Enhanced Time Based Separation (eTBS)
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

Enhanced Time Based Separation (eTBS)
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.
Safely refine separations between aircraft to increase punctuality, enable improved landing rates and/or maintain landing rates as use of larger aircraft grows.
European Wake Vortex Re-categorisation (RECAT-EU) is a new, more optimised categorisation of wake vortex separation.

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.

TBS + ORD:
1. Aircraft type
2. Airspeed profile
3. Wind data
4. Runway occupancy time
5. Minimum radar separation
6. Wake vortex separation

TBS: Indicator separates to 4NM

eTBS: Indicator separates to the runway threshold
The Comparison

- **Distance wake vortex categories**
  - Landing rate: 40–45 Aircraft per hour
  - Separation distance reduces only in moderate to strong headwinds

- **TBS wake vortex categories**
  - Landing rate: 40–45 Aircraft per hour
  - Separation distance reduces only in moderate to strong headwinds

- **eTBS Phase 1: RECAT-EU + Optimised Runway Delivery**
  - Landing rate: 41–46 Aircraft per hour

- **Strong headwinds**
  - Landing rate: 32–38 Aircraft per hour

- **Light headwinds**
  - 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.

Safe separation based on ‘worst-case scenario’ from each class - e.g. heaviest lead aircraft and smallest following.

Now utilises upward of 96 aircraft types, up from six wake categories.

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

- **Distance wake vortex categories**
  - Strong headwinds: 40-45 Aircraft per hour
  - Light headwinds: 32-38 Aircraft per hour

- **TBS wake vortex categories**
  - Separation distance reduces only in moderate to strong headwinds
  - Strong headwinds: 40-45 Aircraft per hour
  - Light headwinds: 36-40 Aircraft per hour

- **eTBS Phase 1:** RECAT-EU + Optimised Runway Delivery
  - Strong headwinds: 41-46 Aircraft per hour
  - Light headwinds: 37-41 Aircraft per hour

- **eTBS Phase 2:** Pairwise Separation + Optimised Runway Delivery
  - Strong headwinds: 42-47 Aircraft per hour
  - Light headwinds: 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