Supplementary Amendment

CAP670 Air Traffic Services Safety Requirements

Safety and Airspace Regulation Group
Safety and Business Delivery

Number: 2021/02 **Issued: 24 November 2022**

Version: 2 **Effective: 23 January 2023**

Cooperative Surveillance Systems & Flight Information Displays

1. Introduction

1.1 On 15 December 2021, the CAA published Version 1 of this Supplementary Amendment to the Air Traffic Services Safety Requirements (CAP 670). Its purpose was to provide:

- a minimum technical specification for a Cooperative Surveillance system for use by an Air Navigation Service Provider (ANSP) to support the provision of Flight Information Service (FIS);
- a description of the functionalities of a Flight Information Display (FID) which may be used as part of a Cooperative Surveillance system in support of FIS.

1.2 It included requirements for system components, positioning, processing and functions of a Cooperative Surveillance system and a FID necessary for alignment with ICAO and UK regulations. **It should be noted that the description and specifications contained within this Supplementary Amendment relate only to the provision of surveillance data in support of Flight Information Services**. Further review is expected (i) in light of use and experience and (ii) as FID functionalities are developed to include more advanced functionalities.

1.3 Version 2 of this Supplementary Amendment has been developed to support the incorporation of requirements relating to the FID within the Manual of Air Traffic Services (MATS) Part 1 (CAP 493).

1.4 Throughout this Supplementary Amendment, there are some requirements that are mandatory and some that are recommended. These are clearly distinguished using the words shall, should and may. Where shall is used, compliance with the requirement is mandatory and no alternative may be applied. Where should or may is used, although the requirement content is regarded as the preferred option, alternative arrangements may be applied if the aerodrome operator/ANSP provides information or data to adequately support and justify them.

2. Background

2.1 Through the delivery of the Airspace Modernisation Strategy (AMS), the CAA will implement FIS as described in ICAO SARPs and PANS (and transposed into UK law

through the Standardised European Rules of the Air as retained (and amended in UK domestic law) under the European Union (Withdrawal) Act 2018)), to replace the current UK FIS.

2.2 FIS is an air traffic service (ATS) provided to:

- all flights provided with air traffic control service in controlled airspace;
- participating VFR flights in class E airspace; and
- participating IFR and VFR flights in uncontrolled, class G, airspace either by air traffic controllers (ATCOs) or flight information service officers (FISOs).

2.3 This document supports the provision of FIS in class G airspace through the use of low integrity Cooperative Surveillance data and the presentation of that data on a FID system.

3. Revised CAP670 requirement

3.1 With effect from 23 January 2023, CAP670 SA 2021/02 Cooperative Surveillance Systems & Flight Information Displays Version 1 is withdrawn and replaced by Version 2.

3.2 Version 2 of this Supplementary Amendment amends CAP 670 as follows:

- CAP 670 Part B, Section 2: Annex A to ATC 02 [Editorial note: new text within extant section];
- CAP 670 Part C, Section 5: Flight Information Display [Editorial note: This is a wholly new section of text that follows Part C, Section 5 Remote Tower Optical Systems].

3.3 CAP 670 is amended as shown in Annex A to this supplementary amendment, using red underline to show revisions. This change will be incorporated into CAP670 at the next amendment in due course.

4. Queries

4.1 Any queries or further guidance required on the content of this supplementary amendment should be addressed to:

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Airspace, ATM & Aerodromes
Safety and Airspace Regulation Group
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5. Cancellation

5.1 This Supplementary Amendment to the Air Traffic Services Safety Requirements shall remain in force until incorporated into CAP 670 or is cancelled, suspended or amended.

Editorial Note. The following amendments should be made to CAP 670 Part B, Section 2: Annex A to ATC 02: Manual of Air Traffic Services Part 2.

Section 3 Aerodrome Control
Chapter 1 Aerodrome Control

Daily Checks.

General responsibilities.

Delegated responsibilities.

Selection of runway-in-use.

Preferential runway.

Description of airfield eg. runways, taxiways, obstructions, diagram etc.

Use of Aerodrome Traffic Monitor and/or Flight Information Display.

