Unmanned Aircraft Systems: EVOLUTION AND OPPORTUNITY

REGULATORY ADAPTATION IN A NEW ERA OF FLIGHT
Unmanned Aircraft Systems Update: Advanced, Accepted and Accelerated

Since the Aerospace Industry Association’s 2013 report on unmanned aircraft systems (UAS), unmanned flight technology and platforms have continued to evolve in new and innovative ways. Small start-ups to major global corporations are establishing UAS-based aviation services and solutions, and there is continued growth projected for military UAS flights and orders.¹

A cultural shift driven by consumer and commercial use is underway as well. Due to the increasing availability of low-cost unmanned systems and their growing acceptance for uses such as videography, most consumers are now aware of unmanned aircraft and their basic capabilities – beyond their initial adoption as a recreational platform. Today, unmanned aircraft have also earned acceptance as a tool for the creative arts, and as vehicles of personal expression.² As a result, negative perceptions are changing.

Meanwhile, the public is becoming aware of the unique challenges associated with unmanned flight and the unaddressed issues of operator qualifications and low-level airspace performance, particularly among hobbyists and other small-UAS users.

This report offers AIA’s perspectives on how government and industry should collaborate on developing regulations, policies, and procedures for integrating unmanned systems into our skies. Guiding principles supported by industry state that, at a minimum, any new rule or policy must:

- Promote emerging technologies while maintaining aviation safety;
- Achieve routine access for unmanned aircraft systems to all classes of airspace;
- Harmonize with international regulations; and
- Reform U.S. export policies.

Progress toward these four objectives is underway. Regulatory efforts among the Executive Office of the President, the Federal Aviation Administration (FAA) and their international counterparts have gained significant momentum in advancing UAS airspace integration. Like regulatory responses to other technology trends, policymakers formulating safety, licensing, spectrum and other operating rules and policies for unmanned systems are playing catch-up to rapidly expanding market demand. However, the regulatory effort – like the UAS industry itself – is today in the midst of rapid maturation and growth.

As the Government Accountability Office (GAO) and other analysts have pointed out, much has been accomplished, but there is still work to be done.³ Fortunately, constructive frameworks have emerged in the past several years that will help achieve critical regulatory goals, clarify gray areas and resolve industry concerns such as those related to UAS national airspace integration, segregation of large and small unmanned vehicles in flight, determination of appropriate operator certifications, and many related security and safety issues.

Regulators are faced with critically important decisions in establishing UAS standards. Large unmanned aerial vehicles (UAVs) in particular – most currently operated by the military with complex command-and-control systems – will one day enter the National Airspace System (NAS) for routine civil and commercial operations. However, integration of large UAS currently has a lower priority within the FAA relative to the immediate regulatory need perceived for addressing smaller unmanned systems.

“UAVs can help us to locate subjects more quickly and oftentimes you can see things from above that you could never see from the ground. We can also send UAVs into situations and conditions that would not be safe to send a manned aircraft into.”

— Matthew Marra, Operations Captain, Northern Colorado Search & Rescue

(Source: Droneblog.com October 26, 2015)
The focus of the current FAA rulemaking effort – addressing unmanned aircraft under 55 pounds – is deserving of an accelerated regulatory process. Commercial operators are complying with the FAA’s waiver process; however, some remain unlicensed operators without formal training or basic knowledge of flight safety.

While commercial operations evolve, a growing number of unintentional near mishaps are occurring in the absence of coordinated rules for both commercial and consumer UAS operators. Officials fighting forest fires in Canada were forced to ground water-carrying helicopters and skimmer planes due to unauthorized UAVs in their airspace. A number of near misses have been reported by commercial airline pilots identifying “rogue drones” in close proximity to their aircraft. Clearly, some basic rules for safe small UAV operation – and remedial efforts at consumer education – are required. As stated above, maintaining NAS safety is essential for the steady and continued growth of commercial aviation and all types of new and emerging products.

In 2013, AIA stated that major challenges to UAS growth included misperceptions regarding the threats posed by UAV flights. Misperceptions regarding privacy and civil rights previously expressed through “anti-drone” advocacy have been refocused by the substantive efforts of regulators and policymakers. Non-aviation industry experts on privacy and data security have also added knowledgeable voices to the conversation, and constructive ideas for addressing privacy and security issues have today begun to eclipse calls for the wholesale banning of local government, commercial and consumer UAV flights. In response to a 2015 Executive Order, for example, AIA and a group of its member companies are participating in the Multi-Stakeholder Process established by the National Telecommunications and Information Administration (NTIA) to develop best practices for UAS privacy policies.

