

PERFORMANCE BASED NAVIGATION

New innovative technology to
reduce the impact of aircraft noise
on communities around Stansted Airport



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FOREWORD

London Stansted Airport is the fourth busiest airport in the UK carrying over 21 million passengers a year. As well as a key enabler of growth and jobs in the local community, we also help to connect business and leisure passengers to over 170 destinations across 32 countries.

In addition to being an economic catalyst for the East of England, we strive to be a responsible neighbour and that means operating in a sustainable way, both by sharing the benefits of living near an airport and limiting any environmental impacts that may be felt as a result of our operation.

We continue to look for ways in which we can manage and reduce the number of local people affected by noise as a result of our operations and we are delighted that we have been able to work in partnership with the community, airlines and industry bodies to introduce new and exciting innovations in aviation technology.

Together with the Stansted Airport Consultative Committee's Environmental Issues Group, over the last two years we have conducted an airspace trial at Stansted that I feel demonstrates significant and positive improvements for the local area. The trial data shows a significant reduction in the number of local people directly overflown. On the two routes trialled, participating aircraft directly overflew 85% fewer people compared to traditional departure procedures.

We welcome feedback from members of the local community about adopting the trial technology permanently at the airport.



Andrew Harrison
Managing Director
Stansted Airport

I have been involved with Stansted Airport for nearly 15 years, initially with my village protest committee but quickly progressing to the 'inside' and working with the airport as part of the Noise and Track Keeping Working Group.

This Group comprises industry specialists and community representatives (who over time have become pretty expert themselves) and has as one of its many tasks to seek to maximise adherence of departing aircraft to the centre line of legally prescribed Noise Preferential Routes (NPRs). On this, thanks to the efforts of the airport staff, we demonstrated considerable success. However, it became increasingly clear that new procedures would be necessary to gain further improvement.

I also chair the Environmental Issues Group (EIG), a sub committee of the Stansted Airport Consultative Committee (STACC). This Group works in tandem with airport staff on all matters environmental – from the usage of utilities and services to the improvement of the noise environment around the airport. I therefore grasped the opportunity to progress the environmental benefits that improved departure route adherence offered.

The EIG has worked jointly with airport staff, the Civil Aviation Authority and NATS, who all in turn have worked with the airlines, to develop two trial instrument departures designed to modern navigation standards, known as RNP1 Departures. These mirror as close as possible the statutory NPRs and have been trialled for two years. They have proved demonstrably effective in improving the accuracy of departing 'tracks' for those aircraft using the trial specification. It has taken at least seven years to bring this to fruition, overcoming the necessary obstacles of simulation testing, safety procedures and regulatory approvals along the way, but our perseverance has now been rewarded.

The EIG together with the airport team now wish to make these two departure 'tracks' permanent, hence this consultation. We all feel the noise and environmental benefits are considerable and urge our local communities to look at the achievements and facts provided here and make their responses accordingly.



Keith Artus
Chairman
Environmental Issues Group of the
Stansted Airport Consultative Committee

OVERVIEW

Aircraft noise can sometimes be seen as intrusive and disruptive, particularly for those people that live closest to the airport and its flight paths. London Stansted Airport ('Stansted') has a long-term aim and commitment to manage, and reduce where possible, the number of people affected by noise as a result of aircraft operations.

Through communication and engagement with local community groups, an opportunity was identified in late 2011 to help reduce the number of people affected by aircraft noise. Stansted agreed to investigate this in further detail.

Our investigation resulted in a trial of modern navigation techniques for departing aircraft from May 2013 – a new innovation in the UK called RNP1 (RF) – which would better enable them to fly two of the existing flight paths more accurately. Keeping to these existing flight paths more accurately means fewer people would be affected by overflying aircraft in the local area.

A partnership approach was taken, engaging a number of bodies in the trial. Those involved from the initial concept of the trial included the Civil Aviation Authority (CAA), Stansted Airport, the EIG (a sub-group of the Stansted Airport Consultative Committee), NATS and easyJet. This allowed for a transparent process whilst testing the latest available navigational technology with a number of industry experts from air traffic control to airlines themselves. We thank all partners for their guidance and input into the trial.