Section 6 Radar Technical
Chapter 1 Equipment Description and Data

General.

Technical description – Primary Surveillance Radar and Secondary Surveillance Radar.

Controls.

Setting up procedures.

Permanent echoes.

Periodic checks.

Closing down.

Coverage (including diagrams).

Technical specification.

Aerodrome Traffic Monitor and/or Flight Information Display.

Surface Movement Radar.

Editorial Note. The following amendments reflect the insertion of a new section of text.

CAP 670 Part C, Section 5: Flight Information Display

Part 1 Preliminary Material

Introduction

FID01.1 Flight Information Display (FID) systems are intended for aerodromes where no ground-based surveillance exists to improve situational awareness for ATS staff and pilots. The requirements below are intended to enable the provision of assistance to pilots to mitigate against the risk of mid-air collision and avoid infringing controlled airspace through the receipt and display of information transmitted from aircraft, such as position, height and other parameters, including from non-certificated electronic conspicuity (EC) devices.

FID01.2 Industry standards for these EC devices have been published in CAP1391, *Electronic Conspicuity Devices*. They are intended for voluntary carriage on registered and non-registered Annex II UK aircraft, non-complex, non-Part 21 UK aircraft of less than 5700kg maximum take-off weight, and for gliders and balloons.

Part 2 Requirements

Cooperative Surveillance - Minimum performance parameters

FID02.1 End-to-end Required System Performance

- Received data items – minimum of Flight Identification (Callsign or Aircraft Registration), Position and Flight Level only
- Accuracy/Precision – Suitable for the needs of the operational unit and described by unit performance requirements
- Positional target refresh rate – at least once every six seconds
- Coverage – typically 100% coverage throughout an ATZ and 90% throughout the associated voice communications Designated Operational Coverage (DOC) or specified operational requirement area for the FID.
- Suitable, approved surveillance display system.

FID02.2 Where the operational requirement cannot be met due to insufficient aircraft equipage or limited reception of information from carry-on portable ADS-B devices, these factors **must** be taken into account in the risk assessment and mitigation of the use of the FID and AFISO/ATCOs **must** be made aware of this limitation. Conventional surveillance systems that can be demonstrated to comply with the required performance parameters and also comply with the display requirements in this specification may also be used to support a FID. ANSPs **shall** however take into account shortfalls in detection as a result of aircraft not fitted with Mode-S transponders.

> **Note**: Carry on devices can exhibit a transient loss of reception due to positioning within the cockpit, and occasionally prolonged loss of reception due to the aircraft's position in relation to the ground antenna.

Flight Information Display and supporting infrastructure

FID02.3 The FID shall be a standalone device and **shall not** interfere with other ANSP air traffic service systems. The FID and its supporting infrastructure (e.g. antennas and receivers and processing for Multi-lateration (MLAT) systems) **shall** therefore not be integrated with existing ANSP displays, processing or distribution equipment (including software). Where a corporate LAN is used only for point-to-point routeing of data then this is acceptable.

FID02.4 To minimise loss, corruption and latency of displayed data, interfaces in the data chain **should** be minimised, only local receiver sites in the vicinity of the aerodrome **shall** be used, and data network routeing **should** be localised.

> **Note:** Vicinity is defined as 'the area near or surrounding a particular place'. In the context of this document it is taken to mean local connectivity of antennas/devices by means including direct/point to point or IP connection set up for direct communications utilising a stable, measured and monitored clock source to ensure the timeliness of data received and distributed.

FID02.5 Where GSM networks are used, for instance in the transmission of data from receiver sites, ANSPs **shall** be aware that the frequencies employed are unprotected and may suffer from interference, and the reliability of such links cannot be fully assured.

FID02.6 One or more of the following processes **shall** be used to provide traffic information to a FID:

- aircraft to ground ADS-B data transmission downlinked to ground-based receivers deployed by ANSPs (for those aircraft capable of transmitting identification, position and height information); and/or

- Triangulation of SSR Mode A/C/S aircraft position via a MLAT solution.
- SSR Mode A/C/S from an Onward Routed Radar Data (ORRD) source where available.

