

## GATWICK RNAV-1 SIDS – CAA PIR ROUTE ANALYSIS REPORT

This section explains the track distribution of conventional SIDs and the RNAV SID replications using a selection of traffic samples since RNAV-1 SID replications were introduced on a permanent basis from November 2013. The samples compared are selected from data provided by Gatwick to try to give as close as possible, like for like samples in terms of the numbers of departures during the given period. This is so we can isolate, so far as possible, the impact of introducing the RNAV-1 SIDs; in some cases there are slightly more conventional SIDs than RNAV-1 SIDs, and likewise, in other cases, there are more RNAV-1 SIDs than conventional SIDs. The difference in samples is indicated within the tables of this report. In some comparisons of track distribution diagrams and track density plots, the CAA has analysed more than 1 sample as shown in the table.

We have also included our observations on the incidence and impacts of tactical radar vectoring. This is a response to feedback which the CAA has received from some groups and individuals located near to Gatwick.

### GUIDE TO TRACK DISPERSION AND DENSITY DIAGRAMS

To fully understand this document, readers will have to view the track dispersion diagrams which are associated with the SID route numbers and the descriptions of track dispersion, track density and associated impacts.

At the beginning of each route analysis, the CAA initially refers to Gatwick's consultation diagrams and forecast impacts of RNAV-1 SID replication implementation and describes the forecast impact. This forecast by Gatwick is cross referred to the diagram figure numbers portrayed in the Gatwick Consultation and Airspace Change Proposal (see <http://www.caa.co.uk/default.aspx?catid=2111&pagetype=90&pageid=16983>) for ease of reference. The analysis then compares the impact of the RNAV-1 SID replications with the conventional SIDs using a number of traffic samples provided since the implementation of RNAV-1 SIDs in November 2013 and indicates where departures are more concentrated as a result of the RNAV-1 SID replications and whether the anticipated impact, has been realised. Notes relating to the details provided in the table are highlighted below. Any sections in the table where details would not be relevant are shaded out.

The explanations of track distribution are described using references to locations shown on the diagrams to help to describe impacts of the RNAV-1 SID replications. Periods of traffic samples, together with numbers of departures are shown in the tables. For traffic samples used to illustrate impacts in 3 altitude bands (4-5000ft, 5-6000ft, and 6-7000ft), different traffic samples from those shown in the track dispersion and density plots are used for comparison purposes. These altitude plots illustrate when aircraft reach the relevant altitude band and are used to illustrate the flight paths flown by both the conventional departures and RNAV-1 departures when they are at and above 4000ft and illustrate the dispersion of traffic, where they are remaining on the SID and where aircraft are being vectored. In the tables where percentages are used to describe dispersions, these are estimated by visual interpretation of the density against the width of the NPR swathe as shown in the diagrams.

A variety of track dispersion plots have been presented to the CAA for PIR analysis. These comprise:

- Track density plots of Trial SIDs used for consultation purposes, and diagrams from the consultation which were used to describe forecast impacts of the RNAV-1 SIDs.
- Track dispersion plots up to 3900 ft for Route 4 (an explanation is shown at the bottom of each diagram).
- Track dispersion plots for all routes up to 4000 ft (an explanation is shown at the bottom of each diagram).
- Track density plots (an explanation is shown at the bottom of each diagram).
- Altitude Slice Diagrams in the altitude bands: 4-5000ft, 5-6000ft, 6-7000ft.

**Track dispersion diagrams** portray each aircraft track on a map, based on radar data. Tracks are overlaid upon each other, such that if many tracks are overlaid on top of each other, individual tracks may no longer be visible. They are useful for illustrating the dispersion of the traffic pattern, but are not as useful for determining the density/concentration of tracks.

**Track density diagrams** = these portray the concentration of flight tracks using a colour code to indicate differing concentrations of flight tracks. They are sometimes referred to as “heat plot” diagrams. Whilst they can be used to illustrate traffic dispersion, they are most useful for illustrating if traffic is concentrated along a route or over a geographic location. Depending on the key used for portraying track concentration, individual tracks towards the outer limits of the dispersion may not be visible on the diagram.

## NOTES RELATING TO THE DATA IN THE TABLES

Col 2 Note 1. Reference to Consultation Document (Con Doc) and ACP diagrams. Month period analysed in the PIR and number of conventional SIDs flown is inserted. Comments provided on conventional SID track dispersion.

Col 3 Note 2. Reference to Consultation Document (Con Doc) and ACP diagrams. Month period analysed in the PIR and number of RNAV-1 SIDs flown inserted. Comments provided on RNAV-1 SID track dispersion.

Col 4 Note 3. Comments provided on impact of change compared with that portrayed in Gatwick’s consultation and ACP submission.

Col 5 Note 4. Observations on any discernible variance with tactical radar vectoring by ATC post RNAV-1 SID replication implementation. The altitude when vectoring is permitted by Air Traffic Control is illustrated at the top of the column. The following information was included in the consultation document.:

The altitude of 4000ft applies to:

- All routes during the night - period 2330-0600 local time;
- Rwy 26 Routes 4,7,8,9 during the day period 0600-2330 local time.
- Rwy 08 Route 2 during the day period 0600-2330 local time.

The altitude of 3000ft applies during the day period 0600-2330 local time to:

- Rwy 26 Route 1 and to Rwy 08 Routes 3, 5 and 6.

Col 6 Note 5. Any remarks of significance.

## **Abbreviations used in the PIR Assessment Route Report Form below.:**

NPR	Noise Preferential Route.
CL	Centreline. (Note, in SID design terminology this is referred to as ‘nominal track’; for the purposes of this report CL and Nominal Track are deemed to have the same meaning and mean the flight path we anticipate the aircraft will follow when flying the SID unless and until vectored of the SID by air traffic control. However, aircraft may be either side of the RNAV-1 CL or Nominal Track by up to one nautical mile for 95% of the flight time which is within the navigation tolerance of RNAV-1 1 SID design parameters).
Deps	Departing aircraft on the SID.
SID	Standard Instrument Departure.
AC	Aircraft.
ACP	Airspace Change Proposal (V 1.1 submitted in January 2013).
Con Doc	Consultation Document (19 July 2012).

Deg	Degree (as in the size of any turn).
Approx	Approximately.
NT	Nominal Track (see comments above regarding CL and NT).
Conv	Conventional (meaning the SIDs predicated on conventional navigation techniques in operation prior to the introduction of RNAV-1 SIDs)

**Terminology:**

Swathe.	This refers to the 3 km wide NPR compliance monitoring swathe .
Vectoring.	This is an extensive ATC tactical radar vectoring operational practice to provide aircraft with an expeditious route to destination and safe separation against other aircraft.

**ROUTE 4 – RWY 26 LAM1X, DVR1X, CLN3X, BIG1X – SAMPLE 1 Comparing Jun 13 (Conv) v Jul 14 (RNAV)**

LINKS	SID Sample Of Relevant Track Dispersion Diagram	Conventional SID Comments (Note 1)		RNAV 1 SID Comments (Note2)		Impact of RNAV SID Replication (Note 3)	Observations on Vectoring (Note 4)	Remarks (Note 5)
		Month	Number	Month	Number			
	Consultation Ref / Diagram	Con Doc Fig 11 <b>400A</b>		Con Doc Fig 12 <b>400B</b>		The forecast impact, based upon the con doc and proposal was:  - A significant increase in concentration around the turn onto east.  - A displacement of traffic using the full width of the NPR swathe towards the western half of the NPR swathe such that traffic would be more to the west of Newdigate. Those residents beneath the western half of the turn would be overflown more often whilst those in the eastern half of the turn would be overflown less often.  - A small amount of RNAV deps flying just beyond the western extremity of the NPR swathe below 4000ft for approximately 20 secs (1-5% of deps). This compared with less than 1% of deps on the conv SID below 4000ft.		
Folder Ref	Diagram <b>LAM1X,</b>	<b>Jun 13</b>	<b>3043</b>	<b>Jul 14</b>	<b>3381</b>		Day: 4000 Night: 4000	
<b>402A</b>	Up to 3900 ft  <b>GAL Slides 4&amp;7</b> <b>CAA2v3</b>	Deps using almost 80% of the width of the NPR swathe during the first half of the 180 deg turn onto east.  The majority of tracks appear to be within the western half of the NPR swathe.  A small number of deps are outside the NPR swathe when passing Capel - Bear Green and remain outside the NPR swathe around the turn as they pass South Holmwood.  The majority of tracks appear to be within the NPR swathe up to 3900ft, though there are a few deps beyond the swathe over South Holmwood and Leigh.	The dispersion of almost all RNAV deps is on the western half of the NPR swathe with a number of ac flying quite wide turns well outside the NPR swathe.  Those ac which have not reached 4000ft appear both within the NPR swathe and outside the western extremity just prior to the completion of the turn.  (Note, as will be seen in later comments, there are significant numbers of deps above 4000ft outside the western extremity of the NPR swathe).  Of those ac at or below 3900ft, it appears that the majority of tracks exceed the NPR swathe as the turn completes, resulting in more tracks over South Holmwood and Leigh than the conv deps.  It is difficult to determine the relative number of ac outside the NPR swathe – this may require further clarification.  It was also noted that an isolated number of deps were flying to the east and on the inside of the	The RNAV SID dispersion has reduced compared with the width of the conv SID departure track dispersion by, in the main over 50% of the conv SID track dispersion. This is in line with data shown by GAL in consultation and the ACP.  There are significantly fewer deps on the eastern half of the NPR swathe around the turn such that Newdigate and the adjacent areas on the right hand side (eastern side) of the turn in direction of flight have significantly less number of overflights.  However, a number of deps are evident outside the NPR swathe on the outside of the turn. The estimate of the duration of this period of flight below the NPR vectoring altitude was estimated during the ACP analysis phase as being approximately 20 seconds before aircraft would reach 4000ft. However, when examining Slide 7 (CAA 3), some flights continue as far as Leigh at 3900ft.  Note: Examination of other track data, including SIDs flown in high wind days has indicated that some particular ac types are prone to flying wider turns than other types. See further comments below.  The deps are more concentrated than the conventional SID dispersion which was the aim of the RNAV SID replication, however, the dispersion observed from the analysis of some particular types is wider than expected and was investigated during the PIR. Comments regarding this will be covered in the main report and the operational analysis.	Not evident in this altitude band.	Track dispersion is in the main as expected; however, it appears that there are a greater number of ac outside the NPR swathe than was expected based on the trial results submitted in the proposal. It is not possible to quantify this number of flights from these "3900ft diagrams".  RNAV sample is + 338		

