UAS BVLOS Operations Aviation Rulemaking Committee Report: Part 1

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1. Introduction

The titled report was published in March 2022 by the UAS BVLOS Operations Aviation Rulemaking Committee (BVLOS ARC) which was established by the FAA in June 2021.[1]

For a background of the study, please refer to JITTI's previous report.[2]

2. Report Structure and Specific Recommendations

The titled report first describes the background, a summary, the specific contents considered, and next, individual recommendations and their rationale. Finally, it consists of specific proposals for new regulatory text and for revising existing regulatory text. Of these, specific recommendations are organized into the following seven fields, with a total of 70 subsections enumerated.

(1) Air & Ground Risk Recommendations: 9
(2) Flight Rules Recommendations: 9
(3) Aircraft and Systems Recommendations: 10
(4) Operator Qualifications Recommendations: 20
(5) Third-Party Services Recommendations: 2
(6) Environmental Recommendations: 5
(7) General & Procedural Recommendations: 15

In this report, the details of specific recommendations related to the above fields (1) to (3) are explained in the following sections.

2.1 Air & Ground Risk Recommendations (AG)

・Recommendation AG 2.1: *The acceptable level of risk (ALR) for UAS should be consistent across all types of operations being performed, and no more restrictive than the accepted fatality rates of general aviation.*

Regarding the ALR for BVLOS operations, the fatality rate of General Aviation (GA) should be used for comparison due to the similarity in that the aircraft is lightweight and mainly flies at low altitudes outside of controlled airspace. Since UAS operations have no passengers, only the fatalities from accidents with crewed aircraft (2nd party) and those on the ground (3rd party) should be considered.

In addition, standards and guidance should be developed based on this ALR. Setting multiple risk levels for different types of operations would complicate the regulatory framework, so consistent values should be set across all operations.

・Recommendation AG 2.2: *The rules should be predicated on the risks of operation based on UA capability, size, weight, performance, and characteristics of the operating environment as opposed to the purpose of the operation.*

In this report, the risk level of the operating environment for BVLOS is categorized into the following four levels according to whether or not risks in the air and risks on the ground have been mitigated in advance.

Level 1: Shielded operations (operations within 100 feet from buildings, etc.), have had air risks with crewed aircraft pre-mitigated, and ground risks have been pre-mitigated by not having continuous flying over occupied areas.

Level 2A: Shielded operations (operations within 100 feet from buildings, etc.), have had air risks with crewed aircraft pre-mitigated, but ground risks have not been pre-mitigated.

Level 2B: Air risks with crewed aircraft have not been pre-mitigated, but ground risks have been pre-mitigated by not having continuous flying over occupied areas.

Level 3: Air risks with crewed aircraft have not been pre-mitigated, and ground risks have not been pre-mitigated.

Although the actual risk level varies depending on the application of flight-related technical mitigation measures (aircraft safety certification, collision avoidance capabilities, etc.) to these operating environments, the required safety threshold should be constant regardless of the type of operation. For this reason, regardless of the four operating environment risk levels listed above, the acceptable air and ground risk levels should be uniquely defined.

Based on this, the risk level is determined according to whether the air risks and the ground risks have been mitigated in advance. Afterwards, a regulatory framework should be developed to reduce the risk to an acceptable level through the application of technical mitigation measures.

・Recommendation AG 2.3: *BVLOS operations to the greatest extent possible should be allowed to occur through compliance with the regulation alone without the need for a waiver or exemption.*

The new regulations should clearly define the technical mitigation measures required to achieve ALR for each of the four operating environment risk levels. This technical mitigation should allow more BVLOS operations to be carried out, with only the more complex and risky cases subject to waivers or exemptions.

・Recommendation AG 2.4: *The FAA should encourage voluntary reporting in accordance with the UAS Aviation Safety Reporting System (ASRS).*

There is value in collecting data for comparative analysis, and systems should be developed for voluntary rather than mandatory reporting. Since the existing ASRS system is a framework for collecting voluntary reports, it is appropriate to extend this to UA.

