Notes comparing RTCA TIS-B MASPS Version 4.2 and EUROCONTROL TIS-B Requirements (0.7c) and Functional Architecture Discussion Paper (0.9).

This document highlights the differences between the latest RTCA MASPs and EUROCONTROL TIS-B documents.

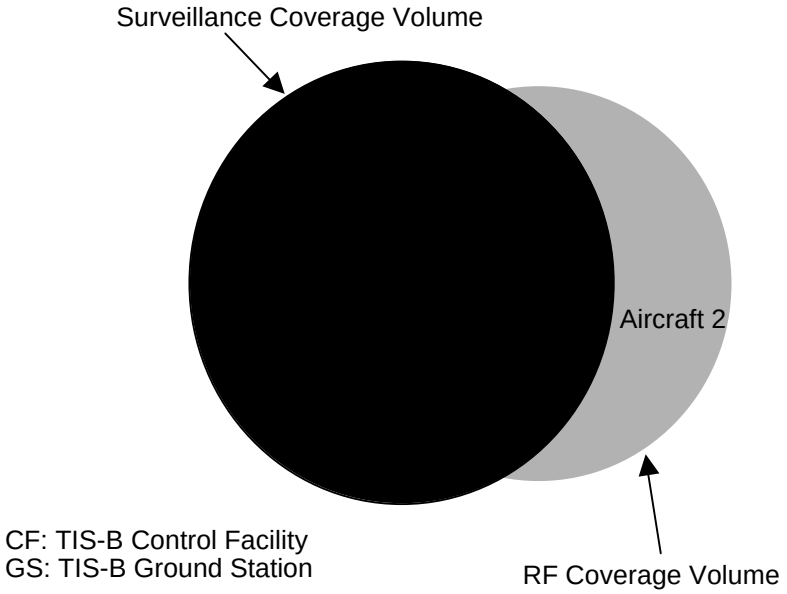
For each comment an extract from the MASPS is given, with the text of particular interest shown in *dark red italics*.

#1	MASPs Para Number: 1.2	Page Number: 3
RTCA Text Extract: TIS-B is a surveillance service that derives traffic information from one or more ground surveillance sources and broadcasts to *ADS-B equipped* aircraft or surface vehicles.		
Comment: EUROCONTROL does not require an aircraft or ground vehicle to be ADS-B equipped in order to receive TIS-B.		

#2	MASPs Para Number: 1.2.2	Page Number: 6

RTCA Text Extract:

This concept is illustrated in Figure 1-3, in which the Surveillance Coverage Volume available to a TIS-B Control Facility is represented by the circle to the left and the RF Coverage Volume available from a TIS-B Ground Station is represented by the darker shaded circle to the right (two dimensional coverage is shown for simplicity). Aircraft 1 is located in the Surveillance Coverage Volume but outside the RF Coverage Volume, therefore it does not receive TIS-B service. Aircraft 2 is located in the RF Coverage Volume and while it can receive TIS-B messages on aircraft in the Surveillance Coverage Volume, it does not receive TIS-B service for the volume of airspace it is located in, since surveillance coverage is not available there. Aircraft 3 can receive TIS-B service for the volume of airspace it is located in, as there is both surveillance coverage and RF coverage. The intersection of the two coverage volumes is the extent of the airspace within which TIS-B service may support a local ASA application. *It should be noted that although Figure 1-3 indicates a fixed airspace of RF coverage, in actual operations it is not guaranteed that aircraft in the RF Coverage Volume will receive any or all TIS-B messages*, and that aircraft outside the RF Coverage Volume may receive some TIS-B messages.



Comment:
By EUROCONTROLs definition the RF coverage volume is the volume of airspace in which reliable reception of a TIS-B service is guaranteed (obviously this is subject to the system operating normally), so the highlighted text is misleading.

