Standard Change

Exchange of XPDR to a Mode S Device

I. PURPOSE AND SCOPE

This document specifies the necessary materials and tools as well as the procedures to be applied for the exchange of an existing Secondary Surveillance Radar (SSR) transponder (XPDR) by a Non-Diversity Mode S transponder for Elementary Surveillance (ELS).

II. BACKGROUND

Conventional SSR systems (Mode A/C) employ technical principles which were originally developed more than 50 years ago. In the meantime, the Air Traffic Control (ATC) operational environment has changed significantly. In the airspace above Core-Europe where the air traffic density is at its highest, the capability of the ATC system was seen to be approaching the capacity that its technical infrastructure could support. To facilitate continued growth in air-traffic the SSR Mode S technology - which is the successor to Mode A/C - was developed. In order to gain operational benefit from Mode S technology, carriage of such equipment has been mandated for most parts of European airspace. Elementary Surveillance (ELS) is the minimum Standard defined by EASA CS.ACNS.ELS for Mode S installations on small airplane or helicopters. In order to facilitate future surveillance options basing on Automatic Dependent Surveillance Broadcast (ADS-B), it makes sense to also be compliant with CS.ACNS.ADS.

III. SAFETY CONSIDERATIONS

All technical measures concerning this change must be carried out by personnel licensed and sufficiently type rated by EASA in accordance with Commission Regulation (EC) 2042/2003, Part-66 (or equivalent). It is the obligation of the installer to ensure that interrelationship between this modification and any other previously installed modifications and/or repairs will not introduce adverse effects upon the airworthiness of the product.

IV. APPLICABILITY / ELIGIBILITY

This Standard Change is applicable to EASA certified ELA 1/2 aircraft/rotorcraft according to Commission Regulation (EC) 948/2012, Part-21, § 21A.90B (a) 1 (iii). Aircraft subject to Enhanced Surveillance (EHS) or antenna diversity are excluded.

V. CONDITIONS

Aircraft to be modified as described in this Standard Change must be non-pressurized and already equipped with an approved Mode A, C, or S transponder.

There are still some aircraft in operation with no transponder installed. However, there might be approved data available for a XPDR installation on the type and model (or similar model) of the aircraft to be modified. If the installer has legally access to these data, the aircraft can be deemed already XPDR equipped which also makes and this standard change applicable.

VI. LIMITATIONS

None

VII. PRE-INSTALLATION JUSTIFICATION AND PLANNING

1. Compilation of Technical Data

Prepare a project folder (on paper or electronically). This folder must include *all* those *parts* of the technical data listed below, *necessary* for this change. It must also include all data (e.g. wire diagrams, drawings, calculations or test results) produced in the frame of this change.

Define and collect the technical data necessary for this project.

[0] This document with completed Flight Manual Supplement template (annexed)

[1] EASA CS.ACNS.ELS

[2] EASA CS.ACNS.ADS

[3] FAA AC-43.13-1B (applicable parts, only)

[4] FAA AC-43.13-2B (applicable parts, only)

[5] USA: 14CFR FAR-43 Appendix F

[6] Aircraft Manual Maintenance Manual and/or Illustrated Parts Catalog

(applicable pages/drawings, only)

[7] Declaration of Design and Performance (DDP) or equivalent technical specifications of the devices to be installed

[8] Installation-, operation- and maintenance- manuals of the devices to be installed

[9] Additional other EASA or FAA Guidance material, basic technical handbooks (if necessary)

Always use the latest issue/revision of the above listed material.

2. Development of an Installation Plan

Define and list the equipment parts and components necessary for this project in an Equipment and Materials List. It is essential for all installed items and the installation in total that the following requirements are fulfilled. Components which are not suitable for this purpose must not become part of the Equipment and Materials List.

Check that the new XPDR is authorized according to ETSO-(2)C112(). Make sure that the new transponder will fit into the mounting provisions of the existing one without major structure modifications. The weight of the new XPDR must be similar or lower than the weight of the old one. The electrical power consumption of the new device must be similar or lower than for the old unit. Investigate the XPDRs technical data ensure that it fulfills the minimum requirements of [1] and - if ADS-B support is intended – [2]. Also check RTCA DO-160() test classes of the new XPDR for suitability for the aircraft, the mounting position and the expected operating conditions (e.g. temperature, pressure, vibration).

Investigate the existing transponder installation including antenna, altitude sources, cables, switches, circuit breakers etc. If parts of it are not compatible with the new XPDR or not technically mature enough, these parts must be replaced. For replacement use parts and components listed in [8]. Antenna positions must be kept as they are. A new antenna must utilize the same physical principle as the original one and be installed in accordance with [8] respectively [4] chapter 3. If wire replacement is necessary, use wire types in accordance with [8] respectively [3] chapter 11 section 6 and 7.

For the antenna connection, a wire with similar or less attenuation than previously installed is required (e. g RG-142, -223, -393).Never use PVC wires like RG-58 or other wires which may contribute significantly to propagation of a fire.

After completion of the List of Equipment Parts and Components, draw a wiring diagram including all newly installed parts and components as well as all interfaces to existing aircraft systems. Furthermore a Schematic Installation Drawing basing on [5] showing the location of all these items is required. Locations for components as well as wire routings and interconnections must meet the requirements of [1] (and [2] if necessary). They should not be changed more than necessary.

Perform a weight and balance and an electrical load analysis using the templates prescribed in CS-Standard Changes chapter I. C.

Contact the aviation authority of the state registry to obtain an ICAO 24-bit aircraft address. If there is already a 406 MHz ELT installed, that address should be already known and found to be programmed into the ELT.