The trial has been a success and Stansted has submitted the results of this trial to the CAA for review. This consultation begins the formal regulatory process to permanently adopt the procedures used in this trial. The full trial analysis report along with other consultation material is available to view at

www.stanstedairport.com/consultation

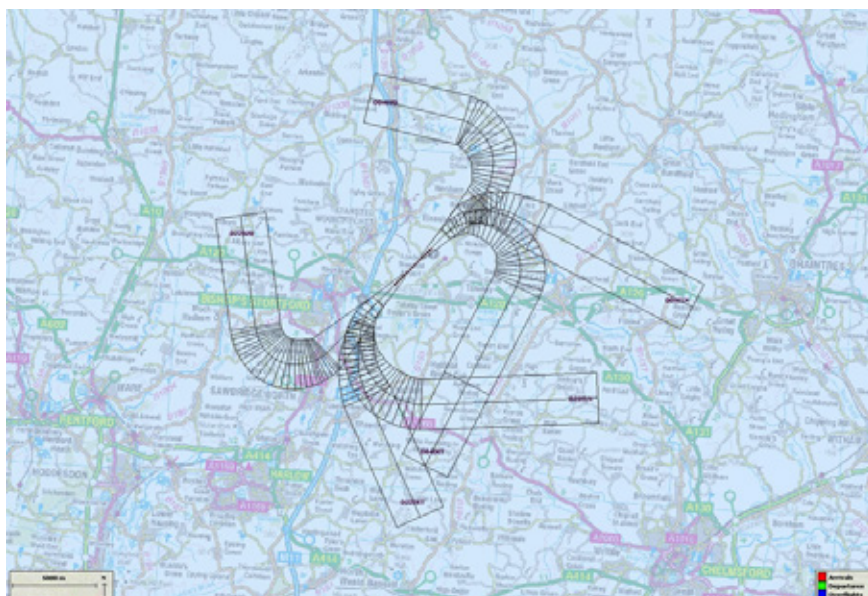
"By using new technology to fly more accurately, fewer people would be overflown."

STANDARD INSTRUMENT DEPARTURES AND NOISE PREFERENTIAL ROUTES

Stansted is a noise designated airport and as such many of the noise controls are set by UK Government, including the establishment of Noise Preferential Routes (NPRs) for departing aircraft. This has been the case since the early 1990's following public consultation.

A Noise Preferential Route is an area surrounding the conventional departure route which is $\pm 1.5\text{km}$. Aircraft are required to remain within this area up to a minimum altitude, usually 4,000ft.

Stansted has six NPRs that encompass the low level initial section of the Standard Instrument Departure Routes (SIDs) before they diverge. A map of the six existing NPRs at Stansted is shown below. These SIDs are designed around conventional ground based navigational aids, which are now becoming obsolete.



London Stansted Noise Preferential Routes (NPRs)

A Standard Instrument Departure 'SID' is the intended route for an aircraft to fly immediately after take-off.

Departing aircraft are deemed compliant when they remain within a NPR corridor up to 3km wide (narrower closer to the runway and 1.5km either side of the SID) until they have achieved a minimum height, usually 4,000ft, when they can change heading onto a more direct heading to destination by Air Traffic Control (ATC).

Historically, there has been a wide spread of departure tracks within these 3km NPRs due to a range of factors influencing the position of an aircraft within the NPR including:

- airframe type
- departure weight
- wind speed and direction
- temperature
- the aircrafts Flight Management System(FMS) capability
- its navigational database encoding
- Noise Abatement Departure Procedures (NADP)

THE TRIAL

Following discussions with local community representatives, two of the existing SIDs (runway 22 Clacton and runway 04 Detling) were selected to design and trial with modern navigational procedures.

The rationale behind this decision is detailed below:

- Replicating a SID on each end of the runway would allow data gathering irrespective of which runway direction was in use due to wind direction;
- Replicating the 22 Clacton SID would help alleviate community concerns by potentially reducing the over-flight of the villages of Hatfield Heath and Hatfield Broad Oak
- Replicating the 04 Detling SID would improve departure track-keeping compliance, as this has traditionally been the hardest route to fly and the least compliant SID at Stansted due to the tight wrap around turn after departure; and
- Replicating the 04 Detling SID would potentially reduce the over-flight of Great Dunmow.

The recommendation from the CAA was to conduct a departure track keeping trial with procedures designed to Required Navigational Performance standard (RNP1) using Radius to Fix (RF) Path Terminators for the turns within the NPR. As previously mentioned, this technology is a new innovation to the UK.

The objective of the RNP1 (RF) SID design was to replicate the existing standard SID as closely as possible to better enable all departing aircraft to keep as close to the centre of the existing NPR as possible.