<p>402B</p>	<p>At 4000 ft GAL Slides: 4 &amp; 7 CAA2v3</p>	<p>Deps using almost 80% of the width of the NPR swathe during the first half of the 180 deg turn onto east.</p> <p>The majority of tracks appear to be within the western half of the NPR swathe.</p> <p>A small number of deps are outside the NPR swathe when passing Capel - Bear Green and remain outside the NPR swathe around the turn as they pass South Holmwood.</p> <p>The majority of tracks appear to be within the NPR swathe up to 4000ft, though there are a few deps beyond the swathe over South Holmwood and Leigh.</p>	<p>NPR swathe. The reasons for this are unclear.</p> <p>The dispersion of almost all RNAV deps is on the western half of the NPR swathe with a number of ac flying quite wide turns well outside the NPR swathe.</p> <p>Those ac which have not reached 4000ft appear both within the NPR swathe and outside the western extremity just prior to the completion of the turn.</p> <p>(Note, as will be seen in later comments, there are significant numbers of deps above 4000ft outside the western extremity of the NPR swathe).</p> <p>Of those ac at or below 4000ft, it appears that the majority of tracks exceed the NPR swathe as the turn completes, resulting in more tracks over South Holmwood and Leigh than the conv deps.</p> <p>It is difficult to determine the relative number of ac outside the NPR swathe – this may require further clarification.</p> <p>It was also noted that an isolated number of deps were flying to the east and on the inside of the NPR swathe. The reasons for this are unclear.</p>	<p>The RNAV SID dispersion has reduced compared with the width of the conv SID departure track dispersion by, in the main by over 50% of the conv SID track dispersion. This is in line with data shown by GAL in consultation and the ACP.</p> <p>There are significantly fewer deps on the eastern half of the NPR swathe around the turn such that Newdigate and the adjacent areas on the right hand side (eastern side) of the turn in direction of flight have significantly less number of overflights.</p> <p>However, a number of deps are evident outside the NPR swathe on the outside of the turn. The estimate of the duration of this period of flight below the NPR vectoring altitude was estimated during the ACP analysis phase as being approximately 20 seconds before aircraft would reach 4000ft. When examining Slide 7 (CAA 3), some flights continue as far as Leigh at 4000ft which was anticipated based upon the proposal.</p> <p>Note: Examination of other track data, including SIDs flown in high wind days has indicated that some particular ac types are prone to flying wider turns than other types. See further comments below.</p> <p>The deps are more concentrated than the conventional SID dispersion which was the aim of the RNAV SID replication, however, the dispersion observed from the analysis of some particular types is wider than expected and was investigated during the PIR. Comments regarding this will be covered in the main report and the operational analysis.</p>	<p>Not evident.</p>	<p>Track dispersion is in the main as expected; however, it appears that there are a greater number of ac outside the NPR swathe than was expected based on the trial results submitted in the proposal. It is not possible to quantify this number of flights from these "4000ft diagrams".</p> <p>Note: However, from other dispersion plots, there are noticeable differences which are discussed later in this report.</p> <p>RNAV sample is + 338</p>
<p>403</p>	<p>Density Plot GAL Slides: 4 &amp; 7 CAA2v3</p>	<p>Deps occupy approx 70% of the width of the NPR swathe in the turn.</p> <p>Majority of traffic in this density plot remains within the NPR swathe.</p> <p>Vectoring obvious after passing Leigh.</p>	<p>Deps occupy approx 30% of the width of the NPR swathe in the turn.</p> <p>Majority of traffic in this density plot exits the NPR swathe after passing Beare Green.</p> <p>Vectoring obvious after passing Leigh.</p> <p>After the turn is complete, the main concentration of these deps occurs along the designed flight path which is just on the outside of the NPR swathe on the northern</p>	<p>The RNAV SID dispersion has reduced compared with the width of the conv SID departure track dispersion by, in the main over 50%. The picture shows a steady turn after departure around the 180 deg turn onto east.</p> <p>This is in line with data shown by GAL in consultation and the ACP but only up to 4000ft as track dispersion arising from vectoring was not shown in either the Con Doc or ACP.</p> <p>The displacement of the Route 4 departures slightly further north than the conv SID is as predicted. This appears to be at variance with the closing paragraph of page 27 of the Con Doc, which indicated that:</p> <p><i>All traffic is turned eastbound onto compass heading when above the vertical limit of the NPR (4000ft AMSL)...such that the track density is expected to be replicated exactly as shown in Figure 12.</i></p> <p>Fig 12 of the Con Doc only shows traffic up to 4000ft as far as South Holmwood, however the later plots on the GAL website (provided 1 Oct 2012) showed traffic as far as Reigate at 4000ft.</p>	<p>Vectoring apparent from Leigh for both conv and RNAV SIDs.</p> <p>No significant change in dispersion of vectored traffic, however, Nalderswood appears to be less often overflown by vectored traffic as a result of the re-alignment and concentration of the RNAV SID track</p>	<p>With a vastly increased number of flights in this density plot than the diagrams presented in support of the proposal, the mean track of the dispersion around the turn onto east appears to be as expected but there is evidence of a wider dispersion of some flights wider than expected whilst others are tighter than expected. It is unclear as to how many flights extend beyond the extremity of the NPR swathe.</p> <p>RNAV sample is + 338</p> <p>Note: However, from other dispersion plots, there are noticeable differences arising from certain aircraft types flying different tracks over the ground which is discussed in the operational report.</p>

			side.	<p>The displacement of traffic on the RNAV SID alignment means that the majority of flights are now closer to South Holmwood, overhead Leigh, and closer to Doversgreen, South Earlswood and South Nutfield. This will be demonstrated in the altitude band dispersion plots.</p> <p>When comparing an average mean track (i.e. a line that reflects the concentration of the traffic) of the expected RNAV traffic as portrayed in the ACP density diagram (the diagram used for both the consultation and the proposal submitted to the CAA) with an average mean track for the RNAV traffic that is demonstrated in the PIR density diagrams, following implementation of the RNAV SIDs, it can be seen that each mean track in the density diagrams is very similar – namely that in general the turn is as expected.</p>		
	<b>Alt Slice Diagrams</b>	<p>Period Number</p> <p><b>1-7 Mar 14 470</b></p>	<p>Period Number</p> <p><b>1-7 Sep 14 574</b></p>			
<b>404</b>	<p>Alt 4-5000ft</p> <p>GAL Slides:2-5</p> <p>CAA Slides 2-5</p>	<p>Some deps are reaching 4000ft just after the commencement of the turn.</p> <p>Most deps reach 5000ft by South Godstone</p> <p>Deps are widely dispersed around the second part of the turn onto east using almost the full width of the NPR swathe.</p> <p>There are a few deps flying outside the western extremity of the NPR swathe during the turn, but most deps appear to be within the NPR swathe.</p> <p>After completion of the turn onto east, there is a concentrated flight path between South Earlswood and Salfords extending to the end of the NPR delineation.</p> <p>Some vectoring is evident to the north and south of the conv SID concentration.</p>	<p>Some deps are reaching 4000ft just after the commencement of the turn.</p> <p>Most deps reach 5000ft by South Godstone.</p> <p>Deps are concentrated around the full turn onto east and the majority leave the western extremity of the NPR swathe passing Beare Green.</p> <p>From the orange coloured dispersion tracks on the diagram (indicating at 4000ft or above), it is evident that the orange deps are above the vectoring restriction of the NPR. However, from this diagram and comparing it to the 3900ft track dispersion diagram (Slide No 7, 3 and 11- only 7 shown above) it can be seen that a number of aircraft are at 3900 when they leave the NPR swathe.</p> <p>After completion of the turn onto east, there is a concentrated flight path over Leigh, which then routes to slightly to the north of South Earlswood whilst most of the deps are above 4000ft by Leigh (using the 3900ft diagrams on Slides No 7, 3, and 11 – only 7 shown above) and this concentrated flight path extends eastwards to the end of the NPR delineation.</p> <p>Some vectoring is evident to the north and</p>	<p>The RNAV SID dispersion (particularly around the second half of the turn) has reduced compared with the width of the conv SID departure track dispersion by, in the main over 50%. The diagram shows a steady turn after departure around the 180 deg turn onto east.</p> <p>A few deps on the conv SID are taking very wide turns (wider than the mean track of the RNAV turn).</p> <p>In the main, conv deps are within the NPR swathe (though recognising this diagram portrays traffic above 4000ft). By comparison, it appears that most of the tracks for RNAV deps are outside the NPR swathe once past Beare Green, resulting in an increase in flights over South Holmwood and Leigh.</p> <p>The concentrated eastbound track towards South Earlswood had moved to the north as is clearly evident from comparison between conv SID and RNAV track dispersion diagrams.</p>	<p><b>Text Inserted 13 Jul:</b></p> <p>Vectoring occurring from a position slightly further north when compared with the conv SID, however, the fan of the vectored track dispersion is similar.</p>	<p><b>Text Inserted 13 Jul:</b></p> <p>Traffic above 4000ft was not assessed in the ACP analysis as deps may be tactically vectored when reaching 4000ft.</p> <p>RNAV sample is + 104 more.</p>



			south of the RNAV SID concentration.			
405	<p>Alt 5-6000ft</p> <p>GAL Slides:6-9 CAA Slides 2-5</p>	<p>Some deps reaching 5000ft + just before the mid point of the turn onto east.</p> <p>Deps are widely dispersed around the second part of the turn onto east using almost the full width of the NPR swathe.</p> <p>There are a few deps flying outside the westerner extremity of the NPR swathe during the turn, but most deps appear to be within the NPR swathe.</p> <p>After completion of the turn onto east, there is a more dispersed flight path between South Earlswood and Salfords extending to the end of the NPR delineation.</p> <p>Some vectoring is evident to the north and south of the conv SID concentration.</p>	<p>Some deps reaching 5000ft + just before the mid point of the turn onto east.</p> <p>Deps are concentrated around the full turn onto east and the majority leave the western extremity of the NPR swathe passing Beare Green.</p> <p>From the blue coloured dispersion tracks on the diagram (indicating at 5000ft or above), it is evident that the blue deps are well above the vectoring restriction of the NPR. However, from this diagram and comparing it to the 3900ft track dispersion diagram (Slide No 7, 3 and 11) it can be seen that a number of aircraft are at 3900 when they leave the NPR swathe.</p> <p>After completion of the turn onto east, there is still a concentrated flight path over Leigh, which then routes to slightly to the north of South Earlswood whilst most of the deps are above 4000ft by Leigh (using the 3900ft diagrams on Slides No 7, 3, and 11) and this concentrated flight path extends eastwards to the end of the NPR delineation.</p> <p>Some vectoring is evident to the north and south of the RNAV SID concentration.</p>	<p>The RNAV SID dispersion (particularly around the second half of the turn) has reduced compared with the width of the conv SID departure track dispersion by, in the main over 50%. The diagram shows a steady turn after departure around the 180 deg turn onto east.</p> <p>In the main, conv deps are now being dispersed beyond the lateral limits of the NPR swathe as they may be vectored by ATC.</p> <p>By comparison, it appears that most of the tracks for RNAV deps are outside the NPR swathe once past Beare Green, resulting in an increase in flights over South Holmwood and Leigh.</p> <p>The concentrated eastbound track towards South Earlswood has moved to the north as is clearly evident from comparison between conv SID and RNAV track dispersion diagrams. However, widespread vectoring is evident more to the south than the north.</p>	<p>Text Inserted 13 Jul:</p> <p>Vectoring occurring from a position slightly further north when compared with the conv SID, however, the fan of the vectored track dispersion is similar.</p>	<p>Text Inserted 13 Jul:</p> <p>Traffic above 4000ft was not assessed in the ACP analysis as deps may be tactically vectored when reaching 4000ft.</p> <p>RNAV sample is + 104 more.</p>
406	<p>Alt 6-7000ft</p> <p>GAL Slides:10-13 CAA Slides 2-5</p>	<p>Some deps reaching 6000ft by the completion of the turn.</p> <p>Deps are widely dispersed around the second part of the turn onto east using the northern half of the NPR swathe as ac complete the turn, after which, deps steady up onto east, or are vectored by ATC onto a 'fan like</p>	<p>Some deps reaching 6000ft after passing Beare Green.</p> <p>Deps are concentrated around the second part of the turn onto east outside but above the northern extremity of the NPR swathe as ac complete the turn,</p>	<p>The RNAV SID dispersion has reduced compared with the width of the conv SID departure track dispersion up to Leigh, in the main by over 50%. After Leigh, widespread vectoring is evident on a similar dispersion as shown with the conv SI dispersion diagram.</p> <p>In the main, conv deps are now being dispersed beyond the lateral limits of the NPR swathe as they may be vectored by ATC. By comparison, it appears that most of the tracks for RNAV deps are outside the NPR swathe once past Beare Green, resulting in an increase in flights over South Holmwood and Leigh.</p> <p>The concentrated eastbound track towards South Earlswood has moved to the</p>	<p>Text Inserted 13 Jul:</p> <p>Vectoring occurring from a position slightly further north when compared with the conv SID, however, the fan of the vectored track dispersion is similar.</p>	<p>Text Inserted 13 Jul:</p> <p>Traffic above 4000ft was not assessed in the ACP analysis as deps may be tactically vectored when reaching 4000ft.</p> <p>RNAV sample is + 104 more.</p>

