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EUROPEAN ORGANISATION
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EUROCONTROL Specification for Time Based Separation (TBS) support tool for Final Approach

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Abstract

This document defines a set of performance requirements for a Time-Based Separation (TBS) support tool, which complies with Commission Implementing Regulation (EU) No 716/2014 (Pilot Common Project regulation).

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Contact Person(s)	Tel	Unit
Sasho NESHEVSKI	+32 2 729 3962	DPS/STAN
Vincent TREVE	+32 2 729 5197	ATM/RDS/APT

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Publications
EUROCONTROL Headquarters
96 Rue de la Fusée
B-1130 BRUSSELS

Tel: +32 (0)2 729 4715
Fax: +32 (0)2 729 5149
E-mail: publications@eurocontrol.int

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EXECUTIVE SUMMARY

The Time-Based Separation (TBS) concept defines a set of wake separation rules in terms of time rather than distance to improve runway throughput resilience to strong/moderate headwind conditions. The controllers need tool support to translate the required time separation / spacing into the equivalent distance separation / spacing for the prevailing headwind conditions to enable visualisation of the required time separation / spacing on the applicable Approach and Tower Controller Working Positions (CWP). This document defines a set of performance requirements for a TBS support tool, which complies with Commission Implementing Regulation (EU) No 716/2014.

1 INTRODUCTION

1.1 Context

This document is the EUROCONTROL Specification for Time-Based Separation (TBS) support tool for final approach (TBS Specification). It has been developed in collaboration with stakeholders from air navigation service providers, airports, aircraft operators, industry bodies and trade associations.

In accordance with the Indicative roadmap with respect to standardisation and regulatory needs [2] EUROCONTROL has undertaken a standardisation activity to produce a specification on the TBS tools performance requirements.

EUROCONTROL Specifications have voluntary status and are developed to support Members States and stakeholders. This Specification has been developed in support of the deployment of ATM Functionality (AF) 2: “Airport Integration and Throughput”, sub-functionality “Time-Based Separation for Final Approach” as well as Operational Improvement (OI) Step AO-0303 ‘’TBS for Final Approach’’ from the ATM Master Plan. This could also be applicable to other wake turbulence OI Steps such as AO-0306 “Wake turbulence separations based on static aircraft characteristics”.

The requirements in this specification are based upon detailed requirements developed and validated in SESAR Project 06.08.01 Flexible and Dynamic Use of Wake Vortex Separations. See Ref. [3] through [11], Section 7.

1.2 Maintenance of the Specification

This EUROCONTROL Specification has been developed under the EUROCONTROL Advisory Framework (ERAF) [12] and is maintained by EUROCONTROL in accordance with the above framework.

2 CONVENTIONS

The following conventions are used in this EUROCONTROL Specification:

a. “**Shall**” – indicates a statement of specification, the compliance with which is mandatory to achieve the implementation of this EUROCONTROL Specification.

b. “**Should**” – indicates a recommendation or best practice, which may or may not be satisfied by all systems claiming conformity to this EUROCONTROL Specification.

c. “**May**” – indicates an optional element.

Numbers within square brackets are used to identify reference documents listed in section 7 e.g. [1] identifies the first reference documents of section 7.

Every requirement and recommendation in this EUROCONTROL Specification is followed by a structured identifier, which can be used to uniquely reference the requirement/recommendation from associated documents and traceability tools. Such identifiers have the form:

TBS-[Fn]-[nnn]

where:

[Fn]: is a sequence of characters to identify the functional area to which the requirement applies, e.g. “FLIGHT” for requirements related to TBS support tool flight data inputs;

[nnn]: is a numeric identifier for a sequence of requirements within the same functional area[1].

