Today unmanned aircraft systems (UAS) are poised to revolutionize entire industries, if not society itself. The FAA estimates that more than $89 billion will be invested in UAS technology by 2023, resulting in a growing aviation market and rapid job creation.¹ Goldman Sachs Research recently forecast the drone market would reach $100 billion by 2020.²

Progress has been made by the FAA regarding the operation of small UAS operating within visual line of sight. Yet as UAS technology accelerates toward the future, significant regulatory uncertainty remains. As rulemaking enters its adolescence,³ the Aerospace Industries Association (AIA) continues to lead U.S. and international efforts for the integration of UAS into the global airspace system. Our objective: Maximize the promise of the technology while maintaining the safety, reliability and security of the skies.

AIA's focus will address “type certified” UAS; typically larger, technically sophisticated aircraft, flying complex missions. It is here, at altitudes up to 60,000 feet and beyond, where the opportunity is greatest.

### Regulatory Challenges

The picture for widespread use of large UAS is becoming clearer. Beyond the current military operations, there is increasing interest from the commercial sector. The potential ecosystem includes: freight delivery, flying taxis, broadband internet delivery and eventually passenger aircraft. Current obstacles to this future are:

- Rulemaking that cannot anticipate innovation lags the rate of emerging UAS technologies.
- Domestic and International regulatory bodies with unclear and/or overlapping roles.
- An outdated export control regime that could classify certain civil UAS as a cruise missile.

This report provides an update regarding the status of regulations and standards, and the emerging issues and evolving challenges that will shape the future of unmanned systems.

### AIA Priorities for Unmanned Systems:

- Preserve Aviation Safety
- Maintain Leading U.S. Market Position
- Encourage Commercial Innovation

### AIA Leadership

Working through domestic and international rulemaking bodies, AIA continues to provide vital industry input to policymakers and regulators as they strive to remove the barriers to UAS integration. This is required to ensure the United States retains its position as the global leader in the future of unmanned flight.

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Regulators must anticipate the near-term arrival of technology that allows unprecedented UAS density and flight persistence.

UAS operations including those in which a single operator flies multiple aircraft, will require a high degree of autonomy. AIA believes this technology must be compatible with existing and future air traffic management systems and infrastructure. Autonomy, sensor technologies and spectrum are the enablers for this integration and are on their way to allowing beyond visual line of sight (BVLOS) operations; a critical capability for certified UAS.

Autonomy

Autonomy is defined by NASA as “harmonious human-machine system integration methods that engender trust and collaboration to ensure safety and reliability in the National Airspace.”

An exponential increase in computing power is driving advancements in autonomous flight, but NASA identifies technology gaps, citing requirements for collaborative systems that engender human-machine trust; effective design, testing, evaluation, verification and validation methods; and the development of mechanisms that allow autonomous systems to perceive relevant environmental circumstances and make “acceptable decisions.” AIA believes that regulators need to engage in near and long-term application of this technology and partner with industry to develop performance based standards as part of their rulemaking process.

“Now, we’re ushering in a new age of American aviation: The unmanned aircraft era. And it’s moving at a quicker pace than anything we’ve seen before. ...[But] as we move toward fully integrating unmanned aircraft into our airspace, the questions we need to answer are only getting more complicated. We’re all going to need to roll up our sleeves. We have a lot of work to do.”

— FAA Administrator Michael Huerta, UAS Symposium, 2017

Update: Part 107

The FAA released its final rule for low-altitude operation of systems under 55 pounds, referred to as Part 107. It eliminates the need for Section 333 waivers, previously required to fly drones for a variety of commercial purposes.

Part 107 limits the altitude of UAS flights to 400 feet unless the aircraft is flying within 400 feet of a structure, in which case it may not fly higher than 400 feet above the top of that structure. Part 107 also limits operation to Class G airspace unless the operator obtains FAA permission prior to operation.

6 NASA 2017, Ibid.
Detect and Avoid Technologies

Sensor technology is advancing at rapid pace. With the fusion of multiple sensor technologies and their marriage to a growing array of advanced software, sensors today often exceed the capacity of human sensory perception. This holds tremendous promise for global airspace system integration, which requires detect and avoid (DAA) operations.

