May 10, 2022

The Honorable Billy Nolen
Acting Administrator
Federal Aviation Administration
Orville Wright Bldg. (FOB10A)
800 Independence Ave., SW
Washington, DC 20591

Dear Acting Administrator Nolen:

Congratulations on your recent appointment to head the FAA. We are encouraged to see someone with your safety background in the military, civilian aviation and continuing in the FAA, now at the administrator position. Regarding aviation safety, particularly in the low-altitude airspace, this letter serves to inform you of the aerial application industry's serious concerns about the FAA's Unmanned Aircraft Systems (UAS) Beyond Visual Line of Sight (BVLOS) Aviation Rulemaking Committee's (ARC) recently published report.

Aerial Application Background

As background to our safety concerns, the National Agricultural Aviation Association (NAAA) represents the interests of the 1,560 aerial application industry owner/operators and 2,028 non-operator agricultural pilots throughout the United States licensed as commercial applicators that use aircraft to enhance the production of food, fiber, and bioenergy; protect forestry; protect waterways, pastureland, and ranchland from invasive species; and control health-threatening pests, including mosquitos and other insect pests that spread West Nile virus, Zika virus and other deadly diseases. NAAA's reference to "aerial application" refers to manned aerial applications. UAS have not yet been sufficiently evaluated for efficacy and drift potential they may pose to the environment and people, including both bystanders and pesticide handlers. A detailed explanation of NAAA's position can be found in our letter sent to the EPA on the issue in January of 2020[1].

Within agriculture and other pest control situations, manned aerial application is an important method for applying pesticides, for it permits large areas to be covered rapidly—by far the fastest application method of crop inputs—when it matters most. It takes advantage, more than any other form of application, of the often too-brief periods of acceptable weather for spraying and allows timely treatment of pests while they are in critical developmental stages, often over terrain that is too wet or otherwise inaccessible for terrestrial applications. It also treats above the crop canopy, thereby not disrupting the crop and damaging it. The productivity, accuracy, speed, and lack of damage to the crop has been recognized in Europe as well.[2] Although the average aerial application company is comprised of but six employees and two aircraft, as an industry these small businesses treat nearly 127 million acres of U.S. cropland each season, which is about 28% of all cropland used for crop production in the U.S.—this doesn't include the 7.9 million acres of pasture and rangeland

---

[1] NAAA letter to EPA, January 16, 2020. https://www.agaviation.org//Files/Comments/UAS%20Letter%20to%20EPA%20re%20testing%20drones%20for%20efficacy%20and%20env%20safety%2020200117.pdf

[2] Kováčik, L., and A. Novák, 2020. "Comparison of Aerial Application vs. Ground Application." *Transportation Research Procedia* 44 (2020) 264–270.

treated by agricultural aircraft annually. Aerial pest control for managers of forests, waterways and public health also add to these many millions of acres– 5.1 million acres of forestland and 5.2 million acres of mosquito and public health applications are treated annually.

Aerial applications are often the only, or most economical method for timely pesticide application. Additionally, aerial application is conducive to higher crop yields, as it is non-disruptive to the crop and causes no soil compaction, thus improving soil health and the amount grown per acre. Data from a Texas A&M University economics study[3] and the 2019 NAAA industry survey[4] were used to calculate that the aerial application industry is directly responsible for the production of 1.69 billion bushels of corn, 199 million bushels of wheat, 548 million pounds of cotton, 295 million bushels of soybean, and 3.33 billion pounds of rice annually that would be lost every year without the aerial application of pesticides. The value of the aerial application industry to farmers, input suppliers, processors, and agricultural transportation and storage industries for corn, wheat, cotton, soybean, and rice production in the U.S. is estimated to be about $37 billion[5]. This figure is expected to grow substantially and in importance as food prices increase and food production becomes an issue of growing importance due to the Russian invasion of Ukraine, supply and demand issues, and a growing global population.

The aerial application of crop protection products results in greater harvest yields of crops. This in turn results in less land being used for agricultural production, preserving more wetlands for natural water filtration, forest ecosystems for carbon sequestration and habitat for threatened and endangered species. The Texas A&M[3] study revealed that the total area of cropland needed to replace the yield lost if aerial application was not available for corn, wheat, soybean, cotton, and rice production is 27.4 million acres, an area roughly the size of Tennessee. Aerial applicators seed 3.8 million acres of cover crops annually.[4] This means that aerial applicators are responsible for helping to sequester 1.9 million metric tons of CO2 equivalent annually, which according to the EPA would be the equivalent of removing approximately 412,000 cars with carbon-combustion engines from the roads each year.