Meanwhile, there is no stopping the growth of UAS technology, the growing number of aircraft in the skies, nor the innovative uses operators are identifying for unmanned systems. Current growth, however, does not signal indefinite U.S. leadership in the global UAS market. Domestic policymakers must balance regulatory efforts with the need for growth and innovation.

This report sets forth the current progress of UAS regulatory initiatives, and points the way forward for those seeking to encourage innovation and U.S. growth in this exciting new frontier of aviation, while ensuring safety and security in the skies.

“One day [Amazon] Prime Air deliveries will be as common as seeing a mail truck. The technical problems are very straight ahead. The biggest issue, or the biggest thing that needs to be worked on, is the regulatory side.”

— Jeff Bezos, CEO and founder, Amazon

(Source: The Telegraph, September 6, 2015)
**The UAS Sector: Double-Digit Growth**

As with other great leaps forward in aerospace innovation, the relatively sudden prevalence of unmanned aircraft around the world has spurred the need for new regulations to maintain air safety. These regulations must confront a rapidly evolving technology that could have significant impact on multiple sectors of the U.S. economy. From package delivery to broadband provision, UAVs are being developed and tested for uses unimaginable just a few years ago.\(^6\)

Meanwhile, new and immediate practical uses for UAVs continue to emerge, and enthusiasm for the technology has created a huge commercial market from what was once a niche interest shared by a small number of hobbyists and researchers. According to the Consumer Technology Association, more than 700,000 UAVs would be purchased by consumers in 2015,\(^7\) and the FAA projects that roughly 7,500 larger, more complex unmanned systems will be operational in the United States within five years.\(^8\)

Military demand for unmanned systems will also continue to grow. Daily military flights are expected to increase by 50 percent – to about 90 per day by 2019 – from current levels of 60-65 per day.\(^9\) U.S. defense spending on UAV research and development is projected to reach $19.6 billion through 2024, and defense procurement is expected to reach $25 billion over the same period.\(^10\) Globally, the military UAV sector is expected to grow by 79% in the coming decade.\(^11\)

Civil government use of unmanned systems is also projected to rise. The TEAL Group projects that worldwide civil UAV production will increase from $3.5 million in 2015 to $302 million in 2023.\(^12\)

Overall, the FAA estimates that more than $89 billion will be invested in UAS technology over the next 10 years.

For now, the U.S. holds the leading position in terms of global UAV sales, development and investment.\(^14\) How can it best maintain that position?

At its most basic level, the challenge before regulators is how to safely open skies to new technologies that promise numerous benefits to the American people and the U.S. economy. Primarily, this involves integrating unmanned systems into the NAS – a process that will require innovative solutions on the ground and in the air, in addition to sound, progressive policy solutions. It will also require UAV interaction with an air traffic management system already in the midst of a multi-year upgrade to meet 21st century aviation demands.

The questions before regulators and the industry have no easy answers. Are UAV operators “pilots”? What type of training should they have? Will technological features on UAVs really mitigate safety risks? Should all UAVs be registered for accountability purposes? What is required for beyond visual line of sight operations? Is there a safe altitude for all UAV flights, or only for certain sizes? What about speed limits?

As regulators grapple with these and other questions, progress toward a regulatory framework is well underway, and various industry stakeholders are engaging the FAA, the White House and international entities formulating policy ideas and proposals. These are important steps that should lead to a comprehensive framework that addresses privacy, radio frequency spectrum access and other issues.

_“The innovators creating unmanned systems today are what the Wright Brother were to manned flight more than 100 years ago: Pioneers leading us toward the next great leap forward in aviation technology.”_  
— David F. Melcher, President and CEO, Aerospace Industries Association
“FAA UAS exemptions for TV and film production are a victory for audiences everywhere as [they] give filmmakers yet another way to push creative boundaries and create the kinds of scenes and shots we could only imagine just a few years ago.”

— Sen. Chris Dodd  
Chairman and CEO,  
Motion Picture Association of America, Inc.