		<p>dispersion stretching in the main from Redhill in the north to Outwood in the south.</p> <p>There are a few deps flying outside the northern extremity of the NPR swathe during the turn, but deps in this altitude band are aligned on the northern extremity of the NPR swathe before being vectored .</p>	<p>afterwhich, some deps steady up onto east, or are vectored by ATC onto a 'fan like dispersion stretching in the main from Redhill in the north to Outwood in the south.</p> <p>Most if not all deps are flying outside the northern extremity of the NPR swathe during the turn. Deps in this altitude band are aligned on north of the northern extremity of the NPR swathe routeing over Leigh and being vectored as indicated above.</p>	<p>north as is clearly evident from comparison between conv SID and RNAV track dispersion diagrams. However, widespread vectoring is evident more to the south than the north.</p> <p>The overall is a change of concentrated flight which has been moved to the left of the conv SID track dispersion all the way around the turn, afterwhich the steady track towards the east has moved to the north , albeit vectoring is somewhat similar.</p>		
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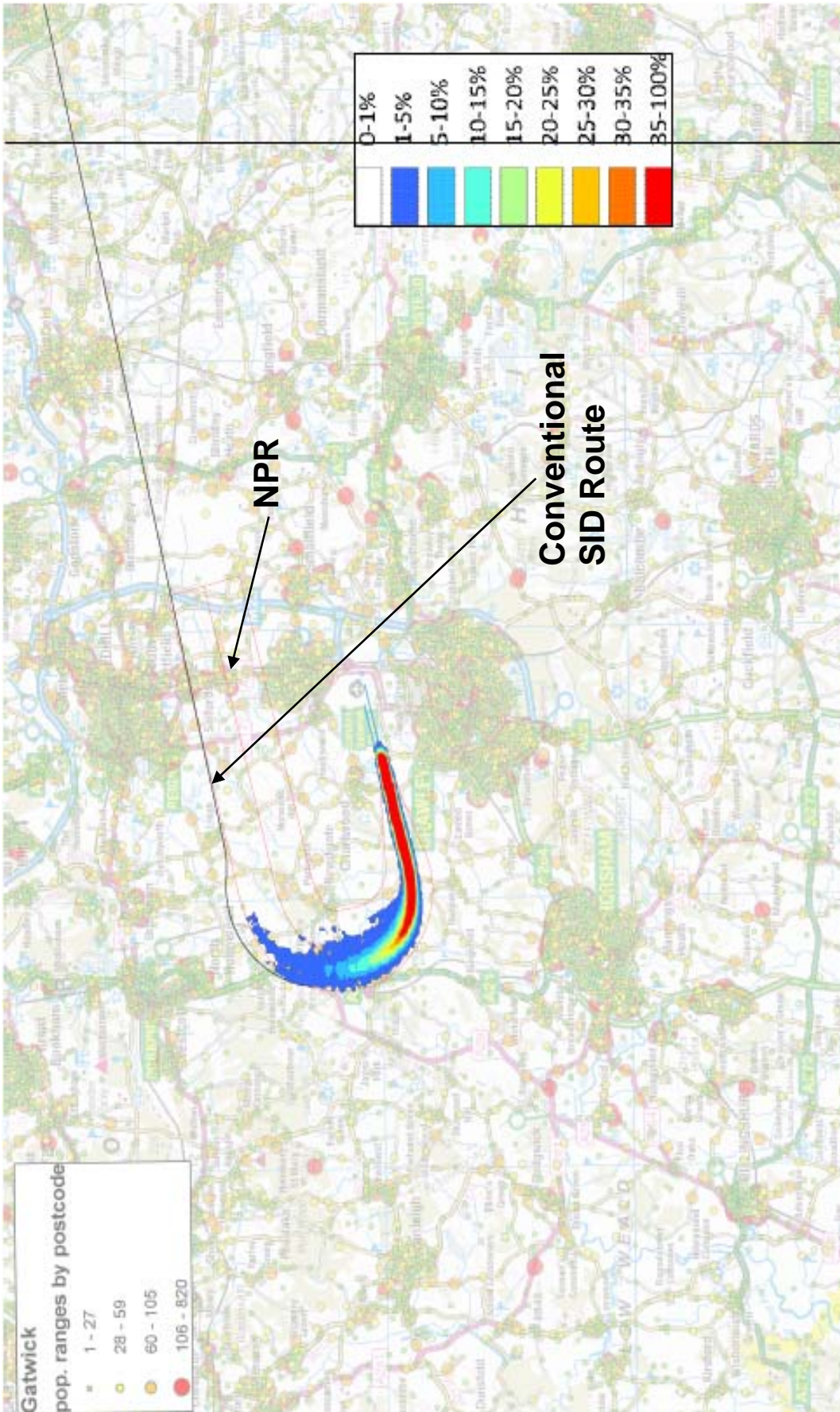


**ROUTE 4 – RWY 26 LAM1X, DVR1X, CLN3X, BIG1X – SAMPLE 2 Comparing Jul 13 (Conv) v Jun 14 (RNAV)**

LINKS	SID Sample Of Relevant Track Dispersion Diagram	Conventional SID Comments (Note 1)		RNAV 1 SID Comments (Note2)		Impact (Note 3)	Observations on Vectoring (Note 4)	Remarks (Note 5)
		Month	Number	Month	Number			
Folder Ref	Diagram <b>LAM1X</b>	<b>Jul 13</b>	<b>2727</b>	<b>Jun 14</b>	<b>2538</b>		Day: 4000ft Night: 4000ft	
<b>407</b>	At 3900ft <b>Slides:</b>	As sample 1		As sample 1.		As sample 1.	As sample 1.	As sample 1.
<b>408</b>	At 4000ft	As sample 1		As sample 1.		As sample 1.	As sample 1.	As sample 1.
<b>409</b>	Density Plot	As sample 1		As sample 1.		As sample 1.	As sample 1.	As sample 1.

**ROUTE 4 – RWY 26 LAM1X, DVR1X, CLN3X, BIG1X – SAMPLE 3 Comparing Aug 13 (Conv) v Aug 14 (RNAV)**

LINKS	SID Sample Of Relevant Track Dispersion Diagram	Conventional SID Comments (Note 1)		RNAV 1 SID Comments (Note2)		Impact (Note 3)	Observations on Vectoring (Note 4)	Remarks (Note 5)
		Month	Number	Month	Number			
Folder Ref	Diagram <b>LAM1X</b>	<b>Aug 13</b>	<b>4092</b>	<b>Aug 14</b>	<b>4364</b>		Day: 4000ft Night: 4000ft	
<b>410</b>	At 3900ft Slides:	As sample 1		As sample 1.		As sample 1.	As sample 1.	As sample 1.
<b>411</b>	At 4000ft	As sample 1		As sample 1.		As sample 1.	As sample 1.	As sample 1.
<b>412</b>	Density Plot	As sample 1		As sample 1.		As sample 1.	Both conv and RNAV diagrams appear to show an increase in flight being tactically vectored; however, this is likely as a result of the greater sample size compared with Sample 1 and 2.	As sample 1.



400 A

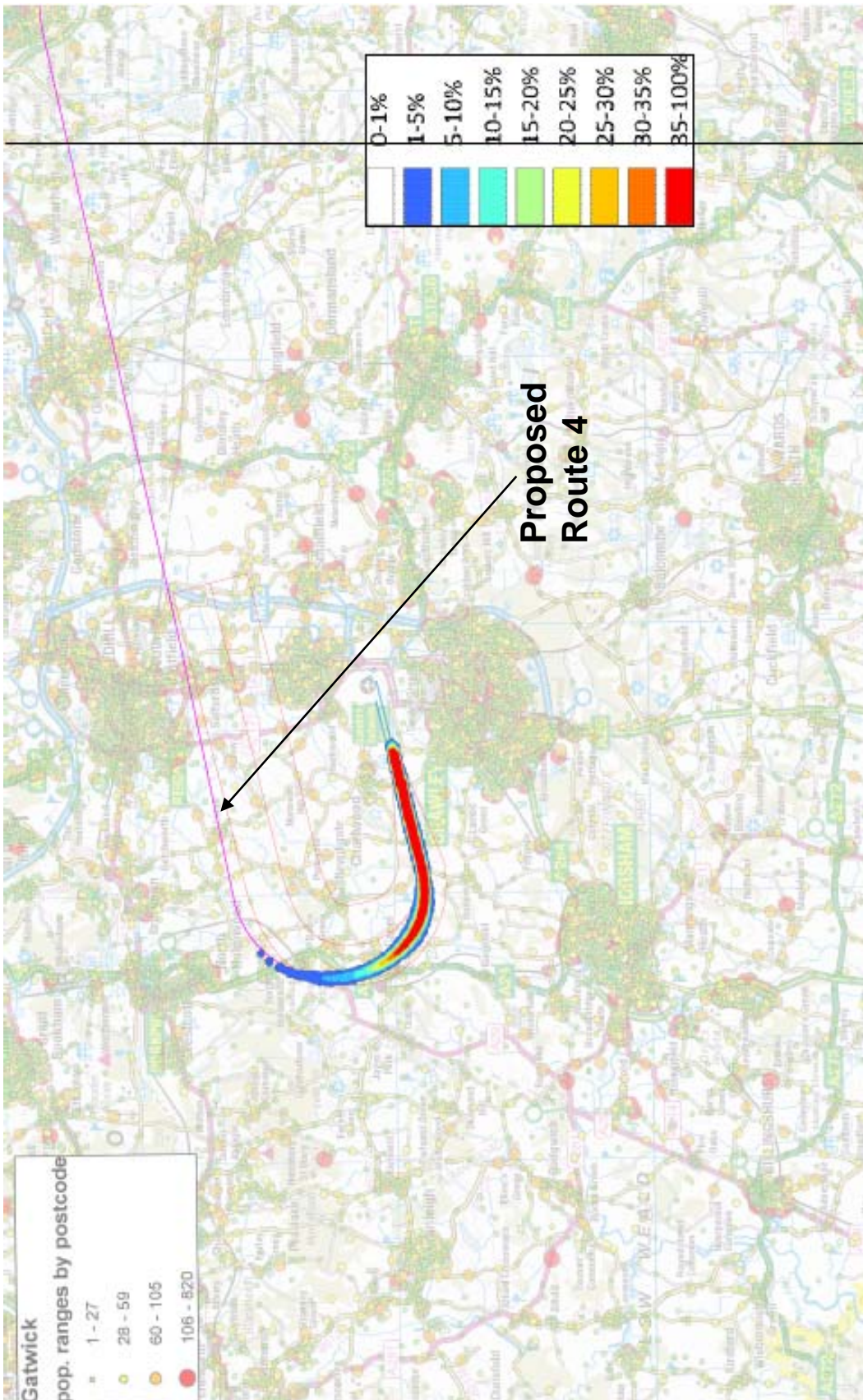
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Figure11) Density plots of aircraft tracks (up to 4000 feet AMSL) following the conventional right turn out SID routes from Runway 26L



