Designation: F2849 – 10

Standard Practice for Handling of Unmanned Aircraft Systems at Divert Airfields[1]

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1. Scope

1.1 This practice identifies and describes equipage and procedures for safely handling unmanned aircraft forced to recover at alternate or diversionary airfields where personnel trained in recovering that type of aircraft may not be present. It is intended to apply to fixed-wing unmanned aircraft conducting non-visual line-of-sight operations. It is intended to establish common locations, labeling, and functions of equipment necessary to safely power down the aircraft without damaging it and common procedures for untrained personnel to follow to contact the owner of the aircraft. It addresses mission planning procedures, automated functions, and manual functions/handling procedures in the preflight, in-flight, and post-flight phases, respectively.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

F2395 Terminology for Unmanned Aircraft Systems

2.2 *Other Standard:*[3]

ICAO Annex 1, Chapter 1

3. Significance and Use

3.1 This practice is written to preclude damage or injury to property and personnel in the event of an unplanned landing by an unmanned aircraft at an airfield not equipped or trained to handle that type of aircraft and to prevent unintentional damage to the aircraft once it lands. It is intended for use by unmanned aircraft equipment designers, procedures developers, and ground personnel.

4. Mission Planning Procedures

4.1 If mission requirements allow, alternate or divert airfields shall be planned within gliding distance of any point along the planned route of flight. This is dependent upon a number of factors including—but not limited to—geographic location of flight operations (for example, austere operating environment or maritime operations with few available airfields) and mission flight profile. If mission planning and divert airfield accommodations are in conflict, mission requirements shall take priority over divert airfield planning.

4.2 Gliding distance is defined as aircraft altitude above ground level (absolute altitude minus 1000 ft for pattern altitude) times its lift to drag ratio (L/D). Zero wind, all engines out, and 50 % fuel onboard are assumed. Aircraft configuration (for example, stores on wings) should be taken into account when determining the L/D ratio to be used for a flight segment.

4.3 Selected airfields shall be capable (for example, runway length, width, bearing strength) of accommodating recovery of the aircraft in its planned configuration.

4.4 Contact information for the alternate airfields shall be updated and made available to the pilot for use during flight.

5. Automated Functions

5.1 At a minimum, the aircraft shall be able to recognize and report the condition of not being capable of maintaining level flight at its mission altitude or at a reduced altitude (that is, sink rate at reduced or full power). This condition shall trigger the aircraft's flight control computer to enter a "divert mode" (that is, a subset of its contingency mode) of functioning. Exceptional conditions where a sink rate exists at full power under normal operating conditions, for example, when encountering mountain wave effects, should also be recognizable. There may be other contingencies such as environmental conditions, system-specific issue, or other factors which trigger the divert mode as well. This is only meant to describe a minimum level of automated functions.

5.2 In divert mode, the aircraft shall automatically *(1)* squawk a predetermined code, *(2)* safe any weapons being carried, *(3)* cease any potentially hazardous emissions to ground personnel unless doing so compromises aircraft safety prior to landing, *(4)* notify via the command and control link the intended alternate airfield to the pilot in command at the ground control station (if the link is still available), and *(5)* disable or destroy any encryption devices as needed once the aircraft has landed and come to a complete stop. The pilot in

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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 International Civil Aviation Organization (ICAO), 999 University Street, Montréal, Quebec H3C 5H7, Canada.

command shall contact the selected airfield to alert them of his inbound aircraft and its emergency.

6. Manual Functions

6.1 The aircraft shall have a panel with standard markings of 'GROUND ACCESS PANEL' which contains the controls and instructions for ground crew to use to *(1)* stop the engine(s) if the aircraft has not already done so automatically, *(2)* move the aircraft (to include information such as hooking up a tow bar, setting/releasing brakes, and using tie-downs), and *(3)* notify the aircraft owner/operator. The panel may be either a designated area on the aircraft with all controls and information mounted externally or consist of an actual enclosed area with a functioning panel secured with standard aircraft external panel fasteners for ease of opening.

6.2 The ground control panel shall be located on the left side of the fuselage at eye level on aircraft measuring more than 1 m from the runway to top of fuselage with landing gear extended or on top of the fuselage on aircraft measuring 1 meter or less from the runway to top of fuselage with landing gear extended. The location shall be outside of the propeller arc(s), the vicinity of engine inlet or exhaust, and any zones posing an emissions hazard to personnel even if deactivated (for example, radar, hydrazine vents).

6.3 The ground control panel shall contain a red, covered shutoff switch labeled "EMERGENCY SHUTDOWN" which shuts down the engine and de-energizes any/all power sources and powered devices when activated.

6.4 If the aircraft carries weapons, the ground control panel shall address how to safe the weapons on the ground and prevent removal/rearming of them by unauthorized ground personnel.

6.5 The ground control panel shall contain basic instructions for basic instructions for using ground equipment to tow or move the aircraft without damaging it.

6.6 The ground control panel shall contain contact information (for example, international telephone number, email address) for the aircraft owner/operator and any other relevant information.

6.7 All writing (for example, labels, instructions) in the ground control panel shall be in English in accordance with ICAO Annex 1, Chapter 1, paragraph 1.2.9. Where space permits and when applicable, it is recommended that writing in the predominant local language also be included. Also where space permits, it is recommended that instructions for functions outlined in 6.3-6.6 be provided on electronic media (for example, USB Flash Drive, CD-ROM) stored inside the ground control panel. The media should be in a widely accepted format (for example, Microsoft Windows), labeled as such, and loaded with a single PDF file in the root directory that contains all instructions.

7. Keywords

7.1 airfield; contingency; divert; landing; UAS; unmanned aircraft systems