Designation: F3003 – 14

Standard Specification for Quality Assurance of a Small Unmanned Aircraft System (sUAS)[1]

This standard is issued under the fixed designation F3003; 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 standard defines the quality assurance requirements for the design, manufacture, and production of a small unmanned aircraft system (sUAS).

1.2 *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]

F2910 Specification for Design, Construction, and Test of a Small Unmanned Aircraft System (sUAS)

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *manufacturer, n*—entity responsible for assembly and integration of components and subsystems to create a safe operating sUAS. The builder of kit built systems provided by a manufacturer must conform to the manufacturer's assembly and test instructions without deviation in order for that kit built system to meet this standard.

3.1.2 *permanent record, n*—records that shall be kept for each sUAS produced.

3.1.3 *propulsion system, n*—consists of one or more power plants (for example, a combustion engine or an electric motor and, if used, a propeller or rotor) together with the associated installation of fuel system, control and electrical power supply (for example, batteries, electronic speed controls, fuel cells, or other energy supply).

3.1.4 *quality assurance manual, QAM, n*—documentation of the quality assurance program.

3.1.5 *quality assurance program, QAP, n*—method of inspections used by the manufacturer to validate and ensure the proper production thereof.

3.1.6 *quality assurance record, QAR, n*—record of quality assurance associated with each sUAS produced.

3.1.7 *small unmanned aircraft system, sUAS, n*—composed of the small unmanned aircraft (sUA) and all required on-board subsystems, payload, control station, other required off-board subsystems, any required launch and recovery equipment, and command and control (C2) links between the UA and the control station. For purposes of this standard, sUAS is synonymous with a small Remotely Piloted Aircraft System (sRPAS) and sUA is synonymous with a small Remotely Piloted Aircraft (sRPA).

3.1.8 *supplier, n*—any entity engaged in the design and production of components (other than a payload which is not required for safe operation of the sUAS) used on a sUAS.

3.1.8.1 *Discussion*—Where the supplier is not the manufacturer, the supplier can only ensure that the components comply with accepted consensus standards.

3.2 *Shall versus Should versus May*—Use of the word "shall" implies that a procedure or statement is mandatory and must be followed to comply with this standard, "should" implies recommended, and "may" implies optional at the discretion of the supplier, manufacturer, or operator. Since "shall" statements are requirements, they include sufficient detail needed to define compliance (for example, threshold values, test methods, oversight, reference to other standards). "Should" statement are provided as guidance towards the overall goal of improving safety, and could include only subjective statements. "Should" statements also represent parameters that could be used in safety evaluations, and could lead to development of future requirements. "May" statements are provided to clarify acceptability of a specific item or practice, and offer options for satisfying requirements.

4. Applicability

4.1 This standard is written for all sUAS that are permitted to operate over a defined area and in airspace defined by a nation's governing aviation authority (GAA). It is assumed that a visual observer(s) will provide for the sense-and-avoid

[1] This test method 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 Jan. 15, 2014. Published January 2014. DOI: 10.1520/F3003-14.

[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.

requirement to prevent collisions with other aircraft and that the maximum range and altitude at which a sUAS can be flown will be specified by the nation's GAA. Unless otherwise specified by a nation's GAA this standard applies only to UA that have a maximum take off gross weight of 55 lb/25 kg or less.

4.2 If a QA manager of a manufacturer that meets a recognized QA standard (ISO, etc) develops and retains evidence that the provisions of that recognized QA standard meets the spirit and intent of this standard then that QA manager can state that the manufacturer's QA process meets the provisions of this standard. The manufacturer's QA manager shall ensure that supplier's QA processes meet applicable portions of this standard.

5. Quality Assurance Program (QAP)

5.1 Manufacturers of sUAS shall develop a QAP in accordance with the criteria established within this standard.

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

5.3 *Quality Assurance Administration*—The manufacturer's administration charged with the implementation of the QAP may consist of one or more company employees, company officials, or manufacturer's agents or assigns. The individuals or entities that make up the quality assurance administration shall be identified within the QAM. The QAP methodology and any quality requirements flowing down to suppliers shall be documented in the QAM.

5.4 *Quality Assurance Record (QAR)*—A record shall be maintained of the date of acceptance and the origin of materials used in the production of system components considered by the manufacturer to be required for the safe operation of their sUAS (see Note 1 and 5.4.1).

NOTE 1—The intent of this record is to provide a means for the manufacturer to identify and reduce the number of sUAS 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.

5.4.1 The manufacturer shall maintain a QAR for each sUAS 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 manufacturer's Record of Compliance.

5.4.1.3 The configuration of each sUAS at its point of delivery (for continued operational safety monitoring purposes), including associated parts lists, installed equipment lists, software version/versions, and a listing of all engineering changes and any deviations from the initial as designed/as tested configuration.

