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On behalf of the Association for Unmanned Vehicle Systems International (AUVSI) and its members, I want to thank the Committee for examining important issues relating to the expansion of unmanned aircraft systems (UAS) in the National Airspace System. Unmanned aircraft extend human potential and allow us to execute dangerous or difficult tasks safely and efficiently, saving time, saving money and, most importantly, saving lives.

Whether it is helping search and rescue teams find a lost child, giving researchers a new understanding of hurricanes, or helping to fight wildfires, the applications of unmanned aircraft in the United States are virtually limitless. The incredible benefits of UAS aren't just theoretical, however; the technology is already serving important homeland security and safety functions here at home. For example:

- U.S. Customs and Border Protection (CPB) currently uses UAS to monitor the border to help interdict illicit trafficking. According to the CPB's Office of Air and Marine, unmanned aircraft in 2011 assisted with the seizure of thousands of pounds of narcotics and the apprehension of dozens of individuals taking part in illegal activities.

- UAS aided the response to the severe flooding of the Red River in the upper Midwest in April 2011. According to the U.S. Customs and Border Protections Office, which leant the UAS to the effort, the UAS mapped more than 800 nautical miles along the flooded tributaries and basins in Minnesota and North Dakota, and provided streaming video and analysis of the areas affected by the flood such as levee integrity and ice damming. The information provided by UAS gave forecasters more accurate predictions of when and where the flooding would be at its worst.

- In 2008, NASA assisted the state of California in fighting wildfires with the use of Ikhana, a UAS equipped with advanced technology. The information about the fires collected by Ikhana was transmitted to command centers within minutes, and then distributed into the field giving firefighters crucial situational awareness.

- UAS were used to help search and rescue teams in the aftermath of Hurricane Katrina. Scientists from the University of South Florida worked with Florida rescuers in Mississippi, in what was the first known use of small UAS for an actual disaster. Brought in to survey Pearlington, MS, within two hours, the responders had the data from the UAS showing that no survivors were trapped and that the flood waters from the cresting Pearl River were not posing an additional threat.

These are just a few examples of the real-world security and safety applications of UAS. And there are likely many more. As with any new revolutionary technology, all of the potential uses of UAS have probably not been thought of yet.

It's important to note, meanwhile, that, just as we recognize the beneficial security and safety functions of UAS, so too does the American public. According to a recent national poll conducted by Monmouth University in New Jersey, nearly two-thirds of Americans support the use of unmanned aircraft to protect the U.S. borders and control illegal immigration. Eighty percent of Americans support the use of unmanned aircraft to help in search and rescue missions.

As we further integrate UAS into the U.S. airspace and recognize the corresponding security and safety benefits, we are also mindful that UAS operations and the technology itself must be as safe as possible. Safety has always been a top priority for the industry, and we are already working with a variety of stakeholders to ensure unmanned aircraft are integrated safely into our nation's airspace. The industry is in regular contact with the Federal Aviation Administration (FAA) and we have met with, and continue to maintain an open dialogue with, representatives from the pilot community, air traffic controllers and others with an interest in aviation safety.

Safety is also one of three main pillars of the industry's new Code of Conduct published earlier this month. We understand and take very seriously the need to conduct UAS operations in safe manner that mitigates risk and instills confidence in our systems. Specifically with regard to safety, the guidelines recommend when and by whom UAS should be flown, address training and crew fitness requirements,

call for a thorough risk assessment before each UAS flight and codify our commitment to respecting other users of the airspace, the privacy of individuals and the concerns of the public.

UAS users' are already demonstrating a commitment to safety. Case in point is the Arlington, Texas Police Department. Home to one of the most fully developed UAS programs of any local law enforcement agency in the country, the Arlington Police Department works cooperatively with the FAA to safely fly its UAS for operational missions citywide. The department has developed pre-flight checklists, flight and squawk logs, training protocols and a standard operating procedure for all UAS flights. This is a model for the safe usage of UAS we hope to instill in manufacturers and operators through our Code of Conduct.

The UAS used by the Arlington Police Department also exemplify the types of unmanned aircraft we can expect to see more of in the coming years. The vast majority of UAS currently flying in the U.S. are small models that weigh under 25 pounds and can fit in the trunk of a car. The Arlington Police Department, for example, is using an 11 pound mini-helicopter, which has proven effective for surveying multi-car crashes on interstate highways. The UAS allow the crash scenes to clear more quickly, reduce pollution and keep officers safe by reducing the amount of time they spend roadside. Even when the domestic airspace is further opened in 2015, most unmanned aircraft will be limited to no more than 55 pounds.

In addition to safe operations, the industry is committed to building safeguards into UAS technology, such as "sense and avoid" systems and other innovations, which will enable a safe and orderly integration. For example, the U.S. Army recently completed a two-week evaluation of a Ground Based Sense and Avoid (GBSAA) system at Dugway Proving Ground in Utah. The system uses 3-D radar and software algorithms to detect other aircraft flying in the vicinity of UAS, and safely steer UAS away from other aircraft. In both live and simulated tests, the system successfully recognized conflicts and navigated UAS away from other aircraft.

