



Standard Practice for Quality Assurance in the Manufacture of Light Unmanned Aircraft System¹

This standard is issued under the fixed designation F2512; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice establishes the minimum requirements for the development of a Quality Assurance and Production Acceptance Program, to be used for the manufacture of Light Airplane Unmanned Aircraft Systems (UAS).

1.2 Other documents relevant to this practice include Practice [F2279](#), 14 CFR Part 21, 14 CFR Part 23, and 14 CFR Part 43.

1.3 *This standard does not purport to address the quality assurance of the data-links, autopilot functions, and control stations.*

1.4 *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 *ASTM Standards:*²

[F2279 Practice for Quality Assurance in the Manufacture of Fixed Wing Light Sport Aircraft](#)

2.2 *FAA Standards:*³

[14 CFR Part 21 Certification Procedures for Products and Parts](#)

[14 CFR Part 23 Airworthiness Standards](#)

[14 CFR Part 43 Maintenance, Preventive Maintenance, Rebuilding and Alteration](#)

3. Terminology

3.1 *Definitions:*

¹ This practice is under the jurisdiction of ASTM Committee [F38](#) on Unmanned Aircraft Systems and is the direct responsibility of Subcommittee [F38.01](#) on Airworthiness.

Current edition approved April 15, 2007. Published May 2007. DOI: 10.1520/F2512-07.

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

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>.

3.1.1 *airplane, n*—engine-driven fixed-wing aircraft heavier than air, that is supported in flight by the dynamic reaction of the air against its wings.

3.1.2 *light airplane UAS, n*—light airplane unmanned aircraft system; maximum gross weight 1320 lb.

3.1.3 *manufacturer, n*—any entity engaged in the production of an unmanned aircraft system.

3.1.4 *permanent record, n*—records shall be kept for each light airplane UAS produced.

3.1.5 *pilot operating handbook (POH), n*—developed by the airplane manufacturer and contains FAA-approved airplane flight manual information.

3.1.6 *quality assurance manual (QAM), n*—documentation of the quality assurance program.

3.1.7 *quality assurance program (QAP), n*—method of inspections used by the manufacturer to verify and ensure the proper production thereof.

3.1.8 *quality assurance record (QAR), n*—record of quality assurance associated with each light airplane UAS produced.

3.2 *Acronyms:*

3.2.1 *AOI, n*—aircraft operating instructions

3.2.2 *MRB, n*—materials review board

3.2.3 *UAS, n*—unmanned aircraft system

4. Significance and Use

4.1 The purpose of this practice is to provide the minimum requirements necessary for the establishment of a quality assurance and production acceptance program for a manufacturer of light airplane UAS.

5. Quality Assurance Program (QAP)

5.1 Manufacturers of light airplane UAS shall develop a Quality Assurance Program (QAP) in accordance with the criteria established within this practice.

5.2 *Quality Assurance Manual (QAM)*—Each manufacturer shall document their QAP in the form of a Quality Assurance Manual (QAM).

5.3 *Quality Assurance Administration*—The manufacturer's administration that is charged with the implementation of the

QAP may consist of one or more: company employees, company officials, or manufacturer's agents or assigns. The individual's that make up the quality assurance administration shall be identified within the QAM.

5.4 Quality Assurance Record (QAR)—A record shall be maintained of the date of acceptance, the origin of materials used in the production of airframe components considered by the manufacturer to be critical to the structural integrity of a light airplane UAS (see **Note 1**).

NOTE 1—The intent of this record is to provide a means for the manufacturer to identify and reduce the number of light airplane UAS within a fleet that may be affected by a materials anomaly that would require corrective action, thereby reducing the economic impact of such corrective action. This paragraph should not be construed as a requirement for specific parts traceability.

5.4.1 Manufacturer shall maintain a Quality Assurance Record (QAR) for each light airplane UAS produced. Each QAR shall consist of the following:

5.4.1.1 Applicable final inspection records, check, and test documentation from the production acceptance procedures (see **Section 8**).