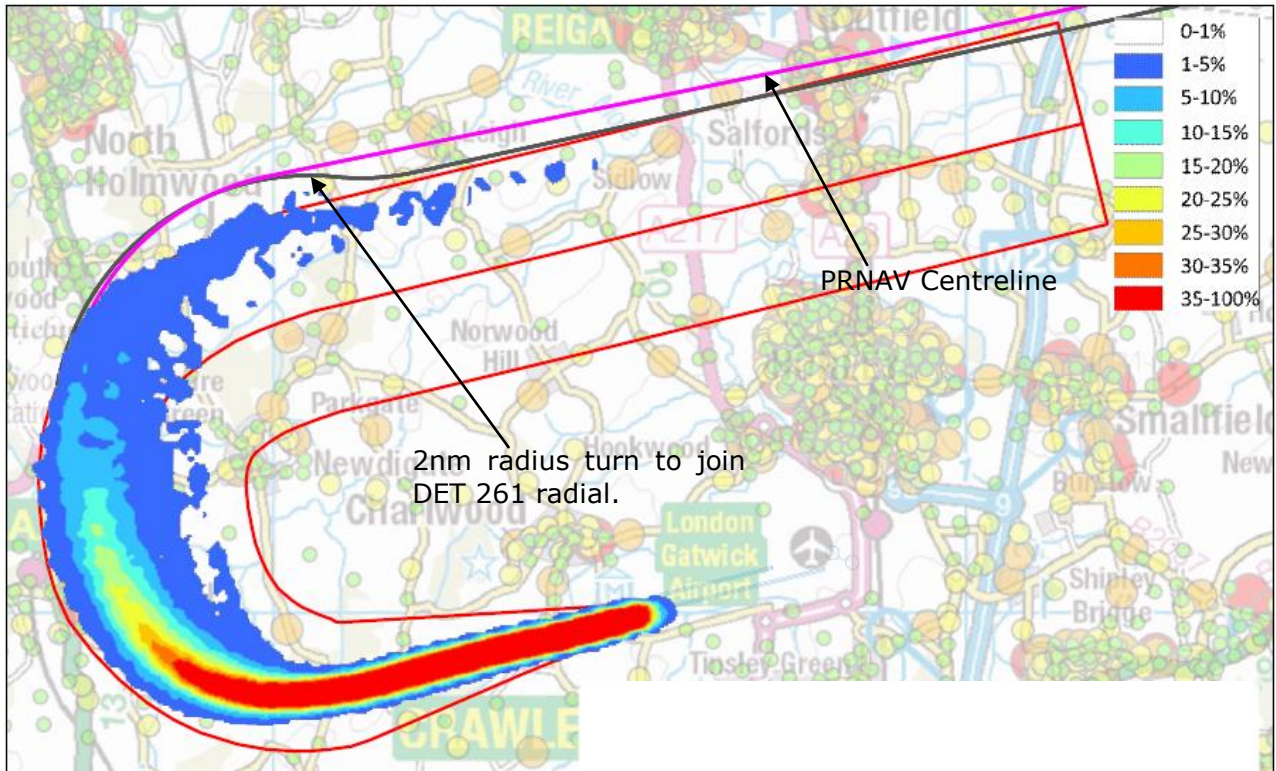
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**Figure12** Density plot of aircraft tracks (up to 4000 feet AMSL) following the PRNAV (**ROUTE 4**) SID route (flight trialled since 2007) which has same design criteria as all other SID routes that turn right on departure from runway 26L.

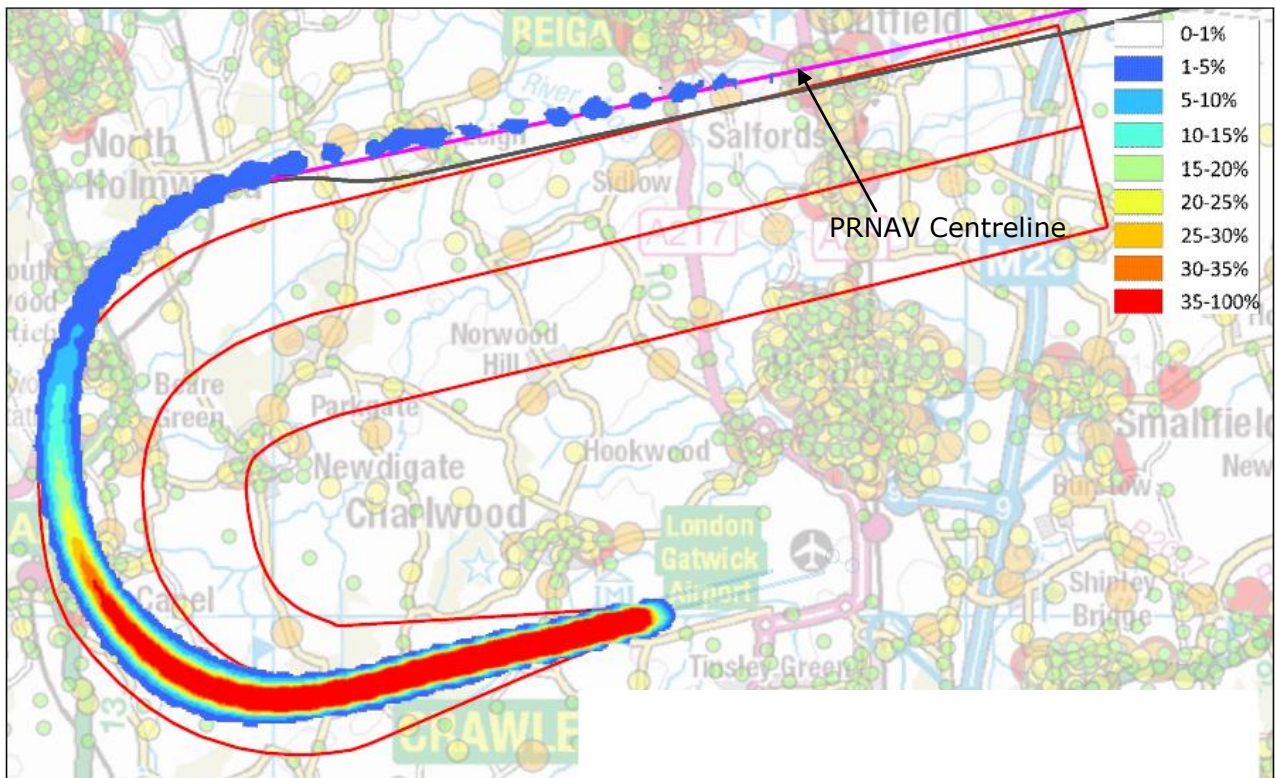




401 A

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**Figure 8 Route 4 Conventional Navigation**



401 B

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**Figure 9 Route 4 PRNAV Navigation**