Regulators have struggled to define requirements for DAA. One government report states: “it is difficult for DAA systems to obtain operational and airworthiness approval because these systems are new and their intended function needs to be defined in the context of the DAA system and associated UAS.” This gap leaves UAS designers in the dark as to what the required safety standards are.

Efforts to leverage today’s technology as part of tomorrow’s solution are already underway. Transport aircraft today are fitted with the Traffic Alert & Collision Avoidance System (TCAS II) that alerts pilots to the presence of other transponder-equipped aircraft. Collaborative efforts between government and industry have already outfitted some larger UAS with the FAA’s newer Airborne Collision Avoidance System for Unmanned Aircraft (ACAS Xu), a system that will be able to operate alongside the legacy TCAS II and the future ACAS variants.

But while this addresses the “Detect” of DAA, what about the “Avoid?” Revolutionary technologies such as artificial intelligence, and machine learning are critical to the future of autonomy and unpredictable dynamic situations. A new regulatory approach must address these challenges before the technology can safely achieve its full potential.

Spectrum

Another issue facing regulators and industry is the lack of acceptable communications spectrum for civil UAS communications and control. RTCA’s SC-228 Special Committee is working to develop Command and Control (C2) Data Link Minimum Operational Performance Standards (MOPS). The initial phase of standards development was focused on UAS equipped to operate in Class A airspace under Instrument Flight Rules. The committee published DO-362, Command and Control (C2) Data Link MOPS (Terrestrial) in September 2016. Phase two of MOPS development is underway and will specify equipment to support extended UAS operations in Class D, E, and perhaps G, airspace. These standards along with availability of critical spectrum bands is crucial for the proliferation of safe UAS operations.

7 FAA: “Unmanned Aircraft Sense and Avoid Certification Obstacles

― U.S. Secretary of Transportation Elaine L. Chao, May 31, 2017
Snapshot: Current FAA Regulatory Initiatives

In 2016, the FAA formed the Drone Advisory Committee (DAC) to outline the challenges facing the incorporation of UAS into the National Airspace System (NAS), according to FAA Administrator Michael Huerta, gather “input from stakeholders...critical to our ability to achieve that perfect balance between integration and safety.”8

Designed to function like the NextGen Advisory Committee9, the DAC is examining the roles and responsibilities of federal and state regulators; airspace access for high-priority UAS operations and the funding of supporting programs, initiatives and technologies. The DAC has enlisted multiple stakeholders to create broad support for an overall UAS integration strategy.

In addition, the FAA’s recent aviation rulemaking committees (ARCs) pertaining to UAS include:

- The Micro Unmanned Aircraft Systems ARC for operations over people, which was delivered to the FAA on April 1st 2016.

- The FAA’s UAS Identification and Tracking ARC was tasked with developing recommendations on the technologies and methods to ensure that UAS flying in the NAS could be easily identified.

The group presented its report to the FAA in October 2017, but was unable to reach consensus and raised serious concerns about applicability and restrictions that might exempt many consumer and hobbyist drones from remote identification requirements.

- The Controlled Airspace ARC examining issues related to UAS operations above Class A airspace meaning altitudes of 18,000 feet and above.

“There is a real need to accelerate methods that are directly focused on protecting national critical infrastructure and keeping the NAS operating safely and reliably.”

— Rob Pappas, Manager of the Program and Data Management Branch, FAA UAS Integration Office, FAA Safety Briefing, June 2017

Federal rulemaking typically requires a three to five-year cycle. U.S regulatory development must reinvent itself to become compatible with the typical 18-month UAS technical development cycle, and balance regulatory focus between small and large certifiable UAS.

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9 To learn more about NextGen, see: www.faa.gov/nextgen/
Regulators must work to harmonize international UAS regulation and ensure that performance based consensus standards are developed in an ordered fashion.

Snapshot: International Regulatory Progress

The GAO recently identified several countries where UAS regulations are more developed and permit more commercial UAS flights than the United States. The FAA must continue to partner with other authorities to speed or accelerate progress of regulations and standards for larger certifiable UAS.

The global effort at international harmonization is led by the Joint Authorities on 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. Supported with resources from the FAA, European Aviation Safety Agency (EASA) and EUROCONTROL, JARUS currently runs working groups that are focused on command, control and communications; safety; DAA capabilities; airworthiness; pilot training and UAS operational requirements.

