

Small Unmanned Aircraft System Aviation Rulemaking Committee

Comprehensive Set of Recommendations for sUAS Regulatory Development

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Unless flagged with a solid dot (●), the material contained in this document represents general consensus of the members of the Small Unmanned Aircraft System (sUAS) Aviation Rule-making Committee. When there is less than general consensus, alternative views are included along with their accompanying rationale.

Forward

The Small Unmanned Aircraft System (sUAS) Aviation Rulemaking Committee (ARC) was focused on making recommendations for Federal regulations for the operation of civil (commercial) sUAS. However it was understood by the members of the ARC that a public entity could fly under the provisions of any rule that might result from these recommendations in lieu of flying under the provisions of a Certificate of Authorization (COA) or in restricted, prohibited, or warning areas. In formulating the recommendations contained in this document, sUAS ARC used the following guiding principles:

1. Enable the operation of sUAS by mitigating, to an acceptable level of risk, the hazards posed to manned aircraft and other airborne objects operating in the National Airspace System (NAS) as well as the public on the surface.
2. The development of regulations authorizing specific operations of certain sUAS could provide a means for operators to request a waiver(s) from such a rule. Such an option is not available to operators today.
3. Visual “see and avoidance” will be used by the sUAS flight crew to mitigate the risk of collision with other aircraft and airborne objects.
4. The primary burden of maneuvering for potential collision risk avoidance should be on the sUAS flight crew.
5. All other aircraft have the right-of-way over sUAS.
6. The above two principles do not relieve burden upon any pilot to see and avoid other aircraft.
7. Operating limitations will be defined to reduce or minimize potential encounters between manned and unmanned aircraft and reduce vulnerability of those on the surface.
8. A formal Federal Aviation Administration (FAA) safety risk assessment will be used to determine whether proposed regulations are acceptable to the FAA from a safety perspective. If a specific recommendation is not acceptable from a safety perspective then the FAA may require additional mitigations and/or controls.
9. Mitigations and controls should be tied to the level of risk to avoid being overly burdensome on the application of sUAS technology. If a specific recommendation is overly excessive or burdensome then the FAA may elect to modify the recommendation in developing proposed regulations.
10. The recommended regulations should not be overly complex to facilitate analysis by the FAA and other stakeholders.
11. Recommendations will leverage existing standards and regulations which govern the operation of small unmanned and Model Aircraft.
12. Where feasible, the ARC will use existing definitions and regulations to develop recommendations.

13. sUAS ARC recommendations for an Special Federal Airworthiness Regulation (sFAR):

- Are intended to enable some initial sUAS operations
- Are not intended to cover all potential applications or aircraft
 - Existing processes such as COAs for public-use aircraft and Special Airworthiness Certificate will remain options.
 - Recommendations are directed at sUAS not necessarily all unmanned aircraft systems.

Overall the committee was focused on a layered approach to ensuring that the potential risks associated with mid-air collisions and/or injury to persons and property is within acceptable levels. Many of the committee's recommendations were made based upon experience with existing aviation operations and regulations and perceptions of risk. Overall, the committee was equally focused on protecting existing air traffic and persons/property on the surface. In general, the philosophy was to minimize encounters, keep sUAS separated from other aircraft and surface risks, avoid collisions, and minimize the impact of collisions that may happen. See Figure 1.

The committee perceives that the recommendations in this document combine together to enable sUAS operations at an acceptable level of risk. As more experience with sUAS is gained and more data generated, these recommendations should be revisited.

For the most part, the committee's recommendations are written in a language like proposed regulations. Rationale and commentary which explain the recommended regulations are imbedded throughout the document and appear inside boxes in italic text. Unless flagged with a solid dot (●), the material contained in this document represents general consensus of the members of the sUAS ARC. When there was less than general consensus, alternative views are included inside boxes in italic text along with their accompanying rationale.

1. Definitions

The following definitions apply to all small unmanned aircraft systems (sUAS) referred to in this regulation.

Auto Flight Management: Pilot-in-Command (PIC) is able to maintain stable flight without constant direct intervention. To at least some degree, control surface movements result from sensors and software automation on-board the aircraft.

Collision Avoidance: Considered a last resort maneuver of an aircraft to avoid an imminent collision. Without the maneuver a collision might occur.

Conflict Avoidance: Activity which seeks to ensure that aircraft remain safely separated and well clear of each other as to not present a collision hazard.

Control Station: Equipment, not on the aircraft, used to maintain control, communicate, guide, or otherwise operate an unmanned aircraft.

Data Communications Links: All links between the unmanned aircraft and the Control Station which includes the command, status, communications, and payload links.

Launch/Recovery Equipment: Equipment, not on-board the aircraft, used to launch and recover an unmanned aircraft which could also include unique navigation and differential positioning equipment used for autonomous landing.

