International Civil Aviation Organization
Asia and Pacific Office

GUIDANCE MATERIAL ON REPORTING PROBABILITY OF ADS-B UPDATE

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1. Background

1.1 Radars rotate at a fixed rate. Typically the air traffic controller is presented with new surveillance data at a rate identical or similar to the rotation rate of the radar, e.g. in the terminal area the screen refresh rate is usually about 5 seconds.

1.2 Probability of detection (Pd) is often used as a performance measure of a radar. It is a measure of the likelihood that a target will be detected. There is an underlying assumption in this definition that this probability applies to a single antenna rotation or controller screen update. This could be called probability of update.

1.3 ADS-B does not have a rotating antenna and typically a message is presented to the ATC centre every 1 second. It is then usually presented to the controller at the same rate as radar so that the controller perception of speed for radar and ADS-B tracks is the same. Normally this implies that multiple ADS-B "detections" are received during the display update cycle.

1.4 To compare the detection probability of radar and an ADS-B receiver system one must consider the operational use of the facility. For ADS-B to have the equivalent (or better) performance as radar, it must have equivalent probability of providing an update to the controller as radar over the same period.

1.5 If a radar system provides an update every 5 seconds, then to compare the radar probability of detection, one must consider the probability of ADS-B detecting and displaying the aircraft in the 5 second period. If one wishes to compare to an en-route radar rotating at 5 RPM, then one must consider the probability of ADS-B detecting and displaying the aircraft in the 12 second period.

2. Radar PD calculation

2.1 The achieved radar Pd is calculated by examining, for a particular coverage area, the achieved detections and dividing by the number of attempts at detection : ie the number of antenna revolutions or number of screen updates, e.g. in 100 antenna rotations 90 detections are presented to the controller and hence the Pd = 90%

3. ADS-B Probability of update calculation

3.1 An equivalent Probability of Update for ADS-B would be calculated by examining, for a particular coverage area, the detections presented to the controller and dividing by the number of possible screen updates Eg: in 100 screen updates, ADS-B positional data is presented to the controller 90 times and hence the Probability of update = 90%

3.2 If there is a desire to measure Probability of Update of ADS-B to be used for a terminal area function, without consideration of a display system, it is recommended that a period of 5 seconds is used. Divide the observation period into 5 second intervals and measure the probability as

$$\frac{\text{the number of 5 second intervals that contain valid useable positional data}}{\text{the number of 5 second intervals}}$$

3.3 If the ADS-B is to be used for an en-route only function, the selected period could be 5, 10 or 12 seconds.

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