・Recommendation AG 2.5: *The rule should enable carriage of hazardous materials beyond the specified quantities. Carriage of hazardous materials beyond the specified quantities shall have appropriate mitigations, as established via a performance-based industry consensus standard that is proportionate to the risk of the operation.*

As current regulations for the carriage of hazardous materials target crewed aircraft, they need to reflect the risk factors associated with operating UA, as well as include assessment and mitigation for ground risks. In addition, regarding the carriage of hazardous materials exceeding the specified quantities, regulations should be established to enable accepted Means of Compliance (MOC) based on industry standards, depending on the operational risks.

・Recommendation AG 2.6: *The rule should allow UAS to conduct transient flight over people. The rule should allow sustained flight over non-participants with strategic and/or technical mitigations applied.*

In order to meet the ALR for flights over people, strategic pre-flight mitigation measures (such as not flying continuously), or technical mitigation measures related to the flight (or a combination of both) should be left to the operator of the UAS. Regarding ground risks, it is believed that the time duration of exposure to risk is most influential, and a distinction should be made between transient flights over people (e.g., temporarily crossing over a road) and sustained flights over people. On the other hand, it recommends that flights transiting densely populated areas temporarily and flights through depopulated areas be equally risk assessed.

・Recommendation AG 2.7: *The rule should be based on a minimum capability needed to safely perform the operation, not a minimum equipment list.*

Excessive equipment requirements are not only costly, but weight penalties can make small UAS inoperable. For these reasons, the minimum capability required for safe

BVLOS operations should be stipulated, and equipment to achieve this capability should be selected flexibly.

・Recommendation AG 2.8: *The FAA should develop pathways to support innovation and accommodate emerging technology. The FAA should give consideration to approvals for low-risk Research and Development initiatives.*

UAS technology is constantly evolving, so it is important to establish policies that support innovation and to be able to respond to new technologies that enable safer and more efficient operations. However, the current approval process for Research and Development does not allow for timely testing.

Therefore, in order to streamline and expedite the approval of low-risk R&D, a comprehensive mandate for UAS test airfields, authorization of R&D activities as official operations, and streamlining exemptions from regulations that require applications are proposed.

・Recommendation AG 2.9: *The FAA should incorporate uncrewed aviation into existing surveys or deploy a survey similar to the General Aviation and Part 135 Activity Survey.*

Although current GA and Part 135 Activity Survey do not include UA, it is essential to understand their operations as they become integrated into airspace systems. For this reason, it has been proposed to integrate UAS operations into GA and Part 135 Activity Survey, or to conduct similar surveys.

2.2 Flight Rules Recommendations (FR)

・Recommendation FR 2.1: *The FAA should amend Part 91.113 (b) to allow a range of sensing methodologies and clarify adequate separation.*

The current phrase "See and Avoid" should be changed to "Detect and Avoid" to allow for technical or non-technical detection of other aircraft. Also, since the current term "well clear" does not have a definition for low-altitude airspace, it should be changed to "adequate separation" so it can be applied for different levels of spacing depending on the situation.

・Recommendation FR 2.2: *The ARC recommends that UA operations in Non-Shielded Low Altitude Areas (i.e., below 400' AGL) yield right of way to crewed aircraft equipped with ADS-B or TABS and broadcasting their position.*

Equip UAS with an approved detection and avoidance system capable of detecting crewed aircraft with Automatic Dependent Surveillance-Broadcast (ADS-B) and Traffic Awareness Beacon System (TABS), or with an approved system capable of detecting all crewed aircraft by other methods such as radar, and give right of way to crewed aircraft with ADS-B or TABS.

・Recommendation FR 2.3: *The ARC recommends that UA operations in Non-Shielded Low Altitude Areas (i.e., below 400'AGL) have right of way over crewed aircraft that are not equipped with an ADS-B out as specified in 14 CFR § 91.225 or TABS.*

Regardless of whether they are crewed or uncrewed, equipped aircraft systems should be given right of way over unequipped aircraft systems. Approximately half of GA aircraft (107,000 out of 220,000 aircraft) are already equipped with ADS-B, and if the ratio increases further due to this recommendation, the safety benefits will not be limited to UAS but extend to all users of the airspace system.