The functional areas are:

- FLIGHT: Flight data inputs;
- SURV: Surveillance data inputs;
- SEP: Separation data inputs;
- SPAC: Spacing data inputs;
- MET: Meteorological data inputs;
- SEQ: Approach arrival sequence inputs;
- SPEED: Aircraft speed profile / time-to-fly modelling;
- CALC: Separation and spacing calculation;
- COMP: Compression spacing calculation;
- HMI: Human Machine Interface for Controller Working Positions;
- SAF: Safety mitigation elements;
- CNTR: Operational control and monitoring.

3 BACKGROUND

3.1 Operational Context

Headwind conditions on final approach cause a reduction of the aircraft ground speed which for distance based separation results in increased time separation for each aircraft pair, a reduction of the landing rate, and a lack of stability of the runway throughput during arrival operations.

This has a negative impact not only on the achieved capacity, but also on the predictability of operations, time and fuel efficiency, and environment (emissions).The impact on predictability for core hubs is particularly important at the network level.

The service disruption caused by the reduction in achieved runway throughput compared to declared capacity in medium and strong headwinds on final approach has a significant impact on the overall network performance. It is also particularly exacerbated if this occurs on the first rotation of the day because of the impact on all the other rotations throughout the day. This service disruption also has a significant impact on airline operations due to delayed and cancelled flights.

The TBS concept addresses this problem by defining procedures and specifying user and high level system requirements to allow stable arrival runway throughput in all headwind conditions on final approach.

3.2 TBS Concept

The objective of time based separation is to improve the landing rate resilience to headwind conditions on final approach by recovering the lost landing rate currently experienced when applying distance based separation. This is achieved by stabilising the delivered time separation between aircraft on final approach across a range of headwind conditions.

The TBS concept involves changing the separation rules on final approach from distance based separation to time based separation. There is a need to facilitate delivery of aircraft to time based separation constraints by the Final Approach and Tower Runway controllers.

[1] Requirement numbers are initially allocated incrementally in tens. This aids the subsequent management of this specification allowing new requirements to be inserted between existing requirements whilst maintaining a logical number sequence.

This is achieved through the provision of indicator support for visualising the applicable separation or spacing constraint, where the indicator support is displayed on the extended runway centreline of the Final Approach controller and the Tower Controllers surveillance display.

Controller separation / spacing procedures will have to be updated to take into account the use of the indicator support in the arrival delivery on final approach.

3.3 Mitigation of the wake risk

A safety case on Time-Based Separation Minima on Final Approach (TBS Minima) as alternative to Distance-Based Separation has been submitted to EASA for review.

Headwind conditions on final approach cause a reduction of the aircraft ground speed which results in increased time separation for each aircraft pair, hence reducing the landing rate.

By operating with TBS minima, established from equivalent time to fly the distance minima in calm wind conditions, the delivered time spacing between aircraft on final approach will be maintained across headwind conditions.

This principle of replacing the distance-based minima by equivalent time-based minima in calm wind conditions is assessed from a wake turbulence risk perspective in this safety case.

By introducing possible dynamic variation of DBS minima as function of head wind, with the application of fixed TBS minima between successive arrivals, some aircraft pairs will be exposed to different wake age compared to their current situation under distance-based separation scheme, and TBS may impact the wake strength that can be potentially encountered. Indeed, the headwind component transports the vortices toward the follower aircraft. When applying DBS, since the distance separation is maintained constant whatever the headwind condition, at first order the age of the vortex potentially encountered by the follower remains constant. On the contrary, when applying TBS in prevailing headwind conditions, because the time separation between the aircraft is maintained constant, the age of the vortex potentially encountered by the follower is reduced.

The wake turbulence encounter risk assessment presented in the safety case provides assurance that applying TBS minima converted from DBS minima are acceptably safe in principle due to the effect of wind on wake decay.

The wake turbulence risk assessment is based on wake vortex data and operational traffic data, built on around 100.000 wake tracks collected by LiDAR technology at major European airports. The wake decay is characterised per generator aircraft type and compared between calm wind and headwind conditions.