# 26 LAMBOURNE

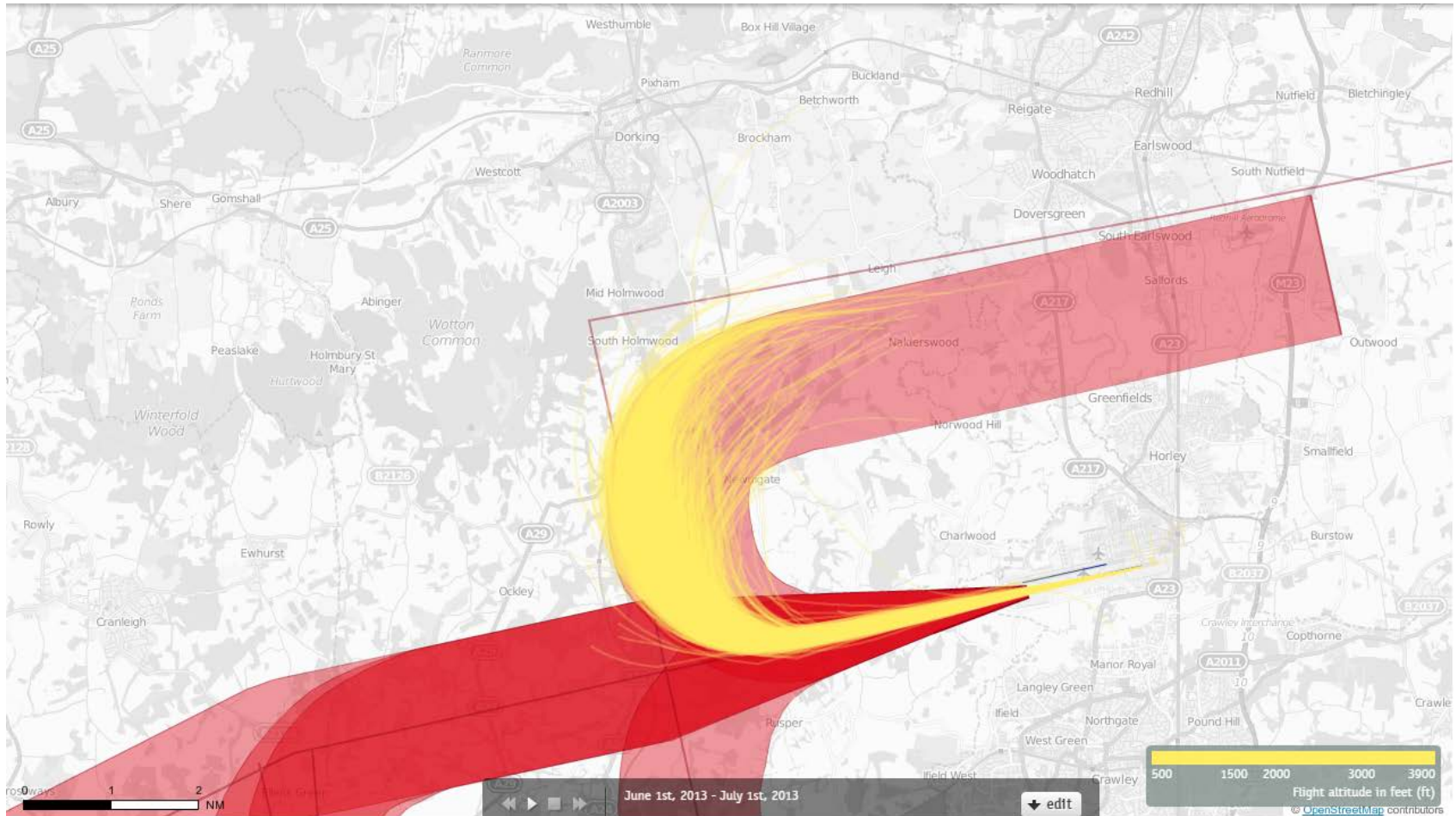
## Route 4

Pre and Post P-RNAV



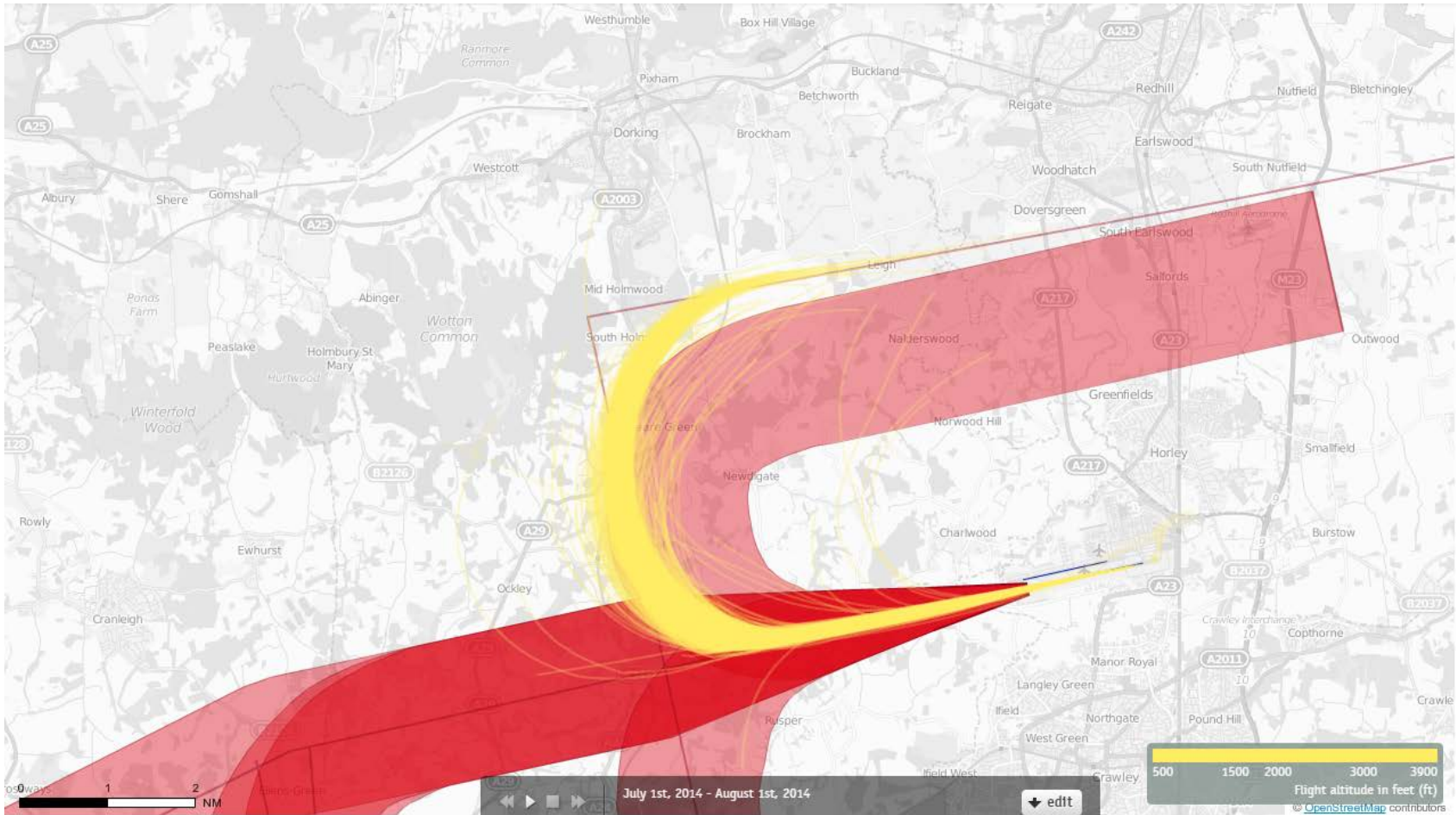
# 26LAMBOURNE June 2013 Aircraft Tracks Cut Off at 3900ft Altitude 3043 Aircraft – Showing CONVENTIONAL Departures Only

