1 Purpose and Scope

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3.1 System Descriptions

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3.6 External Subsystems

Ownship subsystems external to ASA include navigation, TCAS, flight management and flight controls, etc. This section provides requirements associated with both the transmit (ADS-B Out) and receive (ADS-B In) functions, and assumptions on the systems external to the ASA system bounds.

3.6.1 Own-ship Position Data Source

The availability of ASA is dependent on a source of own-ship position information.

It is assumed that the majority of airborne ASA installations will be equipped with GNSS as the geometric position and velocity data source based on the ability to meet the performance requirements necessary to support installed applications.

At the time these MASPS were written, there are no known non-GNSS position sources (e.g. VOR/DME, DME/DME, loran, or inertial for position determination) that meet the performance requirements for ASA. It is possible that future development may lead to a non-GNSS position source that can meet the performance requirements for ASA. These alternate position sources may not necessarily meet the criteria for the primary position source, however, it is possible that they can be utilized to update own-ship position during short instances of GNSS intermittency, while it can be determined that the performance requirements for the active application(s) are met.

ASA installations ~~**will**~~ **shall (R3.xxx)** be equipped with a source of own-ship geometric position and velocity data.

The same own-ship position source **shall** (R3.xxx) be utilized by both “ADS-B In” applications, as well as “ADS-B Out” transmissions.

To qualify for use by ASA, the selected own-ship position data source is assumed to meet the following requirements.

The own-ship position data source **will** be capable of providing A/V geometric position and velocity data that meets the integrity and accuracy performance requirements.

The own-ship position data **will** include the following:

- Own-ship horizontal position in latitude and longitude referenced to WGS-84 ellipsoid.
- Own-ship geometric height above ellipsoid surface, if available.
- The position data accompanied with accuracy and integrity metrics for determination of Navigation Accuracy Category for position (NAC_P) and Navigation Integrity Category (NIC) of the data. Refer to §3.1.2.3.1 for definitions of NAC_P and NIC.
- Individual horizontal position and geometric height validity flags.
- Geometric Vertical Accuracy

The own-ship velocity data **will** include the following:

- Own-ship horizontal velocity. The velocity may be provided in rectangular (north/east velocity for airborne operations) or polar (ground speed and track for surface operations) coordinates. When heading is provided, an indication of true/mag reference is required. Heading referenced to true north is preferred.
- Velocity data – accompanied with accuracy metrics for determination of Navigation Accuracy Category for velocity (NAC_V) of the data. When a velocity accuracy metric is not output by a source, a qualified means to determine a velocity accuracy should be performed. Refer to §3.1.2.3.1 for definition of NAC_V.
- A velocity validity flag

There ~~**will**~~ **shall** (R3.xxx) be a means to determine the SIL value for the own-ship position data source.

There **shall** (R3.xxx) ~~**will**~~ be a means to determine when a own-ship position data source has failed so that an acceptable alternate own-ship position source may be selected, if available.

~~Own-ship position data sources **shall** (R3.xxx) not exceed a data output latency of less than or equal to 1 second from the Time Of Measurement to the time the data is supplied to ASSAP (as illustrated in Fig. xxx, reference point A3 to B3).~~

The maximum time to indicate a change in integrity of the own-ship position data outputs **will** be less than 10 seconds.

3.6.2 Air Data Source

It is assumed that the majority of airborne ASA installations will be equipped with air data sources to provide pressure altitude, pressure altitude rate, barometric pressure setting and air speed, if required. To qualify for use by ASA, the selected air data source is assumed to meet the following requirements.

1. The air data source **will** be capable of providing digital outputs of A/V pressure altitude and pressure altitude rate suitable for surveillance based applications.

2. The pressure altitude data **will** include the following:

   - Pressure altitude referenced to standard temperature and pressure (1013.25 hPa or mB, or 29.92 in. Hg).
   - Pressure altitude outputs covering the operating altitude range of the A/V.
   - Pressure altitude validity flag.
   - Quantization data to determine if pressure altitude outputs are encoded as 25, or 100 ft.

     Note: The finer altitude data resolution of 25 ft is preferred.

3. The altitude rate data, if available, **will** include the following:

   - Rate of change of pressure altitude outputs covering the operating altitude rate range of the A/V.
   - Pressure altitude rate validity flag.

   Note: Complimentary inertial/barometric filtered altitude rate is the preferred source.

Note: *Future versions of this MASPS may require that the airspeed data be broadcast by ADS-B Out, and be available to the ASSAP and CDTI.*

3.6.3 Heading Source

It is assumed that the majority of airborne ASA installations will be equipped with heading data sources to indicate the directional orientation of the A/V. To qualify for use by ASA, the selected heading data source is assumed to meet the following requirements.

The heading data source **will** be capable of providing outputs of A/V heading suitable for surveillance based applications.

The heading data source **will** provide heading outputs supporting the full range of possible headings (e.g. full circle from 0º to 360º).

The heading data source **will** provide heading with a resolution of 6º of arc or finer.

The heading data source **will** provide heading with an accuracy of ±10º, or better (95%).

The heading data **will** include the following:

- Means to determine if A/V heading is referenced to true north or magnetic north.
- Heading validity flag.

3.6.4 TCAS

TCAS interfaces to ASA in two ways: first, if TCAS is installed on an ADS-B transmitting ship, the fact that TCAS is installed, and the TCAS status (e.g., resolution advisory) are included in the ADS-B transmission (§3.1.5.26). The installation and status is reported by the ADS-B receiver (§3.3.1.1.1). If TCAS is installed ~~on a ship~~ with ASA, and if the CDTI is also used as the TCAS traffic display, TCAS tracks and their status ~~need to~~should be supplied to ASA. TCAS interfaces directly to ASSAP, as indicated in Figure 3-1. Table 3-22 indicates the traffic data that should be interfaced to ASSAP from TCAS.