TBS minima will need to be established on a local basis, based on local characterisation of the time-to-fly for aircraft pairs on final approach. The operational application of TBS minima, with the display of equivalent distance to Air Traffic Controllers must be subject to a dedicated analysis, covering in particular the performance, accuracy, availability and reliability of wind prediction, time-to-fly forecast and the ATC support tool.

4 SCOPE

The TBS Specification covers the TBS tool requirements.

As stated in the Annex, paragraph 2.1.3, of the PCP Regulation [1] ‘’Radar separation minima and Wake Turbulence Separation parameters shall be integrated in a TBS support tool providing guidance to the air traffic controller to enable time-based spacing of aircraft during final approach that considers the effect of the headwind.’’ Note that this specification

also considers the option for the a TBS support tool to allow visual separations.

The PCP Regulation also sets out in its Annex the high-level system requirements on the TBS support tool related to Article 3 paragraph (b) ATM Functionality "Airport Integration and Throughput", as follows:

"System Requirements

- *The flight data processing and AMAN systems shall be compatible with the TBS support tool and able to switch between time and distance based wake turbulence radar separation rules*
- *The controller working position shall integrate the TBS support tool with safety nets to support the air traffic controller, in order to calculate TBS distance respecting minimum radar separation using actual glide-slope wind conditions*
- *Local meteorological (MET) information providing actual glide slope wind conditions shall be provided to the TBS support tool*
- *The TBS support tool shall provide automatic monitoring and alerting on non-conformant final approach airspeed behaviour, automatic monitoring and alerting of separation infringement and automatic monitoring and alerting for the wrong aircraft being turned on to a separation indicator*[2]
- *The TBS support tool and associated controller working position shall calculate Indicator distance and display it on controller displays*
- *Safety nets capturing automatic monitoring and alerting of separation infringement shall support TBS operations"*

The EUROCONTROL TBS Specification is consistent with the above system requirements. In particular, the TBS Specification covers the generic TBS implementation case as well as operational environment scenarios with specific traffic mix.

5 PURPOSE

The purpose of this document is to provide a EUROCONTROL Specification for Time Based Separation (TBS) support tool for Final Approach, defining a set of performance requirements applicable to a TBS support tool. EUROCONTROL Specifications have a voluntary status and are developed to support Member States and stakeholders. This EUROCONTROL Specification for TBS supports the objective of the PCP Regulation [1] and will facilitate the compliance to the mandatory requirements set out in this Regulation. Furthermore, this Specification will ensure that TBS operations are performed in a uniform way.

6 TBS TOOL PERFORMANCE REQUIREMENTS

The application of TBS by the ATCO in charge of maintaining radar separation until RWY threshold necessitates a TBS support tool. The TBS support tool is necessary to convert the required time separation / spacing into the equivalent distance separation / spacing for the prevailing headwind conditions. The equivalent distance separation / spacing needs to

[2] Explanatory note: "*wrong aircraft being turned on to a separation indicator*" is understood here as turning an aircraft on a separation indicator that was computed for another following aircraft type

be displayed on the traffic display of the Controller Working Position through indicator support. The following sections present the TBS support tool requirements.

Requirements are structured according to the key steps used by the TBS system from inputs through to the calculation and display of the separation / spacing on the Controller Working Position (CWP).