Safety Concerns with FAA's UAS BVLOS Aviation Rulemaking Committee's Report

NAAA has a shared goal with the FAA of augmenting aviation safety, not abating it, yet we greatly fear that recommendations within the recently released UAS BVLOS ARC report, should they become FAA regulatory policy, will markedly compromise safety for low-altitude manned aircraft. Agricultural aircraft and pilots who perform the operations outlined in the above background information routinely operate at 500 feet above ground level (AGL) down to 10 feet AGL—the same airspace that the ARC is recommending UAS BVLOS operations be able to fly. Our industry is arguably the segment of manned aviation most affected by the proposals in the ARC.

The UAS BVLOS ARC primarily used air traffic control radar to assess the frequency of low-altitude aviation. These are inadequate for detecting agricultural aircraft because ag aircraft operate exclusively below 500 feet AGL, below the minimum height covered effectively by radar.[6] The ARC focused on study conducted with a Mode C veil, which is not a typical operating airspace for agricultural aircraft. While the ARC did use studies with ADS-B data to assess aircraft down to 50 feet AGL, at the time these studies were being conducted, roughly only 10% of the agricultural

---

[3] Dharmasena, S. 2020. "How Much is the Aerial Application Industry Worth in the United States?" Research presented at the 2020 Ag Aviation Expo, Savannah, GA. https://www.agaviation.org/2020aatresearchpapers

[4] National Agricultural Aviation Association. May 2019. "2019 NAAA Aerial Application Industry Survey: Operators." https://www.agaviation.org//Files/Comments/NAAA%202019%20Operator%20Survey.pdf

[5] Dharmasena, S. 2021. "Value of the Agricultural Aerial Application Industry in the United States" Research presented at the 2021 Ag Aviation Expo, Savannah, GA. https://www.agaviation.org/2021aatresearchpapers

[6] Underhill and Weinert. 2021. "Application and Surrogacy of Uncorrelated Airspace Encounter Models at Low Altitudes". *Journal of Air Transportation*. Vol. 29, No. 3, July-September 2021.

aircraft fleet had ADS-B out.[2] As such, it is clear the BVLOS ARC did not have a realistic picture of aerial applicators' presence in the airspace they wish to markedly abate aviation safety rules.

The 2019 NAAA Industry Survey[4] data indicates agricultural aircraft treat 127 million acres of cropland annually with an average field size of 166 acres. Using an average of 70 feet covered by an aircraft in each pass, it is estimated that agricultural aircraft fly 14.8 million miles in application passes annually—and again, that is just for cropland, not the 5.1 million acres of forests, 7.9 million acres of pasture and rangeland, and 5.2 million acres of mosquito and public health applications treated every year by aerial application. According to an agricultural aircraft performance data analysis conducted by Mississippi State University's (MSU) Raspet Flight Research Laboratory (RFRL),[7] the average altitude of an agricultural aircraft during the application passes and turns is 38 feet above ground level (AGL) and the average horizontal distance covered in each turn outside of the target area is around 1,750 feet. Combining this information with the data from NAAA's survey, it's estimated the agricultural aircraft travel 9.6 million miles in turns. Adding these together, it is estimated that agricultural aircraft fly a combined industry total of 24.4 million miles annually at an average altitude of 38 feet. We provide this information to indicate that aerial applicators clearly and typically operate in the part of the NAS below 500 feet AGL where UAS—either operating line of site or BVLOS—operate. It is unfortunate that the RFRL study was not considered by the ARC. RFRL is the only institute designated both as the FAA's UAS Safety Research Facility and as official UAS Test Sites for both the FAA and the Department of Homeland Security.

Considering the distance agricultural aircraft fly annually entirely within airspace being considered for BVLOS, it is also disconcerting that no representative from NAAA/the aerial application industry was invited to participate in the ARC and provide this information. In NAAA's opinion the makeup of the ARC membership is dominated, by a margin of 3.75 – 1, by organizations that do not have a background in aviation safety. Because of this, the report is flawed from the start and there are several glaring, low-altitude manned aviation safety problems in the ARC.

There are other manned aircraft (MA) besides agricultural aircraft that also operate in the 500-foot AGL airspace or below to properly perform their missions, such as emergency medical services, law enforcement, fire suppression, wildlife surveys, powerline patrol, and others. These operations occur in a task-saturated environment for pilots due to the numerous existing obstructions including wires, towers, and terrain. BVLOS operations would add to the saturation by concentrating more aircraft in that airspace.