Note: EC sources in a non-aviation protected band can be used to supplement the above sources for situation awareness only and must not be used to supplement the provision of Flight Information Services.

FID02.7 A multi-source FID **shall** differentiate through symbology, colour or labels between ADS-B equipped aircraft, Mode-S equipped aircraft and data from other sources (e.g., EC sources operating outside of the protected aviation spectrum).

Surveillance Information

FID03.1 Where an Interrogator is used in a MLAT system the system **shall** comply with the requirements of the Mode S Implementing Rule (Regulation (EC) No. 262/2009 as retained (and amended in UK domestic law) under the European Union (Withdrawal) Act 2018) and the Surveillance Performance Interoperability Implementing Rule (Regulation (EU) No. 1207/2011 as retained (and amended in UK domestic law) under the European Union (Withdrawal) Act 2018).

FID03.2 Where an Interrogator is used in a MLAT system either for improved accuracy (ranging) or to supplement the level of RF transmissions, its purpose **should** be understood by the ANSP and failure modes taken into account in the risk assessment and mitigation.

FID03.3 Surveillance information shall only be derived from receiving equipment defined and managed as part of the declared system. The performance of that system, together with the quality and timeliness of the data shall comply with the requirements outlined within this document. Surveillance data obtained from unmanaged sources outside of the declared system such as third party, internet applications, **shall not** be displayed on a FID.

FID03.4 Data from EC sources operating outside of the protected aviation spectrum may be presented on a FID but only where it is derived from a local receiver and will require the system to be capable of differentiating by colour and/or type of position symbol.

FID03.5 Any receiving equipment or display equipment and transmitting equipment (e.g., MLAT Interrogators) **shall** comply with the Radio Equipment Regulations 2017, as amended, and **shall not** emit electromagnetic interference that will result in malfunction of the other equipment in the operating environment. The system **should not** malfunction from electromagnetic interference from the other equipment in the operating environment. Evidence of compliance with these standards will either be Conformity Assessed or have a separate Declaration of Conformity.

Positioning of the Flight Information Display

FID04.1 The FID display and processing equipment **shall not** be integrated with or obscure other ANSP air traffic service systems.

FID04.2 The FID screen **should** be appropriately positioned to aid situational awareness, ensuring that it does not detract from the AFISO/ATCO's view and ability to access the other equipment at the working position.

Display requirements

FID05.1 A FID **shall**, as a minimum, represent the local area in 2D map form and, where available, display information concerning the flight ID, position and altitude/level of aircraft.

FID05.2 A 3D presentation **shall not** be provided.

FID05.3 Altitude information from ADS-B devices will be based on barometric pressure or GNSS-derived altitude. However, only information from barometric pressure **shall** be used.

FID05.4 Altitude information from MLAT can be based on barometric pressure or calculated height. However, only information utilising barometric pressure **shall** be used.

FID05.5 Where barometric altitude data is presented, it may be uncorrected and based on the Standard Pressure Setting or corrected to altitude above sea level using the appropriate QNH setting. However, where uncorrected altitude data is used, AFISO/ATCOs **shall** be made aware of the limitation in the information.

FID05.6 Where corrected altitude data is displayed a QNH value input mechanism **shall** be provided.

FID05.7 Manual entry and changes to this value **shall** be validated by double entry. When it is possible to change the QNH value automatically, the equipment **shall** require the change to be drawn to the AFISO/ATCO's attention.

FID05.8 Where surveillance data from multiple surveillance sources is available for presentation on the FID, the individual sources from which data is to be displayed **shall** be selectable on the FID.

FID05.9 The surveillance sources used and method(s) of differentiation required by FID02.7 above shall be described in Local Instructions for the unit.

FID05.10 ADS-B messages received at separate ground stations, for instance where MLAT receivers are deployed, will (assuming no signal loss) be identical. A single position symbol **should** be presented to the AFISO/ATCO displaying the most recent positional data.