Table 3-22: ~~Own ship's~~ TCAS Traffic Data Interface to ASSAP

Data Item [note 4]	Reference Section
TCAS Traffic Status	§3.4.1.3~~3.2.1.1~~
Target Range	§3.4.1.3~~§3.3.2.3.2.3~~
Target Bearing	§3.4.1.3~~§3.3.2.3.2.4~~
Target Pressure Altitude [note 2]	§3.4.1.3~~§3.3.2.3.2.5~~
TCAS Altitude Rate [notes 3]	§3.4.1.3~~§3.3.2.3.2.6~~
Mode S Address [note 1 and 2]	§3.4.1.3~~§3.3.2.3.2.7~~
TCAS Track ID	§3.4.1.3~~§3.3.2.3.2.8~~
TCAS Report Time [note 2]	§3.4.1.3~~§3.3.2.3.2.9~~

Notes for Table 3-22:

1. *ASSAP that are hosted in the internal TCAS LRU have access to the Mode S (ICAO 24-bit) address (on 1090 MHz Extended Squitter installations).*

2. *For ASSAPs that are hosted externally to TCAS, this information requires a change to the standard TCAS bus outputs defined in ARINC 735B that currently does not provide the Mode S address code, nor does it necessarily output Mode C pressure altitude.*

3. *For display of up/down arrow on the CDTI if there is no ADS-B track that correlates with the TCAS track.*

4. *Range rate and range acceleration may be required in the future.*

~~3.6.4.1 Future Requirements~~

~~(note: Section deleted)~~

3.6.5 Airport Surface Maps

An airport surface map is necessary to support the SURF application for each airport where these applications are used.

The subsystem that provides the airport surface maps is external to ASA system boundaries defined in this MASPS. Airport surface maps are assumed to be encoded into an electronic database. The features, quality, and reference datum assumptions for this ASA external database are stated in the following sub-sections.

Unless stated otherwise, all of the assumptions within this section including its subsections apply for the SURF application.

3.6.5.1 Features

All airport features shown on the CDTI for the SURF application is based on the airport surface map database. At a minimum, this database is assumed to contain the runways and taxiways within the *maneuvering area* of the airport.

Other airport features are desired to be represented in the database including, for example, apron areas, stand guidance lines, parking stand areas, deicing areas, clearways, and vertical objects like buildings and towers.

Note 1: *The "maneuvering area" of an airport is defined as the part of an airport used for take-off, landing, and taxiing of aircraft, excluding aprons [reference ICAO Annex 14, section 1].*

All features of the database are assumed to have sufficient information to support:

1. Determining their horizontal position with respect to the WGS-84 reference datum, and

2. Appropriately labeling the feature on the CDTI.

It is further assumed that the vertical position for at least one feature for each airport surface map is given.

Note 2: *Vertical position is used by the SURF application to support determining whether or not a flying aircraft is close enough to the airport surface for SURF situational awareness display purposes.*

3.6.5.2 Quality

Airport surface map database quality is assessed in terms of feature position accuracy, resolution, integrity, and timeliness (currency).

The accuracy, resolution, and integrity quality of the airport surface map database are assumed to comply with at least one of the following:

1. The database requirements specified in [RTCA DO-257A] (or subsequent revision) for the Aerodrome Moving Map Display (AMMD), or

2. [RTCA DO-272] (or subsequent revision) "Medium" or higher quality database standard *(see note below)*, or

3. Database judged by the approval authority to be current and operationally acceptable for the intended application(s).

Note 1: *Airport map database requirements are defined in [RTCA/DO-272]. [RTCA DO-272] defines three categories of airport map data including "Coarse," "Medium," and "Fine." The categories are groupings for the minimum required accuracy, resolution, and integrity quality of the database.*

The database is assumed to be current.

Note 2: *The valid dates of applicability for the airport surface map database are defined by the Aeronautical Information Regulation and Control (AIRAC).*

3.6.5.3 Reference Datum

The airport surface map database **shall** (R3.xxx) use WGS-84 as its reference datum.

Note: *There are at least ~~two~~ three reasons for using WGS-84 as the reference datum for the airport map. First, international standards require "geographical coordinates indicating latitude and longitude [for airport data] be determined and reported to the aeronautical information services authority in terms of WGS-84," according to Section 2.1.5 in ICAO Annex 14. Thus, the data in WGS-84 is likely to be available. Second, WGS-84 is the coordinate frame required for transmitting ~~ownship position~~traffic position on ADS-B. Third, ownship position is provided to ASSAP/CDTI in WGS-84 reference datum. While it is possible to transform data from one coordinate frame to another, it is required for the standards documents to use a common standard coordinate frame.*

3.6.6 Flight ID Source

ASA receive participants utilize Flight IDs received from ASA transmit participants. The Flight ID of traffic can also be used by crews to unambiguously identify ASA participants on the CDTI. The own-ship Flight ID might be provided by one of many different sources, including; Mode S/TCAS Control Panel, Flight Management System, ACARS, or an Electronic Flight Bag.

The ASA ~~installation~~ transmit susbsystem **shall** (R3.xxx) be provided with an own-ship Flight ID of up to 8 characters.

3.6.7 Flight Control System/Mode Control Panel

The ASA installation **will** be provided with information available from the Flight Control System/Mode Control Panel, which may include; Selected Heading, Selected Altitude, and CAS/Mach~~ACH~~ display mode indication.

3.6.8 Other External Systems

In the future, ASA may interface with other systems, such as:

- Flight control systems
- FIS-B / Weather and NAS status updates / TIS-B Service status
- Terrain and obstacles
- Addressed data link
- ADS-Contract
- Flight Management Systems for other ASA application data