While we appreciate that the ARC would require UAS to be able to sense MA with ADS-B, there is no approved technology or provision in the ARC requiring UAS to provide a method for MA to sense them, and the small size of UAS effectively prevents MA pilots from physically seeing them. The relatively small size of UAS makes visual detection nearly impossible. In 2015, the Colorado Agricultural Aviation Association partnered with the Colorado Department of Agriculture, Agribotix, UAS Colorado, and others to test if manned agricultural aircraft, both fixed-wing and rotor, can locate a UA over a field[8,9]. Of four fixed-wing aircraft pilots, only one could locate the UA and could only do so for a few seconds. The only helicopter, which included a pilot and a visual observer, could find the UA but reported that it was extremely difficult to maintain visual contact.

---

[7] Mississippi State University Raspet Flight Research Laboratory. 2020. "Characterization of Agricultural Aircraft Performance Using Flight Log Data." https://www.raspet.msstate.edu/sites/www.raspet.msstate.edu/files/2022-04/20200825%20Ag%20Data%20Model.pdf

[8] Maddocks and Griffitt. "Test Report - Qualitative Evaluation of Unmanned Aircraft Visibility during Agricultural Flight Operations." https://www.agaviation.org/Files/TBYL%20Visibility%20Flight%20Test%20Report_FINAL.pdf

[9] NAAA eNewsletter. 2015. CoAAA Operation S.A.F.E. Fly-In Highlights Safety and Drone Risks. http://news.agaviation.org/naaa/issues/2015-10-06/index.html

For a low-altitude manned aircraft to visually track a darting, tiny UA while also avoiding ground affixed objects and performing either a policing, application, search, and rescue, etc. task is impossible and a safety hazard. As such, there should be no situation in which a UA—flying either line-of-sight or BVLOS—should not have to give right-away to a manned aircraft. A UA collision with a manned aircraft would likely be disastrous. Research conducted by the University of Dayton Research Institute showed what can happen should a UAS collide with a manned aircraft. The research team mimicked in a laboratory a collision between a small quadcopter and a Mooney M20 aircraft. While the UAS only weighed 2.1 pounds, it did extensive damage to the wing of the Mooney. Should such a collision occur with an agricultural aircraft while it is making a pass in a field at the standard application height of 10 to 15 feet AGL, there would be little opportunity for the pilot to avoid crashing the agricultural aircraft.

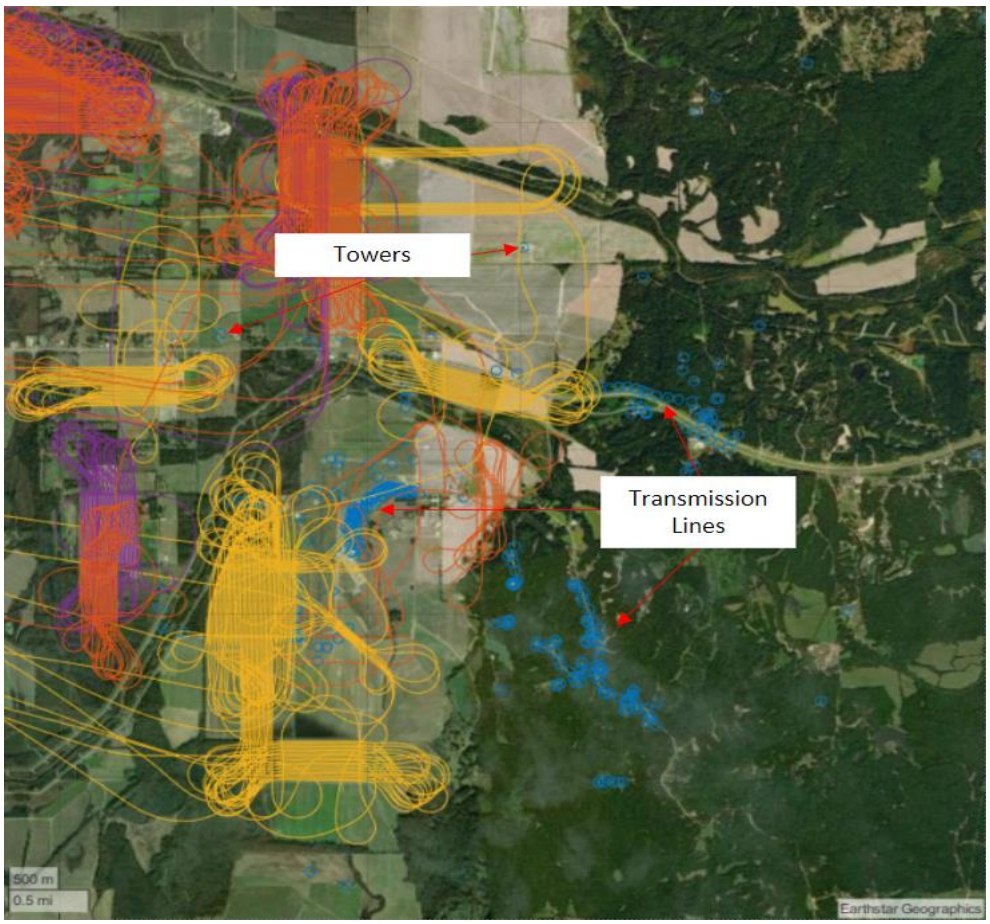
Furthermore, a recent study conducted by the FAA through the Alliance for System Safety of UAS through Research Excellence (ASSURE), shows UAS collisions with aircraft would cause more damage than would a bird strike of similar size, due partially to a UAS' dense motors and batteries. Using simulations, researchers replicated collisions of UAS weighing 2.7 to 8 pounds with common mid-sized commercial and business jets. The "stiffer" parts of a UAV, such as motors, batteries, and cameras, caused the worst damage to engine fans. In some cases, UAS in the simulations also punctured the skin of the aircraft.

