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Standard Practice for Commercial Unmanned Aircraft System (UAS) Pilot Practical Test Standards for Unmanned Aircraft Single-Engine Land (SEL) Remote Control and Autonomous/Semiautonomous¹

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1. Scope

1.1 This practice defines the knowledge, skills, and abilities required of unmanned aircraft pilots to be able to fly unmanned aircraft—single-engine land (SEL) in the national airspace system safely and for hire.

1.2 The commercial unmanned aircraft systems (UAS) pilot practical test standards (PTS)—unmanned aircraft include the areas of operation and tasks that will demonstrate the pilot's ability to fly the unmanned aircraft safely and proficiently.

1.3 This practice does not apply to pilots who will fly mini/small unmanned aerial vehicles (UAVs) for hire within visual range of the pilot, mini/small UAVs being those UAVs listed as lightly regulated.

1.4 This practice provides a PTS intended to meet the Civil Aviation Authority's (CAA) requirements for issuing commercial UAS pilot authorizations.

1.5 The values given in inch-pound units are to be regarded as the standard. The values in parentheses are for information only.

1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 FAA Documents:²

- AC 00-6A Aviation Weather for Pilots and Flight Operations Personnel
- AC 00-45E Aviation Weather Services
- AC 60-28 English Language Skill Standards Required by 14 CFR Parts 61, 63 and 65

¹ This practice is under the jurisdiction of ASTM Committee F38 on Unmanned Aircraft Systems and is the direct responsibility of Subcommittee F38.03 on Personnel Training, Qualification and Certification.

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² Available from Federal Aviation Administration (FAA), 800 Independence Ave., SW, Washington, DC 20591, <http://www.faa.gov>.

AC 61-23/FAA-H-8083-25 Pilot's Handbook of Aeronautical Knowledge

AC 61-67C Stall and Spin Awareness Training

AC 61-84B Role of Preflight Preparation

AC 90-66A Recommended Standards Traffic Patterns for Aeronautical Operations at Airports without Operating Control Towers

AC 91-13C Cold Weather Operation of Aircraft

AC 91-55 Reduction of Electrical System Failures following Aircraft Engine Starting

FAA-H-8083-1 Aircraft Weight and Balance Handbook

FAA-H-8083-3A Airplane Flying Handbook

FAA-H-8083-25 Pilot's Handbook of Aeronautical Knowledge

2.2 Federal Standards:³

14 CFR Part 43 Maintenance, Preventive Maintenance, Rebuilding, and Alteration

14 CFR Part 61 Certification: Pilots, Flight Instructors, and Ground Instructors

14 CFR Part 71 Designation of Class A, B, C, D, and E Airspace Areas; Air Traffic Service Routes; and Reporting Points

14 CFR Part 91 General Operating and Flight Rules

AC 61-65 Certification: Pilots and Flight Instructors

AC 90-48 Pilots' Role in Collision Avoidance

AC 120-51 Crew Resource Management Training

3. Terminology

3.1 Acronyms:

3.1.1 ADM—aeronautical decision making

3.1.2 AFD—Airport Facility Directory

3.1.3 AFM—airplane flight manual

3.1.4 AGL—above ground level

3.1.5 AIM—Aeronautical Information Manual

3.1.6 ASOS—automated surface observing system

3.1.7 ATC—air traffic control

³ Available from U.S. Government Printing Office Superintendent of Documents, 732 N. Capitol St., NW, Mail Stop: SDE, Washington, DC 20401, <http://www.access.gpo.gov>.

- 3.1.8 *ATIS*—air traffic information service
- 3.1.9 *AWOS*—automated weather observation system
- 3.1.10 *BVR*—beyond visual range
- 3.1.11 *CAA*—Civil Aviation Authority
- 3.1.12 *CFIT*—controlled flight into terrain
- 3.1.13 *CRM*—crew resource management
- 3.1.14 *CS*—control station
- 3.1.15 *ETA*—estimated time of arrival
- 3.1.16 *FA*—area forecast
- 3.1.17 *FAA*—Federal Aviation Authority
- 3.1.18 *GPS*—Global Positioning System
- 3.1.19 *IFR*—instrument flight rules
- 3.1.20 *LAHSO*—land and hold short operations
- 3.1.21 *METAR*—Meteorological Aviation Report
- 3.1.22 *NAS*—National Airspace System
- 3.1.23 *NOTAMs*—Notices to Airmen
- 3.1.24 *POH*—pilot operating handbook
- 3.1.25 *PTS*—practical test standards
- 3.1.26 *SEL*—single-engine land
- 3.1.27 *TAF*—terminal aerodrome forecast
- 3.1.28 *UAS*—unmanned aircraft system
- 3.1.29 *UAV*—unmanned aerial vehicle
- 3.1.30 *VFR*—visual flight rules

4. Significance and Use

4.1 Unmanned aircraft present unique challenges for applicants and examiners. Unlike manned aircraft, in which, regardless of the size and complexity of the aircraft, there are still basic similarities in concepts and operations, unmanned aircraft are varied in both flight capability and pilot interaction. Many aspects of unmanned aircraft operations are automated, and the pilots may not have the same information available to them (that is, pitch and bank) that pilots flying manned aircraft have available to them. This will create a situation in which some unmanned aircraft systems (UAS) will not be capable of meeting all the requirements of this practice or will not require the same skill sets that manned aircraft require.

