Designation: F3450 – 20

Standard Guide for Flight Hazard and Surveillance Systems Personnel Certification[1]

This standard is issued under the fixed designation F3450; 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 The purpose of this guide is to address the basic fundamental subject knowledge activities and functions for avionics professionals to be titled Flight Hazard and Surveillance Systems (FHSS) Technicians.

1.2 This guide does not cover weather detection and avoidance systems. These systems will be addressed in a future Aircraft Electronics Technician (AET) endorsement standard.

1.3 This guide is the basis for the FHSS certification, an endorsement to the AET certification. Candidates must be a certified AET to take the certification exam associated with this guide.

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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

F3060 Terminology for Aircraft

F3245 Guide for Aircraft Electronics Technician Personnel Certification

2.2 *FAA Documents:*[3]

AC43.13-1B Acceptable Methods, Techniques, and Practices – Aircraft Inspection and Repair

AC43.13-2B Acceptable Methods, Techniques, and Practices – Aircraft Alterations

FAA Federal Aviation Regulations for Aviation Maintenance Technicians

FAA-H-8083-30 Aviation Maintenance Technician Handbook – General

FAA-H-8083-30 Aviation Maintenance Technician Handbook – Airframe Volume 1

FAA-H-8083-30 Aviation Maintenance Technician Handbook – Airframe Volume 2

3. Terminology

3.1 See Terminology F3060.

3.2 See Table 1 for knowledge level definitions relating to the education requirements for FHSS professionals.

4. Significance and Use

4.1 The guide is intended to be used to assess competencies of qualified individuals who wish to become certified as an FHSS technician through a certification program.

4.2 The guide is intended to be used in concert with a certification provider's structure and materials for management, exam delivery, and candidate preparation.

5. Test Knowledge Requirements

5.1 The following subject knowledge areas shall be assessed by levels (referenced in Table 1) of competency in the exam items.

5.2 *Risk Management*—LEVEL 1 AET understands and can apply the following:

5.2.1 *Safety*—See Guide F3245, Section 6, Core Competencies – Common Maintenance Practices, Fundamentals of On-Equipment Maintenance, and Aircraft Fundamentals.

5.2.2 *Operational Considerations:*

5.2.2.1 Radio frequency (RF) transmission power levels and safety of aircraft maintenance personnel.

5.2.2.2 Regulatory requirements and limitations related to ground testing of aircraft systems.

[1] This guide is under the jurisdiction of ASTM Committee F46 on Aerospace Personnel and is the direct responsibility of Subcommittee F46.02 on Avionics and Information Technology Endorsements.

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[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 Federal Aviation Administration (FAA), 800 Independence Ave., SW, Washington, DC 20591, http://www.faa.gov.

TABLE 1 Knowledge Level Definitions

Definition: Knowledge Levels	
LEVEL 1	A familiarization with the principal elements of the subject. Objectives: • The applicant should be familiar with the basic elements of the subject. • The applicant should be able to give a simple description of the whole subject, using common words and examples. • The applicant should be able to locate methods, procedures, instructions, and reference material. • The applicant should be able to use typical terms.
LEVEL 2	A general knowledge of the theoretical and practical aspects of the subject and an ability to apply that knowledge in a practical manner. Objectives: • The applicant should be able to understand the theoretical fundamentals of the subject. • The applicant should be able to find and interpret maintenance data and information. • The applicant should be able to give a general description of the subject using, as appropriate, typical examples. • The applicant should be able to use mathematical formulae in conjunction with physical laws describing the subject. • The applicant should be able to read and understand sketches, drawings, and schematics describing the subject. • The applicant should be able to apply their knowledge in a practical manner using detailed procedures.
LEVEL 3	A detailed knowledge of the theoretical and practical aspects of the subject. To know, understand, and apply facts, principles, theories, and concepts. To know, understand, and apply facts, principles, theories, and concepts. A capacity to combine and apply the separate elements of knowledge in a logical and comprehensive manner. Objectives: • The applicant should know the theory of the subject and interrelationships with other subjects. • The applicant should be able to give a detailed description of the subject using theoretical fundamentals and specific examples. • The applicant should understand and be able to use mathematical formulae related to the subject. • The applicant should be able to read, understand, and prepare sketches, simple drawings, and schematics describing the subject. • The applicant should be able to apply their knowledge in a practical manner using manufacturer's instructions or other acceptable data. • The applicant should be able to interpret results from various sources and measurements and apply corrective action where appropriate. • The applicant should be able to perform all skill operations to a return-to-service standard using appropriate data, tools, and equipment. • The applicant should be able to perform inspections in accordance with acceptable or approved data.

