Enhanced Time Based Separation (eTBS)

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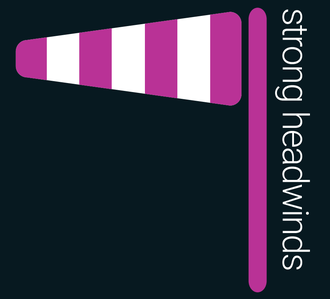
Evolving TBS from SESAR research

TBS tool for Heathrow developed with Lockheed Martin (now Leidos)

TBS tool deployed at Heathrow from March 2015

Ongoing work to further enhance TBS

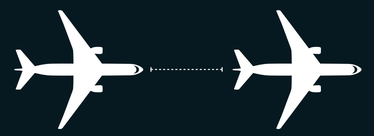
TBS today: an overview



Goal – improve landing rates in adverse headwinds

Traditionally aircraft separated by **distance** (Distance Based Separation or DBS)

TBS defines safe separations according to time rather than distance



This reduces the required distance between aircraft in strong headwinds

Despite slower aircraft ground speed, the reduced separation distance maintains the landing rate

TBS today: an overview

The benefits so far

80%
of wake separations smaller than pre-TBS separations

62%
reduction in wind-related ATFM delay

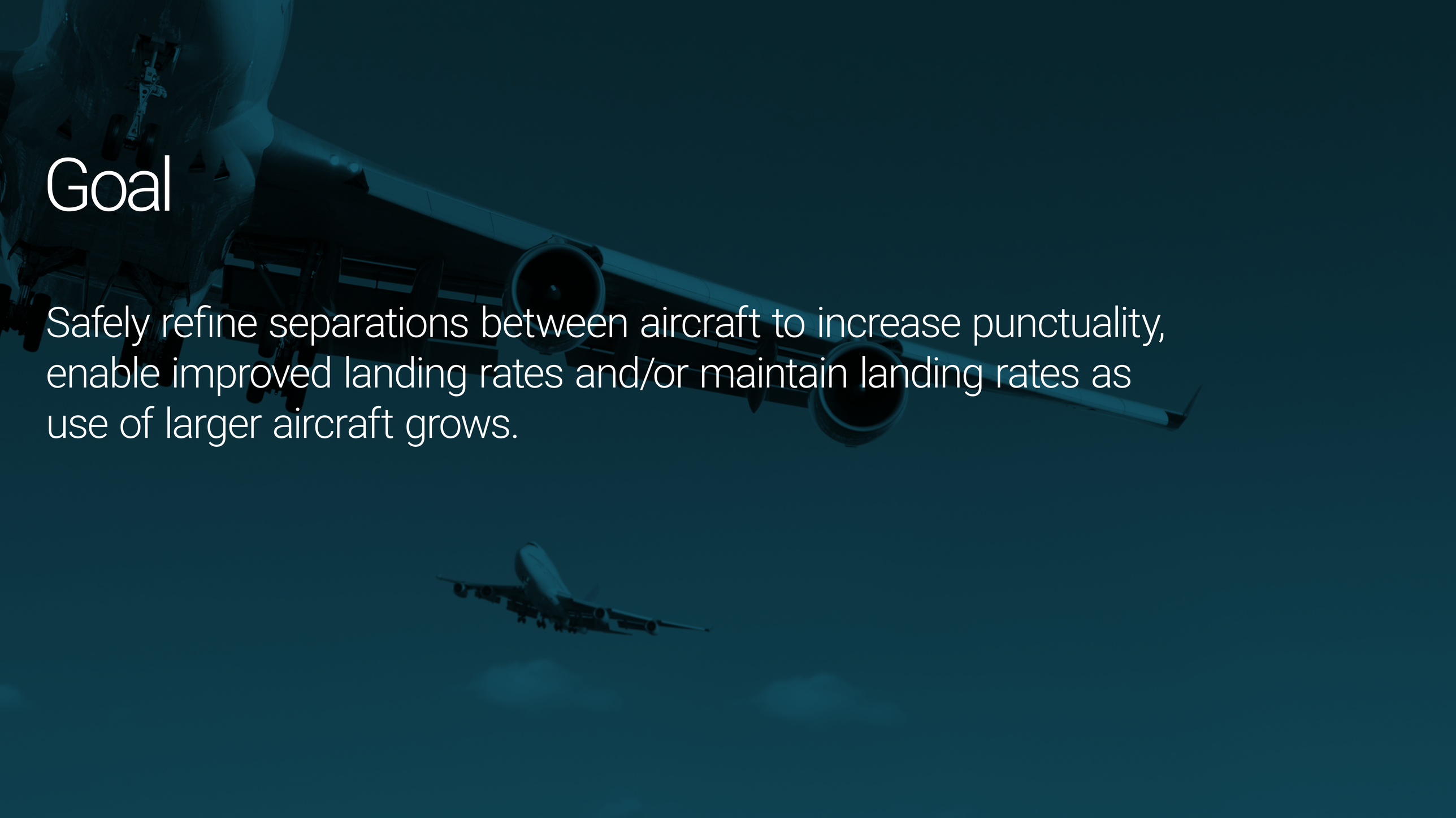
2.6
additional movements per hour recovered in strong winds