NOTE 2—Each item listed in 5.4.1 shall include the sUAS 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*—The manufacturer shall conduct a biennial (every two years) audit of their QAP and maintain a record of all such audits. Any determination of noncompliance 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 for a particular configuration.

6.2 *Configuration Control*—All sUAS 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 to both manufacturing material, or assembly processes, or both. Production documentation shall include, but is not limited to, the following:

6.3.1 Parts lists,

6.3.2 Process sheets/routings,

6.3.3 Component and assembly drawings,

6.3.4 Manufacturing instructions and specifications,

6.3.5 Tooling and gauge drawings,

6.3.6 Software,

6.3.7 Tooling and test equipment calibration documentation, and

6.3.8 Manufacturing material tests.

6.4 *Special Processes*—A system shall be implemented to control all special processes and services related to the production of airframe components considered by the manufacturer to be critical to the structural integrity of the sUAS, such as welding, brazing, heat treatment, plating, structural composites, adhesive bonding, and others appropriate to the sUAS design, that ensures that each process and service is performed in accordance with approved specifications containing definitive standards of quality. Required periodic inspection or calibration, or both, of tooling, gauges, solutions, or any critical equipment used in special processes related to the production of sUAS shall be documented.

7. QA Inspections

7.1 Manufacturers shall implement and document in the QAP a system of inspections to validate conformity of product to all applicable engineering requirements and production specifications.

7.1.1 Conforming, nonconforming, and items awaiting inspection shall be segregated or clearly distinguishable. Items found to be nonconforming shall either be evaluated by a Materials Review Board (MRB) per 7.3 or rejected per 7.4.

7.2 *Receiving Inspection*—The manufacturer shall implement a purchasing procedure that shall ensure all items ordered are clearly specified. Incoming items provided by outside vendors shall be inspected for conformity to applicable specifications or production documentation or both. A record of such acceptance, to include the person accepting the material, shall be included in the permanent record.

7.3 *Evaluation of Nonconforming Items by a Materials Review Board*—A Materials Review Board (MRB) shall be established to determine the disposition of items that do not conform to all applicable engineering requirements and production specifications (nonconforming 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, or a use "as is" determination assures that an item meets all of the relevant design requirements, the MRB may authorize its use in the production of a sUAS. Otherwise, the item shall be rejected.

7.4 The manufacturer shall keep a permanent record showing the disposition of nonconforming items that have been evaluated and accepted by the MRB. The QAR shall document the use of any nonconforming material.

7.5 *Rejection of Nonconforming Items*—A process for disposing of items found to be unusable due to damage, shelf life limits, or other variations shall be defined and implemented. A rejected item shall be mutilated, disposed of, or sufficiently marked as rejected to ensure that it is not used in the production of a sUAS. A rejected item may be secured in a reserved holding area for future disposition or disposal.

8. Production Acceptance

8.1 *Final Inspections*—The manufacturer shall verify and record that the QAR up to the point of acceptance testing is current for each sUAS produced prior to conducting the following production acceptance procedures.

8.2 *Final Testing*—The manufacturer shall validate the proper completion of any ready to fly sUAS by conducting a final system test in accordance with the requirements of Specification F2910.

8.3 *Instrument Calibration*—Any sUAS instrument requiring periodic calibrations shall have a calibration with traceability to a documented requirement (including currency) or tolerance. Tools or test equipment (pitot/static tester, compass, and so forth) used to calibrate a sUAS instrument, as well as all test equipment, should be documented and calibrated with traceability to a recognized standard.

8.4 *Resolution of Discrepancies*—The manufacturer shall develop and implement a system to correct any anomalies found during ground checks or flight testing and be documented in the QAP.

8.4.1 *Noncompliance*—Any sUAS that fails any production acceptance test required by this practice shall be physically tagged as noncompliant. Anomalies shall be reworked per manufacturer's instructions and each reworked anomaly shall be reevaluated.

8.4.2 *Noncompliance Tag*—A noncompliance notice shall be attached to the aircraft in such a manner that it is in clear view of a potential operator of the sUAS.

8.5 *Production Acceptance Documentation*—A written checklist may be used as an acceptable method of documenting production acceptance inspections, checks, and tests and shall be included in the QAR for each sUAS if one is used.

9. Assignment of QA Duties and Responsibilities

9.1 Duties for all QA representatives shall be documented and specify responsibilities and levels of authority.

9.2 sUAS 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. Any such assignment shall be documented in the QAP.

9.3 sUAS manufacturers shall establish training and evaluation programs for all personnel assigned QA duties and responsibilities.

9.4 The manufacturer shall take appropriate steps to ensure that persons performing the QA representative role can provide independent input on product conformity to the manufacturer's senior management.

10. Keywords

10.1 production acceptance; quality assurance; QA; small unmanned aircraft system; sUAS