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1. ADS-B

1.1. UNDERSTANDING WHAT IS ADS-B

ADS-B is a broadcast surveillance system with air-to-ground (aircraft to ATS) and air-to-air (aircraft to aircraft) applications. ADS-B avionics broadcast identification, position, altitude, velocity and other data automatically about every half a second.

The system “depends” on other aircraft systems, like a barometric encoder and global navigation satellite system (GNSS) equipment for the data. ADS-B ground station equipment comprises a receiver unit, an antenna and a site monitor. This line-of-sight surveillance coverage is above 30,000ft, as well as significant coverage at lower levels.

ADS-B is independent of radar and TCAS, although several modern SSR transponders are capable of transmitting both SSR and ADS-B data. Stand-alone ADS-B avionics with no transponder functionality also are available.

ADS-Broadcast is an application of the transponder Mode S, as such; this application is hosted by the transponder. ADS-B reports data by broadcasting. It means that only a Mode S receiver is needed to collect broadcasted data. It does not require any Datalink. Since ADS-B uses the transponder aerial, the range is limited to about 120 NM, therefore when in VHF coverage. ADS-B makes the link with any ATC centers or aircrafts in the vicinity, equipped with an ADS-B receiver capable to pick up broadcasted data.

1.2. REQUIRED AIRCRAFT EQUIPMENT

Presently the equipment required for ADS-B operation is a Transponder with Mode S capability. All Etihad Airways carry this equipment as a mandatory MEL item.

1.3. USING ADS-B

ADS-B systems typically broadcast two means of identifying the transmitting aircraft. The first is the aircraft address (also known as the 24-bit code) and the second is the flight identification (FLTID) – the visual equivalent of a callsign – used to identify targets on a display and link them to their flight plans.

1.3.1. Aircraft address

Each aircraft has a unique aircraft address, which consists of a 24 bit code allocated by CASA. This code is usually entered into the unit by a LAME at installation and may be expressed in either binary or hexadecimal format.

1.3.2. Flight identification

The flight identification (FLTID) is the equivalent of the aircraft callsign and is used in both ADS-B and Mode S SSR technology.
Up to seven characters long and shall be set by the flight crew via a cockpit interface. It enables ATS to identify an aircraft on a display and to correlate a radar or ADS-B track with the flight plan data.

To allow correlation of a FLTID to a flight plan, the FLTID must match the Aircraft Identification (ACID) entered in Item 7 of the Flight Notification. Intuitive correlation between an aircraft's FLTID and radiotelephony callsign enhances situational awareness and communication. Therefore it is imperative that flight crew use the three-letter ICAO airline code used in flight plans, not the two-letter IATA codes.

Note: If you enter either of these codes incorrectly, ATC might not be able to see your aircraft, or might confuse it with another. You could also affect other systems, like TCAS. The codes are flight critical information, so enter them carefully.

1.3.3. Setting the FLTID

The FLTID is the flight number callsign that is extracted from the flightplan which shall be used in the FMS/MCDU.

The callsign for Etihad Airways dictates the option below;

The flight number using the ICAO three-letter designator when a flight number callsign is being used (e.g. ETD123
for ETIHAD 123).

Note: Don't add any leading zeros, hyphens, dashes or spaces to the FLTID.

Sometimes an aircraft may need to use an aircraft identification and callsign other than that corresponding to the FLTID. Air Traffic
Control may approve or direct the use of an alternative FLTID.

1.3.4. Flight planning and ATC displays

The designators currently available on flight plans for surveillance equipment are N (None), A (SSR Mode A), C (SSR Mode A/C), S (SSR Mode S) and D (ADS-C, which is different from ADS-B). AS there are no immediate provision on flight plan forms to indicate specific ADS-B equipment. If your aircraft is equipped, and you are ready to use ADS-B in the air, put notification of ADS-B capability in field 18 as RMK/ADSB. Because the FLTID is the same as the ACID (aircraft identification) used on the flight plan, there is no need to record it separately on the flight plan.

1.3.5. RMK/ADSB Flight Notification Procedures

Operators who meet the Australian requirements for ADS-B operations must indicate ADS-B capability in the flight notification (ATS flight plan) of all approved ADS-B equipped aircraft. This is indicated by entering the letters "ADSB" as the first element following RMK/ in Item 18 of the ATS flight plan, see the examples below;

Example:
(FPL-ABC123-IS
- A332/M-SDHIRWZ/S
- Y SSY0105
- N0453F370 DCT SY H185 ENTRA Y245 BANDA H185 CG/N0452F360 Q69 ITIDE DCT HBA DCT
- N0453F370 DCT SY H185 ENTRA Y245 BANDA H185 CG/N0452F360 Q69 ITIDE DCT HBA DCT
- YHBA0116
- EET/ YBBB0009 REG/VHABC SEL/MQBF OPR/ABACUS AIRLINES PER/C NAV/RNP10 GPSRNAV RMK/ADSB)

If there is a requirement to include additional remarks in Item 18, then 'ADSB' should be entered as the first element following RMK/ with any additional comments separated by a space, see the example below;

Example:
(FPL-ABC123-IS
- A332/M-SDHIRWZ/S
- YSSY0105
- N0453F370 DCT SY H185 ENTRA Y245 BANDA H185 CG/N0452F360 Q69 ITIDE DCT HBA DCT
- YHBA0116
- EET/YBBB0009 REG/VHABC SEL/MQBF OPR/ABACUS AIRLINES PER/C NAV/RNP10 GPSRNAV RMK/ADSB TCAS EQUIPPED
- ACARS EQUIPPED)

The inclusion of multiple RMK/ fields in Item 18 may cause flight plans to reject in some automated ATC systems, see the example below;

Example:
(FPL-ABC123-IS
- A332/M-SDHIRWZ/S
- YSSY0105
- N0453F370 DCT SY H185 ENTRA Y245 BANDA H185 CG/N0452F360 Q69 ITIDE DCT HBA DCT
- YHBA0116
- EET/YBBB0009 REG/VHABC SEL/MQBF OPR/ABACUS AIRLINES PER/C NAV/RNP10 GPSRNAV RMK/ADSB RMK/TCAS
- EQUIPPED ACARS EQUIPPED)

Aircraft address code is not usually needed on flight plans. However, if ATC has approved the use of an FLTID different from the ACID, the aircraft address will be needed to correlate the flight plan to the aircraft. Enter the aircraft address in Item 18 of the flight notification as hexadecimal code (e.g. CODE/7C81CB).

