560 - Uncrewed Aircraft Operations Utilizing Advanced Flight Systems

Overview

This *AMA* document refers to the operation of *sUAS* that utilize *advanced flight systems* such as autopilot *flight controllers* with *GPS*, *gyros*, and *accelerometers* that allow the *remote operator* to fly *semiautonomous flights*, activate preprogrammed *flight modes*, use *stabilization* and *attitude limiting functionalities.*

1. Definition of terms

Please refer to Definitions Section, which contains an alphabetical listing of the definitions of the terms that are used in this document.

2. Operations, requirements, and limitations

a) AMA pilots should first be capable of manually flying their sUAS without using GPS or Intelligent Orientation Control.

b) AMA pilots, when flying sUAS utilizing an autopilot system, must be able to deactivate the autopilot automated flight mode to resume manual control of the sUAS.

c) AMA pilots should perform preflight inspections of their sUAS electronic and navigation control, and power and mechanical systems before each flight.

d) AMA pilots must perform a manual RC test flight of their sUAS before activating a newly installed stabilization or autopilot system and/or after any repairs or replacement of the sUAS essential flight systems.

e) sUAS exceeding 55 pounds cannot use an autopilot for automated flights, except for a failsafe-activated emergency landing or a “return to launch”.

f) AMA pilots may control the flight path of an sUAS with a standard gimbal RC transmitter or a smartphone, tablet, smartwatch, laptop, and/or proprietary controller with mission software using radio frequency telemetry modules for the control link.

g) sUAS must operate on frequencies approved by the FCC for wireless video, radio control, and ground station telemetry systems. Some systems, because of power output or Amateur Band frequencies, will require FCC licensing (AMA documents #580 & 590).

3. Autopilot Flight Mode operations

All flight operations must be conducted within current AMA safety programming. Some autopilot flight-mode functions must not be operated at their maximum capabilities because they are contrary to AMA/FAA sUAS rules.

Note: Any flight modes requiring supplemental rules are indicated by an asterisk (*).

AMA approved sUAS flight modes not requiring GPS

FLIGHT MODE	sUAS OPERATION
1. Stabilization	Stabilizes roll and pitch attitude.
2. Altitude Hold	Maintains a desired altitude.
3. Land/Takeoff	Auto programmed landings/takeoffs.
4. Aerobatic	Allows aerobatics.

AMA approved sUAS flight modes requiring GPS

FLIGHT MODE	sUAS OPERATION
1. Return to Launch	Returns sUAS to GPS launch point.
2. Loiters	Maintains location, altitude, heading.
3. Automated	Autopilot scripted program controls sUAS flightpath via waypoints.
4. Intelligent Orientation Control	sUAS flight follows relative control stick movement and not the direction its nose points.
5. Targeted/Guided	sUAS will fly directly to a waypoint selected in mission planner software.
6. Drift	sUAS roll and yaw flight attitude determined by control stick position.
7. Geo-fencing	Autopilot programed for sUAS flight flying site boundaries (no-fly zones).
8. Position hold	sUAS maintains location and heading but not altitude.
9. Circle	sUAS will circle a selected point with nose continuing to point toward center.
10. Auto-Tracking or Follow-Me*	sUAS will follow a subject's movements using GPS tracking or vision-augmented tracking.

4. Range, separation, altitude, weight,

speed, and classification

a) **Range -** The flight range of sUAS are limited to VLOS of the AMA pilot and/or spotter when necessary.

b) **Separation** - AMA pilots should maintain the flight path of their sUAS at safe minimum separation distances from pilots, helpers, spectators, vehicles, and structures as follows:

- Model aircraft not exceeding 2.0 pounds should maintain a minimum separation of 10 feet from pilots/helpers, 25 feet from spectators, and 50 feet from vehicles/structures.
- greater than 2 pounds should maintain a minimum separation of 25 feet from pilots/helpers, 60 feet from spectators, and 80 feet from vehicles/structures.

c) **Altitude** - Maximum altitudes of sUAS/model aircraft flights are specified in Letters of Agreement with FAA or designee, determined through the FAA's UAS Facility Map and LAANC Authorization, or federal law.

d) **Weight** - sUAS are limited to 55 pounds, unless in compliance with AMA's Large Model Airplane program (AMA document #520-A)

e) **Speed** - sUAS utilizing an Autopilot System for Waypoint flying are limited to a maximum safe speed within the designed flight envelope of the sUAS.