(Source: mpaa.org)
By law, any aircraft operation in the national airspace requires a certified and registered aircraft, a licensed pilot, and operational approval to fly. In order to encourage innovation and discourage “illegal activity,” the FAA has been waiving these rules on a case-by-case basis for operators who demonstrate appropriate compliance and petition for an exemption.

Today, the FAA primarily grants three types of waivers. A Certificate of Waiver or Authorization (COA) permits public agencies and organizations to operate a particular aircraft in a designated area for a specific purpose. A Section 333 waiver allows UAV operations for commercial uses such as aerial photography, surveying, remote sensing, research, and agriculture uses, among others. Experimental certificates allow civil entities and commercial operators to use UAVs for research and development, training and demonstrations.

By the time Congress passed the FAA Modernization and Reform Act of 2012, which directed the agency to “take actions to safely integrate UASs into the national airspace,” the number of waivers and exceptions granted to UAS operators was already increasing at a rapid pace.

The number of public COAs increased from 286 in 2010 to 609 in 2014. Experimental certificates were granted to 15 petitioners in 2010 and 39 in 2014. In 2014, the FAA began granting Section 333 waivers, and within a year, had granted thousands of these exemptions after a period during which the number of exemptions granted was increasing by as much as 12 percent on a weekly basis.

Despite the increase in waiver requests, regulating small UAVs — required to operate at altitudes less than 400 feet and at least five miles away from an airport — has proven difficult. Most hobbyists and consumer users of small UAVs are not required to register flight plans, and many are not aware of the need to file such plans.

While the FAA will continue to grant waivers, it is a stopgap method of UAS regulation that is in danger of being overwhelmed, leaving policymakers and commercial operators united in their desire for permanent rules and a streamlined process.

Beyond Waivers and Exceptions: Regulatory Next Steps

The FAA Roadmap

The FAA’s roadmap for seamless integration of UAS operations into the national airspace addresses issues including operator and pilot training, airspace permissions, platform sizes and technical requirements. It also provides a way for industry to make recommendations, react to proposals and pursue innovations that help move the process forward.

The agency’s UAS Integration Roadmap describes a three-phased process:
### FAA UAS Classifications: Size and Mission

The FAA categorizes UAS by “Risk Classes” that consider size, weight, and operational considerations such as operating under direct visual line of sight or those operating Beyond Visual Line of Sight (BVLOS). These classes also consider weight and altitude restrictions.

#### SIZE

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<thead>
<tr>
<th>SMALL</th>
<th>LARGE</th>
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<tr>
<td>OPERATING ALTITUDE:</td>
<td>OPERATING ALTITUDE:</td>
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<tr>
<td>Typically operates at lower altitudes, due to FAA regulations</td>
<td>Typically operates at higher altitudes, up to 60,000 feet and more</td>
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<td>WEIGHT:</td>
<td>WEIGHT:</td>
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<td>Less than 55 pounds</td>
<td>55 pounds or more</td>
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#### MISSION

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<tr>
<th>WITHIN VISUAL LINE OF SIGHT</th>
<th>BEYOND VISUAL LINE OF SIGHT</th>
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<tr>
<td>No special instruments are needed to ensure the UAS avoids other aircraft</td>
<td>Special instruments are needed to ensure the UAS avoids other aircraft and obstacles</td>
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### Current Progress

In response to the FAA Modernization and Reform Act of 2012 and UAS sector growth, the FAA has expedited procedures to grant one-time UAS flight authorizations for emergency missions such as disaster relief and humanitarian efforts. It has also lengthened the Certificate of Authorization (COA) for unmanned systems from 12 to 24 months.

In addition, the agency has created six UAS test sites that became operational in 2014. These sites are conducting UAS flights, and all are reporting progress. Milestones achieved include the navigation of an unmanned aircraft at a public airfield near Lakota, North Dakota, at the Northern Plains UAS Test Site. The Mid-Atlantic Aviation Partnership test site is now working with unmanned systems to aid emergency responders, survey pipeline infrastructure, study agricultural land, and teach reporters how to use drones for news coverage.

The FAA and industry jointly participated in a committee to develop proposed operational rules for small UAS. The proposed rules were published for public comments in February 2015. The rules limit UAS operations to daylight-only, in confined areas, and within visual line of sight. The initial set of regulations also includes aircraft registration, NAS operations and operator certifications for small UAS.

Although the FAA missed the congressionally mandated deadline of September 2015 to finalize the sUAS regulations, it is moving forward on a series of regulatory actions to govern UAS operations.

