TANGIBLE SECURITY

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This white paper examines opportunities for the Trump Administration and the U.S. Congress to use Self-Regulatory Organizations (SROs), Public Private Partnerships (PPPs), and private sector capital — to unshackle America's Drone/ Unmanned Aerial System ("UAS") sector from destructive over-regulation. Only through a new SRO model supported by common and secure UAS Traffic Management (UTM) infrastructure can the Drone/UAS sector achieve full economic potential for America.

The Drone/UAS Industry and the Urgent Economic Need to Establish a Self-Regulatory Organization

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Executive Summary

America is experiencing rapid growth in new Drone/UAS markets being driven almost entirely by the private sector, with tens of thousands of companies and professionals working to commercialize their ideas in an array of applications, with only minor assistance from federal, state and local agencies, universities and others. This emerging marketplace is capable of creating brand new industries, generating millions of jobs, and being a catalyst for sustained innovation on a massive scale, boosting the global competitiveness of U.S. companies, and generating billions of dollars in new GDP.

However, America may lose it all to other nations. To accelerate growth, the Drone/UAS sector must be free to rapidly innovate and experiment, within a highly safe but adaptable regulatory environment. The combination of a stifling, confusing and overly burdensome FAA regulatory situation and the lack of common UTM infrastructure will continue to impede and possibly extinguish the ability for the U.S. to lead. Without addressing these two major issues, large private sector capital inflows -- the jet fuel needed to sustain explosive sector growth -- may not materialize.

This white paper introduces a novel framework that will provide solutions to these issues and encourage much greater and more timely private sector investment. A Self-Regulatory Organization, or SRO, is recommended to assume from the FAA the vast majority and burden of Drone/UAS Sector regulation and oversight and, most importantly, to accelerate sector collaboration and promulgation of new rules. The new SRO authority sought would be granted through a special act of the U.S. Congress. The cost to implement advanced UTM infrastructure with features such as precision navigation, datalink, BVLOS, dynamic geofencing, automated compliance monitoring, privacy protections and self-funding -- what ADS Infrastructure Partners refers to as " UTM-2" -- will require several billion dollars of up front capital investment. The federal government will not contribute any of this capital, but can facilitate creation of the model. Once established the SRO will streamline regulations, address safety and privacy concerns, reduce market risks and greatly advance the needed capital inflows, for both infrastructure and sector entrepreneurs.

Background

The market demand for drones and UASs has created a new and healthy industry of drone applications and manufacturing here in the United States. Hundreds of companies now manufacture drones, and many more will likely sprout up as the demand for new applications of the technology increases. It is estimated that over the next ten years, production of drones and UASs will more than triple from $4billion annually to $14 billion annually worldwide. Military and homeland security research on UAVs would add another $3 billion annually over the same time. The Association for Unmanned Vehicle Systems International (AUVSI) estimates that the UAS industry will create more than 100,000 jobs in the US by 2025. The real growth in the market will come, however, from the myriad of applications that can benefit other sectors that range

from farming, to utility inspection, to mapping, cinematography, border surveillance, and search and rescue to name just a few.

While the origins of UASs can be traced back to WWI, the electronic versions we recognize today have only come about in the last decade. This has been due in part to an increase in the accessibility of certain technologies by both manufacturers and consumers. Stronger and lighter composites, motors, and lithium batteries have allowed engineers to design UAVs (UAVs and drones are interchangeable terms) that are appealing to consumers and commercial users, and inexpensive to produce. Smartphone technology has also allowed for the market to flourish, by allowing the consumer to use hand held devices to control the UAVs in many cases.

UAVs have spurred innovation in many different market sectors. Farmers can now use UAVs to spray their crops for a fraction of the cost of an aircraft. The American Farm Bureau estimates that farmers will see a return on investment of $12 per acre of corn when using drones to monitor and treat the crop. AUVSI estimates that between 2015 and 2025, UAS integration will contribute $75.6 billion into agriculture. Film makers can now produce aerial shots that used to require a helicopter to capture for a fraction of the price. The cost of using a helicopter can be as much as $40k per day, whereas utilizing a drone with its crew can range from $9k to $15k per day. Companies like Amazon see a not-so-distant future where packages will be delivered same-day, right to the door step, autonomously by drone. UAVs have great potential in aiding first responders by arriving on-scene with unparalleled speed. Many communications service providers are now utilizing UAVs to watch over powerlines and cell towers.

FAA Forecast for Drone/UAS Vehicles (2016)

The FAA recently released its annual Aerospace Forecast Report Fiscal Years 2016 to 2036, which finds a sustained increase in the use of unmanned aircraft systems (UAS) as well as overall air travel.

A key portion of the forecast focuses on projections for the growth in the use of drones. The FAA estimates small, hobbyist UAS purchases may grow from 1.9 million in 2016 to as many as 4.3 million by 2020.