#3	MASPs Para Number: 1.2.2	Page Number: 8

RTCA Text Extract:

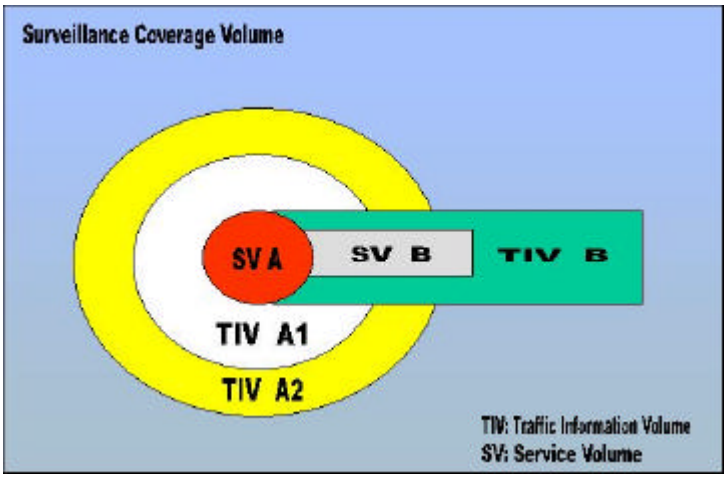


Figure 1-6 shows an example of multiple TIS-B Service and Traffic Information Volumes in a Surveillance Coverage Volume associated with a TIS-B Control Facility. *Service Volume A supports two applications (A1 and A2) each with a defined Traffic Information Volume supporting a different level of TIS-B data quality.*

Comment:
In the EUROCONTROL documents, by definition a service volume is associated with a single TIV, and it is the service that defines the service quality (not the TIV).
Also, it is not clear what is implied by the RTCA statement : is it that one set of TIS-B reports is sent within TIV A1 and TIV A2 but that a report in TIV A1 is of higher quality than a report in TIV A2, or are there separate TIS-B reports for TIV A1 and TIV A2. For example, if an aircraft was in within TIV A1 is a report sent for the TIV A2 application or not? Would there be a TIS-B report for TIV A1 and TIV A2? And if the aircraft then crosses over into TIV A2 is it sent as a new separate service for TIV A2 or is simply that the quality of the report is worse.

#4	MASPs Para Number: 1.2.3	Page Number: 9

RTCA Text Extract:

TIS-B Track Reports will not be filtered when adequate ADS-B aircraft-to-aircraft communication is not available (e.g., due to the RF system used in a multi-link environment or *to ADS-B coverage limitations*).

Comment:
EUROCONTROL do not expect TIS-B to compensate automatically for ADS-B coverage limitations. It is unclear whether this is what is implied by the RTCA document.

#5	MASPs Para Number: 1.2.3	Page Number: 9
RTCA Text Extract: Flight data information (e.g., flight identification *or intent information*) is another source of data that may be used in generating TIS-B Track Reports		
Comment: EUROCONTROL does not foresee the use of intent information for TIS-B. TIS-B is being seen as an interim system, and intent is not expected to be required for initial applications. By the time intent information is expected to be required by applications, it is expected that it can be provided by the ADS-B equipped fleet.		

#6	MASPs Para Number: 2.1	Page Number: 15
RTCA Text Extract: The TIS-B System shall (Shall 2.1-06) be capable of providing TIS-B reports for the following classes of targets: aircraft, vehicles in the airport movement area, and *designated obstacles*.		
Comment: Currently EUROCONTROL requires obstacles to be ADS-B equipped if they are to be distributed via TIS-B.		

#7	MASPs Para Number: 3.1.1.2.1	Page Number: 19
RTCA Text Extract: A TIS-B Track Report shall (Shall 3.1-08) contain, as a minimum, the following data elements: • State Vector • Unique identifier • Time of Applicability • Track accuracy *(NAC)* • Track quality (*expressed in NIC and SIL*) • Position and velocity uncertainties (e.g., Covariances) (optional*)* • ADS-B source • Altitude source • Emergency Status (if available) • Air/Ground State (if available) • Flight identification (if available)		
Comment: EUROCONTROL require that the track accuracy (called position uncertainty in the EUROCONTROL documents) is sent but the resolution has not been defined for the time being. The use of NIC and SIL is under discussion. .		

#8	MASPs Para Number: 3.1.2.1	Page Number: 20

RTCA Text Extract:

1.1.1.1 Sensor Adaptation

The Sensor Adaptation function shall (Shall 3.1-16) align the contributing sensors to a common reference.

Comment:
EUROCONTROL do not define any requirements on how the SDPD should establish the tracks. Performance requirements will be defined in terms of accuracy etc., but EUROCONTROL do not believe it is necessary or desirable to define requirements concerning sensor alignment etc.

#9	MASPs Para Number: 3.1.1.2.1	Page Number: 20

RTCA Text Extract:

(3) An architecture in which multiple Control Facilities are defined with overlap at their boundaries. Each Control Facility generates TIS-B Target Reports only for traffic within its predefined boundaries, such that multiple reports from differing Control Facilities are possible only within the limited overlap region.