4.2 The examiner will have to decide which tasks the applicant's UAS will be capable of completing and test those tasks. As required, the examiner will note any limitations as a result of the UAS being incapable of performing a task on the applicant's certificate per 14 CFR 61.45(b)(2). If the applicant desires to have a certificate with no restrictions or limitations, he/she will need to use a UAS that is capable of completing all the tasks in this practice.

4.3 Information considered directive in nature is described in this practice by the use of "shall" and "must" indicating the actions are mandatory. Guidance information is described in terms such as "should" and "may" indicating the actions are desirable or permissive but not mandatory. A list of acronyms is in Section 3.

4.4 This practice includes the areas of operation and tasks that will demonstrate the pilot's ability to fly the unmanned aircraft safely and proficiently.

5. Practical Test Standards (PTS) Description

5.1 *Areas of Operation*—The areas of operation sections are the phases of the practical test arranged in a logical sequence within each standard. They begin with preflight preparation and end with postflight procedures. The examiner, however, may conduct the practical test in any sequence that will result in a complete and efficient test; however, the ground portion of the practical test shall be accomplished before the flight portion.

5.2 *Tasks*—The tasks are titles of knowledge areas, flight procedures, or maneuvers appropriate to an area of operation. When administering a test based on this PTS, the tasks appropriate to the class airplane used for the test shall be included in the plan of action.

5.3 *Note*—The note section is used to emphasize special considerations required in the area of operation or task.

5.4 *Reference*—The reference section identifies the standards and publication(s) that describe the task. Descriptions of tasks are not included in these PTSs, because this information can be found in the current version of the listed standard or reference. Standards or publications other than those cited in this practice may be used for references if their content conveys substantially the same meaning as the referenced standards and publications.

5.4.1 These PTSs are based on Section 2, AC 61-65 Certification: Pilots and Flight Instructors, and the Aeronautical Information Manual (AIM),⁴ Notices to Airmen (NOTAMs),⁴ the UAS Pilot Operating Handbook,⁴ the Airport Facility Directory (AFD),⁵ FAA-approved flight manuals, and navigation charts.

5.5 *Objective*—The objective lists the elements that shall be satisfactorily performed to demonstrate competency in a task. The objective includes:

- 5.5.1 Specifically what the applicant should be able to do,
- 5.5.2 Conditions under which the task is to be performed, and
- 5.5.3 Acceptable performance standards.

6. Use of This Practice

6.1 This practice requires that all commercial UAS pilot practical tests be conducted in accordance with the appropriate commercial PTSs and policies set forth in Section 4. Applicants shall be evaluated in all tasks included in each area of operation of the appropriate PTS unless otherwise noted.

6.2 The examiner is not required to follow the precise order in which the areas of operation and tasks appear in Section 9. The examiner may change the sequence or combine tasks with similar objectives to have an orderly and efficient flow of the

⁴ Available from Federal Aviation Administration (FAA), 800 Independence Ave., SW, Washington, DC 20591, <http://www.faa.gov>.

⁵ Available from Aviation System Standards, 6500 S. MacArthur Blvd., Oklahoma City, OK 73169-6901.



practical test. For example, radio communications and air traffic control (ATC) light signals may be combined with traffic patterns. The examiner's "plan of action" shall include the order and combination of tasks to be demonstrated by the applicant in a manner that will result in an efficient and valid test.

6.3 The examiner is expected to use good judgment in the performance of simulated emergency procedures. The use of the safest means for simulation is expected. Consideration shall be given to local conditions, both meteorological and topographical, at the time of the test, as well as the applicant's workload and the capabilities of the UAS used. If the procedure being evaluated would jeopardize safety, it is expected that the applicant will simulate that portion of the maneuver.