### AIA Recommendations: Small UAS Rule:

- Create “qualified status” for UAV operators
- Require a driver’s license for operators
- Create night-time operation exceptions for first responders, establishing a path forward for future routine night-time operations
- Allow for lateral and vertical clearances that permit safe inspection of tall structures
- Require a skills-based test for complex systems, in addition to the FAA’s proposed aeronautical knowledge test
As the Agency formulates these regulations, it has weighed a variety of factors with safety implications, including:

- A requirement for two-person UAV flight teams that include an operator and a spotter;
- Whether “visual line of sight” means a view of the UAV with the naked eye or through a First Person View system;
- Maximum boundaries and altitudes for flight;
- Speed limits;
- Classification of operators as airmen; and
- The types of incidents and accidents that should be reported to the FAA.

AIA is among organizations that have provided responses to the proposed rules. Overall, the industry’s position is that the final rule, which – along with other vital regulatory initiatives – will provide a framework in which UAS technology can mature and safely deliver on promised benefits.
Spectrum Strategy
UAS communications, both for command and control and any payload data transmission, require a portion of the electromagnetic spectrum, which is already in very short supply. Without sufficient spectrum, UAS signals may suffer interference from other forms of communication.

At a minimum, the FAA, NTIA, and the Federal Communications Commission (FCC) should prioritize the development of a spectrum access strategy in order to ensure the industry’s ability to reliably implement proposed risk mitigation techniques, thus advancing safe operations in the NAS. This strategy should address Visual Line of Sight and Beyond Visual Line of Sight spectrum needs for command and control. Additionally, spectrum for Detect and Avoid systems and sensor payload networks must be considered.

Progress on spectrum for small UAS is but a first step in a spectrum plan for larger, more complex unmanned systems. In 2012 and again in 2015, the United Nations specialized agency for telecommunications, the International Telecommunications Union (ITU), reached an agreement identifying which bands would support radio line of sight and beyond radio line-of-sight UAS operations, respectively. As industry awaits FCC implementation of the 2012 agreement, standards development is the vital next step for both agreements.

Pilot/Operator Certification
The rule would also be the first in which the FAA is proposing to award an airman’s certification that does not require a skills test. The global community, including the FAA, is benchmarking the rules which require some degree of operator training and insurance. In an integrated NAS, the UAS operator will interface with the air traffic management system and some degree of training will be necessary. This training will likely follow the Risk Classes discussed earlier.

Critical Issue: SPECTRUM ALLOCATION
Progress on spectrum for small UAS is but a first step in a spectrum plan for larger, more complex unmanned systems. In 2012, the United Nations specialized agency for telecommunications, the International Telecommunications Union (ITU), reached an agreement identifying which bands would support radio line of sight UAS operations. As industry awaits FCC implementation of the agreement, vital next steps include identification and implementation of spectrum bands for beyond radio line-of-sight operations. This remains a key area of AIA advocacy.
Aircraft Certification

There are currently no certification requirements for the design and manufacture of unmanned systems. Approval of UAS flight in civil airspace is currently covered by the FAA's waiver system, a stopgap approach while the agency develops permanent regulations.

The Agency’s regulations also allow operations under a restricted category special airworthiness certificate for those aircraft that have been type certificated in the restricted category. Operation of restricted category aircraft is limited to special purposes identified in the applicable type design. These special purpose operations include agricultural, forest and wildlife conservation, aerial surveying, patrolling (pipelines, power lines, and canals), weather observation, aerial advertising, or any other operation specified by the Administrator. Before a special airworthiness certificate is issued, the FAA issues a type certificate (TC) to restricted category aircraft under 14 CFR § 21.25(a) for use only in those special-purpose operations defined in 14 CFR § 21.25(b). Restricted category aircraft include both civil-derived and military-derived aircraft. Each aircraft must meet its respective restricted category requirements before a TC for special-purpose operations is issued.

It is also possible to obtain FAA approval of UAS under the provision of 14 CFR 21.17 (b) and 14 CFR 21.16. However, certain operational restrictions would apply based on the intended mission concept of operation.

New regulations will ultimately spring from longstanding certification processes developed for manned aircraft, but it is nonetheless an unprecedented effort. While certification of manned aircraft focuses on airworthiness and the safety of crew and passengers in the air, UAS airworthiness is primarily concerned with potential threats to other aircraft as well as structures and people on the ground.