・Recommendation FR 2.4: *The FAA should amend FAR Rule Part 91.113(d) to give UA Right of Way for Shielded Operations.*

Crewed aircraft generally do not operate in shielded airspace (airspace within 100 feet of buildings or structures), and operating crewed aircraft there is extremely dangerous. For this reason, by considering UA within a certain range from buildings, etc. as part of the buildings, it is possible for the operator of the UAS to operate with improved saftey and performance in shielded airspace without requiring additional costs or technology. In addition, it's thought that shifting the high-risk operations of crewed aircraft at low altitudes (spraying pesticides, inspecting power lines, etc.) to BVLOS operations by UA will lead to saving the lives of the crew.

・Recommendation FR 2.5: *Pilots should be educated to*

associate obstacles and structures along their flight path with uncrewed flight operations to increase situational awareness during both preflight planning and actual operations.

Crewed pilot training programs should include awareness of UAS operations and emphasize the link between obstacles and structures in their flight path and UAS operations.

・Recommendation FR 2.6: *The FAA should revise §91.103 to include a new part to accommodate UA operations.*

When conducting UAS BVLOS flights using Automated Flight Rules (AFR), the remote pilot needs to confirm the conditions for safe operation and takeoff and landing locations, including weather station information, systems and sensors on-aircraft and other systems that support the flight. Therefore, Section 91.103 on pre-flight procedures should be amended to add pre-flight procedures specific to BVLOS flights of UAS using AFR.

・Recommendation FR 2.7: *The FAA should amend § 91.119 to allow UA operations below the Minimum Safe Altitude restrictions.*

UAS operations with vertical take-off and landing have operational similarities to helicopters, which are currently permitted to operate at or below the minimum safe altitude, and have additional functions such as the ability to return in the event of a loss of communication. Therefore, as with helicopters, UAS should be allowed to operate below the minimum safe altitude for BVLOS flights.

・Recommendation FR 2.8: *The FAA should amend FAR Rule Part 107.31 to include Extended Visual Line of Sight (EVLOS).*

EVLOS is an operation in which a remote pilot cannot visually see the UAS, but a visual observer can see it. Although this EVLOS fits under the BVLOS flight category, it is possible to bring about a high degree of safety because crews involved in the operation have situational awareness of air and ground hazards. Therefore, paragraph 107.31 should be amended to allow EVLOS.

In addition, if certain conditions are met—the location of the UAS is within 3 miles of a remote pilot or visual observer, the UAS location, attitude, altitude and heading can be determined, and the airspace is monitored for aircraft and other hazards—then the remote pilot or the visual observer do not have to visually see the UAS for Limited BVLOS.

・Recommendation FR 2.9: *The FAA should amend FAR Rule Part 107.33 to allow a visual observer to assist and support BVLOS operations.*

Along with Recommendation FR 2.8 above, it is stated that visual observers should be allowed to assist in BVLOS operations, and that the roles and responsibilities of visual observers should be defined.

2.3 Aircraft and Systems Recommendations (AS)

・Recommendation AS 2.1: *The FAA should establish a new 'BVLOS' Rule which includes a process for qualification of uncrewed aircraft and systems. The rule should be applicable to uncrewed aircraft up to 800,000 ft-lb of kinetic energy in accordance with the Operating Environment Relative Risk Matrix.*

Type and production certification for existing aircraft is a lengthy and complex process that was not worth the risks of low-flying UAS. A more streamlined process is also being applied to Light-Sport Aircraft (LSA), which are currently allowed to operate in a wider airspace than UA, albeit with restrictions, and have a kinetic energy of 800,000 foot-pound force (ft-lbs).

For this reason, the table shown below is proposed for the UAS certification process, based on kinetic energy and the four levels of operating environment (see Section 2.1).