6.4 *Special Emphasis Areas:*

6.4.1 Examiners shall place special emphasis upon areas of UAS operations considered critical to flight safety. Among these are:

- 6.4.1.1 Positive aircraft control,
- 6.4.1.2 Positive exchange of the flight controls procedure (who is flying the airplane),
- 6.4.1.3 Stall/spin awareness,
- 6.4.1.4 Collision avoidance (see AC 90-48 Pilots' Role in Collision Avoidance),
- 6.4.1.5 Wake turbulence avoidance,
- 6.4.1.6 Land and hold short operations (LAHSO),
- 6.4.1.7 Runway incursion avoidance,
- 6.4.1.8 Controlled flight into terrain (CFIT),
- 6.4.1.9 Aeronautical decision making (ADM),
- 6.4.1.10 Data link procedures to include lost data link and data link coverage area,
- 6.4.1.11 Situational awareness,
- 6.4.1.12 Checklist usage, and
- 6.4.1.13 Other areas deemed appropriate to any phase of the practical test.

6.4.2 Although these areas may not be specifically addressed under each task, they are essential to flight safety and will be evaluated during the practical test. In all instances, the applicant's actions will relate to the complete situation.

6.5 *Commercial UAS Pilot—Unmanned Aircraft Practical Test Prerequisites*—An applicant for the commercial UAS pilot—aircraft practical test is required to:

- 6.5.1 Be at least 18 years of age;
- 6.5.2 Be able to read, speak, write, and understand the English language. If there is a doubt, use AC 60-28;
- 6.5.3 Possess a private UAS pilot certificate with an airplane rating if a commercial UAS pilot certificate with an airplane rating is sought or meet the flight experience required for a private UAS pilot certificate (unmanned aircraft rating) and pass the private airplane knowledge and practical test;
- 6.5.4 Possess an instrument rating (airplane) or the following limitation shall be placed on the commercial UAS pilot certificate: "instrument flight rules (IFR) flight in the National Airspace System (NAS) for hire is prohibited";
- 6.5.5 Have passed the appropriate private pilot knowledge test since the beginning of the 24th month before the month in which he or she takes the practical test;

6.5.6 Have satisfactorily accomplished the required training and obtained the aeronautical experience prescribed;

6.5.7 Possess at least a current third-class medical certificate;

6.5.8 Have an endorsement from an authorized instructor certifying that the applicant has received and logged training time within 60 days preceding the date of application in preparation for the practical test and is prepared for the practical test; and

6.5.9 Have also an endorsement certifying that the applicant has demonstrated satisfactory knowledge of the subject areas in which the applicant was deficient on the airman knowledge test.

6.6 *UAS and Equipment Required for the Practical Test*—The commercial UAS pilot-unmanned airplane applicant is required by 14 CFR Section 61.45 to provide an airworthy, certificated UAS for use during the practical test. This section further requires that the UAS shall:

6.6.1 Be of U.S., foreign, or military registry of the same category, class, and type, if applicable, for the certificate or rating or both for which the applicant is applying;

6.6.2 Have ability for the instructor/evaluator to have access to the controls, except as provided for in 14 CFR Section 61.45(c) and (e);

6.6.3 Be capable of performing all areas of operation appropriate to the rating sought and have no operating limitations that prohibit its use in any of the areas of operation required for the practical test.

6.7 *Use of Approved Flight Simulator or Flight-Training Device:*

6.7.1 An airman applicant for commercial UAS pilot-unmanned airplane certification may be authorized to use a qualified and approved flight simulator or flight-training device to complete certain flight task requirements listed in this practice.

6.7.2 An airman applicant seeking an added rating to a commercial UAS certificate may also use a qualified and approved flight simulator or flight-training device to complete the flight task requirements. An appropriate class airplane is required to complete the remaining flight tasks for certification. When flight tasks are accomplished with a UAS, certain task elements may be accomplished through "simulated" actions in the interest of safety and practicality, but when accomplished in a flight simulator or flight-training device, these same actions would not be "simulated." For example, when with a UAS, a simulated engine fire may be addressed by retarding the throttle to idle; simulating the shutdown of the engine; simulating the discharge of the fire suppression agent, if applicable; simulating the disconnect of associated electrical, hydraulic, and pneumatics systems; and so forth. However, when the same emergency condition is addressed in a flight simulator or flight-training device, all task elements shall be accomplished as would be expected under actual circumstances. Similarly, safety of flight precautions taken in the UAS for the accomplishment of a specific maneuver or procedure (such as limiting altitude in an approach to stall or setting maximum airspeed for an engine failure expected to result in a rejected takeoff) need not be taken when using a simulator or flight-training device.

flight-training device is used. It is important to understand that whether accomplished with a UAS, flight simulator, or flight-training device, all tasks and elements for each maneuver or procedure shall have the same performance standards applied equally for determination of overall satisfactory performance.