A new framework for Risk Classes has been developed. These classes range from the very small to very large that overlap with commercial air transportation. This helps align processes already in place for an integrated airspace.

For the FAA, a key issue for creating an appropriate certification framework is the analysis of risk – to people and property – and the degree to which that risk can be mitigated through design and operational certification.

For larger UAS, the FAA may subject aircraft to operational risk assessments. As with all commercial aircraft certifications and airworthiness approvals, applicants will be asked to assess the risk levels (e.g. fault hazard analysis) associated with operating an unmanned aircraft based on its intended mission, area of operation, risks to people on the ground, and risks to other aircraft. The potential for procedure and system-level failures must also be assessed by certification applicants.

In order to earn FAA design, airworthiness and production approval, the system must demonstrate adherence to a structured analysis of a Design Assurance Level such as those
required in the manufacture of manned aircraft. The design and assembly process is likely to be governed by Technical Standard Orders (TSOs), the FAA’s minimum performance standards for materials and parts used on civil aircraft.

This risk-based approach is based on standards currently in place for manned aircraft, and would require the submission of a Concept of Operations (CONOPS) document demonstrating that the unmanned aircraft is capable of meeting current performance standards required of manned aircraft operating in the National Airspace System.

AIA supports the general framework adopted by the FAA, which acknowledges that risk increases with the size and speed of an unmanned aircraft. The larger an aircraft is and the faster it flies, the greater its kinetic energy, which is released in the event of a collision. The FAA’s risk-based approach couples the size, weight, intended use, and area of operation into a single approval structure.

Nonetheless, it is expected that even the smallest UAS intended for low-altitude, line of sight flight will be subject to a minimum set of airworthiness approvals or design requirements. For example, rules governing control systems — for unmanned systems of various sizes and complexity — must address issues such as lost link, restricted altitude, and restricted areas of operation. Similarly, size and speed should not be the only measures determining standards for flights over densely populated areas versus remote or rural geographies.

Given private industry’s history of safety innovation and expertise, it is imperative that the FAA engages industry stakeholders in the development of a UAS certification regime. AIA looks forward to the opportunity to engage policy leaders and respond to future rulemaking proposals from the FAA.
The Pathfinder Program
In 2015, the FAA initiated the UAS Pathfinder Program to support development of far-reaching concepts and utilization of current NAS capabilities—many of them elements of the multi-year air traffic control system transformation known as NextGen. Pathfinder programs include government-industry collaboration on the use of UAS for:

- News Gathering
- Railroad infrastructure inspections
- Precision agriculture

The Pathfinder Program elements provide a venue for collaboration on technology, policies, procedures and regulation.

Command and Control Data Link
Essential to the safe operation of UAS platforms in the NAS is the need for a robust command and control infrastructure. RTCA Special Committee 228 is developing Minimum Operational Performance Standards (MOPS) for the Control Non-Payload Communications (CNPC) data link for the telemetry exchange between the control station and the UAS platform. The standards will initially address the terrestrial links using L-band and C-band with follow-on standards activity to develop a satellite communications capability for command and control (C2).

The Special Committee developed standards that are intended to be the foundation for verification and validation. Once the flight tests are complete, these will be released as the C2 standard.

The purpose of the CNPC link is to only provide the command exchange. A separate link will be coordinated for the offload of sensor (payload) data for ground processing.

A critical activity is to ensure alignment on the spectrum. Coordinating spectrum access with other agencies and on a global basis is necessary for the long term success of CNPC. The initial work was accomplished through the ITU process. But the actual execution is more local, where coordination between different agencies, including the NTIA and the FCC, is necessary.

Detect and Avoid (DAA)
Critical to NAS integration will be the ability of UAS platforms of various sizes and missions to operate in a way that ensures safety in the air and on the ground. One requirement of the FAA will be the integration of “detect and avoid” (DAA) technologies with unmanned systems in order to provide collision avoidance for systems flown beyond line of sight.

RTCA, Inc., through its Special Committee 228, is working toward completion of standards for DAA capabilities, and efforts are well underway to develop compliant technology that will integrate with FAA’s Traffic Collision Avoidance System (TCAS). Today, in its second generation, TCAS II also issues vocalized corrective actions to pilots.