5. Recommendations and Information:

a) If your radio control system lacks failsafe capability, consider using programmable digital servos or auxiliary failsafe modules. In the event of a radio signal failure, these components will activate desired safe servo settings or an autopilot for a return to base/launch.

b) When using an autopilot, its return to base/launch function should be programmed to return the sUAS to a safe location and terminate the flight should manual control of the sUAS be lost. When using this function, pay particular attention to the manufacturer's recommended throttle setting to prevent stalling or an uncontrolled decent.

c) Some sUAS that are sold as "Follow me" flying cameras use a smartphone to control and send GPS location data to the sUAS to track and video a subject in motion. To comply with current AMA rules, an optional remote-control device should be available for a spotter to deactivate automated flight if safe operation becomes an issue.

d) When purchasing stabilization and autopilot systems, always try to select quality equipment from reputable dealers, ensure for compatibility with other onboard systems, and install components according to manufacturers' instructions.

6. Privacy Protection Safeguards:

Laws: Federal, State, and Local

AMA members must be aware of and observe any laws regulating the ownership and operation of sUAS.

Cameras/Sensors

The use of imaging technology for aerial surveillance with radio-controlled sUAS capable of obtaining high-resolution photographs and/or video, or using any types of sensors for the collection, retention, or dissemination of surveillance data or information on individuals, homes, businesses, or property at locations where there is a reasonable expectation of privacy is strictly prohibited by the AMA, unless expressed written permission is obtained from the individual property owner(s) or manager(s).

General rules For sUAS operations

a) AMA sUAS flights must be conducted in accordance with the AMA National Model Aircraft Safety Code, AMA supplemental rule documents, flying site specific rules, FAA regulations, and any laws relating to sUAS operations (see AMA document #105).

b) AMA pilots must fly their sUAS strictly for recreational, personal or educational use.

c) AMA pilots when flying sUAS with or without FPV, stabilization or autopilot systems for automated flight, must at all times maintain sUAS within VLOS (see VLOS AMA document # 550A).

d) AMA pilots when flying sUAS in controlled airspace must at all times maintain their sUAS within altitudes and boundaries specified in their Letter of Agreement or an altitude authorized through FAA's Low Altitude Authorization and Notification Capability (LAANC).

e) sUAS must not be flown in a careless or reckless manner or at locations where sUAS activities are prohibited, or in close proximity to crowds of people at outdoor sporting events, music festivals, political gatherings, firework displays, or beaches (see section 4b).

f) AMA pilots shall avoid flying sUAS directly over unprotected people, animals, vessels or structures so as not to endanger the life and property of others who are not directly involved in the sUAS activity.

g) All sUAS flights must yield right-of-way to manned or other uncrewed aircraft.

h) AMA pilots or their spotters must monitor the airspace surroundings sUAS while in flight. If aircraft, people, or property become endangered, pilots must maneuver their UAS to avoid a collision (see AMA document #540D).

Definition of Terms

AMA FPV novice pilot
An AMA member learning to fly FPV with an experienced AMA RC pilot providing flight instruction and serving as an FPV spotter.

AMA pilot/operator
An AMA member who is capable of manually operating an RC transmitter to control a sUAS flight path within its safe, intended flight envelope without losing control or having a collision.

AMA FPV pilot/operator
An AMA pilot who is capable of maintaining stable flight of an FPV sUAS within its intended flight envelope while flying by FPV without losing control or having a collision.

AMA FPV spotter/visual observer
An experienced AMA RC pilot who has been briefed by the AMA FPV pilot on the tasks, responsibilities, and procedures involved in being a spotter, is capable and mature enough to perform the duties.