Model Aircraft: A sUAS used by hobbyists and flown within visual line-of-sight under direct control from the pilot, which can navigate the airspace, and which is manufactured or assembled, and operated for the purposes of sport, recreation and/or competition.

“Mode C Veil”: The airspace within 30 nautical miles (NM) of an airport listed in Appendix D, Section 1 of 14 Code of Federal Regulations (CFR) Part 91 (generally primary airports within Class B airspace areas), from the surface upward to 10,000 feet mean sea level (MSL). Unless otherwise authorized by Air Traffic Control (ATC), aircraft operating within this airspace must be equipped with automatic pressure altitude reporting equipment having Mode C capability. However, an aircraft that was not originally certificated with an engine-driven electrical system or which has not subsequently been certified with a system installed may conduct operations within a Mode C veil provided the aircraft remains outside Class A, B, or C airspace; and below the altitude of the ceiling of a Class B or Class C airspace area designated for an airport or 10,000 feet MSL, whichever is lower. [Directly quoted from the Federal Aviation Administration’s (FAA’s) Aeronautical Information Manual: Official Guide to Basic Flight Information and ATC Procedures, February 14, 2008].

Pilot-in-Command: Same as 14 CFR 1.1

Manual Flight Control: PIC is able to directly control the aircraft such that control inputs made at the Control Station are translated directly into corresponding control surface positions. Augmentations which help maintain flight stability are permitted.

sUAS Flight Crewmember: A pilot, visual observer, payload operator or other person assigned duties for a sUAS for the purpose of flight.

sUAS Pilot: A person exercising control over an unmanned aircraft during flight.

Unmanned Aircraft: An aircraft (as defined by 14 CFR 1.1) that is intended to navigate in the air without an onboard pilot.

Unmanned Aircraft System (UAS): An unmanned aircraft and its associated elements related to flight operation which may include Control Stations, data communications links, support equipment, payloads, flight termination systems, and launch/recovery equipment.

Visual Line-of-Sight: Unaided (corrective lenses and/or sunglasses exempted) visual contact with aircraft sufficient to be able to maintain operational control of the aircraft, know its location, and be able to scan the airspace in which it is operating to decisively see and avoid other air traffic or objects.

Visual Observer: A sUAS flight crew member who assists the sUAS PIC in the duties associated with collision avoidance. This includes, but is not limited to, avoidance of other traffic, airborne objects, clouds, obstructions, and terrain.

Subpart A. Model Aircraft

2. Model Aircraft Operated in Accordance with FAA Accepted Standards

2.1 Applicability

Model Aircraft operations that are conducted in accordance with an FAA accepted set of standards established and administered by a community based association as discussed in Section 2.2, shall otherwise be exempt from the requirements of any Special Federal Airworthiness Regulation (SFAR) that results from this recommendation as long as they are operated by:

- Hobbyist for the sole purpose of sport, recreation and/or competition under the conditions of such an FAA accepted program
- Manufacturers which are flight testing aircraft intended to be operated for the sole purpose of sport, recreation, and/or competition and they are tested at an approved field as defined by and in accordance with an FAA accepted program with the approval of the community-based association responsible for the location
- Educational institutions and/or students for the sole purpose of education or research and they are operated at an approved field as defined by and in accordance with an FAA accepted program with the approval of the community-based association responsible for the location
- Manufacturers which are flight testing aircraft intended to be operated for other than sport, recreation, and/or competition and they are tested at an approved field as defined by and in accordance with an FAA accepted program with the approval of the community-based association responsible for the location

RATIONALE: Reflects FAA's concept of regulating model aviation by exempting Model Aircraft from regulation. Under this approach, modelers participating within an aeromodeling structure/organization such as the Academy of Model Aeronautics (AMA) may operate their Model Aircraft in accordance with an accepted set of standards and operating procedures. Based on a more rigorous attention to safety, risk assessment, and risk mitigation, the accepted standards may provide greater latitude in the Model Aircraft operations. Modelers not participating in the additional safety programming established in an accepted set of standards shall comply with the requirements of Section 3.