FID05.11 Where there are multiple target reports from a single aircraft from different sources, the following **should** apply:

(1) Where only one target can be displayed or processed, the system **shall** be configured such that the target type deemed by the ANSP to be more accurate/reliable in terms of position/non-corruption and detection should be displayed; or
(2) Where it is possible to display multiple targets, there **should** be an option to select the preferred target for display.
(3) The maximum and the minimum display ranges **shall** be suitable for the operational requirement.
(4) The display resolution at the maximum and minimum range **shall** be suitable for the operational requirement.

FID05.12 Flight Identification, position and height information shall be regularly updated on the FID in accordance with the Required Performance Requirement.

FID05.13 Aircraft positions **shall not** be corrected (or extrapolated) to allow for movement between the time of receipt or applicability of data and the time of display.

FID05.14 Prediction data (for instance where a target symbol is provided even though no target has been detected) **shall not** be displayed.

FID05.15 The display **shall** be readable in all ambient light conditions over a range of viewing angles, both vertically and horizontally. Target and map brightness should be independently variable.

FID05.16 The accuracy to which the features are mapped to the system **shall** be defined.

FID05.17 The equipment **should** have the following operator functions, the use will be defined by individual unit procedures:

(1) Selection of display ranges
(2) Display off centre
(3) Choice of maps
(4) Range rings on/off
(5) Choice of leader line length, label block rotation and positioning
(6) Choice of character size
(7) Menu selection/positioning

FID05.18 The surveillance data source providing the position information shall be represented on the FID through either the use of different colours and/or different symbology (position information) as a selectable option.

FID05.19 Position indications may be displayed as individual position symbols, e.g., ADS-B or MLAT symbols, or combined symbols.

FID05.20 The display symbols shall enable the AFISO/ATCO to discriminate between different sources of target reports.

FID05.21 Symbols indicating the type and size of aircraft may be provided where they are based on downlinked data received directly from the aircraft.

FID05.22 The symbol size should not vary with displayed range.

FID05.23 Labels shall be used to provide, in alphanumeric form:
Aircraft identity (e.g., Flight identification, SSR code or Aircraft Registration).

> **Note:** Current CAP1391 devices only indicate an SSR Code 7000 so where multiple sources are used, care should be taken to ensure the correct SSR Code is displayed.

FID05.24 If available, pressure-derived altitude information.

FID05.25 Labels shall be associated with their position indications in a manner precluding erroneous identification by or confusion on the part of the AFISO/ATCO.

FID05.26 Care should be taken where colour alone is used as the single factor for distinguishing information between multiple sets of data that are presented in a similar manner on the display, in considering potential colour failure modes and human factors.

FID05.27 Where information is filtered (for instance using a height filter) the display should clearly distinguish between filtered and unfiltered information.

FID05.28 History dots/solid line may be provided to illustrate the past position of aircraft.

FID05.29 Aircraft position targets shall be configured to be removed after a configurable timeout (e.g., after 1 to 3 interrogations/dropouts).

FID05.30 Some features, map features for example, should be scaled according to their significance on the displayed ranges.

FID05.31 Where the facility is provided for the display to automatically move the labels to various positions (to prevent label overlapping), the equipment shall provide leader lines.

FID05.32 The display configuration may include split-screen displays (for instance one half of the display can present the area of interest, the other half the ATZ). The display configuration shall be controlled by the ANSP and subject to formal configuration control. If appropriate some aspects of the display may be manually configurable by the user, for instance to zoom in (change range) and pan out.

FID05.33 The system should ignore data when the time of applicability is too far in the past.

FID05.34 Where a FID is implemented to perform 'basic functions' in the provision of the flight information service, screen recording is recommended. This can be by means of an inbuilt screen recording facility or generic screen recording software.

> **Note:** CAP 493 MATS Part 1 and CAP 797 FISO Manual describe the 'basic functions' of the FID.

Display map requirements

FID06.1 Display maps may be based on general ground-feature maps (e.g., Ordnance Survey Mapping or Open Street maps), airspace maps based on controlled or uncontrolled sources, and custom-made maps or map features.

FID06.2 An ANSP deploying a FID shall carry out the following steps:

(1) Display map control shall be subjected to formal configuration management.