Automated Flights
The use of an autopilot system to control the flight path of a sUAS/model aircraft. The level of automation/autonomy does not totally remove the AMA pilot from control capability since he/she has VLOS of the sUAS and can activate and deactivate the automation.

Autopilot systems
Used to stabilize and control the flight path of a sUAS without assistance from a pilot. The autopilot system incorporates a microcontroller, inertial measurement unit, GPS receiver, and an altitude sensor. A laptop with mission software allows the pilot to program and save navigable waypoints to the autopilot system's memory for automated flight.

Buddy-box system
A flight-training system that has one transmitter operating as the master controller, while a second transmitter is linked/slaved to it, allowing dual control of a sUAS. The operator of the master transmitter allows one or the other transmitter to control the sUAS. Although this system is commonly used for training novice fliers, it is also useful in situations where an experienced pilot may have an increased likelihood of needing a second pilot's assistance in maintaining control of the sUAS. It might also be helpful in assisting pilots with physical limitations, flying in congested environments, during times of reduced visibility, or anytime during FPV flight when a timely transfer of control might be beneficial.

Controlled airspace
Controlled airspace is a generic term that covers the different classifications of airspace and defined dimensions within which air traffic control (ATC) service is provided in accordance with the airspace classification. Controlled airspace consists of Class A, B, C, D, and E.

Essentials flight systems
Any systems or components necessary to maintain stable flight within a model aircraft's flight envelope. This includes primary RC systems and any stabilization or gyros required to maintain stability and heading in certain types of sUAS/model aircraft that would be uncontrollable or unstable without their use.

First-Person View (FPV)
Refers to the operation of a radio controlled sUAS/model aircraft using an onboard camera's cockpit view to orient and control the aircraft's flight path.

Flight envelope
The range of airspeeds, attitudes, altitudes, and flight maneuvers that a sUAS can safely perform/operate for its intended use.

FPV aircraft
An RC sUAS equipped with a video transmitter to send real-time video images from an onboard camera to a ground-based receiver for display on a pilot's video monitor/goggles. (FPV sUAS types include fixed-wing, rotary-wing, and multirotor platforms.)

LAANC
LAANC is the Low Altitude Authorization and Notification Capability. LAANC provides UAS pilots with access to controlled airspace at or below 400 feet, and Air Traffic Professionals with visibility into where and when UAS are operating.

Model Aircraft, small Uncrewed Aircraft Systems (sUAS), Uncrewed Ariel Vehicles (UAV), Remotely Piloted Aircraft, and Drones
Remotely controlled and/or autopilot controlled uncrewed aircraft capable of sustained flight in the atmosphere. The small sUAS have a maximum weight of 55 pounds.

Multirotor
A remote-controlled model aircraft whose lift and flight path are derived from the aerodynamic forces acting on more than one powered rotors that are turning about vertical axes and includes tricopters, quadcopters, hexacopters, and octocopters, etc.

Non-essential flight systems
Any systems or components that are not necessary to maintain stable flight within the sUAS flight envelope. This includes autopilot or stabilization systems that can be activated and deactivated in flight by the pilot without affecting stable flight.

Park Pilot aircraft
A remote-controlled sUAS limited to 2 pounds in weight, speeds less than 60 mph, and designed for park flying in small urban area locations.

RC test flight

Requires an AMA pilot to manually operate an RC transmitter to control a sUAS flight path and determine if the aircraft is capable of maintaining stable flight within its safe intended flight envelope.

Uncontrolled-airspace
Uncontrolled airspace or Class G airspace is the portion of the airspace that has not been designated as Class A, B, C, D, or E. It is therefore designated uncontrolled airspace. Class G airspace extends from the surface to the base of the overlying Class E airspace which in most areas is 1,200 feet AGL and is not subject to ATC jurisdiction. FAA authorization is not required to fly UAS/drones or model aircraft in Class G.

Visual line-of-sight (VLOS)
Distance at which the pilot and/or spotter located with the pilot/operator is capable of maintaining visual contact with the sUAS and determine its orientation and altitude without enhancements other than corrective lenses.