Birds are a risk to manned aviation and cause damage to ag aircraft and in several cases have come completely through the cockpit window, striking the pilot, or have markedly dented and stuck into the leading edge of ag aircraft and they are made of softer materials—hollow bones, sinew and water—compared to hard plastic, nickel and other more durable materials that make up a UAS. Birds that have crashed through ag aircraft cockpit windows include mallard ducks (weight: 1.6 – 3.5 pounds) and turkey vultures (weight: 3.5 pounds). According to a joint report by the FAA and the U.S. Department of Agriculture's Animal and Plant Health Inspection Service (USDA-APHIS), between 1990 and 2012 over 131,000 wildlife strikes occurred with civil aircraft, 97 percent of which were the result of collisions with birds, with 25 producing fatalities. Small UAS are generally like birds in their difficulty to be seen by manned aircraft pilots and birds don't always give way or sense and avoid. The FAA UAS BVLOS ARC recommendation to increase the maximum weight limit of a BVLOS UAS to 1,320 pounds would produce a maximum kinetic energy level of 800,000-foot pounds which are aircraft about the size and speed of a Piper J3 Cub. To allow a weight increase to a UAS of this degree, while not requiring ADS-B In technology or requiring a UAS to give right-away to manned aircraft—all recommendations of this ARC—would abandon any principle of aviation safety and responsibility. A drone of this size and velocity colliding with a manned, low-altitude aircraft would result in a fatal accident.

Another, most pressing concern with the ARC is granting UAS to fly BVLOS without giving right away or having ADS-B technology equipped when operating in "Shielded Areas." The ARC's definition of shielded area is a "*volume of airspace that includes 100' above the vertical extent of an obstacle or critical infrastructure and is within 100 feet of the lateral extent of the same obstacle or critical infrastructure…"* The ARC defined an obstacle as "*any object of natural growth, terrain, or permanent or temporary construction or alteration, including equipment or materials used and any permanent or temporary apparatus."* This would seemingly include 100 feet from the ground, any plant or tree, or any structure. This does not appear to be an unintended consequence, as other areas of the ARC mention that the Shielded Area includes both *natural or manmade objects.* According to the ARC, in this volume of airspace, UAS do not need to have ADS-B in, or other means to detect manned aircraft (MA) because according to the report, MA do not operate in this airspace. This claim is dumbfoundingly inaccurate. As documented by this letter, it is the exact space that aerial applicators operate in when performing their mission treating cropland bordered by trees, utility poles, within 100 feet AGL and the like.

As defined, the shielded area would allow UAS to have right of way over all manned agricultural operations without providing any means for agricultural aircraft to detect UAS. While flying 24.4 million miles annually as an industry at an average height of 38 feet AGL, agricultural aircraft operate as closely as possible to all obstacles within or adjacent to their application target site. Indeed, FAR Part 137.49 allows that "*during the actual dispensing operation, including approaches, departures, and turnarounds reasonably necessary for the operation, an aircraft may be operated over other than congested areas below 500 feet above the surface and closer than 500 feet to persons, vessels, vehicles, and structures, if the operations are conducted without creating a hazard to persons or property on the surface.*"

The figure below, provided by RFRL, is an example of the proximity of agricultural aviation operations next to obstacles. The color lines represent the flight tracks of agricultural aircraft while making applications. The parallel lines immediately adjacent to each represent the individual spray passes, while the arcs at the ends of the passes are turns. The lines extending off image to the left are ferry flights to and from the application sites. The blue circles indicate the location of obstacles taken from FAA's DOF (Digital Obstacle File) database. This clearly demonstrates the proximity to obstacles within which agricultural aircraft operate. The passes and turns occur at an average height of 38 feet AGL, while the ferry flights occur at an average height of 469 feet AGL.



