

NEWEST PROVISIONS IN REGULATIONS APPLIED FOR SMALL UNMANNED AIRCRAFT SYSTEMS

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Abstract: 26 January 2015 at 3 a.m. a quadrotor was landed on the White House lawn. This event showed that the UAV-technology is readily available at many hobby shops, and the access to these robot systems is still open for everyone. The fly into White House garden raised many security issues whether Secret Service is able to keep White House clear from such intruders infiltrating into sensitive zones of the White House. This controlled flight into White House grounds accelerated regulatory and rulemaking works and activity carried out in many countries by many organizations authorized to make rules and regulation in this special field of the aviation. The purpose of the author is to give an overview about new norms and rules planned to be activated in regulations of the Federal Aviation Authority, United States, as an example, and, where it is invited, to make comments and proposals on the given issues open for discussions.

Keywords: UAV, UAS, small UAS, regulations of the UAS, integrating UAS into airspace, segregated airspace, non-segregated airspace, human factors.

1. INTRODUCTION

Unmanned Aerial Vehicles (UAV) and Unmanned Aerial Systems (UAS) are useful tools in many governmental (public), and in many non-governmental (civil) applications. There are many different types of UAVs with large variety of possible sensors applied for solution of the given flight mission.

The emerging problem of these UAV flights is the use of airspace, and ensuring flight safety at the level of the manned aircraft, as the minimum.

The UAV flights in civil applications are organized by their operators responsible for keeping regulations, and behavior in general. The unfortunate event emerging on US White House lawn showed that airspace management is still based on thin legs [1].

Due to the potential beneficial applications of small UAS, the FAA has been seeking to incorporate the operation of UAS into the national airspace system (NAS) of the USA since 2008. April 2008, the FAA chartered the small UAS Aviation Rulemaking Committee (ARC).

In April 2009 the ARC provided the FAA with recommendations on how small UAS could be safely integrated into the NAS.

Since that time, the FAA has been working on a rulemaking to incorporate small UAS operations into the NAS.

2. RELATED WORKS, PRELIMINARIES

The Federal Aviation Authority had released news about rulemaking activity on the issues of the integration of the UAS flights into common airspace [2].

The summary of the newly proposed initiatives can be found at [3], whilst the complex legal study can be found at [4].

The 14CFR Part 107 FAA Federal Aviation Regulations (FARs) will be supplemented with new chapters dealing with UAV regulations [5].

In UAV airworthiness compliance evaluation Szabolcsi had published a series of papers. In scientific article [6] Szabolcsi gave new definitions, which can be applied in UAV certification procedures including both type- and airworthiness.

Due to lack of regulations in the field of UAV airworthiness certification Szabolcsi derived a new concept of the flying and handling qualities of the UAVs applied in measure of compliance procedure [7].

In article [8] Szabolcsi had laid down basic principles applied in airworthiness certification of the automatic flight control systems of the UAVs.

In scientific paper [9] Szabolcsi derived flying qualities proposed for measure of the compliance of the type- and airworthiness of the lateral/directional automatic flight control of the UAVs.

In paper [10] Szabolcsi defined flying qualities available for measure of the compliance of the type- and airworthiness of the longitudinal short period motion of the automatic flight control of the UAVs.

3. PROVISIONS AND PROPOSALS FOR UAS REGULATIONS

In references [3,4] a new set of proposed definitions, rules and norms are published and in many cases expert are invited to make comments on these items and issues.

The references of [3,4] cited here are dividing the new proposals of the following four chapters:

1. operational limitations of the UAS;
2. operator certification and responsibilities;
3. aircraft requirements;
4. model aircraft.

The following chapters are deriving the new proposals and provisions to regulate those areas not covered yet with norms and rules. The author will make his comments to fill gaps, or, to show bottlenecks in the norms proposed by rule makers.

4. OPERATIONAL LIMITATIONS OF THE UAS

This set of new norms very important ensuring flight safety of the UAS integrated into any airspace.