Achieving an effective collision avoidance system for unmanned aircraft, however, will require a an effective mix of DAA technologies. These systems will need to consider both cooperative and non-cooperative airspace system targets.

ACAS-Xu
In January 2015, NASA, the FAA, General Atomics and Honeywell successfully demonstrated a proof-of-concept DAA system, marking a major milestone to inform the development of standards and regulations for development of the Airborne Collision Avoidance System for Unmanned Aircraft (ACAS-Xu). Researchers evaluated three self-separation displays and algorithms and their ability to effectively inform a UAS operator/pilot of nearby traffic and help resolve conflicts in a timely manner. Though similar to TCAS II in many ways, ACAS-Xu is being designed foundationally for UAS. The recommended DAA requirements that RTCA eventually offers will depend upon upcoming validation and verification activity and the associated data analysis.

ADS-B
Currently part of NextGen, Automatic Dependent Surveillance-Broadcast (ADS-B) is a satellite-based surveillance system that uses GPS to pinpoint an aircraft’s precise location and constantly broadcasts that information and other critical data (altitude and air speed, for example) to nearby aircraft and air traffic controllers. FAA completed the nationwide ADS-B ground infrastructure installation in 2014 and the system awaits
large-scale operator adoption of transponders by the agency’s 2020 mandate to deliver its full benefits.

The UAS Traffic Management System

Distinct from Detect and Avoid solutions such as ADS-B and ACAS-Xu, NASA and industry are developing the UAS Traffic Management (UTM) System, which is designed to enable civilian UAV operations at low altitudes. The FAA is considering that a low-level navigable route structure may require reclassification of airspace to accommodate system performance and infrastructure requirements for small UAS operations. Once fully developed, the UTM system may enable safe and efficient high-density, low-altitude airspace operations by providing capabilities such as:

- Airspace design
- Flight corridors
- Dynamic geofencing
- Severe weather and wind avoidance
- Congestion management
- Terrain avoidance
- Route planning and re-routing
- Separation management, sequencing and spacing
- Contingency management

According to NASA, UTM is essential “to enable the accelerated development and use of civilian UAS applications.” The UTM system will not require human operators to monitor every vehicle continuously, but will provide data for “human managers” to make strategic decisions related to airspace operations. This approach would ensure that only authenticated unmanned systems operate in approved airspace. In its most mature form, the UTM system will use autonomous functions such as self-configuration, self-optimization and self-protection. The self-configuration aspect will determine whether a flight should continue given current or predicted weather conditions.

Two types of UTM systems are envisioned. The first is a Portable UTM System, which would move between different areas and support operations such as precision agriculture and disaster relief. The second is a Persistent UTM System, which would support low-altitude operations and provide continuous coverage for a geographical area. NASA’s near-term goal is a demonstration of the UTM by 2020. Already, baseline UTM capabilities are being deployed in the operational NAS prior to the NASA prototype.

SAA Technology Goals

**DETECT** – Is something there?

**SENSE** – Is it a threat or target?

**AVOID** – Maneuver to miss.

Source: FAA Literature Review, September 2009, pg. 11.
Privacy

AIA’s previous paper on unmanned systems compared the public’s privacy concerns about unmanned aircraft surveillance to those regarding video content produced by variety of static or handheld devices. Unlike smartphone video, UAS surveillance missions were predicted to be highly regulated – by multiple government agencies and subject to existing laws protecting personal privacy and due process.

Today, that prediction is borne out by the government’s approach. Recent policy actions include a February 2015 memorandum on UAS privacy, civil rights and civil liberties issued by the President. In it, the President directs the federal government to “take all steps to ensure that privacy protections and policies relative to UAS continue to keep pace” with increased use of unmanned systems. The memo includes guidelines for policies and procedures regarding data collection and retention, and adherence to existing federal accountability, transparency and reporting standards. In addition, it orders a multi-stakeholder engagement process to “develop and communicate best practices for privacy, accountability and transparency issues regarding commercial and private UAS use in the NAS.”

Response to the President’s memo included initiation of a multi-stakeholder process at the NTIA, which has included comment solicitations, numerous meetings, and proposed procedural frameworks. After issuing a call for public comment in March 2015, the NTIA initiated a series of public stakeholder meetings.

Information provided at these meetings included numerous privacy policies and plans from the FAA and its academic, civil society, and private-sector partners for the nation’s designated UAS test sites. Plans presented were derived from a diverse array of foundational documents, including those from law enforcement officers, wireless industry advocates, realtors and photojournalists.

