to develop best practice in maintenance. When would we see compliance being audited? Provide use cases or case studies for this? We need to ask the right questions.

Human Factors in UAS Operations

First pass at write-up to get something out there with more work to be done on it. Section should stay but perhaps could be re-organized following a task analytics approach in terms of what the human is responsible for. Yes, human factors are covered in pilot licensing but also in airworthiness, safety, risk management, interactions with stakeholders, and CONOPS. Maybe a CONOPS type gaps analysis?

Displays and controls may not be user-friendly to the pilot in the field. We want to make it easier for the pilot to operate the aircraft.

There is misunderstanding of the word autonomy. Autonomy doesn't exist in manned aviation (whereas automation does). We don't have fully autonomous civil operations. They are automated but not autonomous—there are different levels.

ASTM aviation technical committee on manned and unmanned is working on definitions, levels, and certification frameworks to be released as two technical reports. Terminology one hopefully out by end of the year.

Expand third gap on crew training to include sleep deprivation, operating more than one radio, and other public safety centric human factors. There are flight time duty rest rules in CFRs 135, 121, 117 that apply for different operations which could be adopted for UAS. Complex operations may have other people affecting the mission, e.g., those controlling video. NFPA 2400 includes aspects of this.

Much done in the military environment on this especially for larger, long-range missions. Not all of that in is translatable to the small and medium sized UAS civilian environment.

WG4 – Emergency and Medical Response (Chapter 9)

WG Co-Chairs

- Christine DeJong, Director of Business Development, ASTM International
- Kristy Kiernan, PhD, Assistant Professor, Program Chair MS in Unmanned Systems, College of Aeronautics, Worldwide, Embry-Riddle Aeronautical University

sUAS for Public Safety Operations

NFPA and ASTM working together on scenarios. NFPA 2400 aimed for release in mid-November.

Hazardous Materials Incident Response and Transport

ASTM / NFPA JWG isn't looking at transport.

Does blood count as hazmat? It is a biohazard. We looked at and abandoned the issue of delivery of medical supplies as a use case because of lack of interest. We also talked about in the context of commercial package delivery. We do talk about public safety payloads later on in this section. Do we want to add it to this section on hazmats? It's not hazmat and it not normally considered a public safety operation. You could tie it to search and rescue (SAR). Call this section "public service" operations instead of "public safety"? Does someone want to work on this? Anyone working with Zipline or UPS in Uganda? Any E54.09 standards on this? The test methods

specify specific performance parameters; we haven't gotten into this area. NFPA 2400 provides uses of UAS providing emergency medical services. UASSC WG4 context is 911 emergency response. This is more public health and the payload. Let's not limit ourselves to response. Recovery is important too. Post disaster recovery responses are horizontal. UASSC charter says our focus is civil, commercial, and public safety applications so let's keep it public safety and it probably fits best in this section. AirMap is part of North Carolina IPP program and they are doing medical services delivery. A number of people (Ritesh, Mike Wixted, Tracy) have contacts and offered to do outreach to see if we can get a contribution on this.

Forensic Investigations Photogrammetry

We labored hard over what to call this, starting with Traffic Accident Reconstruction and settled on the current name after speaking with people who do this every day.

A quality standard makes it easier for attorneys to submit evidence. There is a need for industry standards.

Washington State patrol has a large program on this now. Mitch Droz may have a contact to reach out to.

This is a popular, non controversial use of UAS technology.

This is a use case for data processing.

Revise recommendation to say operational standards are needed for the use of UAS to conduct forensic investigations and for the on board sensors used to collect data, rather than just focus on the sensors?

The user community wants something to meet a minimum resolution.

ASTM has a committee on forensic science. Suggestion to also consult the NIST OSAC on forensics digital subcommittee. In addition to NFPA 2400, NFPA's fire and explosion investigations committee uses this.

We're talking about general mapping accuracy and use of imagery, not necessarily photogrammetry. Suggestion to remove photogrammetry from the title and rename it Forensic Investigations or Mapping Applications?

UAS Payloads in Public Safety Operations

Does this get into cybersecurity? It's more about the mechanical interfaces, electrical connections, communications message sets. This could be a business development opportunity to support public safety. Is this horizontal or specific to public safety? Yes, it is horizontal but it is also centric to public safety. We may need a sector to identify the need and drive the market to give rise to a horizontal standard. Ryan and Kevin are looking at combining this with the next section/gap.

sUAS Drop Control Mechanism – Looking to drop this into the prior gap as they are so closely related.