The newly proposed regulations are strictly follows [3,4] and supplemented with comments and proposals of the author to be as defined below:

1. Unmanned aircraft must weigh less than 55 lbs (cca 25 kg). The ‘weight’ used here is the total gross weight of the UAV including all devices and gauges applied on-board. The trend of the UAV development shows that weights are decreasing with simultaneous increase of technical capabilities.
2. Visual line-of-sight (VLOS) only; the unmanned aircraft must remain within VLOS of the operator or visual observer.
3. At all times the small unmanned aircraft must remain close enough to the operator for the operator to be capable of seeing the aircraft with vision unaided by any device other than corrective lenses. The requirement defined here is no devices with exemption of contact lenses can be used to enlarge flight envelop in VLOS.
4. Small unmanned aircraft may not operate over any persons not directly involved in the operation. It means that urban flights aloft human are forbidden.
5. Daylight-only operations (official sunrise to official sunset, derived by the local time).
6. Must yield right-of-way to other aircraft, manned or unmanned. There is still a missing rule and norm how to yield right-of-way to other UAV, and how to decide who is first.
7. May use visual observer (VO) but not required. There is a possibility to assign observes supporting activity of the operator.
8. First-person view camera cannot satisfy “see-and-avoid” requirement but can be used as long as requirement is satisfied in other ways.
9. Maximum airspeed of 100 mph (87 knots).
10. Maximum altitude of 500 feet above ground level. This altitude limit is lower than Class G airspace provides.
11. Minimum weather visibility of 3 miles from control station.
12. No operations are allowed in Class A (18,000 feet & above) airspace.

13. Operations in Class B (upper limit is 10,000 feet), C (upper limit is 4,000 feet), D (upper limit is 2,500 feet) and E airspace are allowed with the required ATC permission.
 14. Operations in Class G airspace (FL600) are allowed without ATC permission.
 15. No person may act as an operator or VO for more than one unmanned aircraft operation at one time. There are some solutions providing simultaneous control of more than one UAV. The ground stations designed with that capability must be changed to that of capable of control a single UAV.
 16. No careless or reckless operations. It is responsibility of the operator to behave keeping all written or unwritten rules of UAV flights and ground maintenance.
 17. Requires preflight inspection by the operator. The operator must be able to maintenance the UAV, to carry out inspections defined in regulations following special check-lists prepared for given type of the UAV.
 18. A person may not operate a small unmanned aircraft if he or she knows or has reason to know of any physical or mental condition that would interfere with the safe operation of a small UAS. The personal responsibility of the UAV operator for this condition is undoubtedly.
 19. Proposes a microUAS (μ UAS) option that would allow operations in Class G airspace, over people not involved in the operation, provided the operator certifies he or she has the requisite aeronautical knowledge to perform the operation. The total mass of the μ UAS is defined to be less than 4,4 lbs (cca 2 kg) [4].
1. pilot of a small UAS would be considered for “operator”. A classical terminology of the ‘pilot’, and his or her rights and responsibilities are no longer used. There were many argues made on this item. Some of experts stated that operator is a pilot with those rights and responsibilities provided for pilots of manned aircraft. The opposing opinion was that UAV operator is the person trained well-enough to steer the UAV, and he/she must not be considered for pilot, due to his absence aboard. After a long-time discussion a proposal is made by FAA to make difference between UAV operator, and pilots of manned aircraft.
 2. operators would be required to
 - pass an initial aeronautical knowledge test at an FAA-approved knowledge testing center. Still there is no decision about any training courses and its syllabuses available for UAV operator applicants. The basic principle of the testing procedure will be outlined later.
 - be vetted by the Transportation Security Administration;
 - obtain an unmanned aircraft operator certificate with a small UAS rating (like existing pilot airman certificates, never expires). The UAV pilot will be designated among those of operating air vehicle aloft.
 - pass a recurrent aeronautical knowledge test every 24 months. The basic idea is very close to certification of the maintenance staff as it is regarded in EASA Part-66 Regulation. The certificate expires after a given endurance, and, it must be prolonged after given period of time.
 - Be at least 17 years old. It is matter of decision whether the national UAV regulations can be different from that of the FAA proposals, or it can compile rules and procedures from regulations mentioned above.
 - Make available to the FAA, upon request, the small UAS for inspection or testing,

5. OPERATOR CERTIFICATION AND RESPONSIBILITIES

The long-lasting argues finally came to the end: a question about piloting of the UAV is answered, and, requirements for operators are proposed to be as follows [3,4]:

and any associated documents/records required to be kept under the proposed rule. This rule strictly follows those regulations are in force for any types of the manned aircraft.