A panel run by the International Civil Aviation Organization (ICAO) is working to deliver standards for unmanned aircraft that cross international borders.

AIA Leadership Initiative

AIA recently launched the Upper Airspace Working Group (UAWG), to develop positions related to policy and strategy regarding international regulation and standards, unique to high-altitude Upper-Class E airspace (per the U.S. classification 60,000 ft. and above) for UAS, manned aircraft, spacecraft, and other users.

UAWG will present recommendations at the ICAO Global Air Navigation Industry Symposium, for inclusion in the Global Air Navigation Plan, an ICAO document that ensures synchronization of aviation efforts across member nations.

Dedicated international regulatory efforts continue among entities such as the EASA, which in 2009 established a technical framework for all UAS operations regardless of their weight in 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.”

To achieve UAS integration into the global airspace system, there should be increased regulatory reliance on performance-based international consensus standards.

There are a myriad of domestic and international committees, working groups and associations undertaking standards development, but with no clear lanes that define roles and responsibilities in the larger integration effort. This may result in overlap between the numerous standards entities. Despite the laudable efforts of these organizations, and the incorporation of the American National Standards Institute (ANSI) this work could result in regulatory regimes that are confusing, contrary, and duplicative.

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The U.S. government must support modification of UAS-related export and trade restrictions which unnecessarily constrain U.S. market leadership and influence on global standards.

The Outdated Missile Technology Control Regime

While the United States currently enjoys technological and global market dominance, the application of the Missile Technology Control Regime (MTCR) to UAS exports threatens this position and invites other nations to compete on a playing field tilted against U.S. innovators.

The MTCR is an informal and voluntary set of commitments agreed to by an association of countries that share non-proliferation goals for systems capable of delivering weapons of mass destruction.

The 30-year-old regime has been an effective tool in limiting the proliferation of weapons delivery systems like missiles, but it has not evolved to account for the current and potential use of modern unmanned systems, particularly those designed primarily for civil use.

The MTCR places missiles into two categories. “Category I” systems can carry a 500-kilogram payload as far as 300 kilometers. “Category II” systems are all others with less than Category I capability. Since UAS can have the same range and payload capabilities as missiles, they are automatically subject to the MTCR.

The MTCR framework must be reformed to distinguish between missiles and UAS. The United States must ensure its application does not needlessly impinge upon the national security, foreign policy, and economic benefits of American UAS exports.11

AIA Leadership Initiative

The AIA International Council and the UAS Export Working Group are coordinating with the U.S. Government to update the MTCR and related U.S. UAS export policy to change the current “strong presumption of denial” for exports of large UAS.

Challenges remain between the present state of regulation and full integration of UAS into the global airspace system. The aerospace industry, its partners and stakeholders are up to the task to help define the path to achieve integration. AIA will continue to lead and advocate for policies, regulations and standards that allow America to reap the tremendous technological advances, economic rewards and societal benefits of UAS. Our recommendations for the way forward include:

- Regulators must anticipate the near-term arrival of technology that allows for unprecedented UAS density and flight persistence and;
  - Codify the near-term needs for DAA, Autonomous certification and Spectrum allocation.
  - Focus increasingly on larger certifiable classes of aircraft operating in the global airspace system, including above Class E.
- Regulators must work to harmonize international UAS regulation and ensure that performance based consensus standards are developed in an ordered fashion.
- The U.S. government must support modification of UAS-related export and trade restrictions which unnecessarily constrain U.S. market leadership and influence on global standards.

**Conclusion**

As innovators continue to develop new UAS capabilities for unmanned aircraft, the pressure for a regulatory regime to keep pace with the rapid evolution of this disruptive technology will only increase. It is incumbent upon industry and government leaders to accelerate their ongoing collaboration toward a framework that will safely open U.S. and international skies to the conveniences, efficiencies and economic opportunities promised by this burgeoning aerospace market.

“While drones are clearly here for good, the reality is that the industry is still in its infancy. A century ago, people couldn’t foresee that clunky wood-and-fabric biplanes would morph into sleek aluminum jets capable of knitting through the air at supersonic speed. And today, we can’t possibly predict everything drones will be doing five or 10 years down the line.”

— FAA Administrator Michael Huerta, Las Vegas, NV, September 6, 2017