up-to 44
movements per day recovered

TBS is not the end of the story. In fact it’s just the start.

Goal

Safely refine separations between aircraft to increase punctuality, enable improved landing rates and/or maintain landing rates as use of larger aircraft grows.



Enhanced TBS Phase 1

Currently, aircraft in the UK are categorised into six wake vortex classes based on size and weight

CURRENT

Light | Small | Medium | Upper Medium | Heavy | Super Heavy

European Wake Vortex Re-categorisation (RECAT-EU) is a new, more optimised categorisation of wake vortex separation.

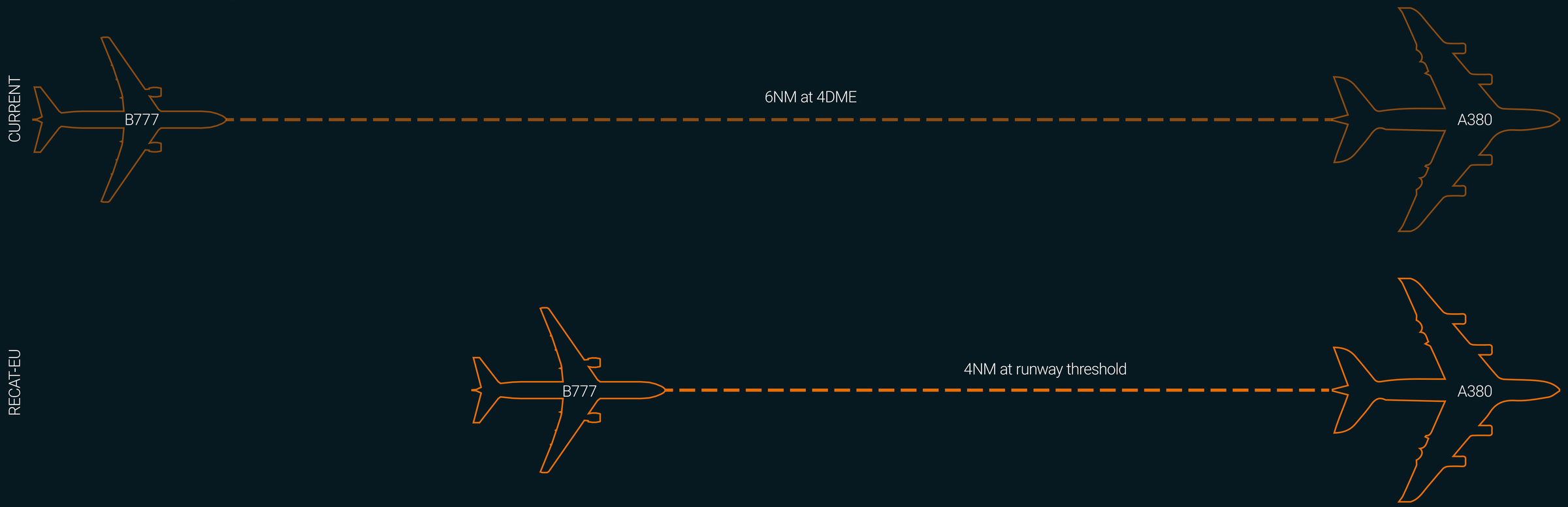
RECAT-EU

Light | Lower Medium | Upper Medium | Lower Heavy | Upper Heavy | Super Heavy

This new categorisation is particularly beneficial at major international airports such as Heathrow, as it refines the categorisation of Medium and Heavy aircraft, the main aircraft types using such airports.