Security

UAS incursions into restricted airspace are becoming more common, and while none have resulted in loss of life or serious injury, they have exposed how difficult it is for security agencies to thwart the presence of small, unmanned aircraft. Most high-profile UAS incidents – including crashes at the White House and the U.S. Open – occur from errors by relatively benign operators, but policymakers fear it is just a matter of time before more sinister players utilize unmanned systems for criminal or terrorist activities.

These fears are not completely unfounded. An individual was arrested in 2011 after a failed plot to attack the U.S. Capitol and Pentagon using remote-controlled aircraft armed with explosives. And in another incident, fighting erupted after a drone was used to drop drugs into an Ohio prison yard in 2015.

As local law enforcement officials cite a lack of guidance on dealing with UAS threats, federal regulators ponder the limits of their own effectiveness. In the words of one policymaker: “Lone wolf terrorists, drug smugglers, and foreign spies don’t care about FAA rules.”

FAA has responded by adding to its Pathfinder Program evaluation of industry’s latest technology that will passively detect, identify, and track UAS and their ground-based operators. This effort initially focuses on assessing the technology’s safety and security capabilities within a five-mile radius of airports.

“There’s a good-sized body of general privacy law out there, waiting to absorb the coming influx of domestic drones and associated surveillance.”

— Wells C. Bennett, Brookings Institution

(Source: “Civilian Drones, Privacy and the Federal-State Balance”)
Meanwhile, as unapproved flights continue over sporting events, near public landmarks and in close proximity to critical infrastructure, the Department of Homeland Security is taking steps to educate law enforcement agencies and the public about small unmanned systems. The agency’s National Protection and Programs Directorate released a model aircraft reference aid to inform the public about potential illicit uses, impacts, and indicators of malicious activity. The Science and Technology Directorate continues to tout the capabilities of small UAVs for state and local law enforcement agencies and first responders.

Like the FAA, the Department of Homeland Security should also develop a long-term roadmap. Interim steps could include clearer guidelines for law enforcement officials and public education about restricted airspace. A comprehensive plan, however, should unfold in step with the FAA’s efforts at NAS integration and include an exploration of technologies such as “geo-fencing” and tracking/monitoring systems that could enable or support a national UAS security strategy.

“Congress must ensure that agencies do not fall victim to the sensationalism that drives worst-case scenario based planning. Such an approach to risk management can justify enormous expenditures, no matter how unlikely the prospects are that the dire event will take place.”

— Gregory S. McNeal, JD/PhD, Associate Professor of Law & Public Policy, Pepperdine University

(Source: Testimony before the U.S. House of Representatives Committee on Homeland Security Subcommittee on Oversight and Management Efficiency, March 18, 2015.)
International Efforts

According to the GAO, there are several countries whose UAS regulations are more developed than those in the United States. These include Australia, Canada, France, and the United Kingdom. Canada and France currently allow a greater number and larger variety of commercial operations than the United States.28

The International Civil Aviation Organization (ICAO), the United Nations specialized agency for civil aviation, in 2014 established a new expert panel that is now working to deliver standards for unmanned aircraft that cross international borders. Due for adoption by Member States in 2020, the standards will guide ICAO’s 191 member states in promulgating their own national regulations. AIA supports ICAO with subject-matter expertise at various levels. AIA has also been the leading industry voice in supporting the effort to identify internationally harmonized spectrum for satellite-based command-and-control for beyond line of sight operations. Only through global harmonization can the UAS market achieve its full potential.

Another global effort at international harmonization is led by the Joint Authorities for Rulemaking on Unmanned Systems (JARUS). Comprised of approximately 40 countries, JARUS was established in 2007 to recommend technical, safety and operational requirements for safe UAS integration. It is supported with resources from the FAA, EASA and EUROCONTROL, the European Organization for the Safety of Air Navigation, an intergovernmental body with 41 member states. JARUS currently runs working groups that are focused on command, control and communications, safety, detect and avoid capabilities, airworthiness, pilot training and UAS operational requirements.

The International Organization for Standardization (ISO) has also established a UAS Subcommittee to serve as a global venue for UAS standards development. Administered by AIA, this subcommittee brings together experts from manufacturer, academic, government, R&D, and operator communities to develop standards that enable and promote the sector growth.