Search and Rescue: sUAS FLIR Camera Sensor Capabilities

Why are we singling out thermal? It's about the safety community picking the right tool for the job. FLIR is the most obvious choices for SAR. It is the primary one used by the fire service and law enforcement. Many SAR missions are in low light conditions. FLIR, video, RGB, multi-spectral are options. Maybe a need will be identified for the other technologies later on.

Search and Rescue: sUAS Automated Waypoint Missions

Is there a need for a separate standard or is this just a use case for BVLOS that could be referenced in that section? Ryan may have other updates that didn't get put in. This is about the ability of the user to be able to program the sensors position. It is more comprehensive than just the waypoint.

Why do we have to have a standard for flight management? We've called out the need for sensor web enablement standards, some of which exist. This is a use case.

Ryan and Mark R. should talk to each other.

Response Robots – no comments

Law Enforcement Tactical Operations

No gaps identified. As noted in the write-up, often these operations need to be conducted at night and covertly which may require a revision to Part 107.205 to include a waiver for anti-collision lights if and when a safety case can be made to support the waiver request.

Counter UAS

Remote ID comes into play and was originally intended so law enforcement could track drones. Add a cross-reference to it. Public safety officials should have the highest level of access to C-UAS. Bad guys don't play by the rules.

VA Dept of Corrections wants to prevent contraband.

How will this interface with geo-fencing?

Remote ID to be discussed at 9/26 AUVSI Hill Day.

Bullet two should point to remote ID. Bullet three is the real gap.

Remote ID not the same as C-UAS technology. C-UAS is not being addressed in the ASTM remote ID work.

Threats to water supply, electric grid, infrastructure, are real.

FAA pathfinder program included a drone detection initiative. We should add a reference to that.

Open Discussion

Representatives of UASSC Leadership

- Art Hinaman, Manager, Technical Support Branch, Office of UAS Integration, Federal Aviation Administration (on behalf of UASSC Co-Chair Earl Lawrence)
- Tracy Lamb, BA, Avn. MBA, Avn. ATPL, VP of Regulatory and Safety Affairs & Chief Pilot Association for Unmanned Vehicle Systems International (on behalf of UASSC Co-Chair Brian Wynne)

This was an opportunity to revisit anything discussed during the day or for comments not previously raised.

We don't have some players at the table that need to be here, e.g. rail (BNSF). Call for everyone to get new participants from other areas involved in this collaborative and in standards development.

Meta-standard concept sounds interesting. What's the history on that?

Have we gotten operators involved? Maybe a portal to get feedback from them. That could provide a useful source of near real time information.

Please provide us with contact info or reach out to your network.

Suggestion to get 6-month lead feedback from the IPP. What standards did you follow? Lessons learned? And also to get regular feedback.

SDO coordination? ASTM, RTCA, SAE, AUA had been meeting to discuss coordination and that will continue. It's usually industry, not the SDOs, who decide which SDOs they want to participate in and what's in the standards. Comment that there isn't a lot of reference to OSHA standards in the roadmap. How prevalent in CONOPS should those be?

It's important that we stay plugged into what's happening in ICAO and JARUS. We're all working on similar problems.

We currently have 57 gaps and 60% are high priority, 35% medium, and the balance are low. Is that the right curve that we want to see? Some people's scoring of the gaps is noted following the prioritization matrix in section 1.3; others just list the conclusion. We want to be realistic. We also need to identify the dependencies among the gaps.

Suggestion to hear from the SDOs on what they plan to work on and how they're prioritizing the work.

Next Steps and Closing Remarks

Mr. McCabe's slide showed the forward calendar as looking like this:

- 9/25 – release roadmap for 30-day comment (if not Tuesday, by the end of next week in any case)
 - 9/27 – Steering Committee call (3-4 pm Eastern)
- 10/29 – WGs reconvene to review comments, make revisions
 - 11/1 - Steering Committee call (3-4 pm Eastern)
- 12/3 – Finalize roadmap for publication
 - 12/6 - Steering Committee call (3-4 pm Eastern)

By end of next week, we'll circulate the roadmap for internal and external comments. We'll update it before sending it out, mostly margin comments. When we send it out we use the ISO comment template so comments can easily be collated.