(2) Inclusion of the individual elements on the map shall be as identified and documented in the operational requirement.

(3) Where airspace map data is provided from another source that cannot be assured, any map data must be checked against airspace changes.

FID06.3 The definition of such elements should be in terms of ATS requirements. These elements shall include the following:

(1) Visual Reference Points (VRPs)
(2) Adjacent airfields
(3) Danger areas, prohibited areas, etc.
(4) Limits of controlled airspace/airspace boundaries
(5) The following elements are optional:
Adjacent areas of flying activity, for example, hang gliding sites, parachuting sites, etc.
(6) Runway extended centrelines
(7) Map north marker
(8) Representation of Instrument Approach Procedure paths

Note: For certain ATS units, additional points may be required.

FID06.4 The identified map features and aircraft positions shall be referenced to a single defined geodetic coordinate system. At least three features of new display maps shall have their accuracy assessed within 15NM of the aerodrome. Aircraft position data shall be

accurately mapped onto the display system so that it registers correctly with maps and other sensor data.

Recommendation: The display maps should be in WGS84 format.

> **Note:** Where an ANSP chooses to use an alternative coordinate system, this shall be aligned to aerodrome and airspace survey data.

Testing and Verification of Required Performance Requirements

FID07.1 The performance requirements for Accuracy and Target Latency of ADS-B are outside the control of the ANSP, and the CAA will commission ongoing testing to demonstrate continued compliance of CAP1391 devices with the national requirement. However, the ANSP shall carry out its own testing to provide assurance that the display system can meet all the Required Performance Parameters

FID07.2 Manufacturers shall be required to provide evidence to assure the accuracy of MLAT systems against the Required Performance Parameters for a FID solution.
Target positional accuracy and latency shall be determined (in general through testing and trials) for each airborne surveillance receiver type (e.g., ADS-B or MLAT) by checks on circuit/runway position of aircraft (or vehicles temporally fitted with CAP1391 devices) or by checking pilot position reports against visual reference point (VRP) markers overlaid on the visual reference charts to act as points of reference.

FID07.3 Where possible, accuracy and coverage measurements should be correlated to aircraft types (and types of installations) or manoeuvres where it is beneficial and applicable to awareness[1] (e.g., fixed wing versus rotary operations, or in-cockpit device installations that may affect coverage). Results from testing/trialling should confirm such correlations and should be recorded. For example:

(1) Regularly requested position reports correlated with the FID position plots and recorded using associated display screenshots; or
(2) Comparing position reports with outputs from software recording of the target positions or display screen data, where utilised.

> **Note:** Testing may be based on planned flight trials or targets of opportunity.

FID07.4 Sufficient opportunities for carrying out tests or trials shall be planned, and data captured to the extent that a reasonable judgement can be made on results based on the quality of the data. For example:

(1) Sufficient aircraft numbers and types representative of the airspace users;
(2) Sufficient manoeuvring and turning flights, including aerobatics if applicable.

Safety Assurance

FID08.1 Flight Information Displays will be considered as Air Traffic Service Equipment, forming part of the ATS functional system, and as such subject to Change Management in accordance with UK Regulation (EU) No. 2017/373.

Software Assurance

FID09.1 Where a FID is used to perform basic functions to support the provision of flight information service, it is not anticipated that any derived safety requirements will be onerous and no specific software requirements will apply. A FID is used as a secondary system to

[1] The requirement of such correlation will be dependent on the aerodrome's operations. E.g., It may be beneficial to know of any zone where conspicuity may be difficult.

confirm pilot reports and to supplement information received from pilot reports and the ATCO's/AFISO's visual observations. However, the system shall be assessed as fit for purpose by demonstrating that the software related requirements and the Required System Performance are met.

FID09.2 Any changes in software, including the addition of plug-ins, will require documented assurance to demonstrate ongoing fitness for purpose. Where a manufacturer or software provider cannot provide formal assurance using an appropriate software assurance standard, it will be incumbent on the ANSP to carry out a full set of tests to verify that all requirements of this specification are still being met.