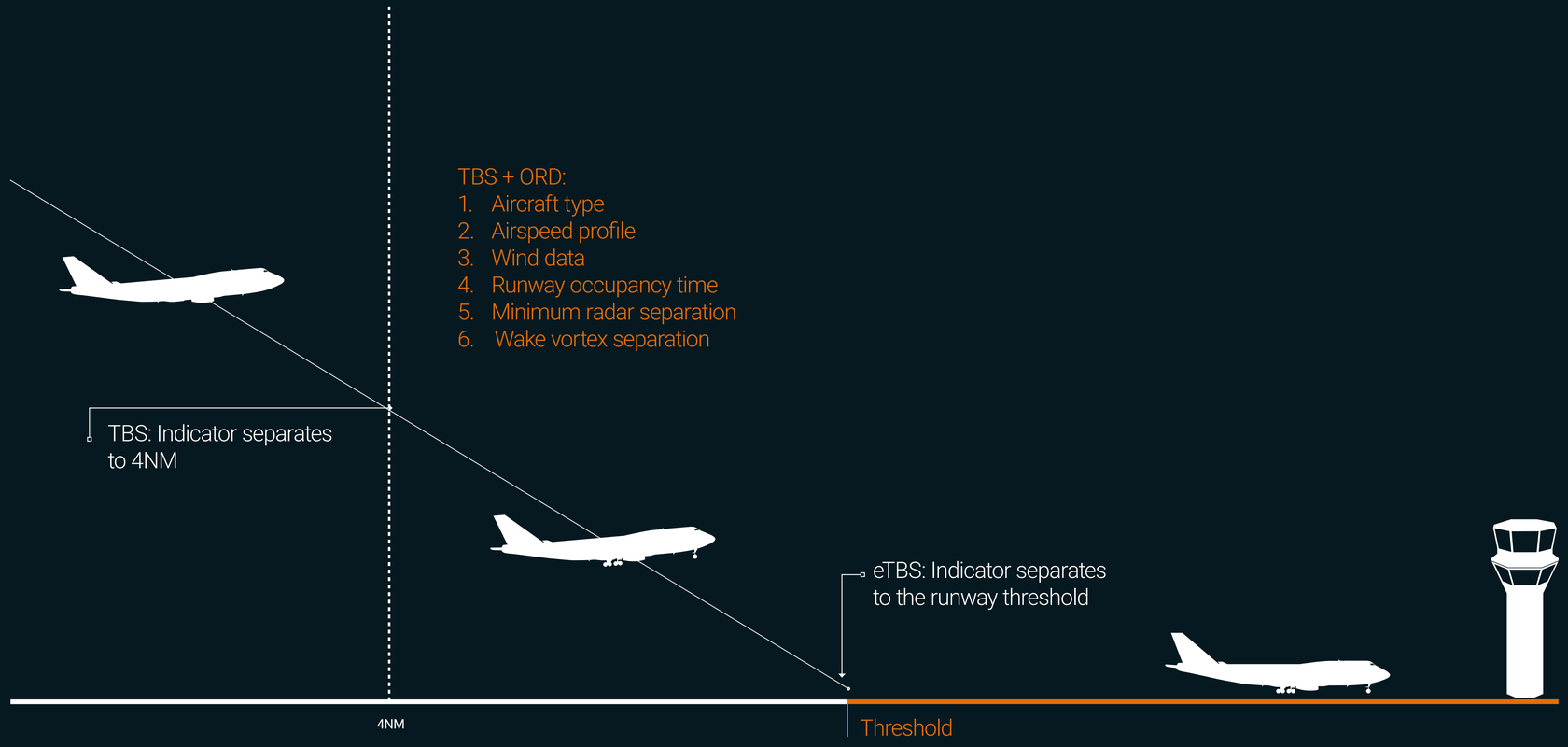
Example

For example, under existing categories the separation distance between an A380 and B777 is 6NM at 4DME.
Using RECAT-EU categories this distance reduces to 4NM at runway threshold.



Optimised Runway Delivery: Delivering Efficient TBS

Based on extensive data analysis, Optimised Runway Delivery models the anticipated compression between each aircraft pair so that controllers are able to efficiently provide wake vortex separation to the runway threshold.