COMMENTARY: *It is important that manufacturers of Model Aircraft are able to test fly their aircraft as they do today without having to adhere to sUAS regulations. In order to give educational institutions (e.g., universities) the flexibility to provide "hands on" instruction and training to students preparing for careers in the UAS and aviation industries they are allowed to fly these systems under the requirements for Model Aircraft. For consistency, manufacturers who develop sUAS that are functionally similar to Model Aircraft, are allowed to test at a location following a community-based and FAA-accepted program.*

2.2 Accepted Model Aircraft Standards and Procedures

Accepted Model Aircraft Standards and Procedures may be established and administered by a community-based association. An accepted set of standards shall be based upon accepted and recognized safety principles and will include but not be limited to the following:

RATIONALE: *Community based organizations, such as the AMA, that have credibility within the Model Aircraft community and that have an established safety record and have demonstrated the ability to influence participant compliance shall be afforded the opportunity to establish a set of safety standards that are more comprehensive than the requirements and limitations given for non participating modelers, and use these standards as an alternative means of compliance with any regulations which may results from these recommendations. Since such standards are more comprehensive, operations under such standards shall allow for a broad spectrum of operations and greater latitude in the AMA operations.*

- (1) Prescribed safety program entailing oversight, assessment, risk mitigation, and accident/incident reporting.
- (2) General safety guidelines and operating principles.
- (3) Operating guidelines specific to the location and to the type, size, performance, and propulsion of the various Model Aircraft.
- (4) Comprehensive programming addressing Model Aircraft having non standard weight, or identified as having unusual propulsion types or extraordinary flight characteristics.
- (5) Programming to facilitate Model Aircraft events, competition, national and international record attempts, gatherings, and Model Aircraft demonstrations and exhibitions.
- (6) Educational programming that assures participants are provided relevant safety information and validates the learning process.
- (7) Educational programming that addresses essential piloting issues including:
 - Recognition and avoidance of manned aircraft
 - Safe operation near spectators and other non participants

- Safe and cooperative operation with other modelers
 - Transitioning to higher performance and more complex models
- (8) Methodology for establishing and designating dedicated Model Aircraft flying sites providing:
- Guidelines for flying site location, configuration and design layout applicable to its intended use and the type(s) of Model Aircraft flown, and which ensures Model Aircraft operations do not interfere with manned flight operations
 - Safety guidelines that ensure the safety of the public and provide adequate separation of persons and property from the Model Aircraft operations
 - Guidelines for coordinating and reviewing operating policies and procedures with the airspace controlling authority for those flying sites located within controlled airspace
 - Guidelines for coordinating and reviewing operating policies and procedures with the airport and applicable airspace control authority for those flying sites located within 3 NM of a military or public-use airport, heliport, or seaplane base.
 - Guidelines for establishing and disseminating flying site operating procedures, limitations and safety guidelines including the following:
 - Hours of Operation
 - Flying site operating procedures
 - Frequency control procedures (if applicable)
 - Traffic pattern and flight operations
 - Cooperation with other modelers
 - Applicable altitude restrictions
 - Applicable No-Fly zones and operating area limits
 - Flight line and pit area safety procedures
 - Spectator and public access policies
 - Emergency Procedures (e.g., Fire, First Aid)

3. Model Aircraft Not Operated in Accordance with Accepted Set of Standards ●

3.1 Applicability ●

The following general requirements and limitations apply to Model Aircraft which are not operated in accordance with an FAA accepted set of standards, but are operated by hobbyists for the sole purpose of sport, recreation, and/or competition.

ALTERNATIVE VIEW: Eliminate Section 3.0 in its entirety.

ALTERNATIVE RATIONALE: AMA believes this approach is flawed in that it fails to recognize the substantial diversity of the hobby, establishes unrealistic and unenforceable restrictions, and leaves absent a safety surveillance program to oversee the activities of those modelers who choose not to participate in a formal aeromodeling structure/organization. More importantly, as a baseline set of standards, these limitations have the inherent potential of imposing a devastating impact on the aeromodeling activity and the hobby industry.

3.2 General Requirements ●

- (1) Model Aircraft shall be flown in open spaces and in a manner that does not endanger the life and property of others.
- (2) Model Aircraft shall yield the right of way to all manned aircraft.
- (3) Model Aircraft shall not interfere with operations and traffic patterns at airports, heliports, and seaplane bases.
- (4) Model Aircraft shall not be operated at locations where Model Aircraft activities are prohibited.
- (5) Model Aircraft are limited to unaided visual line-of-sight operations. The Model Aircraft pilot must be able to see the aircraft throughout the entire flight well enough to maintain control, know its location, and watch the airspace it is operating in for other air traffic. Unaided visual line-of-sight does not preclude the use of prescribed corrective lenses.
- (6) Model Aircraft shall be designed, equipped, maintained and/or operated in a manner in which the aircraft remains within the intended area of flight during all operations.
- (7) Model Aircraft pilots may not intentionally drop any object from a Model Aircraft that creates a hazard to persons or property.
- (8) Model Aircraft shall be operated in a manner that respects property rights and avoids the direct overflight of individuals, vessels, vehicles, or structures.
- (9) Model Aircraft shall not be operated in a careless or reckless manner.
- (10) Model Aircraft pilots shall not operate their aircraft while under the influence of alcohol or while using any drug that affects the person's faculties in any way contrary to safety.
- (11) Model fixed-wing and rotorcraft aircraft shall not use metal-blade propellers.
- (12) Model Aircraft shall not use gaseous boosts.
- (13) Model Aircraft shall not use fuels containing tetranitronmethane or hydrazine.
- (14) Model Aircraft shall not use turbine-powered engines (e.g., turbo-fan, turbo-jet) as a propulsion source. ●

RATIONALE: Turbine powered aircraft are perceived by many members of the sUAS Aviation Rulemaking Committee (ARC) as being a higher risk.