The trial has been limited with an average of 5 – 6 departures per day (10%) flying the RNP1 (RF) procedures as opposed to all aircraft flying the same conventional route. Only operators with state regulatory approval for RNP1 (RF) operations can participate in the trial.

Those that have been able to participate so far are:

- AtlasAir
- easyJet
- Fayair
- FEDEX
- German Wings
- Global Supply Systems
- Pegasus
- UPS

All the above airlines have all flown the RNP1 (RF) SIDs with a variety of aircraft types and sizes. We expect the numbers of aircraft able to operate on RNP1 (RF) SIDs to increase over the coming years as further regulatory approval for operators evolves.

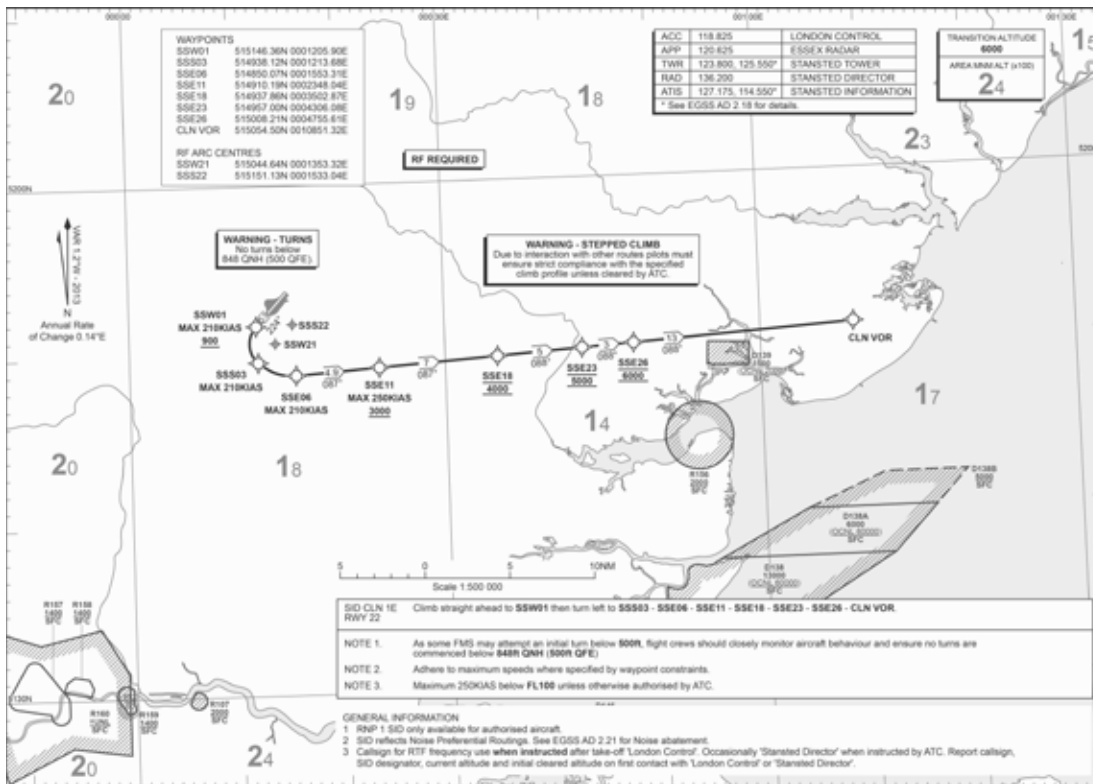
WHAT IS RNP1 (RF)?

Required navigation performance (RNP) is a type of performance-based navigation (PBN) that allows an aircraft to accurately fly a specific path between two defined points in space.

RNP also refers to the level of performance required for a specific procedure or a specific block of airspace.

An RNP of 1 means that a navigation system must be able to calculate its position to within 1 nautical mile. RNP SIDs can also incorporate Radius to Fix (RF) turns, that better enable accurate track keeping, especially through tight radius turns. This then provides the same ability to conform to the track-keeping accuracy during the turn as in straight line segments. Bank angle limits for different aircraft types and winds aloft are also taken into account in RNP1 (RF) SID procedure design.