The following documents need to be added to the project folder:

[10] Equipment and Materials List

[11] Wiring Diagram

[12] Schematic Installation Drawing

[13] Weight & Balance Calculation

[14] Electrical Load Analysis

[15] Allocation of ICAO 24-bit Aircraft Address

VIII. INSTALLATION INSTRUCTIONS

All kind of work must be carried out according to the general guidance given by [3] and [4]. As a first step all equipment parts and components to be installed must be visually inspected for defects, omissions, completeness and correctness of labels and equipment approvals.

Remove the previously installed XPDR and those parts of the installation which are not compatible with the new XPDR or not technically mature enough.

Install the new transponder according to [8] as well as [11] and [12]. Program the ICAO 24-bit aircraft address as well as other configuration data into the transponder. If an Aircraft Identification (Flight-Id) can be pre-programmed, use the aircraft registration (left aligned without dashes or blanks).

IX. INSTALLATION TESTS

1. General Testing Considerations

All Tests must be carried out using automatic or semiautomatic State-of-the-Art test equipment. The test equipment must be current concerning inspections and calibrations. The results are to be documented in a Ground Test Report which must be stored in the project folder. For the Ground Test Report the templates given in CS-Standard Changes chapter I. C must be used. If there are additional necessary tests (and maybe additional templates) defined by [8] they must be attached. As an alternative, printouts from the test equipment are acceptable if all results requested by the templates are available.

2. Considerations for Transponder Testing

When not in use, ensure all transponders are selected to ‘OFF’ or ‘Standby’. In between testing, i.e. to transition from one altitude to another, select the transponder to ‘Standby’ mode.

Before starting any test, contact the local Air Traffic Control Unit (ATC) and advise them of your intention to conduct XPDR testing. Advise ATC of your start time and test duration. Also inform them of the altitude(s) at which you will be testing, your intended Aircraft Identification (Flight -d) and your intended Mode A code.

Set the Mode A code to 7776 (or other Mode A code agreed with ATC). Set the Aircraft Identification (Flight Id) with the first 8 characters of the company name. This is the name of the company conducting the tests. Set the on-the-ground status for all Mode S replies, except when an airborne reply is required (e.g. for altitude testing).

Where possible, perform the testing inside a hanger to take advantage of any shielding properties it may provide. As a precaution, use antenna transmission covers whether or not testing is performed inside or outside. When testing the altitude (Mode C or S) parameter, radiate directly into the ramp test set via the prescribed attenuator.

If testing transponder parameters other than ‘altitude’, set altitude to -1000 feet (minus 1000 feet), or over 60000 feet. This will minimize the possibility of nuisance ACAS warning to airfield and overlying aircraft.

3. Ground Tests to be carried out

Testing for correct functionality shall include at least the items required by the templates.

Perform an installation test according to [5] and [8].

Perform an Electromagnetic Interference (EMI) Test.

Perform a compass swing test

The following documents need to be added to the project folder:

[16] Ground Test Report

[17] EMI Test Report

[18] Compass Swing Test Report

X. MANUALS

1. Flight Manual

Complete the attached Flight Manual Supplement template and add a copy of the document to the basic flight manual of the aircraft. Also update its equipment list and its weight & balance data.

2. Maintenance Manual

Compile a Maintenance Manual Supplement consisting of [10], [11], [12] and those parts of [8] describing required scheduled maintenance activities or defining maintenance as on condition, only. Mark it with the aircraft serial number of the aircraft. Add these data to the Maintenance Manual of the aircraft.

XI. RECORDS

Make sure that all above mentioned documents having numbers in rectangular brackets are in the project folder. For repetitive changes carried out by the same installer, only documents specific to the particular aircraft need to be stored. In such cases a clear reference to the first project of this kind must be made. These data must be kept readily available at the installer’s site for at least 8 years.

Make sure that the Flight Manual and the Maintenance Manual have been updated and enhanced as described above.

XII. RELEASE TO SERVICE

Add a special entry in the Release to Service Form:

“This change is EASA approved according to CS-Standard Changes,

Standard Change No. IV.A-2.”

Approved
Aircraft / Rotorcraft
Flight Manual Supplement

Installation of a Mode S Transponder

<Name of the equipment manufacturer and the equipment>

in

<Aircraft/Rotorcraft manufacturer, type, model, *according to EASA list)>*

Serial No.: ……..

This Flight Manual Supplement is approved by EASA together with CS-Standard Changes, Standard Change No. IV.A-2.

<Remove "Aircraft" or "Rotorcraft" as required.>

Section I: General

This Flight Manual Supplement describes the installed Non-Diversity Mode S Transponder compliant with the requirements of Elementary Surveillance (ELS) as defined for European Airspace.

Installed Equipment:

<List the installed equipment by stating the name of the manufacturer, the equipment and its part number. >

Optional Functionalities	**enabled**	**disabled**
ADS-B out		
TIS (may be not available in particular airspace)		
Automatic GND/FLT Switching		

Section II: Limitations

No change to basic flight manual.

Section III: Normal Procedures

Detailed procedures for normal operation can be found in the Pilots/Operators Guide from the equipment manufacturer.

<Add title part number and the current revision with the statement “or later revisions”.>

Section IV: Abnormal Procedures

No change to basic flight manual.

Section V: Emergency Procedures

No change to basic flight manual.

Section VI: Performance

No change to basic flight manual.

Section VII: Weight and Balance

Refer to the current weight and balance sheet of the aircraft.

Section VIII: System Description

A detailed technical description of the installed equipment can be found in the above mentioned Pilots/Operators Guide from the equipment manufacturer.