

CHANGE ISSUE – RTCA / DO-242A

# MASPS for ADS-B Rev. A

Tracking Information (committee secretary only)	
Change Issue Number	38
Submission Date	5/14/01
Status (open/closed/deferred)	Rev. A – CLOSED
Last Action Date	2/22/02

Short Title for Change Issue:	Definitive criteria is needed for determination of whether an aircraft is airborne or on the ground
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MASPS Document Reference:		Originator Information:	
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Paragraph number(s)		E-mail	Garret.livack@faa.gov
Table/Figure number(s)		Other	livack@worldnet.att.net

Proposed Rationale for Consideration (originator should check all that apply):	
<input type="checkbox"/>	Item needed to support of near-term MASPS/MOPS development
<input type="checkbox"/>	DO-260/ED-102 1090 MHz Link MOPS Rev A
<input type="checkbox"/>	ASA MASPS
<input type="checkbox"/>	TIS-B MASPS
<input type="checkbox"/>	UAT MOPS
<input type="checkbox"/>	Item needed to support applications that have well defined concept of operation
<input type="checkbox"/>	Has complete application description
<input type="checkbox"/>	Has initial validation via operational test/evaluation
<input type="checkbox"/>	Has supporting analysis, if candidate stressing application
<input type="checkbox"/>	Item needed for harmonization with international requirements
<input type="checkbox"/>	Item identified during recent ADS-B development activities and operational evaluations
<input type="checkbox"/>	MASPS clarifications and correction item
<input type="checkbox"/>	Validation/modification of questioned MASPS requirement item
<input type="checkbox"/>	Military use provision item
<input type="checkbox"/>	New requirement item (must be associated with traffic surveillance to support ASAS)

Nature of Issue:	<input type="checkbox"/> Editorial	<input type="checkbox"/> Clarity	<input type="checkbox"/> Performance	<input type="checkbox"/> Functional
<u>Issue Description:</u>				
<p>How will any of the candidate ADS-B data links determine if an aircraft (such as an helicopter) is on the ground or in ground hover just above the airport surface? Also, for aircraft on takeoff, or aircraft that may be doing a “touch and go”, this same issue applies.</p> <p>Technical issue: The use of a baro aided pressure altimeter may not be of sufficient accuracy to provide accurate AGL height data. The MASPS Ad Hoc working group needs to address this issue. (See page 32, paragraph 2.1.2.2.1.2, “Altitude”).</p>				

Originator’s proposed resolution if any:	None submitted.
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Ad Hoc Group Deliberations:

May 24, 2001: The ad hoc group agreed that this Issue Paper will be DEFERRED to a future revision of DO-242 due to a lack of mature concept of operations.

August 30, 2001: This Issue Paper was renamed from “Helicopter On Ground – Hovering” to “Determination of Airborne and On-Ground States”. This Issue Paper was also Re-OPENED and will be considered for inclusion in DO-242A.

October 26, 2001: A draft proposal of criteria for on-ground and airborne determination was examined (242A-WP-9-09) at the October WG6 meeting. After some discussion it was agreed that the criteria needed for the MASPS should not be from the point of view of ADS-B applications, but rather from the perspective of when certain ADS-B messages need to be transmitted. This approach will be consistent with the 1090MHz MOPS and will be based on the approach taken in Tables 2-9a and 2-9b of that document. [AI 9-4]

January 29, 2002: This Issue Paper was discussed by WG6 at their January meeting as part of the review of 242A-WP-11-01. The Table originally created based on DO-260 was determined to be unnecessarily complicated. It was decided to define this determination criteria in a computer language-like “If-Then-Else” format.

February 22, 2002: Final text for this Issue Paper was approved at the February WG6 meeting. It was decided that the value of this state (airborne, on the ground, or unknown) did **not** need to be a required element of the Mode Status report. This determination criteria will be defined in Revision A only for the purpose of specifying what State Vector elements are required at any given time.

Working Group 6 Final Resolution:

A new section was created to specify the determination criteria for whether an ADS-B participant should consider itself airborne, or on the airport surface. Section 3.4.3.1, as it appears in the draft DO-242A delivered to RTCA on March 4, 2002 is found in Attachment A of this Issue Paper.

### 3.4.3.1 Air/Ground State

A transmitting ADS-B participant's *air/ground state* is an internal state in the transmitting ADS-B subsystem that affects which SV report elements are to be broadcast, but which is not required to be broadcast in ADS-B messages from that participant.

Notes:

1. *It is possible that a future edition of this MASPS would require a participant's air/ground state to be broadcast. This would occur if an operational concept for a user application that needs air/ground state were to be included in the ASA MASPS currently being developed.*
2. *A transmitting ADS-B participant's air/ground state also affects whether the aircraft size (length and width) codes in the MS report are to be broadcast. (See §3.4.4.6 below.)*

A transmitting participant's air/ground state has the following possible values:

- “Known to be airborne,”
- “Known to be on the surface,” and
- “Uncertain whether airborne or on the surface.”