ALTERNATIVE VIEW: Eliminate the limitation.

ALTERNATIVE RATIONALE: The blanket prohibition of turbine engines does not take into consideration the various and diverse turbine engines currently produced and impose an unjustified economic impact on the hobby industry.

3.3 General Limitations ●

- (1) Model Aircraft shall not exceed 55 pounds (lbs).
- (2) Model Aircraft shall remain clear of clouds.
- (3) Model Aircraft will not operate in Class B airspace without the permission of the ATC authority.
- (4) Model Aircraft shall not be operated within 3 NM miles of an airport, heliport, or seaplane base without the permission of the ATC authority or airport manager.
- (5) Model Aircraft shall operate in close proximity to the ground, at or below 400 feet (') above ground level (AGL), and shall at all times remain below and well clear of all manned aircraft. ●

RATIONALE: By keeping Model Aircraft at or below 400' encounters with manned aircraft are reduced. This recommended general limitation is consistent with the current Model Aircraft guidance contained in AC91-57.

ALTERNATIVE VIEW: Replace (5) with the following:

Model Aircraft shall operate in close proximity to the ground, shall stay at or below 400' AGL when within 3 NM of an airport, and shall at all times remain below and well clear of all manned aircraft.

ALTERNATIVE RATIONALE: Though it is agreed that there needs to be some altitude limit on the modelers that are not participating in a structured safety program such as AMA's, AMA also knows from their experience that creating a hard and fast across the board altitude limit, such as 400' is unnecessarily restrictive, unrealistic, and arguably poses a greater risk to personnel on the ground. AMA's experience has shown that the greatest risk to other participants in the NAS and perhaps the only significant risk posed by model aviation is when Model Aircraft are operated within three miles of an airport. The language in the ALTERNATIVE VIEW mirrors the current guidelines in the AMA Safety Code.

- (6) Notwithstanding the above limitations, Model Aircraft weighing less than or equal to two lbs incapable of reaching speeds greater than 60 miles per hour (mph) (52 knots), and powered by electric motor or mechanical stored energy (e.g.,

rubber-band powered) may operate within 3 NM of a military or public-use airport or heliport; if they remain a safe distance from the airport or heliport, remain well clear of all manned aircraft, and remain below 400' AGL.

RATIONALE for the above limitations:

- (1) Currently accepted domestic weight limit and has international precedent as well.*
- (2) Is consistent with the concept of visual line-of-sight (VLOS).*
- (3) Class B is positive control. All aircraft are required to operate on a clearance. Gaining permission from ATC is equivalent to receiving a clearance.*
- (4) Model Aircraft permitted to operate within 3 NM of the airport will be provided applicable operating limitations.*
- (5) 400' is appropriate for Model Aircraft operations in Class C airspace without coordinating with ATC and is consistent with the intention of current domestic policy and with the UK, CASA, and Canada.*
- (6) This is consistent with the guidelines currently established by AC91-57.*
- (7) Makes a blanket exception for models weighing two lbs or less. This is an appropriate allowance for "Park Flier" and "toy" type models and allows them to use parks and small fields closer to airports.*

- (7) Model Aircraft will not be flown at an airspeed that would cause the aircraft to inadvertently leave the prescribed maneuvering area. ●

RATIONALE: *The pilot will be responsible for limiting their speed so that they can remain within the prescribed maneuvering area.*

ALTERNATIVE VIEW: Replace (7) with the following:

Model Aircraft cannot be operated at airspeeds which exceed 100 mph (87 knots).

ALTERNATIVE RATIONALE: *Restricting the speed of Model Aircraft not participating in an FAA-accepted safety program will mean that high-performance aircraft will not be operated by individuals that are not being scrutinized by their peers. Eliminating high-performance aircraft will also help to ensure that the operator will be able to keep their aircraft within the defined operational area (line-of-sight and below 400' AGL). Limiting the speed also will reduce the likelihood of turbine powered aircraft being operated without the guidance of an FAA-accepted safety program. Turbine powered aircraft are perceived by many members of the ARC as being a higher risk.*

- (8) Model Aircraft cannot launch pyrotechnic devices which explode or burn.

- (9) Excluding take-off and landing, no powered Model Aircraft may be flown closer than 25 feet to any individual, except for the pilot and the pilots helper located at the flight line.