< BACK



# 26LAMBOURNE July 2014 Aircraft Tracks Cut Off at 3900ft Altitude 3381 Aircraft – Showing P-RNAV Departures Only

< BACK



# 26 LAMBOURNE

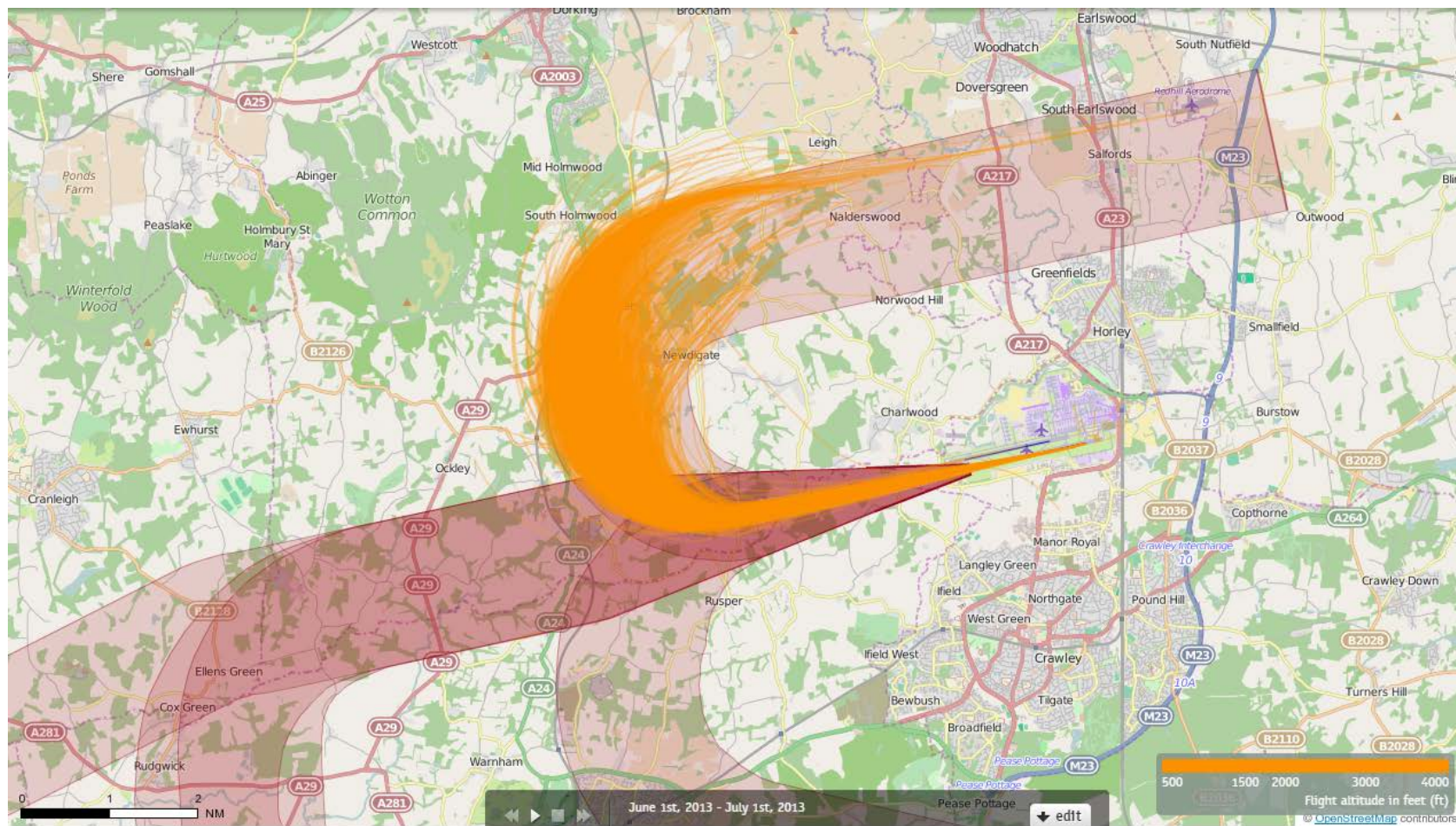
## Route 4

Pre and Post P-RNAV



# 26LAMBOURNE June 2013 Aircraft Tracks Cut Off at 4000ft Altitude < BACK

## 3043 Aircraft – Showing CONVENTIONAL Departures Only







# 26 LAMBOURNE

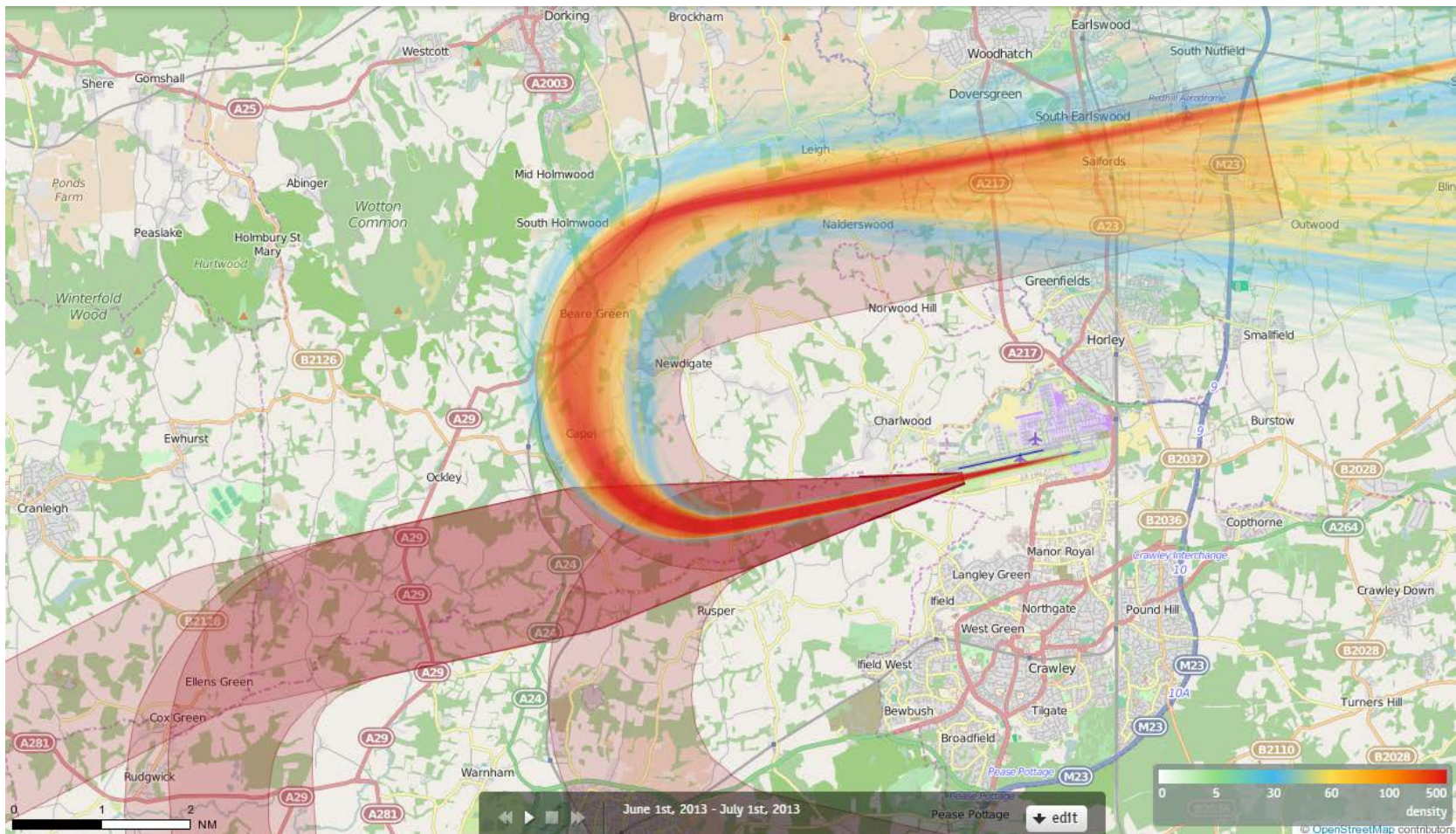
## Route 4

Pre and Post P-RNAV



# 26LAMBOURNE Density June 2013

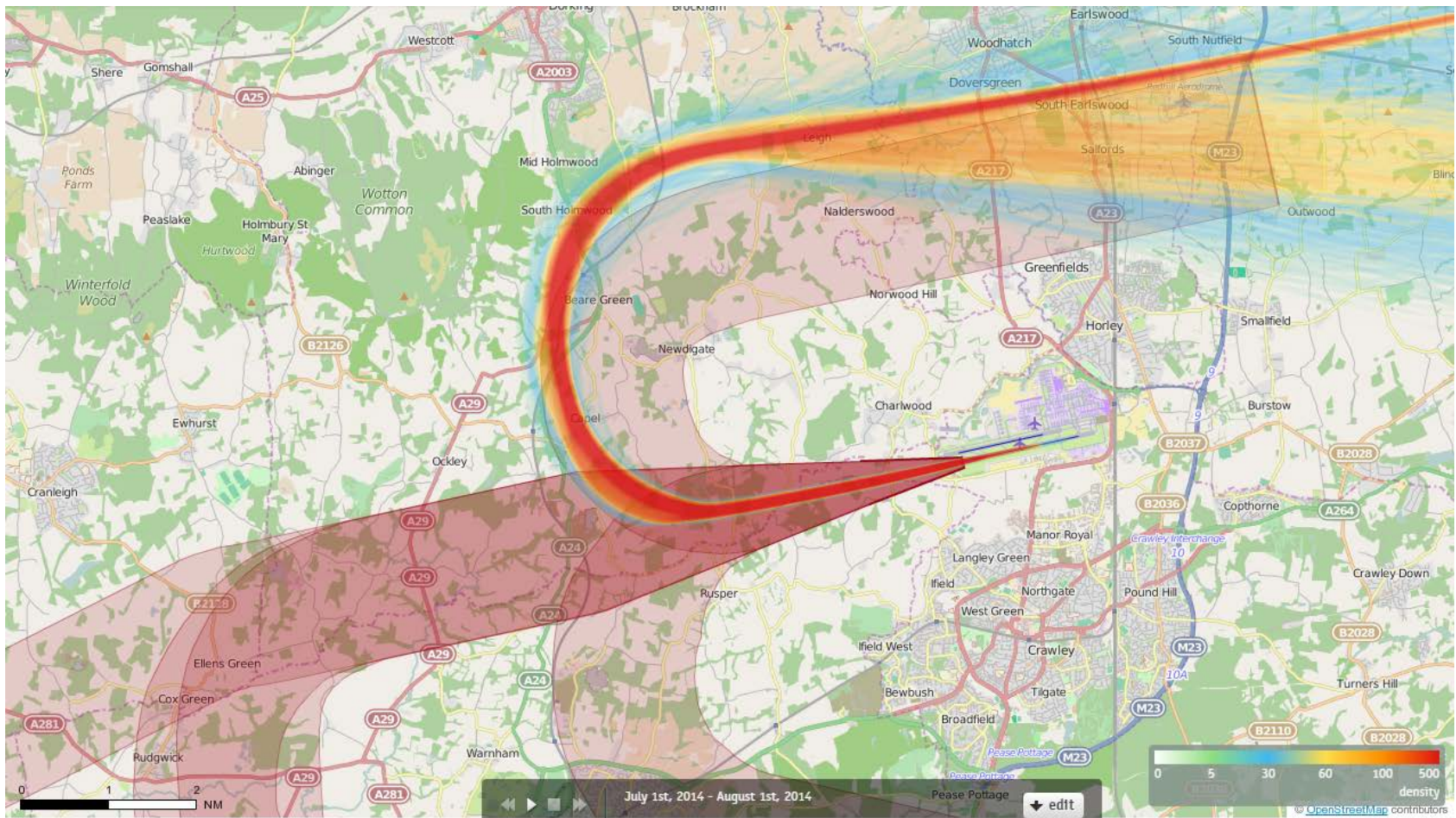
## 3043 Aircraft – Showing CONVENTIONAL Departures Only





# 26LAMBOURNE Density July 2014

## 3381 Aircraft – Showing P-RNAV Departures Only



# 26 LAMBOURNE

## Route 4

Altitude Bands

4000-5000ft

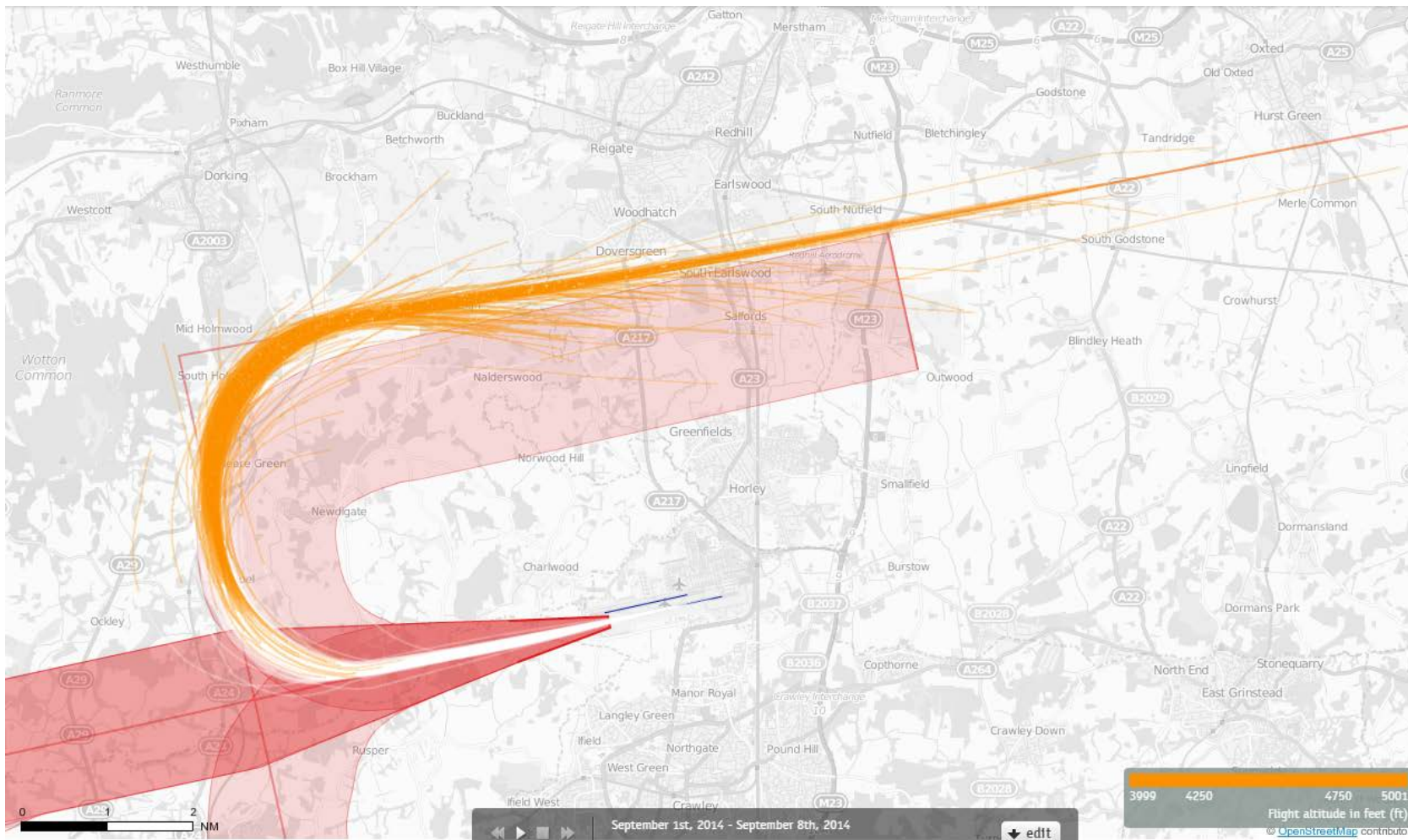
# 26 LAM Departures 1<sup>st</sup>-7<sup>th</sup> March 2014