Interoperability

FID10.1 Interoperability requirements contained in the UK Basic Regulation (UK Reg (EU) No. 2018/1139) are applicable to all components of an ATS functional system and as such this includes FIDs. A Declaration of Verification and Technical File shall be produced. A Declaration of Suitability for Use (DSU) is also required for all components. Where a manufacturer cannot provide this, for instance where equipment deployed is not specifically intended to be used for ATS purposes, then the ANSP shall produce a DSU declaring compliance with the relevant regulatory technical requirements contained in this specification.

FID10.2 Where an Interrogator is used in a MLAT system the system shall comply with the requirements of the Mode S Implementing Rule and the Surveillance Performance Implementing Rule. Evidence of compliance shall be provided.

FID-MLAT

Introduction

FID11.1 Multi-lateration (MLAT) is a form of independent co-operative surveillance. MLAT systems use the time difference of arrival (TDOA) of the existing 1090 MHz transmissions from aircraft, between several ground receivers to determine the position of the aircraft. A MLAT system can be passive or active allowing it to interrogate transponders.

FID11.2 Standards have already been specified for the existing 1090 MHz and 1030 MHz transmissions in ICAO SARPS Annex 10 Volume 4, hence derivation of further standards will not be pursued with respect to this. However, setting requirements for MLAT systems is necessary to ensure that the MLAT systems are compatible with the existing systems, formats and protocols, and the type of service the MLAT serves e.g., Flight Information Services utilising a FID.

Scope

FID12.1 The requirements in this section apply only to MLAT systems used to support Flight Information Service provision utilising a FID.

FID12.2 The requirements and guidance are specific to MLAT systems used to support Flight Information Service provision utilising a FID and **do not** relate to MLAT system used to provide separation services.

FID12.3 Although MLAT can be applied to many signal types transmitted by aircraft, this document refers to MLAT using 1090 MHz signals.

Part 2 Requirements

ICAO SARPs

FID13.1 All FID MLAT Interrogators shall comply with the SARPs in ICAO Annex 10, Volume 4 Chapter 6.

Active MLAT System Transmitter Requirements

FID14.1 The interrogator capability shall be identified and justified with respect to the current and planned aircraft equipage requirements, and level of interrogations already used in the area of interest.

Recommendation: Measures should be taken to minimise the effect of active MLAT operation on the 1030/1090 MHz radio frequency environment.

FID14.2 Interrogations from MLAT systems shall not set “lockout” on any targets.

FID14.3 The Interrogation rate shall be configured to meet the operational requirement.

FID14.4 All interrogation types used by the MLAT system shall be defined.

FID14.5 All active MLAT systems must transmit in accordance with National IFF/SSR Committee (NISC) requirements (as defined in CAP761) and conditions specified in the relevant Interrogator Approval certificate.

Active MLAT Systems Capable of Mode S Interrogation

FID15.1 All active FID MLAT systems which have a Mode S interrogator shall not utilise any of the following functionality:

(1) Mode S all call interrogations,
(2) Mode S interrogator lock out on acquired Mode S targets, permanently or intermittently, in part or totality of its coverage, or
(3) Multisite communications protocols for data link applications.

ADS-B Capable MLAT Systems

FID16.1 MLAT systems capable of receiving ADS-B messages using Mode S Extended Squitter shall comply with the system characteristics stated in CAP 1391.

FID16.2 Where an ANSP intends to use ADS-B positional data or other data items transmitted in ADS-B messages, such data items shall be identified with their intended use.

FID 16.3 The ability to de-code ADS-B messages shall be demonstrated as part of commissioning trials.

Receiver Synchronisation

FID17.1 The receiver synchronisation method shall be defined and justified as appropriate to the operational requirement.

Receiver Geographical Distribution

FID18.1 The geographic distribution of sensor locations shall be such that the required probability of detection and coverage can be obtained at all levels where the service will be provided.

FID18.2 The system should be installed and optimised such that the loss of data from any single receiver or interrogator does not cause a loss of the required coverage. Where it does, this shall be highlighted to the user by means of an alarm.