The 24.4 million miles traveled annually by the U.S. agricultural aviation fleet at an average altitude of 38 feet AGL while making passes and turns is all within the airspace that the ARC proposes to consider shielded. At certain times of the year in many locations the density of agricultural aircraft operating in a given area is exceptionally great in order to treat crops for specific pests where there is a narrow temporal window for making an efficacious application. As aforementioned, many other segments of aviation also operate in this airspace including helicopter air ambulance, law enforcement, fire suppression, animal damage control and others. The data from NAAA's industry survey and MSU's RFRL study provide undeniable proof that agricultural aircraft operate

extensively within what the ARD defines as a shielded area. With no way for agricultural aviators to detect UAS and UAS operators being excused by the FAA of all considerations for the safety of MA, eventual loss of life of a manned aviator from colliding with a UAS within a shielded area is highly likely.

The solution to the shielded area is to not accept this recommendation. UAS operating in shielded areas must have ADS-B In technology and must always give way to the manned aircraft.

Another area of concern within the ARC report is a rewrite of part 137, *manned agricultural aircraft operations* to fit UAS. Clearly no one with agricultural aviation experience was on the ARC. BVLOS agricultural operations should not be allowed. While it is obvious that UAS was not foreseen when part 137 was developed, the concept of making agricultural applications without anyone at the field is troubling. A certified pilot who is also certified by a state(s) department of agriculture in pesticide applications should be required to be at the field being treated. In the case of applying pesticides, the pilot has much more to do than pilot the aircraft. Part 137 lists specific requirements of an agricultural pilot which includes among others, "*survey of the area to be worked, safe handling of economic poisons and the proper disposal of used containers for those poisons, safe flight and application procedures,"* and mandates that, "*No persons may dispense or cause to be dispensed, from an aircraft any material or substance in a manner that creates a hazard to persons or property on the surface."* Pesticide labels, which, under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) are legal documents that must be followed, dictate that applicators "DO NOT apply this product in a way that will contact workers or other persons, either directly or through drift." The EPA's Worker Protection Standard (WPS) includes an Application Exclusion Zone (AEZ) that requires applicators to cease an application when a person comes within the zone, which is a specific distance in feet based on the application method. The ARC gives no indication on how these laws can be complied with, particularly without the pilot and visual observers being at the field. NAAA maintains that these rules and other application associated tasks that impact both the safety and efficacy of the application cannot be performed without the pilot at the field. The presence of a pilot in the cockpit provides a view of the area that cannot be duplicated with artificial optics. A UAS working BVLOS making an application could not possibly detect people present unless there were far more technology mandated to be equipped on the drone such as certified detecting devices sensing moving, heated objects grounding the UAS and many other safety technologies since there is no visual observer aboard surveying the area to ensure application safety.

Finally, it should be noted that of the UAS BVLOS ARC members, Helicopter Association International (HAI), Airline Pilot Association, General Aviation Manufacturers Association and Aircraft Owners and Pilots Association, all voted to not concur with the final report. HAI represents many of the other aviation industries that operate in the low-altitude airspace below 500 feet AGL. These are organizations who along with NAAA understand and represent manned aviation industry safety concerns. NAAA did serve on the 2017 Aviation Rulemaking Committee on UAS Identification and Tracking. NAAA voted to not concur with that ARC's final report and was part of a minority report that recommended tracking and identification of all UAS over half a pound—something the ARC's final report did not include. The good news is that the FAA agreed with the minority report and the agency's final rule on the remote identification (RID) of unmanned aircraft systems (UAS) released in January of 2021requires drones to be equipped with technology that will determine a drone's location and the time it is operating in specific locations for all drones over 0.55 pounds operating outside of an enclosed structure. This gives us hope that the FAA will make the significant safety changes for low-altitude manned aviator recommended earlier in this letter when it releases its UAS BVLOS rule in the future.

NAAA is aware of the important functions which can be accomplished by UAS, but at the same time protecting the safety of current and future users of the national air space is mandatory and is the FAA's prime directive. NAAA requests the FAA address these life-saving issues vital to the agricultural aviation industry and other MA in the low-altitude airspace by considering the above stated comments.

Thank you for your consideration.

Sincerely,

Andrew D. Moore
Chief Executive Officer