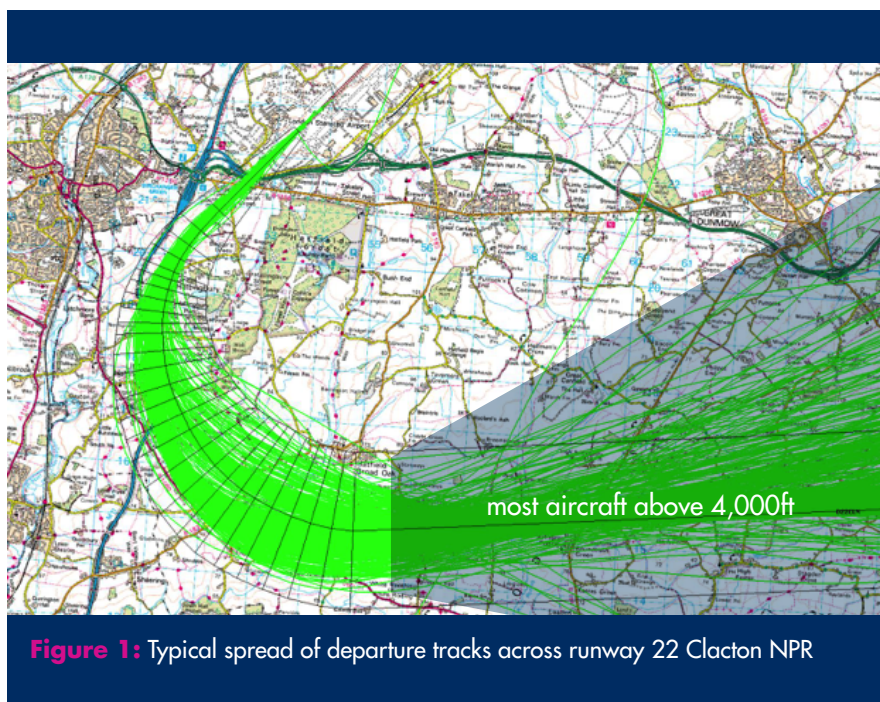
A typical example of the runway 22 Clacton RNP1 (RF) SID design is shown below.



TRIAL RESULTS

22 Clacton Standard Departure Procedures

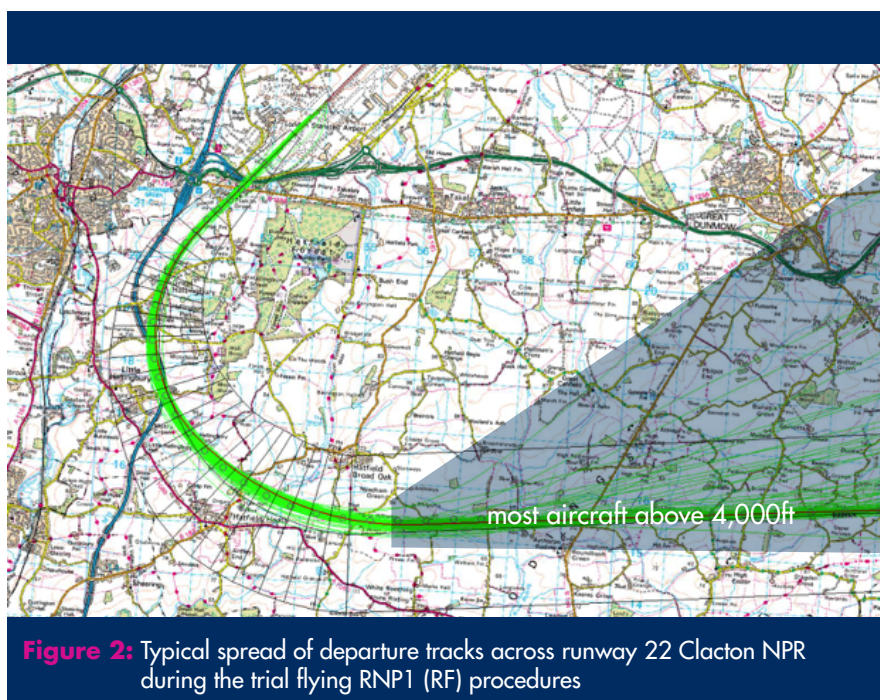
Figure 1 shows a typical spread of departures within the 3km wide NPR. The point where most aircraft are at approximately 4,000ft and can be vectored is also highlighted.