5.4.1.2 A copy of the Manufacturers Statement of Compliance.

5.4.1.3 The configuration of each light airplane UAS at its point of delivery (for continued operational safety monitoring purposes), including associated parts lists and installed equipment lists.

NOTE 2—Each item listed in **5.4.1** shall include the light airplane UAS serial number and date of manufacture.

5.5 Quality Assurance Revisions—A system shall be implemented to ensure that only the latest revisions to the QAM are in use.

5.6 Quality Assurance Audits—Manufacturer shall conduct an annual audit of their QAP. Manufacturer shall maintain a record of all such audits. Any determination of non-compliance shall be resolved and a revision to the QAM shall be made if necessary to address any anomalies found.

6. Engineering and Manufacture

6.1 Record of Compliance—The manufacturer shall keep a permanent record of the design documentation used to show compliance of a particular configuration.

6.2 Configuration Control—All light airplane UAS configurations in production shall have Records of Compliance to the latest released revision.

6.3 Production Documentation—The manufacturer shall maintain a record of all production documentation, including revisions. Production documentation may include, but is not limited to, the following:

- 6.3.1** Parts lists,
- 6.3.2** Process routings,
- 6.3.3** Component and assembly drawings,
- 6.3.4** Manufacturing instructions and specifications, and
- 6.3.5** Tooling and gauge drawings.

6.4 Special Processes—A system shall be implemented to control all special processes and services related to the pro-

duction of airframe components considered by the manufacturer to be critical to the structural integrity of the light airplane UAS, such as welding, brazing, heat treatment, plating, structural composites, adhesive bonding, and so forth, that ensures that each process and service is performed in accordance with approved specifications containing definitive standards of quality, and that periodic inspection of gauges, solutions, or any critical equipment is controlled and documented.

7. Quality Assurance Inspections

7.1 Manufacturers shall implement and document a system of inspections to verify conformity of product to all applicable engineering requirements and production specifications

7.1.1 Conforming, non-conforming, and items awaiting inspection must be separated or clearly distinguishable. Items found to be nonconforming shall either be evaluated by a Materials Review Board (MRB) per **7.4** or rejected per **7.5**.

7.2 Receiving Inspection—Manufacturer shall implement a purchasing procedure that shall ensure all items ordered are properly specified. Incoming items provided by outside vendors shall be inspected for conformity to applicable specifications.

7.3 Acceptance of Conforming Items—Conforming items shall be distributed as required or placed in a secure storage area for future use.

7.4 Evaluation of Non-Conforming Items by a Materials Review Board—A Materials Review Board (MRB) may be established to determine the disposition of non-conforming items, and shall consist of one or more manufacturer's designated technical representatives. MRB representatives shall be identified within the QAM. If analysis, additional inspection, functional checks, repair, rework, and so forth assures that an item meets all of the relevant design requirements, the MRB may authorize its use in the production of a light airplane UAS. Otherwise, the item must be rejected per **7.5**. The manufacturer shall keep a permanent record showing the disposition of non-conforming items that have been evaluated and accepted by the MRB.

7.5 Rejection of Non-Conforming Items—A process for disposing of items found to be unusable due to damage, shelf life limits, or other variations must be defined and implemented. A rejected item must be mutilated, disposed of, or sufficiently marked as rejected to ensure that it is not used in the production of a light airplane UAS. A rejected component may be placed in a reserved holding area for future disposition or disposal.

8. Production Acceptance

NOTE 3—The following criteria should not be construed as requirements for specific features to be included on a fixed wing unmanned aircraft system. When a requirement specifies a feature that does not exist on a light airplane UAS, the requirement does not apply.

8.1 Final Inspections—Manufacturer shall verify and record that a shop order for each light airplane UAS produced has been completed prior to conducting the following Production Acceptance procedures.

8.1.1 Airplane Unmanned Aircraft System (Airplane UAS)—Manufacturer shall verify the proper completion of the production process prior to the further distribution of any

ready-to-fly light airplane UAS. The following ground check and flight test procedures shall be conducted and documented for each ready-to-fly light airplane UAS.