Comment:
EUROCONTROL do not understand this statement.

#10	MASPs Para Number: 3.1.2.1	Page Number: 24

RTCA Text Extract:

The Tracking function shall (Shall 3.1-28) maintain a false TIS-B Track Report rate that meets the ASA application requirements.

Note:Table 3-1 provides an example of criteria for a single-sensor Surveillance Processing Subsystem to use under nominal conditions for track initiation, TIS-B Track Report generation, and track drop.

Source	***Track Initiation***	***TIS-B Track Report Generation***	***Track Drop***
Radar Reinforced Mode A/C	*1 plot*	*3 plots*	*3 plots*

Radar Reinforced Mode S	*1 plot*	*2 plots*	*3 plots*
Radar (Mode A/C only)	*3 plots*	*4 plots*	*3 plots*
Radar (Mode S only)	*1 plot (roll call reply)*	*2 plots*	*3 plots*
Radar (Search only)	*4 plots*	*6 plots*	*3 plot*
Doppler Radar (search only)	*4 plots*	*5 plots*	*3 plot*
ASDE III/AMASS	*TBD*	*TBD*	*TBD*
ADS-B	*1 report*	*1 report*	*15 sec*
Multilateration	*TBD*	*TBD*	*TBD*

Comment:
EUROCONTROL does not expect to define requirements for track initiation and track drop in the terms used by the RTCA. Subject to further discussion, it is expected that the requirements for track initiation will be defined in terms of a time after entering the TIV (and it will effectively become a constraint of the TIV that it is sufficiently within the surveillance coverage volume that a track has already been initiated by the tracker), and for track drop will be defined in terms of a time after leaving the TIV.

#11	MASPs Para Number: 3.2.1.2	Page Number: 26

RTCA Text Extract:

The TIS-B Target Report shall (Shall 3.3-07) contain:

- State Vector
- Unique identifier
- Time of Applicability
- Track quality (expressed in NIC and SIL)
- Track Accuracy (NAC)
- Emergency Status (if available)

Comment:

EUROCONTROL define a TIS-B report at User level, by the following: "*A set of data items (i.e. one or more track data items) corresponding to a single Object Of Interest delivered to a TIS-B User compose a TIS-B Report*".

- ⇨ A TIS-B report does not necessarily contain all track data items
- ⇨ Each TIS-B report shall include a TIS-B service identifier
- ⇨ Each TIS-B report shall include a time of applicability (valid for all track data items of the report)
- ⇨ Track data items are not necessarily required to be delivered all at the same refresh period

Track data items are not necessarily required to be delivered all at the same time to the Users. Anyhow, there is a need that certain data items are obligatorily grouped together when delivered (e.g. position and position uncertainty)

#12	MASPs Para Number: 3.2.1.2	Page Number: 26

RTCA Text Extract:

The following additional TIS-B Target Report data elements are optional and may be included if available.

- Flight identification
- Air/Ground State

Comment:
EUROCONTROL include other data items that are to be included "when available". EUROCONTROL does not have the concept of optional data items per se.

#13	MASPs Para Number: 3.2.1.2	Page Number: 27

RTCA Text Extract:

(3) An architecture in which multiple Control Facilities are defined with overlap at their boundaries. Each Control Facility generates TIS-B Target Reports only for traffic within its predefined boundaries, such that multiple reports from differing Control Facilities are possible only within the limited overlap region.

Comment:
EUROCONTROL do not understand this statement.

#14	MASPs Para Number: 3.2.1.2	Page Number: 27

RTCA Text Extract:

Target Reports for targets located within multiple Service Volumes shall (Shall 3.2-10) be broadcast so as to support the requirements of all such Service Volumes.

Note: This requirement avoids the need to broadcast duplicate data for such targets.

Comment: EUROCONTROL would not expect to have these circumstances very often, however in the circumstances where services do overlap, the current EUROCONTROL architecture would require the TIS-B reports to be sent independently for each service, so there may be duplicate data. Note if duplicates are not sent then the TIS-B report will need to contain several TIS-B service identifiers to identify which services the report is part of.

#15	MASPs Para Number: 3.2.2.1	Page Number: 27
MASPs Para Number:	**Page Number:**	
RTCA Text Extract: *Note: as an example, an adjustment of configuration could enable the service volume to be changed if surveillance capability was degraded to a point where it could not support the corresponding traffic information volume. As another example, an alternate transmitter could be designated to replace one that has failed.*		
Comment: In the interest of keeping the system design as simple as possible, EUROCONTROL do not foresee the possibility to dynamically change the TIS-B service volume configuration.		