22 Clacton trial results

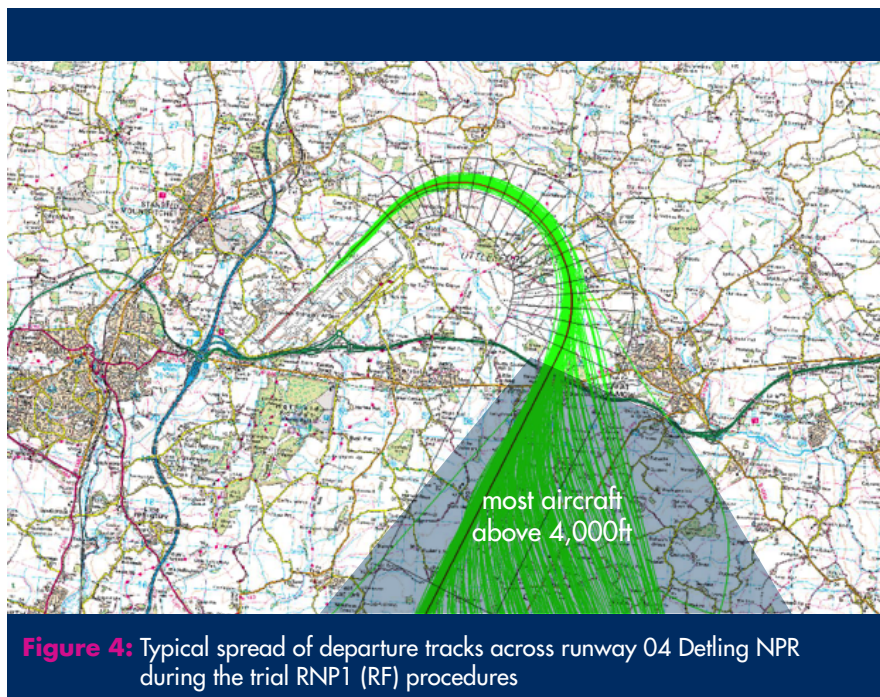
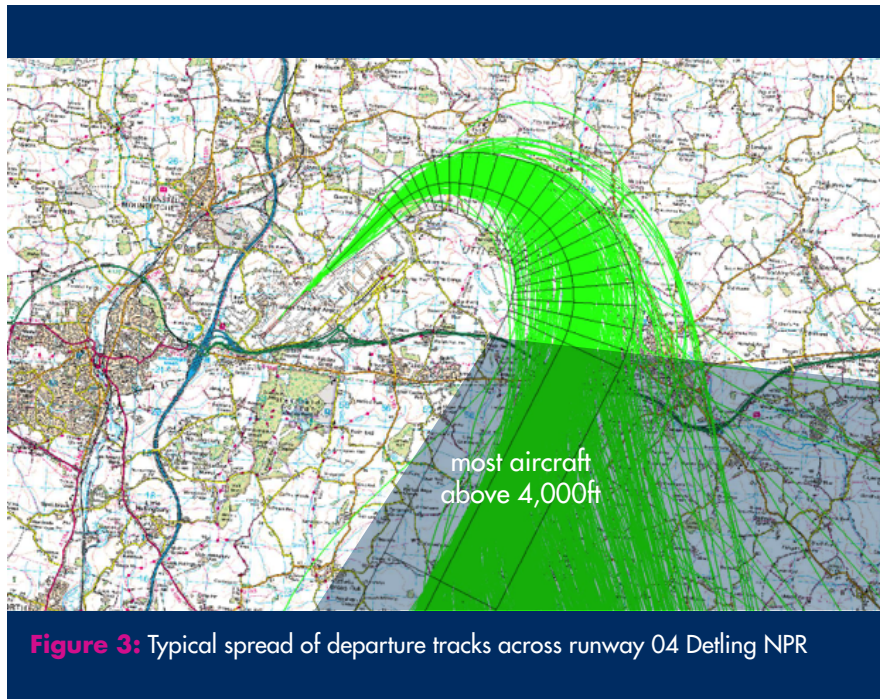
Figure 2 shows a small sample of aircraft flying the RNP1 (RF) trial procedures. The RNP1 (RF) SID is shown as a red line and the design routes aircraft between Hatfield Heath and Hatfield Broad Oak whilst also avoiding the overflight of Little Hallingbury earlier in the departure route. This designed RNP1 (RF) trial SID replicates the conventional SID.

The results of the trial indicate that there is a strong adherence to the designed procedures, irrespective of aircraft type, weight, FMS and wind speed/direction which traditionally have a strong influence of how an aircraft fly's a conventional SID. Typically at around 4,000ft in height, over 99% of aircraft are within a swathe of less than 500m, instead of the typical 3km wide NPR.



