With demand for air travel starting to increase again in Europe, the continent’s airports need to find new ways to manage their limited airside resources more efficiently; there’s an off-the-shelf solution just waiting to be implemented.

In December 2015 Paris Charles de Gaulle airport is scheduled to become the first European airport to deploy a new separation standard for aircraft on approach to, and departing, the airport. The “Re-categorisation of the International Civil Aviation Organization (ICAO) Wake Turbulence Separation Minima” (or RECAT) is a relatively simple procedure which will significantly increase the airport’s capacity at peak hours and could become an important driver in Europe’s busiest airports’ future ability to handle more aircraft through a limited number of runways.

The procedure and the concept may be simple but the research and science behind RECAT is extensive and complex.

A quick way to add capacity at congested airports
Until now separation distances between aircraft on final approach have mainly been determined by standards drawn up by ICAO over 40 years ago, which set fixed separation distances for three categories of aircraft – Light, Medium and Heavy. These categories can cover a large range of aircraft – the Medium category, for example, encompasses aircraft from the size of a Boeing 757 down to a Beech 1900. Since 2002 EUROCONTROL has been working with the world’s most capable researchers to determine the exact behaviour and strength of wake vortices generated by individual aircraft on final approach. New measuring technologies, such as the two Light Detection and Ranging (LiDAR) sensors currently in operation, have given EUROCONTROL greater insights into how these vortices shift and dissipate in different wind conditions and what the subsequent effect will be on following aircraft.

The result of this research is RECAT-EU, which divides the ICAO Medium and Heavy categories each into two categories and creates a Super Heavy category for the Airbus A380. In October 2014, following a thorough stakeholder consultation and detailed review of the safety assessment, the European Aviation Safety Agency (EASA) confirmed that the RECAT-EU safety case provides the assurance necessary for deployment.

“EUROCONTROL is in a unique position, having the most comprehensive wake vortex database.”

Robert Graham, Head of Airport Research, EUROCONTROL

We are talking to other airports about the concept which will allow them to increase departure capacity in specific strong wind conditions so that they don’t need a two-minute delay after a Heavy departure.”

Vincent Trève, RECAT-EU Project Manager, EUROCONTROL

and a small change to the flight plan management system. You would think that moving from four categories to six would add to the workload but we have found the reverse to be true. The two new categories are actually applied quite rarely and the total number of separations doesn’t change fundamentally, but the added capacity of RECAT brings gives you much more time to manage the overall traffic workload. Our simulator work has shown that with the new categories more runway throughput is possible and the whole TMA (terminal manoeuvring area) is less constrained.”

The simulation research suggests that Paris Charles de Gaulle will see an increase in peak departure capacity of 6% following the deployment of RECAT-EU. EUROCONTROL experts suggest there are between 10 and 12 congested European airports where the new procedure could make a real difference and half of these are talking to the Agency about the possibility of introducing the system.

“Within the next two years there will probably be two to three airports introducing RECAT-EU and two to three more in the following two years,” said Vincent Trève.

The next few years will see other RECAT developments as EUROCONTROL research into this area, which has now been taken up within the Single European Sky ATM Research (SESAR) programme, seeks to extend the benefits of applying more flexible separation criteria. This means working with new partners – including air navigation service providers (ANSPs), ACI Europe and Dubai airport, which has already implemented a part of RECAT-EU. The future direction of work has been driven by a number of different factors, including the need to look closely at whether and how separation distances between the leader and following aircraft can be defined pairwise (RECAT-2) and research into whether separating aircraft dynamically – based on prevailing weather conditions – on the basis of time, rather than distance, can improve both safety and capacity. Collectively this research is called RECAT-3.

“Time-based separation has been in use since March at London Heathrow,” said Vincent Trève. “With this concept the dynamic basis of separation is a function of weather, such as headwinds, and we are talking to other airports about the concept which will allow them to increase departure capacity in specific strong wind conditions so that they don’t need a two-minute delay after a Heavy
departure. This can be both a tactical procedure – based on the actual wind conditions – and a more strategic process which, together with more accurate wake and weather monitoring, should mean in the long term the strategic management of the runway operations and accurate forecasting methodologies will become integrated within the flow management system.”

“We are starting to share this rich knowledge and to develop it further through additional data collection or via strategic partnerships such as our agreement with Dubai, which will provide a comprehensive set of Heavy
aircraft type data including the Airbus A380, so important to Emirates at its home base in Dubai,” said Robert Graham. “The big deal about our wake data is its re-usability for different airports and one focus we have is the next step beyond RECAT-EU, which will provide airports such as Heathrow with additional runway throughput capability with its ever-increasing number of A380 movements. This work is now underway in SESAR with our partner NATS.”

“We’re building upon the research and development (R&D) activity that’s been undertaken with RECAT-EU and we know the benefits that will come and Paris Charles de Gaulle is the first example of a deployment,” said Paul Adamson, Head of Airports at EUROCONTROL. “We see RECAT-EU as the first stepping stone along a series of improvements that can be made.”

The capacity-enhancing benefits which RECAT can bring are particularly important now for European airports and the entire ATM network, as traffic is starting to grow again after many years of decline and stagnation.

“From our most recent Challenges to Growth study, we need nine additional runways in Europe between now and 2035,” said Paul Adamson. “I don’t think we’re going to see them and anything that can help will be welcomed. The study forecasts that by 2035 there will be 20 or 21 airports operating at the levels that we now see at Heathrow so we need to be ready for that and these 20 airports will need solutions like RECAT-EU.”

“For airports, RECAT delivers two benefits – a local benefit, which they will see immediately, and a network benefit, which will reinforce and compound the immediate benefit. We want to generate further capacity from the network and having capacity enhancements during the day will help the network recover more quickly from any adverse conditions.”

Local benefits will be in terms of overall runway capacity, with potential increases of 6% or more. Significantly, these capacity increases will be delivered during peak periods and are set to increase as the traffic mix evolves towards larger aircraft. From both the local and network perspectives RECAT-EU also brings the potential of a more rapid recovery from adverse conditions, with simulations indicating a potential reduction in delay of more than 20%. As we move towards RECAT-2 and RECAT-3 these benefits may of course be enhanced even further.

“We now have a product that can be customised for an individual airport traffic mix and is the baseline for the next step which will provide further benefit for those airports that will deploy time-based spacing in the context of the SESAR deployment programme,” said Robert Graham.

Researchers are already looking beyond RECAT-2 to RECAT-3. RECAT-2 will define separations for each pair of aircraft from a matrix of 115 by 115 aircraft. This will cover separations for more than 95% of the most common global aircraft types. Similar research work is underway in the USA, where different categorisation standards currently apply, and EUROCONTROL researchers are working towards developing a common US/European RECAT-2 package to be put before ICAO for incorporation into the Procedures for Air Navigation Services – Air Traffic Management (PANS-ATM) Document 4444. RECAT-3 will create a dynamic pair-wise separation scheme, which gives an extra level of flexibility in applying separations by using meteorological data from ground and air system sensors to identify when separations can be further refined.

“There is a risk that people think that the ultimate solution is RECAT-2 and they want to wait for that,” said Paul Adamson. “But in fact it’s a stepped improvement and the biggest improvement comes with the initial deployment of RECAT-EU, after which when further refinements emerge from the R&D world they will be relatively easy steps for people to make.”

“We have a package that is starting to gain international recognition, starting with Dubai, and it is underpinned by the in-depth quality of the safety case and technical assessment supported by EASA endorsement,” said Robert Graham. “This recognition is building a momentum of support for the updating of ICAO PANS-ATM wake vortex separation minima.”