The Comparison

light headwinds

strong headwinds

Distance wake vortex categories

Landing rate 40-45 Aircraft per hour

Landing rate 32-38 Aircraft per hour

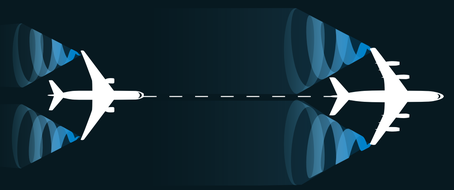
TBS wake vortex categories

*Separation distance reduces only in moderate to strong headwinds

Landing rate 40-45 Aircraft per hour

Landing rate 36-40 Aircraft per hour

eTBS Phase 1: RECAT-EU + Optimised Runway Delivery

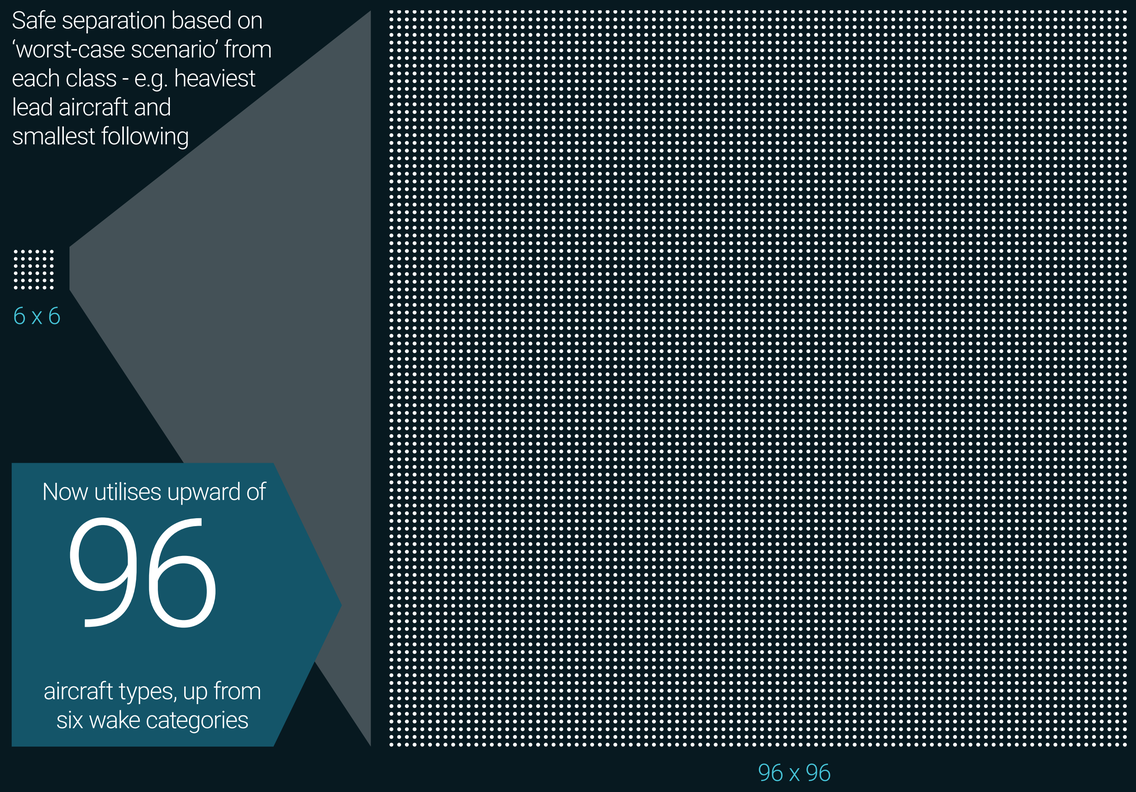


Landing rate 41-46 Aircraft per hour

Landing rate 37-41 Aircraft per hour

Enhanced TBS Phase 2: TBS plus Pairwise Separation

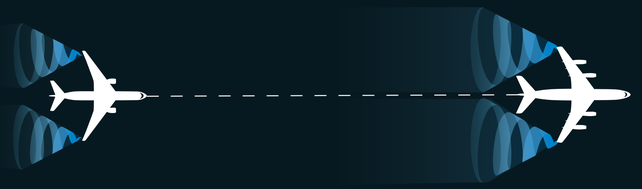
Pairwise Separation identifies safe separation distances between specific types of aircraft not just the wake vortex category

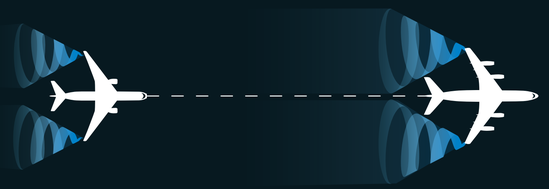


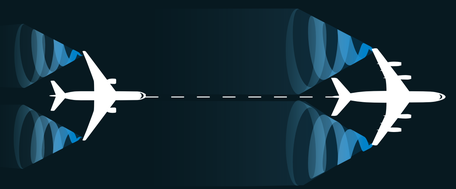
Existing Time-Based Separation concept applied, creating Time-Based Pairwise Separations for each aircraft pairing delivering resilience and enhanced capacity.