6.8 Flight Instructor Responsibility—An appropriately rated flight instructor is responsible for training the commercial UAS pilot applicant to acceptable standards in all subject matter areas, procedures, and maneuvers included in the tasks within each area of operation in the appropriate commercial UAS pilot PTS. Because of the impact of their teaching activities in developing safe, proficient UAS pilots, flight instructors should exhibit a high level of knowledge, skill, and the ability to impart that knowledge and skill to students. Throughout the applicant's training, the flight instructor is responsible for emphasizing the performance of effective sense-and-avoid procedures.

6.9 Examiner⁶ Responsibility—The examiner conducting the practical test is responsible for determining that the applicant meets the acceptable standards of knowledge and skill of each task within the appropriate PTS. Since there is no formal division between the "oral" and "skill" portions of the practical test, this becomes an ongoing process throughout the test. Oral questioning, to determine the applicant's knowledge of tasks and related safety factors, should be used judiciously at all times, especially during the flight portion of the practical test. Examiners shall test to the greatest extent practicable the applicant's correlative abilities rather than mere rote enumeration of facts throughout the practical test. If the examiner determines that a task is incomplete, or the outcome uncertain, the examiner may require the applicant to repeat that task, or portions of that task. This provision has been made in the interest of fairness and does not mean that instruction, practice, or the repeating of an unsatisfactory task is permitted during the certification process. When practical, the remaining tasks of the practical test phase should be completed before repeating the questionable task. Throughout the flight portion of the practical test, the examiner shall evaluate the applicant's use of sense and avoid procedures.

6.10 Satisfactory Performance—Satisfactory performance to meet the requirements for certification is based on the applicant's ability to safely:

- 6.10.1 Perform the tasks specified in the areas of operation for the certificate or rating sought within the approved standards,
- 6.10.2 Demonstrate mastery of the UAS with the successful outcome of each task performed never seriously in doubt,
- 6.10.3 Demonstrate satisfactory proficiency and competency within the approved standards,
- 6.10.4 Demonstrate sound judgment, and
- 6.10.5 Demonstrate single-UAS pilot competence if the UAS is type certificated for single-UAS pilot operations.

6.11 Unsatisfactory Performance:

6.11.1 The tolerances represent the performance expected in good flying conditions. If, in the judgment of the examiner, the applicant does not meet the standards of performance of any task performed, the associated area of operation is failed, and therefore, the practical test is failed. The examiner or applicant may discontinue the test at any time when the failure of an area of operation makes the applicant ineligible for the certificate or rating sought. The test may be continued ONLY with the consent of the applicant. If the test is discontinued, the applicant is entitled credit for only those areas of operation and their associated tasks satisfactorily performed. However, during the retest, and at the discretion of the examiner, any task may be reevaluated, including those previously passed. Typical areas of unsatisfactory performance and grounds for disqualification are:

6.11.1.1 Any action or lack of action by the applicant that requires corrective intervention by the examiner to maintain safe flight,

6.11.1.2 Failure to use proper and effective sense and avoid/collision avoidance techniques to clear the area before and while performing maneuvers,

6.11.1.3 Consistently exceeding tolerances stated in the objectives, and

6.11.1.4 Failure to take prompt corrective action when tolerances are exceeded.

6.11.2 When a notice of disapproval is issued, the examiner shall record the applicant's unsatisfactory performance in terms of the area of operation and specific task(s) not meeting the standard appropriate to the practical test conducted. The area(s) of operation/task(s) not tested and the number of practical test failures shall also be recorded. If the applicant fails the practical test because of a special emphasis area, the notice of disapproval shall indicate the associated task: that is, Area of Operation VIII, Maneuvering during Slow Flight, failure to use proper sense and avoid procedures.

6.12 Crew Resource Management (CRM)—CRM refers to the effective use of all available resources: human resources, hardware, and information. Human resources include all groups routinely working with the control station (CS) crew or UAS pilot who are involved with decisions that are required to operate a flight safely. These groups include, but are not limited to, dispatchers, maintenance personnel, air traffic controllers, and weather services. CRM is not a single task, but a set of competencies that must be evident in all tasks in this PTS as applied to either single UAS pilot operations or UAS crew (see AC 120-51 Crew Resource Management Training).

6.13 Applicant's Use of Checklists—Throughout the practical test, the applicant is evaluated on the use of an appropriate checklist. Proper use is dependent on the specific task being evaluated. The situation may be such that the use of the checklist, while accomplishing elements of an objective, would be either unsafe or impractical, especially in a single-UAS pilot operation. In this case, a review of the checklist after the elements have been accomplished would be appropriate. Division of attention should be considered when using a checklist.

6.14 Use of Distractions during Practical Tests—Numerous studies indicate that many accidents have occurred when the

⁶ The word "examiner" is used throughout the PTSs to denote either the inspector or designated UAS pilot examiner who conducts an official practical test.