	Kinetic Energy less than 25,000 ft-lbs	**Kinetic Engery no less than 25,000 ft-lbs and less than 800,000 ft-lbs**
Level 1	Remote pilot must confirm that the UAS has the minimum capability required for BVLOS operations	(Same as <25,000 ft-lbs)
Level 2A	A manufacturer's declaration of	Special Certificate of Airworthiness

	compliance based on industry standards that is followed by the FAA acceptance	by FAA (similar to LSA)
Level 2B	In addition to the requirements of Level 1, must have Collision Avoidance Capability based on industry standards	(Same as <25,000 ft-lbs)
Level 3	Meets the requirements of both Level 2A and 2B	Meets the requirements of both Level 2A and 2B

・Recommendation AS 2.2: *The new BVLOS rule should address Maintenance, Repair, and Modifications of UA.*

In order for UAS to continue to operate safely, it is necessary to perform maintenance, repairs and modifications. For this too, a table below based on kinetic energy and the four levels of operating environment (see Section 2.1), should be applied.

	Kinetic Energy less than 25,000 ft-lbs	**Kinetic Engery no less than 25,000 ft-lbs and less than 800,000 ft-lbs**
Level 1	Based on the manufacturer's maintenance instructions, the operator carries out maintenance and checks	(Same as < 25,000 ft-lbs)
Level 2A	After receiving training from the manufacturer, the operator performs maintenance based on the maintenance instructions provided by the manufacturer. Repairs and alterations must be carried out by the manufacturer, and if carried out by the operator, the operator must make a declaration of compliance.If licensed to operate, evaluating the maintenance program is part of the licensing process.	The newly created UAS Repairperson will carry out maintenance, repairs, and modifications based on the manufacturer's maintenance instructions and approved repair/modification instructions.If licensed to operate, evaluating the maintenance program is part of the licensing process.
Level 2B	In addition to the requirements of Level 1, maintenance related to Collision Avoidance Capability is required	(Same as <25,000 ft-lbs)
Level 3	Meets the requirements of both Level 2A and 2B	Meets the requirements of both Level 2A and 2B

・Recommendation AS 2.3: *The new BVLOS rule should address software qualification for UA and Associated Elements (AE).*

Since existing software design assurance standards for crewed aircraft are not adequate for UA, the following table based on kinetic energy and the four levels of operating environment (see Section 2.1), should be applied.

	Kinetic Energy less than 25,000 ft-lbs	**Kinetic Engery no less than 25,000 ft-lbs and less than 800,000 ft-lbs**
Level 1	The software must operate properly as designed for the intended operation. The remote pilot must follow the manufacturer's instructions.	(Same as <25,000 ft-lbs)

Level 2A	The manufacturer must have a documented process to demonstrate that the software is implemented correctly as per the system requirements. (This process is similar to that required in the Durability & Reliability (D&R) compliance certification process for UAS pending type certification.) The remote pilot must follow the manufacturer's instructions.	(Same as < 25,000 ft-lbs)
Level 2B	Same as Level 2A	(Same as <25,000 ft-lbs)
Level 3	Same as Level 2A	(Same as <25,000 ft-lbs)

・Recommendation AS 2.4: *The new rules should include UA noise certification requirements appropriate to the operating environment. Compliance should be demonstrated through a simple testing methodology.*

As shown in the table below, the requirements for noise certification should be allowing relaxed thresholds over industrial facilities and sparsely populated areas by considering both the external noise in the operating environment and the noise exposure to humans. In addition, while the current testing method for crewed aircraft requires verification of compliance for a wide range of test conditions using special testing equipment, the testing method for UA should be simpler.

	Kinetic Energy less than 25,000 ft-lbs	**Kinetic Engery no less than 25,000 ft-lbs and less than 800,000 ft-lbs**
Level 1 **Level 2A** **Level 2B** **Level 3**	Satisfy the requirements (threshold and simple testing methodology) according to the operating environment	(Same as <25,000 ft-lbs)

・Recommendation AS 2.5: *The FAA should establish a new BVLOS Rule which includes a process for qualification of the AE of an uncrewed aircraft system.*

The AE of UAS are those elements other than the aircraft (e.g. remote pilot station, launch and recovery equipment, etc.) defined by interface and performance specifications to perform their intended function. If critical parts are included in AE, the manufacturer should prepare a list of them and specify their maintenance instructions, service life, etc., which is necessary for preventing failures, as shown in the table below.