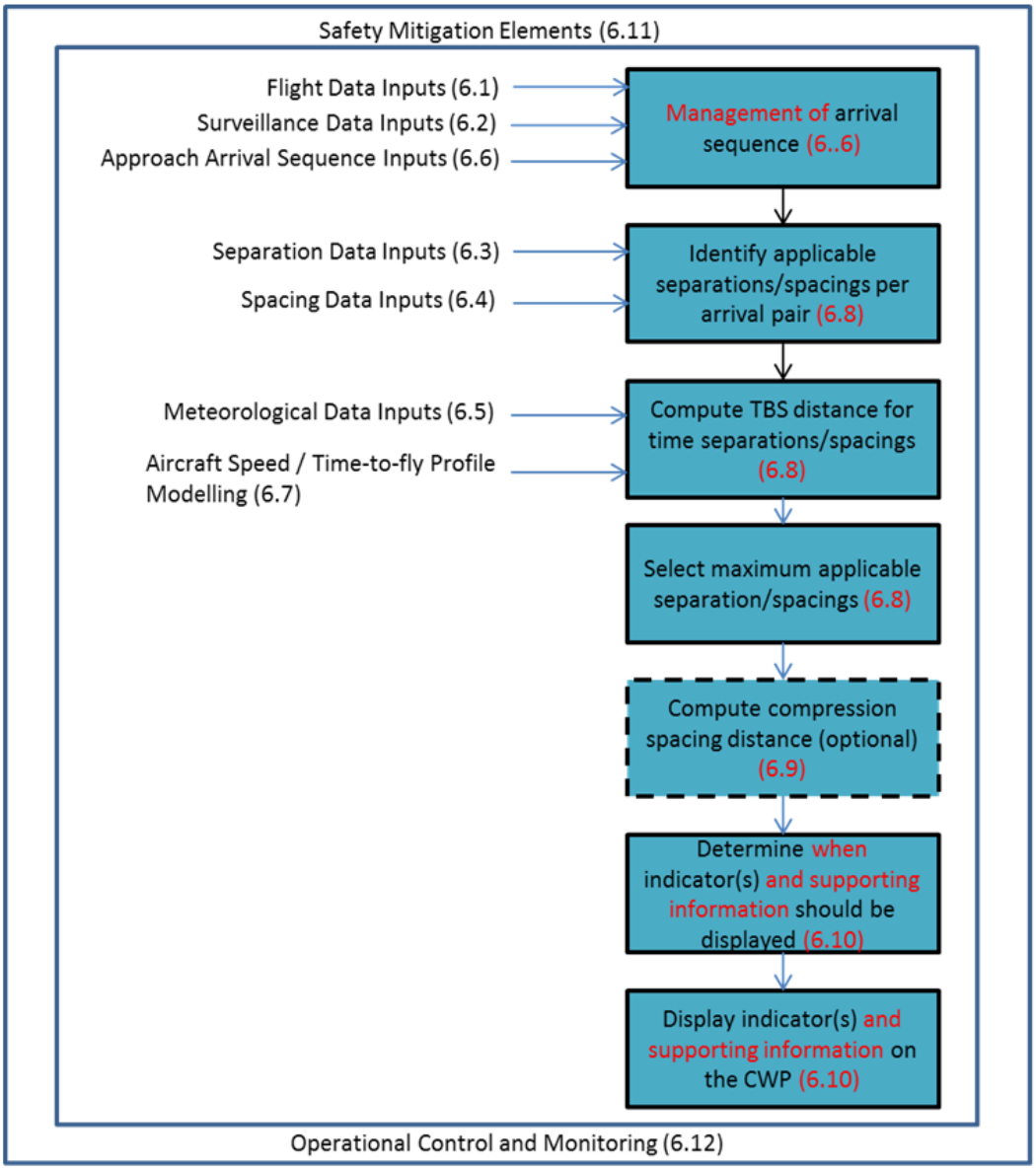

Figure 1 – Indicator distance calculation steps

6.1 Flight Data Inputs

TBS-FLIGHT-010 ICAO aircraft type for all arrival aircraft shall be provided to the TBS support tool.

TBS-FLIGHT-020 Wake category for all arrival aircraft should be provided to the TBS support tool.

TBS-FLIGHT-030 Default separation rule shall be defined if provided ICAO aircraft type is not recognised by TBS support tool.

6.2 Surveillance Data Inputs

TBS-SURV-010 Aircraft position, including altitude, for all arrival aircraft shall be

provided to the TBS support tool.

TBS-SURV-015 Provided aircraft position should have the same performance as the applicable ATC display used for separation purposes

TBS-SURV-020 Downlinked airborne parameter data may be provided to the TBS support tool.