22 Clacton Up to 4,000ft	Number of people directly overflown
Aircraft flying traditional departure procedures	3,800
Aircraft flying RNP1 (RF) procedures	500

Data supplied by ERCD using 2014 CACI Ltd population data



04 Detling Standard Departure Procedures

The second SID that was trialled with RNP1 (RF) procedures was the runway 04 Detling. This was chosen as this is the hardest to fly and traditionally the least compliant in terms of track keeping within the NPR due to the tight right turn immediately after take-off.

Figure 3 shows a typical spread of tracks across the conventional 04 Detling NPR and the typical height where aircraft are vectored when they are above 4,000ft.

The 04 Detling RNP1 (RF) SID also shows a very tight concentration of tracks as shown in Figure 4. The designed RNP1 (RF) SID shown as the red line avoids the overflight of Little Easton and Great Easton, with the greatly reduced overflight of Great Dunmow. Typically, over 99% aircraft flying the RNP1 (RF) SID were within a swathe of less than 420m. This RNP1 (RF) SID closely replicates the conventional SID.

04 Detling trial results

The 04 Detling results have shown a high degree of accuracy in terms of lateral track keeping when analysed against the designed RNP1 (RF) SID. It is clear that the benefits of this Performance Based Navigation turns through the RNP1 (RF) design prove to be extremely accurate and flyable, with in excess of 98%+ of operations contained within a swathe of just 400 metres. What is most noticeable about the design is how track keeping accuracy has been achieved with a wide range or aircraft types. This improved accuracy of track keeping has been demonstrated irrespective of aircraft type and size with aircraft from a small Gulfstream GV (SP) G550 to a very large Boeing 747-8F operating on the RNP1 (RF).

04 Detling	Number of people directly overflown
Up to 4,000ft	
Aircraft flying traditional departure procedures	1,200
Aircraft flying RNP1 (RF) procedures	200

HOW CAN I HAVE MY SAY?

We are seeking the views of our local communities about the permanent adoption of this technology.

As part of your response, please indicate:

- Your name and postcode
- If you are commenting on behalf of an organisation
- Whether or not you support adopting the technology used in the trial
- Please also indicate if you do not wish your name, or any other personal details to be included in the consultation feedback report.

To respond to the consultation, you can send your thoughts to us via email at consultation@stanstedairport.com

or write to us at:

Airspace Consultation Team
Airfield Operations
3rd Floor
Enterprise House
Stansted Airport
CM24 1QW

All consultation responses will be submitted to the CAA.

We are also holding a series of local community outreach events covering all elements of Stansted Airport's operation including local employment, public transport provision and this consultation.

If you would like to come along and speak to a member of the airport team, please drop in on the following dates:

- 22 September 2015 – Foakes Hall, Great Dunmow – 3pm to 7pm
- 24 September 2015 – Rhodes Centre, Bishops Stortford – 3pm to 7pm
- 07 October 2015 – Hatfield Heath Institute – 3pm to 7pm

TIMELINE

The consultation begins on 1 September 2015 and will close on 27 November 2015 and we invite you to share your views. Details of how to do this can be found below.

At the close of the consultation period, Stansted Airport will collate and review all feedback received, submit a consultation feedback report to the CAA and then submit an airspace change proposal to the CAA with the aim of adopting the trial technology permanently.

GLOSSARY

ATC	Air Traffic Control – air navigation service provider for controlled airspace
CAA	Civil Aviation Authority – UK regulator for civil aviation
EIG	Environmental Issues Group – a sub committee of STACC
FMS	Flight Management System – a specialised computer system that automates in-flight tasks including aircraft navigation
NADP	Noise Abatement Departure Procedure – a procedure adopted to minimise noise immediately after take-off
NPR	Noise Preferential Route – an area +/- 1.5km either side of a SID, where departing aircraft concentrate
PBN	Performance Based Navigation – specifies performance in terms of accuracy within airspace
RF	Radius to Fix – a curved path designed within a RNP1 SID
RNP1	Require Navigational Performance of 1 Nautical Mile
SID	Standard Instrument Departure – conventional departure route based on ground navigational aids
STACC	Stansted Airport Consultative Committee, a regular meeting of locally elected members, industry and community groups
04 DET	Runway 04 Detling SID
22 CLN	Runway 22 Clacton SID