#16	MASPs Para Number: 3.2.2.1.1	Page Number: 28

RTCA Text Extract:

Service Status data may provide TIS-B System users with pertinent service policies and status regarding a TIS-B Service. Service Status data may be used by an ASA application to determine the service parameters and whether the TIS-B Messages received can be used by the end-user. The means by which Service Status data are conveyed to the ASA application is not specified.

The Service Status shall (Shall 3.2-18) include the following data:

- Service identification (number)
- Service availability (e.g., Operational, Non-operational)
- Service type (e.g., Basic, Full Coverage, ADS-B Validation, Intent Information, Multi-link Gateway)

The Service Status may also include these optional data:

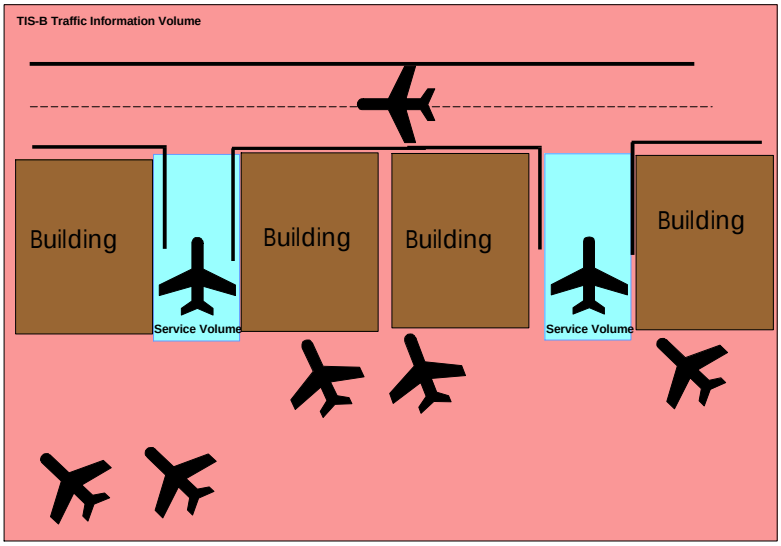
- Expected minimum service quality
- Service volume boundary (e.g., reference point, vertex count and list of three dimensional vertices)
- Target count in Traffic Information Volume

Comment:

The EUROCONTROL heartbeat message does not foresee to include explicitly a service availability bit (the heartbeat would not be sent if the service were unavailable), nor a service type. However these requirements should be considered for inclusion in the EUROCONTROL architecture.

The minimum service quality is not included within the heartbeat message, nor currently the service volume boundary. These items are under discussion within the EUROCONTROL meetings.

Service Volume shape. EUROCONTROL believe that it should be possible to define a Service Volume that is not contiguous. This is because there may be circumstances, for example at airports, where there are 'blindspots' that would need to be covered by TIS-B, and it would be preferable for all these blindspots to be covered by a single service (and therefore a single service volume). The diagram below illustrates the need for such a definition of service volumes:



#17	MASPs Para Number: 3.2.2.2	Page Number: 29

RTCA Text Extract:

The Report Filtering function shall (Shall 3.2-25) be capable of suppressing the output of TIS-B Target Reports based on one or more of the following criteria:

- Transponder Code
- Aircraft address
- Aircraft Flight Identification
- Flight plan data
- Surveillance source (e.g. ADS-B link, sensor class if available)
- Update rate to meet the announced Service Level

Comment:
EUROCONTROL do not currently foresee the ability to filter tracks based on the contents of the associated flight plan.

#18	MASPs Para Number: 3.3.1	Page Number: 31

RTCA Text Extract:

The Link Specific Processing Subsystem shall (Shall 3.3-04) output Link Status data to the TIS-B Distribution Subsystem.The Link Specific Processing Subsystem shall (Shall 3.3-05) generate Link Status data to include, but not be limited to the following:

- Broadcast system failures
- Conditions that may limit or reduce the broadcast capacity
- All detected system errors that occur
- Conditions when a TIS-B Message is not transmitted

Comment:
EUROCONTROL have yet to define what status data is to be reported. A proposal for a new ASTERIX category (category 66) is being prepared for discussion within the STFRDE that will contain proposed status information for ADS-B and TIS-B groundstations.