5.3 *Transponder and Automatic Dependent Surveillance-Broadcast (ADS-B) Systems:*

5.3.1 *General*—LEVEL 1 AET understands and can explain the following:

5.3.1.1 *Purpose*—Allows Air Traffic Control (ATC) personnel to monitor aircraft movement and operational status of an aircraft through an interrogation method where a ground radar system interrogates the transponder of the aircraft and receives replies from the transponder.

5.3.1.2 *Function/Use:*

(1) The transponder system provides control methods for pilot input of squawk code and selection of mode of operation.

(2) The transponder system interfaces with the aircraft's altitude sensing system for pressure altitude information.

(3) The transponder system replies to interrogations from Air Traffic Control Radio Beacon System (ATCRBS) or other aircraft to report the aircraft's squawk code (Mode A), altitude (Mode C), aircraft identification information (Mode S), and broadcast precise flight information including Global Positioning System (GPS) latitude/longitude (Mode ES – Extended Squitter).

(4) The transponder system uses Side-Lobe Suppression (SLS) to prevent replies to interrogation pulses other than the primary P1 pulse.

5.3.1.3 *Common Test Equipment:*

(1) Transponder Test Set.

5.3.2 *System Components*—LEVEL 1 AET can identify and describe the following:

5.3.2.1 Control Panel,

5.3.2.2 Receiver/Transmitter (R/T) unit,

5.3.2.3 Antennas, and

5.3.2.4 Altitude Source.

5.3.3 *Integration*—LEVEL 2 AET understands and can explain the following:

5.3.3.1 The transponder system interfaces to the aircraft's altitude sensing system for aircraft altitude (Mode C), which may include any of the following aircraft systems:

(1) Encoding Altimeter,

(2) Remote (Blind) Altitude Encoder,

(3) Air Data Computer (ADC), and

(4) Air Data and Attitude Heading Reference System (ADAHRS).

5.3.3.2 The transponder system may interface to the aircraft's navigation system for GPS or heading information (Mode ES – Extended Squitter), or both, which may include any of the following aircraft systems:

(1) Attitude Heading Reference System (AHRS),

(2) GPS Navigation System, and

(3) Built-in GPS receiver.

5.3.3.3 The transponder system may interface to a navigation/moving map such as a Multi-Function Display (MFD) for the display of received traffic or weather information, or both.

5.3.3.4 *Inputs:*

(1) Identification (IDENT) to enable constant transponder replies for specified duration.

(2) Weight-on-Wheels (WOW)/Squat Switch or equivalent airspeed switch input to determine if the aircraft is on-ground or in-flight.

(3) L-Band Suppression to prevent the transponder from replying to other L-Band systems on the aircraft.

(4) Altitude, which could be received in any of the following formats:

(a) Gillham Code,

(b) RS-232 Databus, and

(c) ARINC 429 Databus.

5.3.3.5 *Outputs:*

(1) L-Band Suppression to prevent other L-Band systems on the aircraft from receiving the transponder's replies to ATC interrogations.

5.3.4 *System Testing*—LEVEL 2 AET understands and can demonstrate the following:

5.3.4.1 General system testing to include any of the following methods:

(1) Built-In Test Equipment (BITE);

(2) Function testing to include mode selection, squawk code selection, and IDENT; and

(3) Integration testing to verify altitude information.