6.3 Separation Data Inputs

TBS-SEP-010 Distance based wake turbulence separation rules shall be provided to the TBS support tool based on ICAO aircraft type.

TBS-SEP-020 Time based wake turbulence separation rules shall be provided to the TBS support tool based on ICAO aircraft type.

TBS-SEP-025 Default separation rule shall be defined if provided ICAO aircraft type is not recognised by TBS support tool.

TBS-SEP-030 All applicable Minimum Radar Separation (MRS) rules shall be provided to the TBS support tool.

TBS-SEP-040 Minimum runway time separation shall be provided to the TBS support tool.

6.4 Spacing Data Inputs

TBS-SPAC-010 Minimum runway spacing shall be provided to the TBS support tool.

TBS-SPAC-020 All applicable spacing rules to be manged by the tool shall be provided to the TBS support tool.

TBS-SPAC-030 Individual spacing gaps between aircraft pairs should be provided to the TBS support tool.

TBS-SPAC-040 If allowed without TBS, visual separations may be also allowed by the TBS support tool.

6.5 Meteorological Data Inputs

TBS-MET-010 The actual glide-slope wind conditions shall be provided to the TBS support tool.

TBS-MET-020 Uncertainty on the actual glide-slope wind provided to the TBS support tool shall be quantified.

6.6 Approach Arrival Sequence Inputs

TBS-SEQ-010 The approach arrival sequence information shall be provided to the TBS support tool.

TBS-SEQ-015 The TBS tool may automatically determine the final approach sequence for arriving aircraft

TBS-SEQ-020 Modification of the approach arrival sequence information shall be supported by the TBS support tool.

TBS-SEQ-030 Runway intent for all arrival aircraft shall be provided to the TBS support tool.

6.7 Aircraft Speed Profile/ Time-to-fly Modelling

TBS-SPEED-010 An expected aircraft speed profile or time-to-fly model on the final

approach glide-slope shall be provided to the TBS support tool.

6.8 Separation and Spacing Calculation

TBS-CALC-010 The TBS support tool shall be able to switch between time and distance based wake turbulence radar separation rules.

TBS-CALC-020 If using DBS mode the TBS support tool shall use the distance based wake separation rules.

TBS-CALC-030 If using TBS mode the TBS support tool shall use time based wake separation rules.

TBS-CALC-040 As a minimum the TBS support tool shall support wake turbulence radar separation rules.

TBS-CALC-050 The TBS support tool may support other separation or spacing constraints.

TBS-CALC-060 All applicable separations and spacings between each in-trail aircraft pair in the approach arrival sequence shall be identified by the TBS support tool.

TBS-CALC-070 All applicable separations and spacings between each not-in-trail aircraft pair in the approach arrival sequence shall be identified by the TBS support tool.

TBS-CALC-080 The TBS distance for all time based separations and spacings shall be computed by the TBS support tool considering the glide-slope wind conditions and an expected speed profile / time-to-fly model.

TBS-CALC-090 The maximum of all applicable separation or spacing distances managed by the TBS support tool shall be selected as the indicator distance.

TBS-CALC-100 The latest time the indicator distance is computed shall correspond to the time a stable indicator is required by the controller.

TBS-CALC-110 If there is a change to the sequence, as maintained by the TBS support tool, the indicator distance for all affected aircraft pairs shall be re-calculated.

TBS-CALC-130 If the indicator represents a time based separation then its display option shall be configured as always on.

6.9 Compression Spacing Calculation

TBS-COMP-010 A compression distance should be calculated by the TBS support tool considering the glide-slope wind conditions and an expected speed / time-to-fly profile.

6.10 Human Machine Interface for Controller Working Positions

TBS-HMI-010 The TBS support tool shall support the display of indicators on the CWP of the ATCO in charge of maintaining radar separation until RWY threshold.

TBS-HMI-020 The displayed indicator distance shall be consistent between all applicable CWPs.