WG calls will resume in the last week of October or first week of November, possibly weekly, to resolve the comments.

ANSI has made a commitment to FAA to publish the roadmap by the end of the year.

Mr. McCabe thanked everyone for their participation and invited them to the reception.

Participants

Qassim	Abdullah	Woolpert, Inc.
Anuj	Agrawal	Earth Networks
Jonathan	Alvear	International Trade Administration - U.S. Department of Commerce
Sarah	Bloomquist	American National Standards Institute (ANSI)
Fred	Borda	Aerial Innovation
Javier	Caina	DJI
Kai-Dee	Chu	U.S. Department of Homeland Security (DHS)
Kelley	Cox	American National Standards Institute (ANSI)
Stephen	Crimaudo	American Petroleum Institute (API)
Brian	Daly	AT&T
Christine	DeJong	ASTM International
Mitch	Droz	Wolf UAS LLC
Rehan	Ehsan	Consumer Technology Association (CTA)
Joe	Eyerman	RTI International
Karen	Faerber	RelmaTech Limited (UK)
Deirdre	Gallop-Anderson	U.S. Department of Homeland Security (DHS)
Ritesh	Ghimire	Federal Aviation Administration (FAA)
Gordon	Gillerman	NIST - U.S. Department of Commerce
Nathan	Green	Truweather Solutions
Jon	Gustafson	WSP USA, Inc.
Philip	Hall	RelmaTech Limited (UK)
Joe	Heaps	U.S. Department of Justice/National Institute of Justice
Carlos	Hernandez	Virginia Department of Corrections
Art	Hinaman	Federal Aviation Administration (FAA)
Joe	Hollerer	Security Industry Association (SIA)
Nafis	Kamal	Aeronyde Corporation
Philip	Kenul	ASTM International
Kristy	Kiernan	Embry-Riddle Aeronautical University (ERAU)
Richard	King	Network Designs
Kevin	Kochersberger	Virginia Tech / National Institute of Justice
Ryoji	Koike	Aerial Innovation
Marianna	Kramarikova	Telecommunications Industry Association (TIA)
Tracy	Lamb	Association for Unmanned Vehicle Systems International (AUVSI)

Earl	Lawrence	Federal Aviation Administration (FAA)
Keisha	Manning (Webex)	SmartSign
Jennifer	Marshall	NIST - U.S. Department of Commerce
Philip	Mattson	U.S. Department of Homeland Security (DHS)
Jim	McCabe	American National Standards Institute (ANSI)
Sam	McGuire	Red Mountain Scientific
Brian	Meincke	ASTM International
Mary	Mikolajewski	ASTM International
Rich	Moran	Alliance for Telecommunications Industry Solutions (ATIS)
Arun	Murthi	Federal Aviation Administration (FAA)
Peter	Musgrove	AT&T
Travis	Norton	Bureau Veritas
Ron	Ogan	IEEE and USAF Civil Air Patrol
Kerin	Olson	Federal Aviation Administration (FAA)
Egbert	Oostburg	Drone Aviator, Inc
Michael	Palm	Underwriters Laboratories Inc
Ryan	Peterson	Orem Fire Department
Eshwar	Pittampalli	FirstNet - U.S. Dept. of Commerce NTIA
Michael	Presutto	Fredericksburg Police Department
Jeffrey	Randorf	U.S. Department of Homeland Security (DHS)
Mark	Reed	Air Line Pilots Association (ALPA)
Mark	Reichardt	Open Geospatial Consortium (OGC)
Judith	Ritchie	SAE International
Chris	Sadler	York County Fire and Life Safety
Fran	Schrotter	American National Standards Institute (ANSI)
Iain	Sharp (Webex)	Alliance for Telecommunications Industry Solutions (ATIS)
Don	Shinnamon	Aeryon Labs
Jace	Sotomayor	University of Hawaii Applied Research Laboratory
Shawn	Talmadge	Virginia Office of Public Safety and Homeland Security
Harold	Thistle	American Society of Agricultural and Biological Engineers
Andy	Thurling	NUAIR Alliance
Anthony	Tisdall	JMA Solutions, LLC
Sam	Weich	Ligado Networks
Michael	Wixted	National Fire Protection Association (NFPA)
Brian	Wynne	Association for Unmanned Vehicle Systems International (AUVSI)