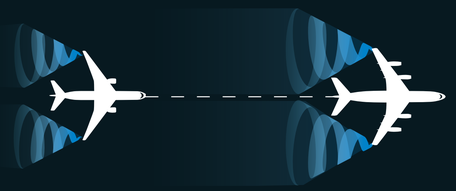
The Comparison

	light headwinds	strong headwinds
Distance wake vortex categories	Landing rate 40-45 Aircraft per hour	Landing rate 32-38 Aircraft per hour
TBS wake vortex categories *Separation distance reduces only in moderate to strong headwinds	Landing rate 40-45 Aircraft per hour	Landing rate 36-40 Aircraft per hour
eTBS Phase 1: RECAT-EU + Optimised Runway Delivery	Landing rate 41-46 Aircraft per hour	Landing rate 37-41 Aircraft per hour
eTBS Phase 2: Pairwise Separation + Optimised Runway Delivery	Landing rate 42-47 Aircraft per hour	Landing rate 38-42 Aircraft per hour





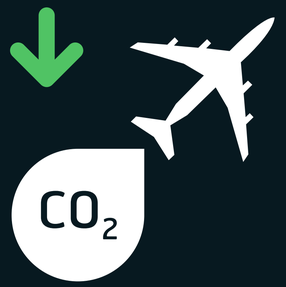




The Benefits

More flights with fewer delays and cancellations at some of the world's busiest airports.

Improved Resilience



Less Emissions

Lower Fuel Costs

Increased Movements

Reduced Delay