## 4000-5000 feet (470 Aircraft – CONVENTIONAL ONLY)





# 26 LAM Departures 1<sup>st</sup> – 7<sup>th</sup> September 2014 4000-5000 feet (574 Aircraft – P-RNAV ONLY)





# 26 LAM Departures 1<sup>st</sup>-7<sup>th</sup> March 2014

## 4000-5000 feet (470 Aircraft – CONVENTIONAL ONLY)





# 26 LAM Departures 1<sup>st</sup> – 7<sup>th</sup> September 2014 4000-5000 feet (574 Aircraft – P-RNAV ONLY)



# 26 LAMBOURNE

## Route 4

Altitude Bands

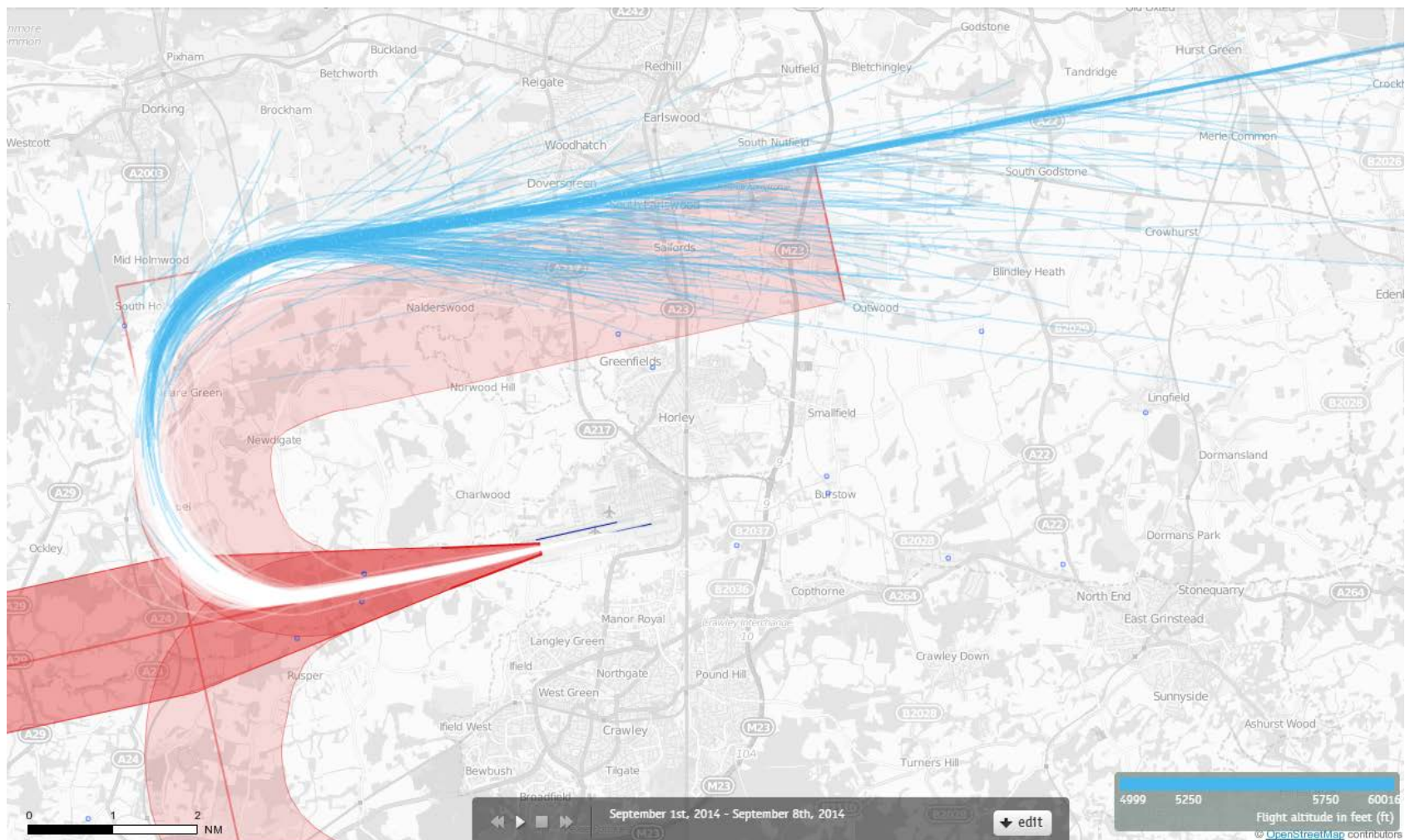
5000-6000ft





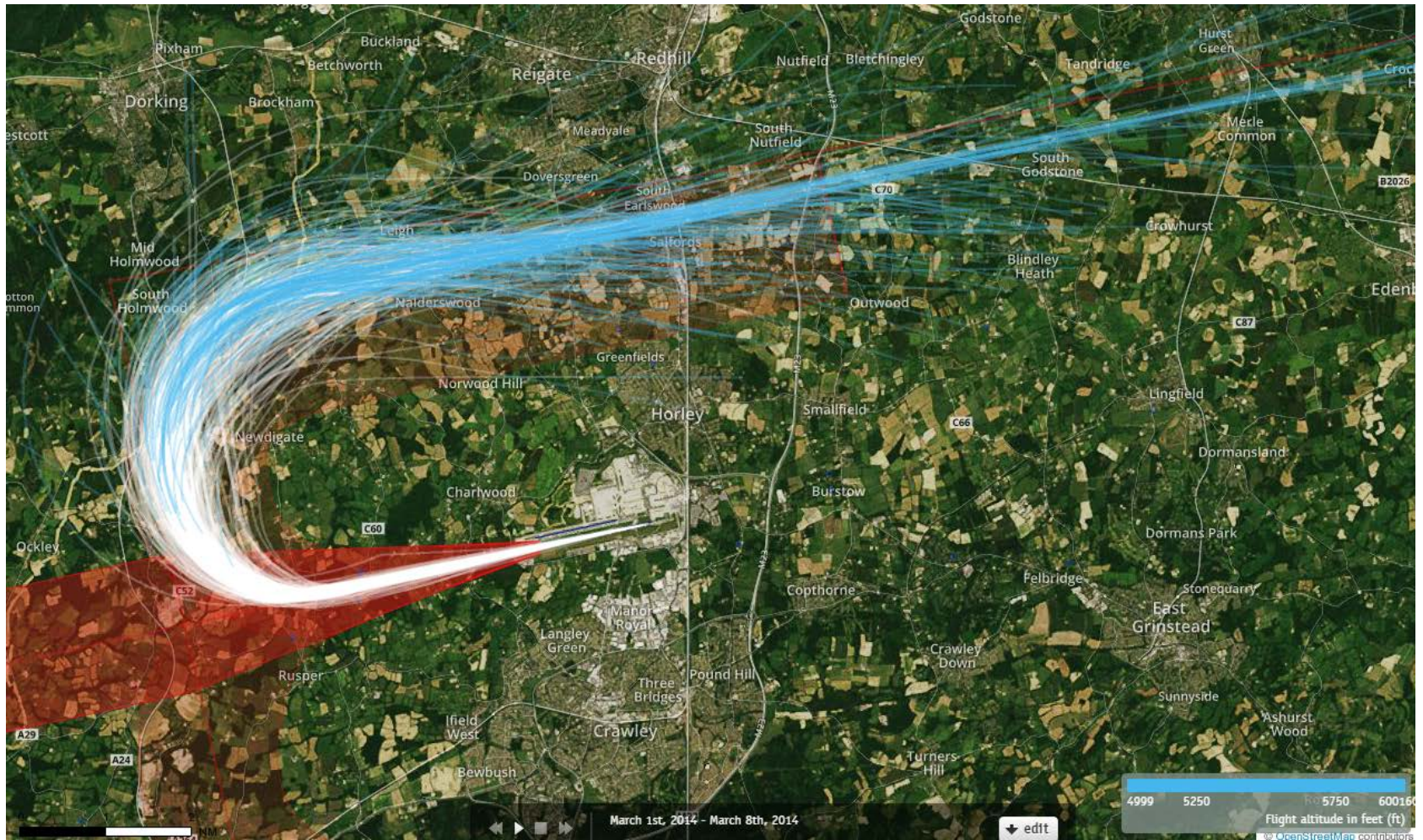


# 26 LAM Departures 1<sup>st</sup> – 7<sup>th</sup> September 2014 5000-6000 feet (574 Aircraft – P-RNAV ONLY)





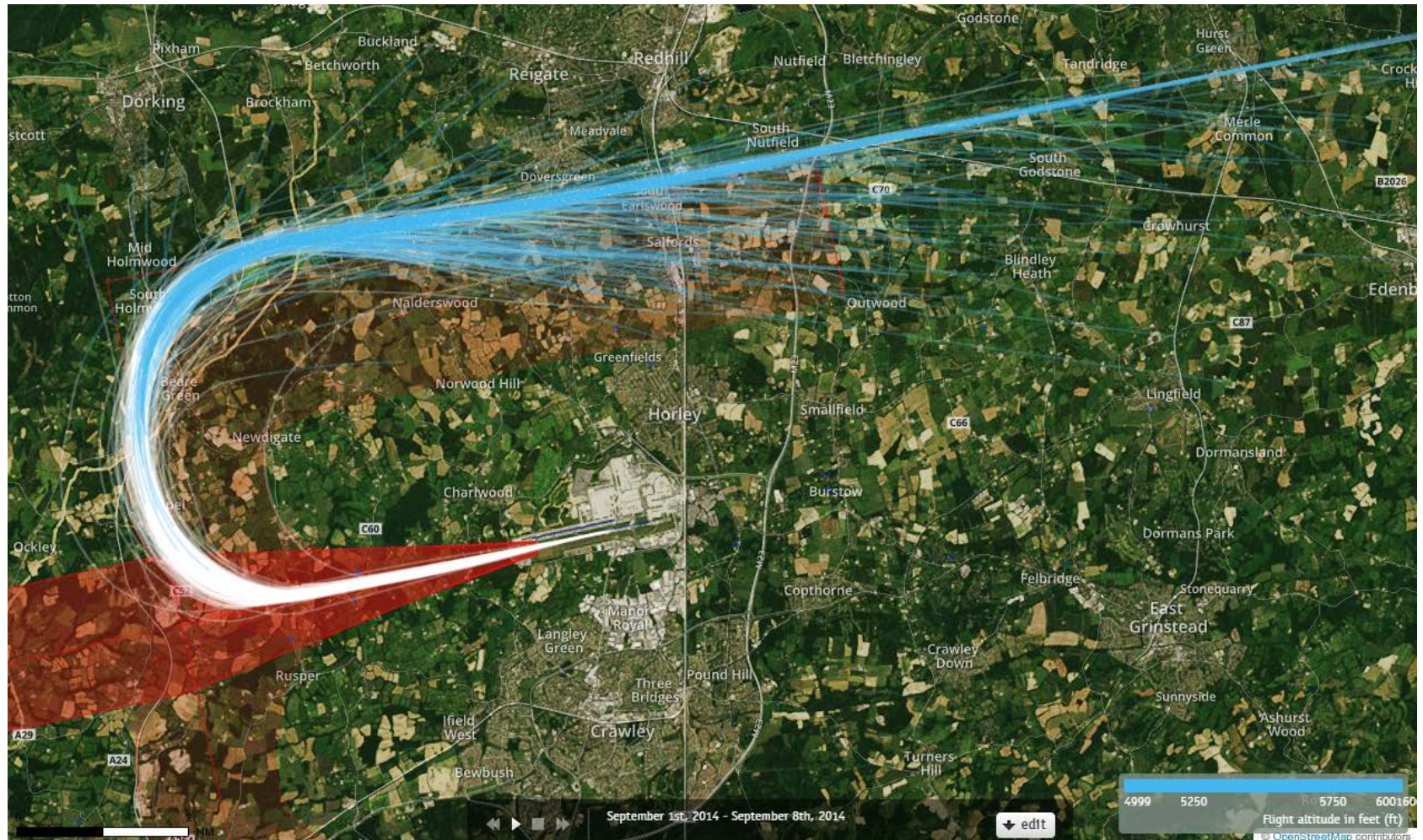
# 26 LAM Departures 1<sup>st</sup>-7<sup>th</sup> March 2014 5000-6000 feet (470 Aircraft – CONVENTIONAL ONLY)