Sales of UAS for commercial purposes are expected to grow from 600,000 in 2016 to 2.7 million by 2020. Combined total hobbyist and commercial UAS sales are expected to rise from 2.5 million in 2016 to 7 million in 2020.

Source: FAA 2016

Unfortunately, the United States is lagging behind other countries in terms of having established operating rules and regulations, which is already forcing operators to look elsewhere while prototyping UAV programs. Since 2015, Amazon has used Canada to develop and test its drone delivery services. Amazon's original plan of testing its UAVs in a remote area of Washington State at altitudes

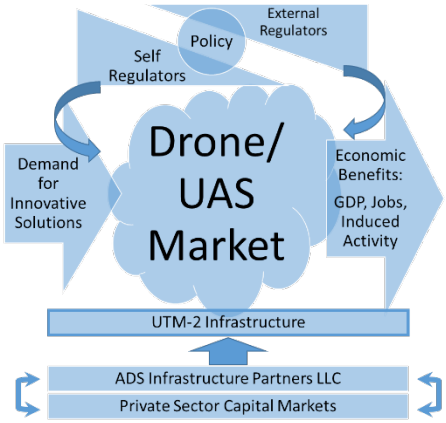

Figure 1 Drone/UAS Market Eco System With Self-Regulation and UTM-2

below 500ft was ultimately dropped since, by the time the FAA had approved their request 6 months later, the proposed solution set was already "obsolete" according to the company.

As drones and UASs become even more prevalent in the coming years, the infrastructure needed to support safe and cyber-protected operations will become even more critical, and a limiting factor in market growth. Companies such as Harris, Raytheon, Thales, Airbus, and Amazon are all great examples of companies who will be shaping the future of UAV usage in the U.S. Recent advances in techniques such as geofencing will enable complex UTMs such as that being developed by NASA to be implemented. The key to their success will be having the systems in place prior to UAV usage becoming even more established.

FAA is working hard but is limited to the tools it has available. Standards are being developed through efforts organized by the Radio Technical Committee for Aeronautics (RTCA) and other groups, supported by limited funding provided by FAA. For example, SC-228 is a special RTCA committee working on standards for "detect-and-avoid" technology, which is widely seen as crucial for drones to be able to regularly use national airspace, and for the communications necessary in order to keep drones linked with their remotely based pilots. We recognize that the FAA does hope to use ATSM standards for drones in the same way it does for LSAs and will do for Part 23 aircraft. Part 107 doesn't require certification and neither will its immediate extensions. Large UAS will likely be regulated in any event under a Part 23-like version of Part 21.17-3 and the yet-to-the defined middle ground, such as

a "Permit to Fly", is also likely to be based on industry standards.

With the need for a vast array of vehicles to pass certification, operating standards across hundreds of applications, and common interoperability standards to be supported by UTM, not to mention compliance with federal, state and local privacy laws, today's approach is simply not working.

Market Growth and Need for Industry Self-Regulation

Many involved with the Drone/UAS community expect that the Federal government will step up and provide prescriptive regulations as well as oversight of all activities from policies, to certification, to flight operations. But this is not going to be the case. Today, the FAA spends $16 billion annually to operate the air traffic system, this within a safety/regulatory environment that can, at times, take over a decade to produce a single new rule. The federal government is also technically insolvent; as such, providing funding for both FAA operations and modernization programs like NextGen, as well as embarking on the next "big thing" in UAS infrastructure, is quite inconceivable today.

So, what can be done? Industry self-regulation is the process by which an organization monitors its own adherence to legal, ethical, and safety standards as opposed to an outside, independent agency such as the FAA to monitor and enforce those standards[i]. This "delegation of authority" assigns important responsibilities to the industry itself, properly staffed with subject matter experts, while an agency, federal or state, or both, maintains specific enforcement responsibilities to ensure that the public benefit is maximized.

On the other hand, the Drone/UAS sector has many characteristics reflecting complex industries that function effectively and safely under self-regulation. These features include: 1) Rapid technological innovation at every point in the value chain; 2) The need for collaboration among a fast growing number of diverse players willing to work together on common standards to improve economics and communicate best practices; 3) Expertise that evolves quickly enough to understand the implications to health and safety of emerging innovations and breakthroughs; 4) Ability to finance the costs of self-regulation by the members themselves; and 5) Recognition that the system must maintain its integrity through governance anchored in public transparency and individual responsibility.