The GBSAA system provides a window into the type of "sense and avoid" technologies available for the U.S. domestic airspace. Meanwhile, the development of this particular system is ahead of schedule. The Army has said the GBSAA could be deployed as early as March 2014, one full year ahead of the Army's initial estimate of 2015.

In addition to "sense and avoid" systems, it is important to underscore that many UAS have multiple redundant systems that add extra layers of safety and security. This is an especially relevant point in

light of the recent media attention surrounding so-called 'spoofing' of a GPS signal by researchers at the University of Texas. 'Spoofing' is not a new issue. Papers have been written on the subject since the 1990s and, in 2001, the U.S. Department of Transportation broadly examined vulnerabilities in the GPS system relating to aviation, maritime and ground applications.

The industry is well-aware of 'spoofing.' Meanwhile, as the DOT vulnerability assessment demonstrates, 'spoofing' is not a concern unique to UAS. 'Spoofing' has implications for any technology that depends on GPS for guidance and timing, whether it is manned or unmanned aircraft, your cell phone or your car. In fact, commercial airliners are relying more and more heavily on GPS signals to locate the runways at airports and, with the advent of the next generation air traffic control system, all aircraft – manned and unmanned – will rely on GPS for navigation.

At the same time, 'spoofing' is not as simple or easy as news reports suggest. To successfully spoof a GPS signal, one must have the equipment and capability to broadcast a counterfeit signal at a high enough power level to overpower the GPS signals emanating from more than 20 satellites in orbit around the earth. One must know the location of the target vehicle and be able to track it. If the target vehicle is not in close proximity to the spoofing device, this requires a detection system such as radar. Meanwhile, custom software is needed to make adjustments to the target vehicle's course. It took the University of Texas team four years to develop the necessary software, and the professor overseeing the experiment has acknowledged that the skills involved in 'spoofing' are "outside the capability of any average American citizen." In sum, in a controlled experiment where an aircraft is kept low to the ground, hovering in place and equipped with minimal safeguards, spoofing is feasible. Under real-world conditions, however, 'spoofing' is much more difficult.

That said, the industry takes the potential for 'spoofing' very seriously and is already advancing technologies, such as SAASM – Selective Availability Anti-Spoofing Module – to prevent it. SAASM, which involves the authentication of encrypted satellite signals, is already widely used by the military to thwart GPS spoofing. The Department of Defense (DOD) issued a directive that, as of October 2006, required all newly acquired UAS systems – as well as systems going through major modifications or upgrades – to be SAASM-equipped. As has happened with other technologies, innovations developed for the military could transition in some form to the civilian market in the years to come. In fact, GPS itself was a military technology that transitioned to civilian use.

In addition to SAASM, many unmanned aircraft also have alternate navigation systems, such as radio links and backup inertial systems, which provide redundancy to GPS. Other backup technologies exist – or are being developed – that autonomously guide unmanned aircraft to a safe landing at a pre-determined location in the unlikely event of interference with navigation signals. Other 'spoofing' countermeasures have been proposed since the 1990s, some of which are relatively simple software changes. Finally, it is also important to remember that while an aircraft itself may be unmanned, a trained professional is behind the controls, ready to respond, and bring a safe resolution to any problem that may arise.

Like any other technology, unmanned aircraft technology continues to become smarter and safer every day. In preparation for the expansion of UAS in the domestic airspace, AUVSI member companies have been hard at work developing new technologies that would add extra layers of safety and security to unmanned aircraft. More and more innovations will be available in the very near future.

While the industry continues to refine and enhance UAS technology, the FAA is preparing for its rule-making process, which will unfold over the next few years. In addition, later this year, the FAA is expected to announce the selection of six UAS test sites around the country. This window will provide ample time for all stakeholders to develop a robust framework for the integration of unmanned aircraft, put the technology to the test and resolve any outstanding issues.

Other concerns have been raised, for example, about privacy – concerns which the industry is actively working to address. AUVSI has met with nearly a dozen privacy advocates and civil liberties organizations, as well as other interested parties, to understand their concerns, encourage them to work together and let them know that, like them, AUVSI supports Americans' rights to privacy, especially the protections afforded under the Fourth Amendment to the U.S. Constitution. Meanwhile, the industry's recently released Code of Conduct clearly articulates our commitment to respecting individuals' privacy. As the integration progress, the industry will continue to engage in a constructive, thoughtful and civil dialogue on the national, state and local levels with all parties to address any privacy concerns.

The unmanned aircraft systems industry is committed to the safe and responsible integration of unmanned systems into the national airspace. We look forward to continuing to work with Congress, the FAA, DHS and other stakeholders to ensure unmanned aircraft are integrated safely and responsibly, so we can unlock the tremendous potential of this technology to enhance public safety, advance scientific research and otherwise benefit society.