FID18.3 The sensor antennas shall be sited such that it meets the operational requirement within the area of interest.

Link Performance

FID19.1 The data transmission links used between the sensors and the central processing system shall be identified and supported by suitable Service Level Agreements (SLA) and/or redundancy and system monitoring considerations.

Note: Various communication links including RF links, satellite links, copper wire links and fibre optics may be used for communications between sensors and the central processing system within the same MLAT system.

FID19.2 The suitability of the data transmission links chosen shall meet the operational requirement such as reliability, availability, continuity and integrity.

FID19.3 Where such data transmission links are operated by third parties, ANSPs should have appropriate service level agreements in place for repair, maintenance, accessibility and the performance of the links.

Redundant Sensor Configuration

FID20.1 The system should, where possible, mitigate the loss of sensors required for obtaining a 2D position throughout the required coverage area.

FID20.2 The impact on coverage and accuracy in failure of each individual sensor shall be determined and shall be demonstrated as acceptable to continue the intended operation.

FID20.3 In the case of more than one sensor failure, the suitability of the system to continue operation shall be decided based upon the achievable coverage and the accuracy levels. The operational strategy in such situations shall be defined including operational procedures.

FID20.4 The procedures in such situations shall be clearly documented and the users of the system shall be fully trained to handle such event.

MLAT Performance Monitoring

FID21.1 The MLAT system shall implement a method(s) of performance monitoring for on-going system integrity and end-to-end performance monitoring.

FID21.2 The performance monitoring mechanisms shall be clearly defined with the parameters subject to monitoring.

Note: These must include any in-built status monitoring and external monitoring mechanisms.

FID21.3 The system shall be capable of indicating to AFISO/ATCO when the MLAT system performance is suitable for operational use and when the system performance does not permit its use for providing the intended service.

Note: These may include visual and audible means or both.

FID21.4 The system shall indicate to the AFISO/ATCO when the system is operating under redundant conditions, if this is deemed necessary.

FID21.5 The system shall be capable of indicating to the AFISO/ATCO the current operational status of the sensor network and any failures.

FID21.6 Where one or more Remote Field Monitors (RFMs) are also used for time synchronisation purposes, the impact of the loss of those RFMs to the time synchronisation function as well as to the system status monitoring function shall be assessed and indicated in design assurance documentation.

FID21.7 Where GNSS time synchronisation used, the impact of the loss of the GNSS signal shall be assessed.

FID21.8 If the system loses time system synchronisation, the autonomy time of the system shall be specified.

Sensor Siting Requirements

FID22.1 The structure upon which the receivers/transmitters, antennas are mounted shall be of sufficient stability to withstand all expected weather conditions in the operational environment, especially with respect to maximum wind speed and icing.

FID22.2 Where possible, the maximum wind speed, temperature and humidity conditions expected in the operational environment should be identified.

System Interfaces

FID23.1 The output of the MLAT system should be a digital data output, using standard communication protocols (e.g., ASTERIX).

MLAT Output and Processing

FID24.1 The data output rate shall be identified and the MLAT system shall use the data output method that gives the highest quality and positional accuracy of data.

FID24.2 The processing and tracking system shall be capable of handling the data received by the MLAT receivers and outputting the data at the required rate.

Note: MLAT system may receive a large amount of data depending on the amount of data transmissions occurring on the 1090 MHz frequency at any given time, however the required data rate may be much slower than this depending on the application. Hence the system must accommodate a processing mechanism that delivers data of best quality and accuracy at the required rate.

Power Supply

FID25.1 The stability of the power supply to the system shall be consistent with the availability and continuity of service requirements.

Low Level Coverage

FID26.1 The coverage and the probably of detection in the low levels of altitude shall meet the performance requirements necessary for the intended application in the lower levels of the area of interest.

Note: MLAT system coverage and probability of detection can significantly vary across vertical levels.

MLAT Performance

1. **Probability of Update**

Recommendation: The probability of update within the system refresh period should be at least 90% for the MLAT system.

2. **False Targets**

Recommendation: The number of false targets during any update should be as low as possible.