As shown in Figure 2, regulation of the Drone/UAS sector by the FAA will severely curtail America's economic opportunity. (For the purpose of this white paper, the term Drone/UAS Regulatory Association ("DURA") is used). Establishment of DURA would place equal emphasis between safety and economic growth for the sector, as shown, and would certainly hasten the establishment of needed infrastructure. Sector expansion would begin to accelerate as soon as the DURA model is implemented (discussed below). On the other hand, examples of successful SROs in the United States and around the world are many and include the following:

- The American Medical Association ("AMA") sets rules for ethics, conflicts, disciplinary action, and

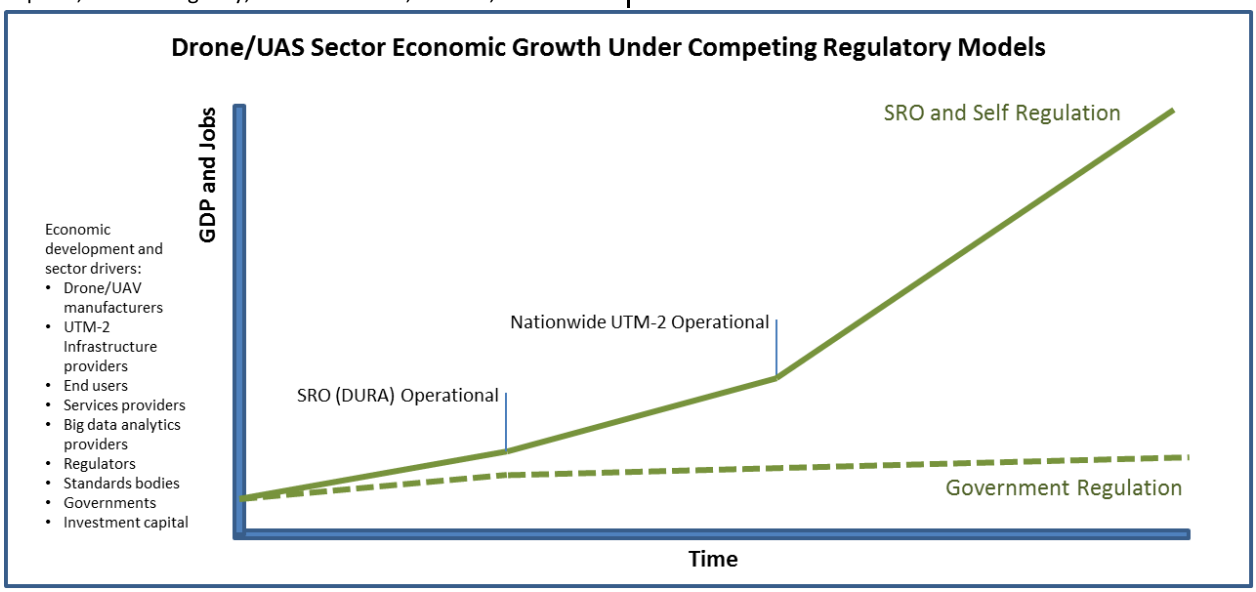

Figure 2 - Economic Growth Under Competing Regulatory Models

accreditation in the complex and rapidly evolving field of medicine.

- The Financial Industry Regulatory Authority ("FINRA") serves to regulate the financial services sector through a delegation of powers granted by the Securities and Exchange Commission. FINRA has the authority to develop rules, levy fees, and enforce compliance.
- Part 103 – Ultralights. The FAA has chosen not to promulgate regulations regarding pilot certification, vehicle certification, and vehicle registration, preferring that the ultralight community assume the initiative for the development of these important safety programs. The ultralight community is expected to take positive action to develop these programs in a timely manner and gain FAA approval for their implementation.
- NavCanada and other Air Navigation Service Providers ("ANSPs") represent dozens of examples of SROs delegated authority to manage air traffic control systems, and in some instances the oversight of commercial and general aviation operators. Generally, airworthiness certification is retained by the civil aviation authority, or in the case of Europe, areas are delegated to IASA.

Table 1 highlights one possible scope of authority for a self-regulatory body set up to perform the complex oversight of the Drone/UAS sector, leaving responsibility for important oversight functions impacting the NAS and manned aircraft with the FAA.

Table 1 Scope of Responsibility Between Government and SRO

Government Responsibilities (Inherently governmental)	**Self-Regulatory Organization Responsibilities**
Groups: U.S. Congress, FAA, DoD, DHS, law enforcement, state and municipal agencies, and others	**Group:** Drone/UAS Regulatory Association (DURA)
• SRO enabling legislation and congressional charter • Airspace definition and boundaries (static and dynamic) (See call-out) • Performance based regulations • Minimum safety standards • Rules for delegation of authority to designees • Privacy rules • National security rules • Enforcement • Etc.	• Design and operation of the rulemaking process • Responsibility for RTCA activities • Interoperability standards • Certification standards • Quality system standards • Training programs • Designee programs • Self-funding mechanisms for determination of fees to finance DURA • Run competitions for implementation of UTM-2 • Etc.

Table 1 would need to be authenticated through industry and government work groups and negotiations. Of prime concern will be the efficacy of DURA given the rapid technological change experienced by the sector, and the need to be responsive to an increasingly concerned public on safety, security, property rights and privacy matters. These issues can be instrumented through an effective and comprehensive UTM-2 architecture.