Fortunately, disparities in progress have not thwarted efforts at international efforts to harmonize UAS standards and regulations. In fact, the GAO’s 2015 report on unmanned systems states:

“Many provisions of the FAA’s proposed rules are similar to those in other countries. However, the FAA may not issue a final rule for unmanned systems until late 2016 or early 2017, and rules in some of these countries continue to evolve. Meanwhile, unlike under FAA’s proposed rule, Canada has created exemptions for commercial use of small UAVs in two categories that allow operations without a government-issued certification, and France and Australia are approving limited beyond line of sight operations. Similar to the United States, other countries are facing technology shortfalls, such as the ability to detect and avoid other aircraft and obstacles, as well as unresolved issues involving limited spectrum that limit the progress toward full integration of unmanned systems into national airspace.”29

Dedicated international regulatory efforts continue among entities such as the European Aviation Safety Agency (EASA), which in 2009 established an interim certification policy and is working toward a technical framework for the European Union (EU). EU rules will likely treat unmanned systems as a new type of aircraft, with “proportionate rules based on risk of operation.” Like the FAA, EASA seems committed to technologies and standards that lead to full airspace integration, and acknowledges: “Public acceptance is key to the growth of drone services.”30 EASA’s approach is to create regulations that are proportionate, progressive and risk-based, while also “complemented by industry standards.”

As with international efforts to unify standards and operations for an upgraded air traffic control system for manned flight, ongoing international cooperation is vital to avoid a patchwork of restrictive, country-specific rules that would only serve to hinder innovation and leave the benefits of UAS technology unrealized.
AIA RECOMMENDATION: Industry Engagement for International Rulemaking

JARUS activity is currently focused on small UAS, and it is unclear how industry will be included in the effort. Rulemaking activities typically take longer without involvement by key industry stakeholders, who contribute valuable technical knowledge to rulemaking teams. AIA recommends that JARUS leadership actively seek industry expertise during future rulemaking initiatives.
Conclusion

U.S. regulatory leadership would generate more economic value than its costs. A key consideration is that many of the public benefits of UAS operations – such as for emergency and disaster response – will be immediately available once FAA puts a final rule in place for small UAVs.

Guiding principles supported by industry state that, at a minimum, any new rule or policy must:

- **Ensure continued trends in aviation safety while delivering societal benefits.** Commercial flight is safer today than at any time in the history of aviation. Maintaining safe skies through a timely, risk-based approach is the first priority.

- **Achieve routine access for unmanned systems to all classes of airspace with incumbent users for increased capacity and efficiency.** Regulations must anticipate that UAV flights may one day become routine as most commercial flights are today.

- **Harmonize with international policies and regulatory efforts.** The U.S. must keep pace with efforts that support a common set of international standards and practices.

- **Support U.S. National Security Objectives and Ensure U.S. Competitiveness in the Global Marketplace.** The U.S. must revise outdated export policies to maintain U.S. technological superiority, foster R&D, and ensure our partners and allies look to the U.S. to provide for national security requirements.

Larger challenges loom in terms of the ongoing work toward NAS integration, including full and sustained funding of NextGen and other FAA initiatives that will encourage development of technologies allowing safe, secure and routine UAV flights in crowded U.S. skies. In the meantime, the FAA’s current regulatory framework offers a reason for optimism among the innovators and consumers that are at the forefront of this revolution in aviation technology.
1 “Pentagon eyes sharp increase in drone flights by 2019: official,” Reuters, August 17, 2015.

For evidence, look no further than the annual New York City Drone Film Festival, which will convene for the second time in 2016: www.nycdronefilmfestival.com.

2 Testimony of Gerald L. Dillingham, Ph.D., Director, Physical Infrastructure Issues, Government Accountability Office, before the House of Representatives Subcommittee on Aviation, Committee on Transportation and Infrastructure. December 10, 2014.


7 Reuters, 2015.


9 TEAL Group Corporation, page 1.

10 Ibid.

11 TEAL Group Corporation, page 23.

12 FAA Modernization and Reform Act of 2012 (Public Law 112-95), section 332.


17 NASA. http://utm.arc.nasa.gov/index.shtml


23 Statement of Chief Richard Beary, President of the International Association of Chiefs of Police, Subcommittee on Oversight and Management Efficiency, Committee on Homeland Security, United States House of Representatives, March 18, 2015


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