8.1.1.1 *Ground Check*—Prior to flight-testing, the manufacturer shall conduct a thorough ground inspection of each light airplane UAS produced to verify at least the following:

(1) *Weight and Balance*—Empty weight and proper center of gravity location has been calculated and verified to be within limits.

(2) *Systems Check*—The proper function of all switches and circuits, instrumentation, brakes, and any other appropriate systems shall be verified.

(3) *Flight Controls Check*—All flight controls shall be checked for smooth and proper function and proper maximum deflections.

(4) *Engine Check*—Engine checks and procedures shall be performed to verify:

(a) Proper engine installation, (for example, spark ignition or turbine, as appropriate),

(b) Proper servicing of all engine fluids,

(c) No apparent fuel, oil, or coolant leaks, as appropriate,

(d) Propeller installation and pitch adjustment, as applicable,

(e) Performance of an engine “run-in” with adjustments, as required,

(f) Tachometer indicates engine idle RPM and maximum static RPM is within manufacturer’s published limits,

(g) Proper function of engine instrumentation,

(h) Proper function of ignition system(s).

(5) *Placards Check*—The light airplane UAS shall be checked to verify that all placards and switch markings are in place.

(6) *Preflight Inspection*—The following shall be verified:

(a) All required documentation must be available at the control station if it is not possible to store aboard the aircraft.

(b) All visible surfaces are free of deformation, distortion, or other evidence of failure or damage.

(c) Inspection of all visible fittings and connections for defective or insecure attachment.

(d) Complete walk-around inspection in accordance with the AOI.

8.1.1.2 *Taxi Test*—After completion of the Ground Check, a Taxi Test shall be conducted to verify as applicable:

(1) Brake function.

(2) Landing gear tracking and steering.

(3) Proper compass readings, to be verified by a reference, and corrected.

8.1.1.3 *Flight Test*—After completion of the Taxi Test, a flight test shall be conducted.

(1) *Operational Safety Flight Test*—Safe flight operation of each completed light airplane UAS shall be verified, as applicable, to include acceptable handling and control

characteristics, stall characteristics, engine operation, airspeed indications, and overall suitability for normal flight in accordance with the POH. The flight test procedure, at a minimum, shall include recorded verification of the following:

(a) Takeoff runway wind, outside air temperature, and pressure altitude,

(b) Verification that takeoff distance meets manufacturer’s published specification,

(c) Verification that the climb rate meets or exceeds the manufacturers published specification,

(d) Appropriate response to flight controls in all configurations,

(e) Wings-level idle-power stall speed in all configurations, including verification of appropriate stall warning and stall recovery characteristics,

(f) Verification of no unusual performance or handling characteristics, and

(g) Proper engine operating temperatures.

(2) *Design Confirmation Flight Test*—For each completed light airplane UAS, or by random sampling at a frequency determined appropriate by the manufacturer, and for the first production unit off the production line, an in depth test flight shall be conducted to verify production uniformity and to verify design flight characteristics.

8.2 *Instrument Calibration*—Any light airplane UAS instrument requiring periodic calibrations shall have a current calibration.

8.3 *Resolution of Discrepancies*—Manufacturer shall develop and implement a system to correct any anomalies found during ground checks or flight-testing.

8.3.1 *Non-Compliance*—Any light airplane UAS that fails any production acceptance test required by this standard shall be physically tagged as non-compliant. Anomalies shall be reworked per manufactures instructions, and each reworked anomaly must be re-evaluated.

8.3.1.1 *Non-Compliance Tag*—A non-compliance notice must be attached to the aircraft in such a manner that it is in clear view of a potential operator of the light airplane UAS.

8.4 *Production Acceptance Documentation*—A written checklist may be used as an acceptable method of documenting Production Acceptance inspections, checks, and tests.

9. Assignment of QA Duties and Responsibilities

9.1 Light airplane UAS Manufacturers may assign QA duties and responsibilities to outside parties for the purpose of establishing satellite manufacturing, assembly, or distribution facilities, or a combination thereof.

10. Keywords

10.1 light unmanned aircraft system; light unmanned aircraft systems; production acceptance; quality assurance

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