The code is complex and non-intuitive, and manual entry of it is prone to human error, so use it only when necessary and check it carefully. If you lodge flight notification by radio, tell ATS the aircraft FLTID if it differs from the callsign.

1.3.6. ADS-B phraseology

Specific and generic R/T phraseology will be used for ADS-B and radar services. Specific phraseology will be used when it is necessary to differentiate between radar and ADS-B. The ADS-B equivalent of 'SQUAWK' is 'TRANSMIT' and ADS-B is pronounced 'ay-dee-essbee' over the radio.

Generic phraseology will be used where it is not necessary to differentiate between a service provided by radar and one provided by ADS-B. In many of these cases no change to existing phraseology is required. For example, "IDENTIFIED" and the various vectoring instructions will be applicable to either technology.

1.3.7. ADS-B phraseology quick reference

The following table gives an overview of the new Radar and ADS-B phraseology.

Circumstance	Radar Phraseology	ADS-B phraseology
Termination of radar and/or ADS-B service	IDENTIFICATION TERMINATED [DUE (reason)] (instructions)	
Radar or ADS-B ground equipment unserviceability	SECONDARY RADAR OUT OF SERVICE (appropriate information as necessary) or PRIMARY RADAR OUT OF SERVICE (appropriate information as necessary)	ADS-B OUT OF SERVICE (appropriate information as necessary).
To request the aircraft's SSR or ADS-B capability	TRANSPONDER (ALPHA, CHARLIE or SIERRA as shown in the Flight Plan) or NEGATIVE TRANSPONDER	ADS-B TRANSMITTER (TEN NINETY DATALINK) or ADS-B RECEIVER (TEN NINETY DATALINK) or NEGATIVE ADS-B
To request reselection of FLT ID*	RE-ENTER MODE S AIRCRAFT IDENTIFICATION	RE-ENTER ADS-B AIRCRAFT IDENTIFICATION
To request the operation of the IDENT feature*	SQUAWK [(code)] [AND] IDENT	TRANSMIT ADS-B IDENT
To request termination of SSR transponder or ADS-B transmitter operation*	STOP SQUAWK [TRANSMIT ADS-B ONLY]	STOP ADS-B TRANSMISSION [SQUAWK (code) ONLY]
To request transmission of pressure altitude*	SQUAWK CHARLIE	TRANSMIT ADS-B ALTITUDE
To request termination of pressure altitude transmission due to faulty operation*	STOP SQUAWK CHARLIE WRONG INDICATION	STOP ADS-B ALTITUDE TRANSMISSION [(WRONG INDICATION or reason)]

* Note that some ADS-B installations may not provide for entry of FLTID, transmission of IDENT or isolation of pressure altitude by the pilot. Some ADS-B installations may share controls with the SSR transponder, meaning that independent operation of the two systems is not possible. If it is not possible to comply with a particular instruction advise ATC and request alternative instructions.

1.4. OPERATIONS

Although ADS-B broadcast is automatic whenever the Transponder is activated, understanding what ATC might require from the flight crew, how to handle emergencies and how to use the cockpit interface effectively are central to safe flight.

ATC might ask you to change your FLTID, if possible, so you must know if you can do so and how. They might also ask you to stop transmitting an ADS-B signal because they have detected an error, such as altimeter failure, in your equipment. If this is not possible, notify ATC immediately that you are unable to comply.

If the ADS-B transmitter and SSR transponder are combined, switching ADS-B off may also make the aircraft invisible to SSR and TCAS.

1.4.1. Emergency codes

In addition to general emergency, unlawful interference and communications failure messages, ADS-B technology being developed includes a low fuel alert and a medical emergency facility for transmission of your situation to ATC. Not all aircraft may be fitted with a pilot interface that allows transmission of these messages.

Emergency notification to ATC will differ according to the type of equipment carried and surveillance coverage available, so make sure you know which equipment is on board. Does the aircraft have ADS-B emergency functionality, or only an on/off switch? Is it linked to the transponder, so that squawking 7600 also sends an ADS-B communications failure message?

In an emergency you should use all available means to signal your status, irrespective of expected surveillance and communications coverage.

1.4.2. Radar or ADS-B

You may not always know which surveillance system is being used and how you are being controlled. You may be told only that you have been 'identified', but it may be unclear whether you have been identified with radar, ADS-B or both. Unless ATC uses specific phraseology, use both ADS-B and transponder equipment to give the controller the best surveillance picture.

1.5. APPLYING FOR ADS-B SERVICES

Airservices Australia will administer the ADS-B approval process. Therefore we at Etihad Airways must submit an application that details the avionics configuration of each ADS-B equipped aircraft in the fleet that might operate into Australia. Airservices will then confirm that the avionics meet required for ADS-B services.

Web Address: *www.airservicesaustralia.com/adsb/operations*

Following avionics approval and prior to receiving ADS-B services, Etihad Airways must advice Airservices Australia in writing that pilots and dispatchers/operations officers (if applicable) have completed relevant ADS-B training.

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