5.3.4.2 Periodic operation check in accordance with regulatory requirements and guidance, which typically includes the following checks:

(1) Radio Reply Frequency,

(2) SLS,

(3) Receiver Sensitivity,

(4) RF Peak Output Power,

(5) Mode S Diversity Transmission Channel Isolation,

(6) Mode S Address,

(7) Mode S Formats,

(8) Mode S All-Call Interrogations,

(9) ATCRBS-only All-Call Interrogation, and

(10) Squitter.

5.3.5 *Configuration Management*—LEVEL 2 AET understands and can demonstrate the following:

5.3.5.1 Accessing configuration and maintenance functions to include any of the following methods:

(1) On-screen maintenance and configuration,

(2) Onboard Maintenance System (OMS) access, and

(3) Maintenance Computer (MPC).

5.3.5.2 Configuration of integration settings:

(1) Hardwire strapping, and

(2) Software selection.

5.3.5.3 Configuration of aircraft identification settings.

5.3.5.4 Backup of configuration settings.

5.4 *Traffic Collision-Avoidance and Alerting System (TCAS):*

5.4.1 *General*—LEVEL 1 AET understands and can explain the following:

5.4.1.1 *Purpose*—Provides active surveillance of surrounding transponder-equipped aircraft and performs collision threat calculations to alert the pilot of a potential flight hazard.

5.4.1.2 *Function/Use:*

(1) The TCAS actively interrogates the transponders of surrounding aircraft and receives replies from those aircraft.

(2) The TCAS interfaces with the aircraft's altitude sensing/reporting system for pressure altitude information.

(3) The TCAS uses the replies from other aircraft, along with own-aircraft altitude, to calculate the bearing, range, and altitude separation of each intruder aircraft.

(4) The TCAS calculates the threat of collision for each intruder aircraft and provides aural and visual alerts to the flight crew of any imminent flight hazard.

(5) TCAS have varying levels of functionality often associated with the use of an acronym correlating to the systems functionality, which may include Traffic Advisory System (TAS), Traffic Information System – A (TIS-A), Traffic Information System – B (TIS-B), Traffic Collision-Avoidance and Alerting System – I (TCAS-I), Traffic Collision-Avoidance and Alerting System – II (TCAS-II), or Airborne Collision Avoidance System – II (ACAS-II).

5.4.1.3 *Common Test Equipment:*

(1) TCAS Ramp Generator.

5.4.2 *System Components*—LEVEL 1 AET can identify and describe the following:

5.4.2.1 Dedicated control unit,

5.4.2.2 Dedicated display unit,

5.4.2.3 Control/Display Unit (CDU),

5.4.2.4 R/T unit, and

5.4.2.5 Antennas:

(1) Directional antenna, and

(2) Omni-directional antenna.

5.4.3 *Integration*—LEVEL 2 AET understands and can explain the following:

5.4.3.1 The TCAS interfaces to the aircraft's altitude sensing/reporting system for aircraft altitude, which may include any of the following aircraft systems:

(1) Encoding Altimeter,

(2) Remote (Blind) Altitude Encoder,

(3) ADC, and

(4) ADAHRS.

5.4.3.2 *Inputs:*

(1) WOW/Squat Switch or equivalent airspeed switch input to determine if the aircraft is on-ground or in-flight.

(2) L-Band Suppression to prevent the TCAS from receiving own-aircraft transponder replies.

(3) Altitude, which could be received in any of the following formats:

(a) Gillham Code,

(b) RS-232 Databus, and

(c) ARINC 429 Databus.

(4) Audio Suppression to prevent the TCAS from generating audio alerts when higher-priority alerting systems are producing an active audio alert.

(5) Heading from a slaved compass system or AHRS.

5.4.3.3 *Outputs:*

(1) Audio Suppression to prevent other lower-priority alerting systems from generating an audio alert when the TCAS is producing an active audio alert.

(2) L-Band Suppression to prevent own-aircraft transponder from replying to TCAS interrogations.

(3) Discrete logic signals to enable visual alerts of the presence of collision threats

(4) Resolution Advisory (RA) to indicate a recommended maneuver to avoid an imminent collision (TCAS-II and ACAS-II only).

(5) Traffic display information typically in the form of a digital databus.