#### 3.4.3.1.1 Determination of Air/Ground State

A transmitting ADS-B participant applies the following tests to determine its air/ground state:

1. If a transmitting ADS-B participant is *not* equipped with a means, such as a weight-on-wheels switch, to determine whether it is airborne or on the surface, and that participant's emitter category is one of the following, then it **shall** (R3.47) set its air/ground state to “known to be airborne” :

Light Aircraft  
Glider or Sailplane  
Lighter Than Air  
Unmanned Aerial Vehicle  
Ultralight, Hang Glider, or Paraglider  
Parachutist or Skydiver  
Point Obstacle  
Cluster Obstacle  
Line Obstacle

*Note 1: Because it is important for fixed ground or tethered obstacles to report altitude, Point Obstacles, Cluster Obstacles, and Line obstacles always report the “Airborne” state.*

2. If a transmitting ADS-B participant is *not* equipped with a means, such as a weight-on-wheels switch, to determine whether it is airborne or on the surface, and that participant's emitter category is one of the following, then that participant **shall** (R3.48) set its air/ground state to "known to be on the surface" :
  - a. Surface Vehicle – Emergency
  - b. Surface Vehicle – Service

3. If a transmitting ADS-B participant is *not* equipped with a means, such as a weight-on-wheels switch, to determine whether it is airborne or on the surface, and that participant's emitter category is "rotorcraft," then that participant **shall** (R3.49) set its air/ground state to "uncertain whether airborne or on the surface."

*Note 2: Because of the unique operating capability of rotorcraft (i.e., hover, etc.) an operational rotorcraft always reports the "uncertain" air/ground state, unless the "surface" state is specifically declared. This causes the rotorcraft to transmit those SV elements that are required from airborne ADS-B participants.*

4. If a transmitting ADS-B participant is *not* equipped with a means, such as a weight-on-wheels switch, to determine whether it is airborne or on the surface, and its ADS-B emitter category is not one of those listed under tests 1, 2, and 3 above, then that participant's ground speed (GS), airspeed (AS) and radio height (RH) **shall** (R3.50-A) be examined, provided that some or all of those three parameters are available to the transmitting ADS-B subsystem. If GS < 100 knots, or AS < 100 knots, or RH < 100 feet, then the transmitting ADS-B participant **shall** (R3.50-B) set its Air/Ground state to "known to be on the surface."
5. If a transmitting ADS-B participant *is* equipped with a means, such as a weight-on-wheels switch, to determine automatically whether it is airborne or on the surface, and that automatic means indicates that the participant is airborne, then that participant **shall** (R3.51) set its air/ground state to "known to be airborne."

6. If a transmitting ADS-B participant *is* equipped with a means, such as a weight-on-wheels switch, to determine automatically whether it is airborne or on the surface, and that automatic means indicates that the participant is on the surface, then the following additional tests **shall** (R3.52) be performed to validate the “on-the-surface” condition:

- a. If the participant’s ADS-B emitter category is any of the following:  
“Small Aircraft” or  
“Medium Aircraft” or  
“High-Wake-Vortex Large Aircraft” or  
“Heavy Aircraft” or  
“Highly Maneuverable Aircraft” or  
“Space or Trans-atmospheric Vehicle”

and one or more of the following parameters is available to the transmitting ADS-B system:

- Ground Speed (GS) or
- Airspeed (AS) or
- Radio height from radio altimeter (RH)

and any of the following conditions is true:

- GS > 100 knots or
- AS > 100 knots or
- RH > 100 ft,

then the participant **shall** (R3.53-A) set its Air/Ground state to “known to be airborne.”

Otherwise, the participant **shall** (R3.53-B) set its Air/Ground state to “known to be on the surface.”

### 3.4.3.1.2 **Effect of Air/Ground State**

The set of SV elements to be broadcast by ADS-B participants is determined by those participants’ air/ground state as follows:

- a. ADS-B participants that are known to be on the surface **shall** (R3.54) transmit those State Vector report elements that are indicated with bullets (“•”) in the “required from surface participants” column of Table 3.4.3.
- b. ADS-B participants that are known to be airborne **shall** (R3.55) transmit those SV report elements that are indicated by bullets (“•”) in the “required from airborne participants” column of Table 3.4.3.

ADS-B participants for which the air/ground state is uncertain **shall** (R3.56) transmit those SV report elements that are indicated by bullets in the “required from airborne participants” column. It is recommended that such participants should also transmit those SV elements that are indicated with bullets in the “required from surface participants” column.