TBS-HMI-025 The displayed indicators may however be customised to meet specific Tower Runway and Final Approach controller needs of the ATCO in charge of maintaining radar separation until RWY threshold.

TBS-HMI-030 The indicators shall be displayed on the extended runway centreline of the applicable runway.

TBS-HMI-040 The indicator display should update at the same time with no discernible difference as the radar update of the associated aircraft.

TBS-HMI-050 The TBS support tool shall support the controller decision to turn onto final approach.

TBS-HMI-060 The HMI design for the indicator may be configurable depending on the type of separation / spacing.

TBS-HMI-065 The HMI design may allow to hide indicator for a specific pair if visual separation is allowed by the ATCO for that pair.

TBS-HMI-070 If more than one type of indicator is displayed on the CWP HMI of the ATCO in charge of maintaining radar separation until RWY threshold, then indicator HMI design should be clearly distinguishable to avoid ambiguity.

TBS-HMI-080 The HMI design shall allow controllers to identify the aircraft associated with each displayed indicator.

TBS-HMI-090 The approach arrival sequence, as maintained by the TBS support tool, may be available on the CWP HMI of the ATCO in charge of maintaining radar separation until RWY threshold.

TBS-HMI-100 During a mode transition (e.g., DBS to TBS) those indicators not already displayed shall use the new mode of operation.

TBS-HMI-110 During a mode transition (e.g., DBS to TBS) those indicators already displayed shall use the previous mode of operation.

TBS-HMI-120 The compression indicator distance should be displayed on the CWP HMI of the ATCO in charge of maintaining radar separation until RWY threshold.

6.11 Safety Mitigation Elements

TBS-SAF-010 The computed TBS distance representing the time based wake turbulence separation shall be acceptably safe from a wake risk point of view after considering the effect of uncertainty in the speed profile of the aircraft.

TBS-SAF-020 The computed TBS distance representing the time based wake turbulence separation shall be acceptably safe from a wake risk point of view after considering the effect of uncertainty in the glide-slope wind conditions.

TBS-SAF-030 If compression indicators are implemented, the computed compression distance shall be acceptably safe after considering the effect of uncertainty in the speed profile of the aircraft.

TBS-SAF-040 If compression indicators are implemented, the computed compression distance shall be acceptably safe after considering the effect of uncertainty in the glide-slope wind conditions.

TBS-SAF-050 The TBS support tool shall provide to the ATCO in charge of maintaining radar separation until RWY threshold automatic monitoring and alerting on non-conformant final approach airspeed behaviour as expected by the expected speed profile / time-to-fly model.

TBS-SAF-060 The TBS support tool shall provide to the ATCO in charge of maintaining radar separation until RWY threshold automatic monitoring and alerting of separation infringement.

TBS-SAF-070 The TBS support tool shall provide to the ATCO in charge of maintaining radar separation until RWY threshold automatic monitoring and alerting for the wrong aircraft being turned on to a separation indicator.

TBS-SAF-075 The TBS support tool may be capable of automatic updates for the wrong aircraft being turned onto a separation indicator.

TBS-SAF-080 The TBS support tool shall provide automatic monitoring and alerting of catch up of the indicator.

6.12 Operational Control and Monitoring

TBS-CNTR-010 The TBS support tool shall provide alert to controllers and supervisors in case of degradation of the data Inputs.

TBS-CNTR-020 The TBS support tool shall alert controllers and supervisors in case of failure of the TBS support tool.