- Report an accident to the FAA within 10 days of any operation that results in injury or property damage. The injury can be caused for human or non-human beings. There is still no norm upon that cases which differ from each other significantly. The volume of the damage caused in properties also not defined yet. If to follow that rule any damage must be reported independently of its volume, i.e. it can put large overload on aviation authorities responsible for archiving incidents and accidents.
- Conduct a preflight inspection, to include specific aircraft and control station systems checks, to ensure the small UAS is safe for operation.

If there is no technical support the operator must execute any activity necessary to have safe UAV.

6. AIRCRAFT REQUIREMENTS

The aircraft requirements are very important ensuring that level of the flight safety defined for manned aircraft. The newly proposed rules are followings:

1. FAA airworthiness certification not required. However, operator must maintain a small UAS in condition for safe operation and prior to flight must inspect the UAS to ensure that it is in a condition for safe operation. Due to lack of procedure defined for the inspection it is proposed to prepare it for the given UAS type and train, drill operator to execute it carefully.
2. Aircraft Registration required (same requirements that apply to all other aircraft). The type certification of the UAS is required, and provides safe UAVs applied for given flight missions.
3. Aircraft markings required (same requirements that apply to all other aircraft). If aircraft is too small to display markings in standard size, then the aircraft simply needs to display markings in the largest practicable manner.

7. THE MODEL AIRCRAFT

The FAA has issued an Advisory Circular AC91-57 on model aircraft in 1981 deriving operating standards for the operators [11].

The Public Law 112-95 of the USA defines a model aircraft as an “*unmanned aircraft that is (1) capable of sustained flight in the atmosphere; (2) flown within visual line of sight of the person operating the aircraft; and (3) flown for hobby or recreational purposes.*”

The Section 336 of Public Law 112-95 defines a model aircraft as an “unmanned aircraft”. A model aircraft that weighs less than 55 pounds would fall into the definition of small UAS.

Public Law 112-95 specifically prohibits the FAA from promulgating rules regarding model aircraft that meet all of the following statutory criteria:

- the model aircraft is flown strictly for hobby or recreational use;
- the model aircraft is operated in accordance with a community-based set of safety guidelines and within the programming of a nationwide community-based organization;
- the model aircraft is limited to not more than 55 pounds unless otherwise certified through a design, construction, inspection, flight test, and operational safety program administered by a community-based organization;
- the model aircraft is operated in a manner that does not interfere with and gives way to any manned aircraft;
- when model aircraft is flown within 5 miles of an airport, the operator of the aircraft provides the airport operator and the airport

air traffic control tower (when an air traffic facility is located at the airport) with prior notice of the operation.

The references [3,4,11] give deep details of model aircraft design and certification, and defines strong rules for the maintenance of the UAV on-ground, and aloft. The past decades were famous for continuous rulemaking following changes in the technology and in aviation, in general.

Final findings of [3,4] about model aircraft are as follows below:

1. proposed rule would not apply to model aircraft that satisfy all of the criteria specified in Section 336 of Public Law 112-95 (listed above);
2. the proposed rule would codify the FAA's enforcement authority in part 101 by prohibiting model aircraft operators from endangering the safety of the NAS.

CONCLUSIONS

The FAA of DoT U.S. has long-lasting experiences in UAV and UAS regulations.

Starting with early 80's many knowledge and experiences had been compiled in regulations starting with simple-paged advisory circulars, and finishing with highest, common, public law.

Although proposed regulations try to cover as much as fields of aviation, there are many issues still open for discussion and comments awaited by regulatory experts.

The most important items not regulated yet are as follows:

- UAV aircraft worthiness evaluation;
- procedures applied for evaluation of the UAV worthiness;
- UAV operator selection;
- UAV operator certification;
- UAV operator registration;
- rights and responsibilities of the UAV pilot;
- procedures of the preflight inspections made by UAV operators;
- establishment of the approved knowledge testing centers;
- establishment of the syllabus of the operator training;

–involving certified trainers into drill of the UAV operators.

The open issues in the field of UAV regulations open very intensive period of time, and busy with challenges to be solved by aviators. The economically-driven initiatives forecast that solution to all problems threatening development of UAV technologies will be found in very short time.

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