	Kinetic Energy less than 25,000 ft-lbs	**Kinetic Engery no less than 25,000 ft-lbs and less than 800,000 ft-lbs**
Level 1 **Level 2A** **Level 2B** **Level 3**	AE must be designed and manufactured in such a way that the UAS has the regulated minimum capabilities. Operators must also carry out checks based on the maintenance instructions provided by the manufacturer.	(Same as <25,000 ft-lbs)

・Recommendation AS 2.6: *The new rule should define who must make a declaration of compliance.*

In order to respond to cases where operators add functions as system integrators, the following table should be used to determine who must make a declaration of compliance.

	Aircraft Itself	Associated Elements (other than the Aircraft)	Integration of Services by Third Parties
Aircraft only Manufacturer	Declaration of Compliance and obtain FAA acceptance or Special Airworthiness Certificate		Can be implemented
Associated Elements only Manufacturer		Declaration of Compliance and obtain FAA acceptance for AE with safety-integrated function	Can be implemented
Aircraft and AE Integrators	When conducting major modifications to the aircraft, coordinate with the aircraft manufacturer and make a new declaration of compliance	When modifications are made to AE that have safety-integrated function, make a new declaration of compliance	Can be implemented

・Recommendation AS 2.7: *Establish a new Special Airworthiness Certification for the UAS category under Part 21.*

UAS with kinetic energy no less than 25,000 ft-lbs and less than 800,000 ft-lbs, where the operating environment is at high risk, should require a Special Airworthiness Certificate (SAC) instead of an airworthiness certification for crewed aircraft. For this reason, based on the current regulations for SAC for LSA, it should be possible to formulate regulations for SAC for UAS, revise related regulations, and use them for commercial purposes like delivering small cargo.

・Recommendation AS 2.8: *The FAA should establish a Repairperson Certification for the UAS Category to perform inspection, maintenance, and repair of UAS holding SAC under this proposed rule.*

Since UA have different structures, systems, performance, etc. from crewed aircraft, there should be specific requirements stipulated for UA repair mechanics. In addition, as a specific method, a way of formulating a new category for UAS, and a way of adding content specific to UAS to the existing category of LSA have been proposed.

・Recommendation AS 2.9: *Recommend exemption from Production Certification requirements IF TC applicants declare compliance to the LSA standard for a quality system.*

Since UAS have improved safety and reliability through fast development cycles and short life cycles, concerns have been raised that imposing production certification requirements on crewed aircraft would delay improvements in safety and reliability. For this reason, UAS should not be subject to production certification requirements, and regulations should be introduced based on a declaration of compliance by the applicant, similar to the quality system for LSA.

・Recommendation AS 2.10: *The FAA should consider*

allowing third party test organizations to audit compliance.

In Europe, there is a system of Notified Bodies (NB) designated by EU member countries as organizations for third-party evaluation of products before they are put on the market. There is also a Certified Body (CB) system in the United States.

For UAS that pose a particularly high risk in its operating environment, it is proposed that third party assessments of compliance to industry standards be utilized and that such third parties be authorized to conduct compliance audits.

3. Summary

As mentioned above, the recommendations are wide-ranging. Of the flight rules in section 2.2, those related to the right of way (FR 2.2, FR 2.3 and FR 2.4) are content that significantly changes the current rules that always prioritize the passage of crewed aircraft over the passage of UA. Therefore, if they are introduced, it will have a big impact.

In addition, aircraft and systems recommendations described in Section 2.3 are broadly categorized according to whether kinetic energy of the UA is less than 25,000 ft-lbs or more. This threshold is said to be equivalent to the Small UAS weight threshold of 55 pounds (approximately 25 kg) under current regulations (Part 107). Also, for UAS exceeding this threshold with kinetic energy between 25,000 ft-lbs and 800,000 ft-lbs (Light UAS), a system similar to the current aircraft certification and repairperson certification for LSA should be introduced.

The next report will provide specifics on recommendations not included in this report, such as operator qualifications, third-party services, and environmental protections.

References

1) FAA, UAS BVLOS ARC Final Report
https://www.faa.gov/regulations_policies/rulemaking/committees/documents/index.cfm/document/information/documentID/5424

2) Yoshihiro Fujimaki, BVLOS Operations and Participation Report from the 2022 FAA Drone Symposium
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