7 REFERENCES

1. Commission Implementing Regulation (EU) No 716/2014 of 27 June 2014 (The Pilot Common Project Regulation)
2. REFERENCE AND SUPPORTING MATERIAL - (EC) NO 716/2014 - ARTICLE 4(B); Indicative roadmap with respect to standardisation and regulation needs
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11. Flexible and Dynamic use of Wake Turbulence Separations, EXE 835 VALR - Appendix D – Human Performance Assessment Report, Edition 00.01.00, deliverable of SESAR Project No. 06.08.01
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8 ABBREVIATIONS AND DEFINITIONS

8.1 Abbreviations

Term	Definition
AF	ATM Functionality
AMAN	Arrival Manager
ANS	Air Navigation Service
ATC	Air Traffic Control
ATCO	Air Traffic Control Officer
ATM	Air Traffic Management
CALC	TBS separation / spacing calculation requirements
CNTR	Operational control and monitoring requirements
COMP	Compression spacing calculation
CWP	Controller Working Position
DBS	Distance Based Separation
EU	European Union
ERAF	EUROCONTROL Advisory Framework
FLIGHT	Flight data input requirements
HMI	Human Machine Interface
ICAO	International Civil Aviation Organization
MET	Meteorological data inputs
MRS	Minimum Radar Separation
OI	Operational Improvement
ORD	Optimised Runway Delivery
OSED	Operational Service and Environment Definition
PCP	Pilot Common Project
PWS	Pair Wise Separation
RECAT EU	Re-categorisation in EU (scheme)
ROT	Runway Occupancy Time

SAF	Safety mitigation element requirements
SAR	Safety Assessment Report
SEP	Separation data inputs
SEQ	Approach arrival sequence inputs
SESAR	Single European Sky ATM Research
SPAC	Spacing data inputs
SPEED	Aircraft speed / time-to-fly profile modelling
SURV	Surveillance data input requirements
TBS	Time Based Separation
THR	Threshold
VALR	Validation Report
WDS	Weather Dependant Separation
WTC	Wake Turbulence Category

8.2 Definitions

Term	Definition
Actual glide-slope wind	Wind information covering the spatial and temporal range of applicability of the separation indicator computed on the basis of this wind information
Approach Arrival Sequence	A list of aircraft presented in the expected order of arrival.
Arrival aircraft	Arrival aircraft means those to be sequenced on final approach.
Compression distance	A distance that represents the amount of compression predicted to occur between two aircraft from the time the leader passes a defined point (typically the deceleration fix) and the time the leader reaches the runway threshold.
Compression indicator	A reference on the Final Approach and Tower Runway CWP to visualise the compression distance.
DBS mode	A mode of operation when indicators are calculated using distance based wake separation rules.

Distance based wake turbulence radar separation rules	Wake turbulence radar separation rules defined in distance which can be category based or aircraft pair based.
Expected aircraft speed profile or time-to-fly model	A model which defines an expected aircraft speed profile or time-to-fly model needed for converting time to distance in the separation / spacing calculation.
Glide-slope wind conditions	MET information along the glideslope (At minima from threshold to a distance corresponding to the separation delivery point plus the maximum separation to apply). Can be one or more of wind effect, wind speed and / or wind direction.
Indicator	A reference on the Final Approach and Tower Runway CWP to visualise the indicator distance.
Indicator distance	The distance computed for an indicator which represents the required separation or spacing.
Individual spacing gaps	An increase of separation behind a given aircraft in the approach sequence, this one can be, for example, requested for clearing a departure in mix mode
In-trail aircraft pair	A consecutive pair of aircraft on final approach which are using the same localiser.
Minimum radar separation	The minimum allowable separation allowed between two aircraft based upon the radar performance requirements.
Minimum runway time separation	Is the time separation rule ensuring safe operation on the runway. Primarily, this time separation result from the runway occupancy time, but can also be related, for example, to other constrain like departure in mix mode or runway inspection
Minimum runway spacing	Is the spacing rule ensuring safe operation on the runway. Primarily, this spacing result from the runway occupancy time, but can also be related, for example, to other constrain like departure in mix mode or runway inspection
Not-in-trail aircraft pair	A consecutive pair of aircraft on final approach which are not using the same localiser (i.e. parallel runways).
Separation	A legal minimum time or distance allowed between two

	aircraft.
Spacing	A time or distance between two aircraft which does not represent a separation.
TBS distance	The distance that an aircraft will fly for a given time, wind and expected speed profile.
TBS mode	A mode of operation when indicators are calculated using time based wake separation rules.
TBS support tool	A tool that converts the required time separation / spacing into the equivalent distance separation / spacing for the prevailing headwind conditions and displays this on the CWP.
Time based wake turbulence radar separation rules	Wake turbulence radar separation rules defined in time, which can be category based or aircraft pair based.