Funding, Construction, Security and Access to UTM Infrastructure

Prior to articulating some specific benefits and prospective limitations of financing publicly accessible UTM infrastructure, it's instructive to first define what we mean by the term – "UTM-2" -- and why it is important. The term "UTM-2" refers to those defined UTM components identified through NASA, and added layers of privacy policy, cyber security protections and fee collection.

We view UTM infrastructure as a highly integrated and interconnected coast-to-coast "system-of-systems' that is necessary in order to create the conditions such that a scalable UAV market can evolve in a systematic versus random, sub-optimized, ad hoc manner. As such, providing dynamically complex UTM infrastructure requires much more than a series of integrated technical solutions. Much like The Open Systems Interconnection (OSI) model that separates data communications between any two networked systems into several interconnected layers whereby each layer relies on one another for supporting capabilities, our view of UTM infrastructure entails supporting interdependencies between and among multiple "systems" such as innovative technologies, policy, regulation, oversight, and approvals.

Drone/UAS Airspace Definition Under SRO:

The interface between the national airspace system and the airspace under DURA regulation is dynamic by definition. In general, Drone/UAS airspace is Class G airspace below 500 feet AGL, with exclusion zones passively and actively defined as needed to ensure safety of flight in the NAS, and public policy, are complied with.

NASA's UAS traffic management (UTM) system concept for low-altitude airspace leverages concepts from the system of roads, lanes, stop signs, rules and lights that govern vehicles on the ground today, whether the vehicles are driven by humans or are automated. Building on its legacy of work in air traffic management for crewed aircraft, NASA is researching prototype technologies for a UTM system that could develop airspace integration requirements for enabling safe, efficient low-altitude operations. The UTM system would enable safe and efficient low-altitude airspace operations by providing

services such as airspace design, corridors, dynamic geofencing, severe weather and wind avoidance, congestion management, terrain avoidance, route planning and re-routing, separation management, sequencing and spacing, and contingency management. In its most mature form, the UTM system could be developed using symbiotic characteristics that include self-configuration, self-optimization, and self-protection. The self-configuration aspect could determine whether the operations should continue given the current and/or predicted wind/weather conditions.

Funding, construction and access to UTM-2 would take several years, once DURA is in place. Funding will be justified through a PPP where the private sector capital, in the form of equity and debt, would be advanced through a special purpose entity set up as a tax exempt 501(C)3 "Public Safety Organization" (PSO). The UTM-2 architectures would likely be constructed in layers to enable a broad set of inter-connected or autonomous systems capable of supporting an array of Drone/UAS missions.

From a risk mitigation perspective, UTM-2 architectures – and drone/UASs -- need to be designed so as to incorporate protections against cyber-based threats. A GAO study released in April, 2015, reported that "significant security-control weaknesses threaten the FAA's ability to ensure the safe and uninterrupted operation of the National Airspace System (NAS), partially because it has not yet developed a cybersecurity threat model". As drone/UAS's transition to UTM-2 and operations within the highly interconnected NAS, critical infrastructure must be protected by the incorporation cybersecurity safeguards at each level of the architecture.

Access to UTM-2 would likely be provided over a very broad number of wireless networks. Users would be able to reserve airspace under various categories and a small access fee would be charged and paid for at the time of the operation (Apple Wallet?).

We believe the answer to funding UTM-2 is with the creation of ADS Infrastructure Partners, LLC, utilizing alternative and innovative financing tools to provide private sector capital and best practices, needed for design, construction, and cyber-secure operation of UTM-2.

Taken holistically, these strategies will lead to reduced program risk, better economic outcomes and better taxpayer value. The Government should be encouraged to borrow from the Office of the Secretary of Transportation (OST) whose expertise is deep and extensive, as well as from the Office of the Secretary of Defense (OSD), whose participate in these endeavors may also become a key success factor;

It is our view that without a thoughtful approach to UTM infrastructure financing and, subsequently, having a robust UTM-2 infrastructure in place, the UAV market simply cannot achieve its fullest potential.

Next Steps

This white paper is meant to be a call to action for the Drone/UAS sector, federal, state, and local governments, academia, and the cyber and National Security communities. Through this and our previous white paper, "ATC Reform: The Way Forward" [1] we have outlined a logical, well thought through approach to overcome the inertia that has heretofore precluded any meaningful progress to either ATC modernization or UTM infrastructure implementation.

The most immediate next step will be to assemble a working group and draft a detailed and actionable blueprint. This will be a step-by-step roadmap with goals, economic priorities, procedures and savings, and built around proven PPP structures, but tailored to the unique requirements of safe, secure and economical self-regulation.

[1] GAO-15-370; Publically released April 14, 2015.