ANNEX A - TRACEABILITY TO REGULATORY REQUIREMENTS

This annex provides traceability between relevant European legislation, in particular, from the Articles of Commission Implementing Regulation (EU) No 716/2014 of 27 June 2014 (The Pilot Common Project regulation) and the technical provisions of the EUROCONTROL Specification for TBS. The first column identifies the relevant Articles of the regulation.

The second column identifies regulatory requirements where this specification's implementation can support compliance.

The third column provides a reference to the requirements in the TBS Specification that can support compliance to the PCP regulation.

Regulation Reference	Regulatory Requirements	EUROCONTROL TBS Specification reference
Annex, Para 2.1.3	The flight data processing and AMAN systems shall be compatible with the TBS support tool and able to switch between time and distance based wake turbulence radar separation rules	TBS-FLIGHT-010 TBS-FLIGHT-020 TBS-FLIGHT-030 TBS-SURV-010 TBS-SURV-015 TBS-SURV-020 TBS-SEP-030 TBS-SEP-040 TBS-SPAC-010 TBS-SPAC-020 TBS-SPAC-030 TBS-SPAC-040 TBS-SEQ-030

Regulation Reference	Regulatory Requirements	EUROCONTROL TBS Specification reference
		TBS-CALC-010
Annex, Para 2.1.3	The controller working position shall integrate the TBS support tool with safety nets to support the air traffic controller, in order to calculate TBS distance respecting minimum radar separation using actual glide-slope wind conditions	TBS-SEP-010 TBS-SEP-020 TBS-SEP-030 TBS-MET-010 TBS-MET-020
Annex, Para 2.1.3	Local meteorological (MET) information providing actual glide slope wind conditions shall be provided to the TBS support tool	TBS-MET-010 TBS-MET-020
Annex, Para 2.1.3	The TBS support tool shall provide automatic monitoring and alerting on non-conformant final approach airspeed behaviour, automatic monitoring and alerting of separation infringement and automatic monitoring and alerting for the wrong aircraft being turned on to a separation indicator	TBS-SAF-050 TBS-SAF-060 TBS-SAF-070 TBS-SAF-075 TBS-SAF-080
Annex, Para 2.1.3	The TBS support tool and associated controller working position shall calculate Indicator distance and display it on controller displays	TBS-SPEED-010 TBS-SEQ-010 TBS-SEQ-015 TBS-SEQ-020 TBS-CALC-020 TBS-CALC-030 TBS-CALC-040 TBS-CALC-050 TBS-CALC-060

Regulation Reference	Regulatory Requirements	EUROCONTROL TBS Specification reference
		TBS-CALC-070 TBS-CALC-080 TBS-CALC-090 TBS-CALC-100 TBS-CALC-110 TBS-CALC-130 TBS-COMP-010 TBS-HMI-010 TBS-HMI-020 TBS-HMI-25 TBS-HMI-030 TBS-HMI-040 TBS-HMI-050 TBS-HMI-060 TBS-HMI-065 TBS-HMI-070 TBS-HMI-080 TBS-HMI-090 TBS-HMI-100 TBS-HMI-110 TBS-HMI-120 TBS-SAF-010

Regulation Reference	Regulatory Requirements	EUROCONTROL TBS Specification reference
		TBS-SAF-020 TBS-SAF-030 TBS-SAF-040 TBS-CNTR-010 TBS-CNTR-020
Annex, Para 2.1.3	Safety nets capturing automatic monitoring and alerting of separation infringement shall support TBS operations	TBS-SAF-060

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