# 26 LAM Departures 1<sup>st</sup> – 7<sup>th</sup> September 2014

## 5000-6000 feet (574 Aircraft – P-RNAV ONLY)





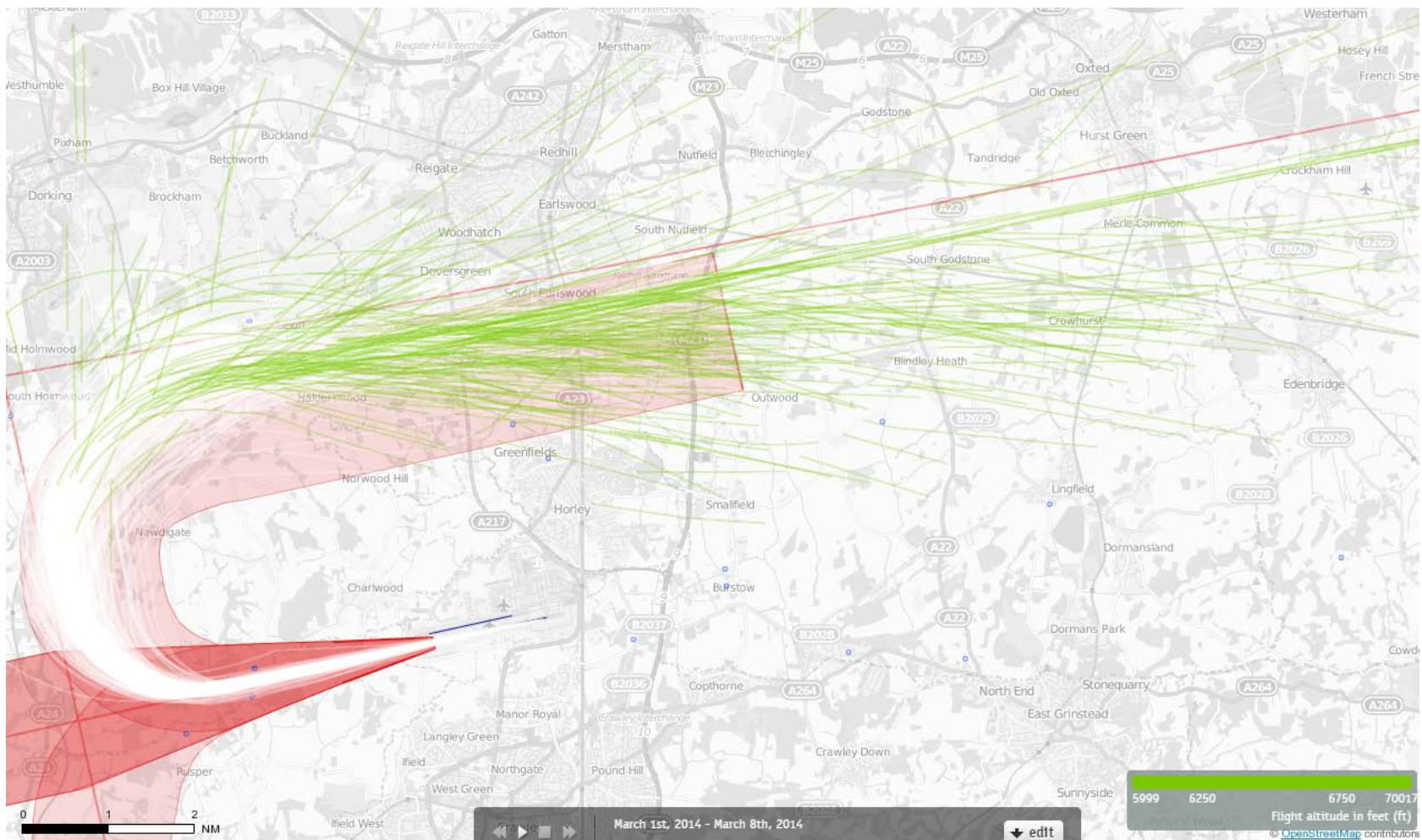
# 26 LAMBOURNE

## Route 4

Altitude Bands

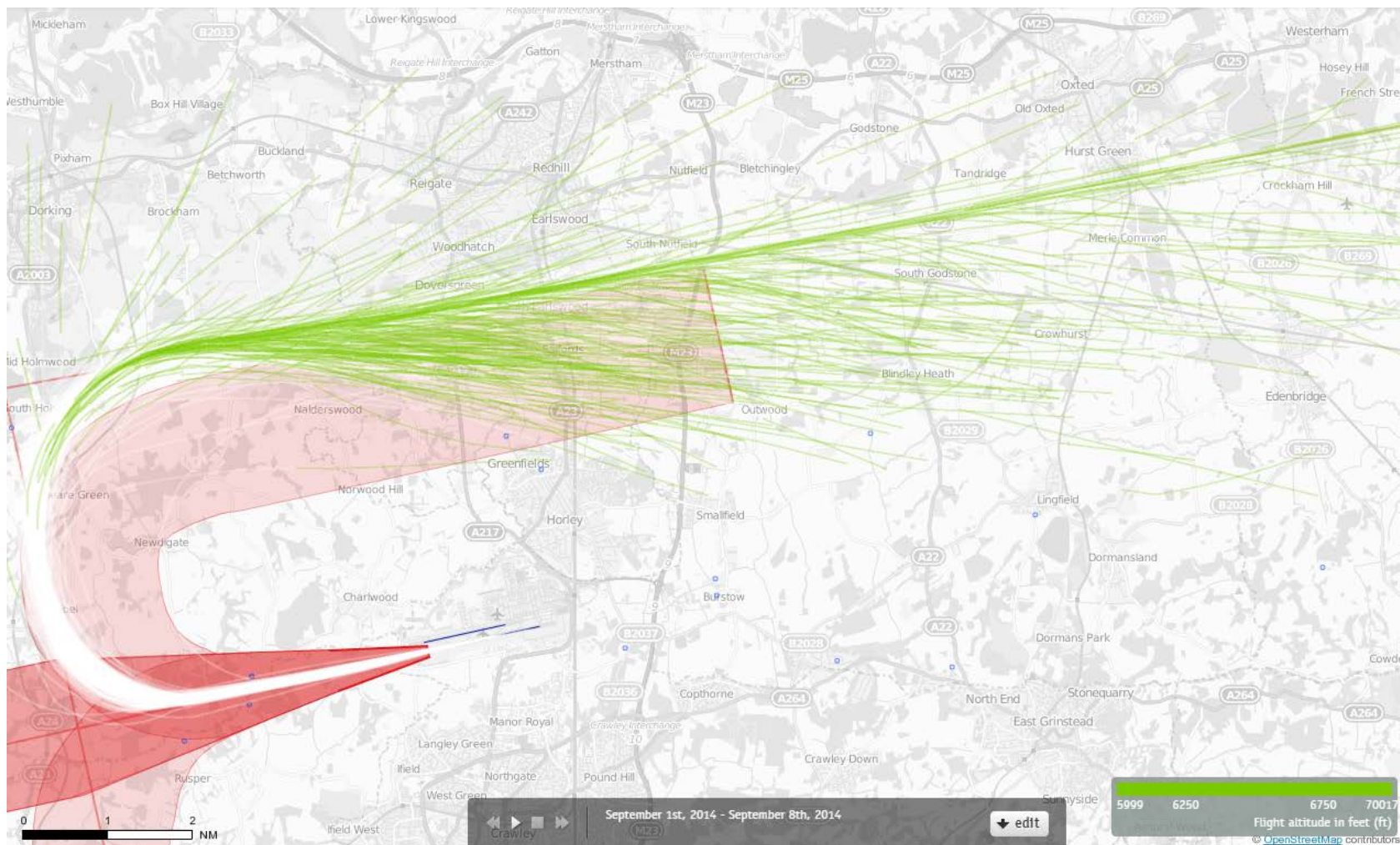
6000-7000ft

# 26 LAM Departures 1<sup>st</sup>-7<sup>th</sup> March 2014 6000-7000 feet (470 Aircraft – CONVENTIONAL ONLY)



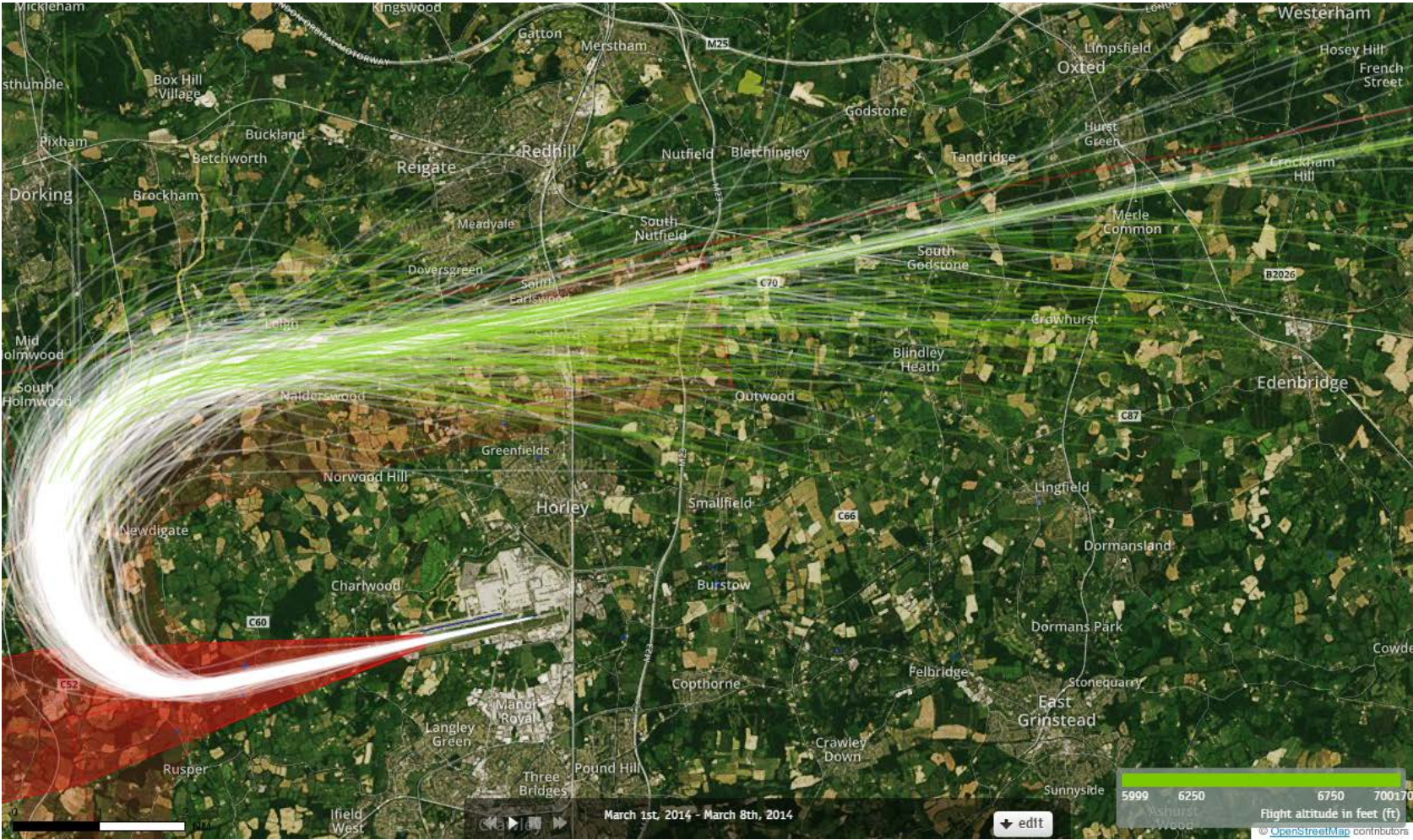
# 26 LAM Departures 1<sup>st</sup> – 7<sup>th</sup> September 2014

## 6000-7000 feet (574 Aircraft – P-RNAV ONLY)





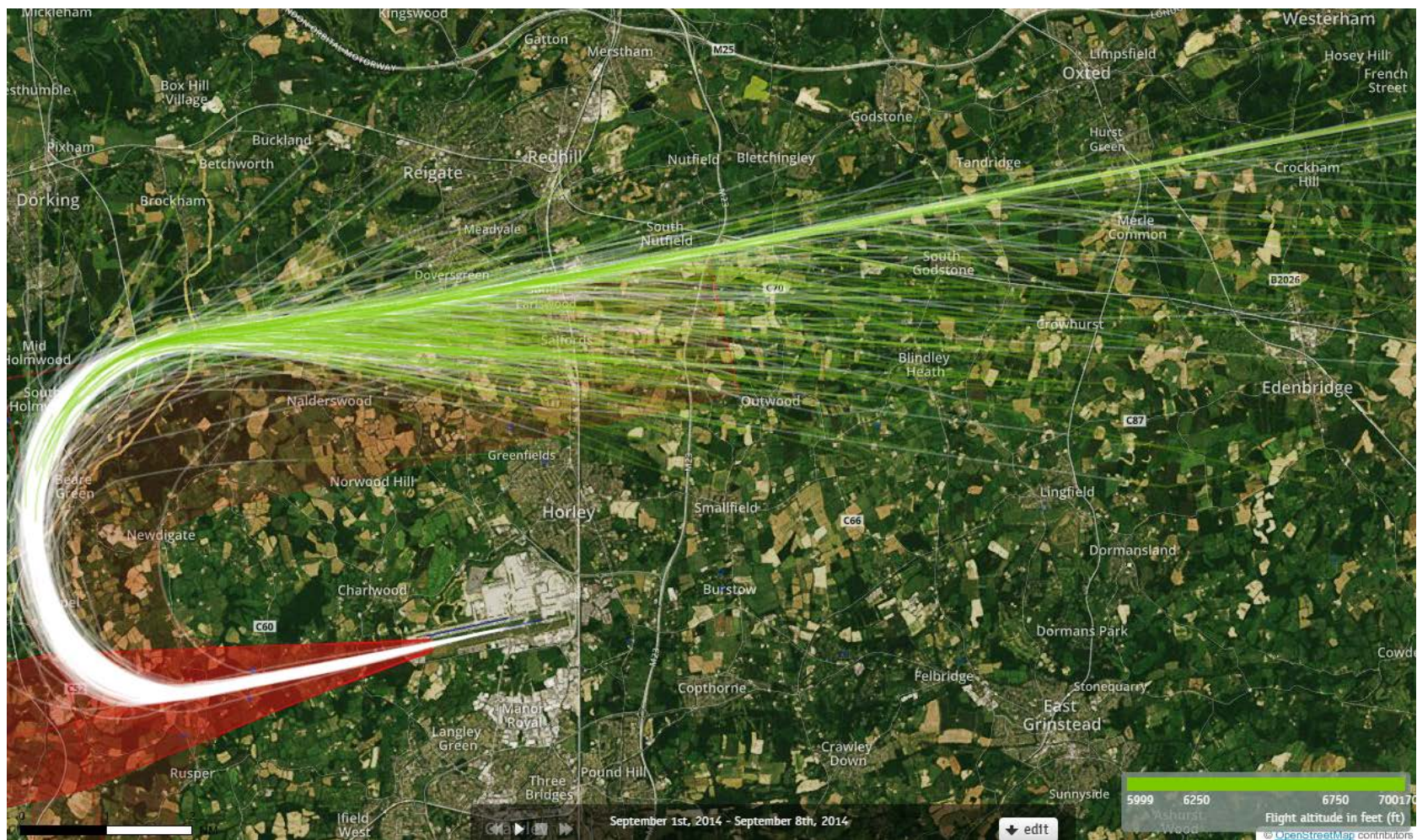
# 26 LAM Departures 1<sup>st</sup>-7<sup>th</sup> March 2014 6000-7000 feet (470 Aircraft – CONVENTIONAL ONLY)





# 26 LAM Departures 1<sup>st</sup> – 7<sup>th</sup> September 2014

## 6000-7000 feet (574 Aircraft – P-RNAV ONLY)



26 LAMBOURNE

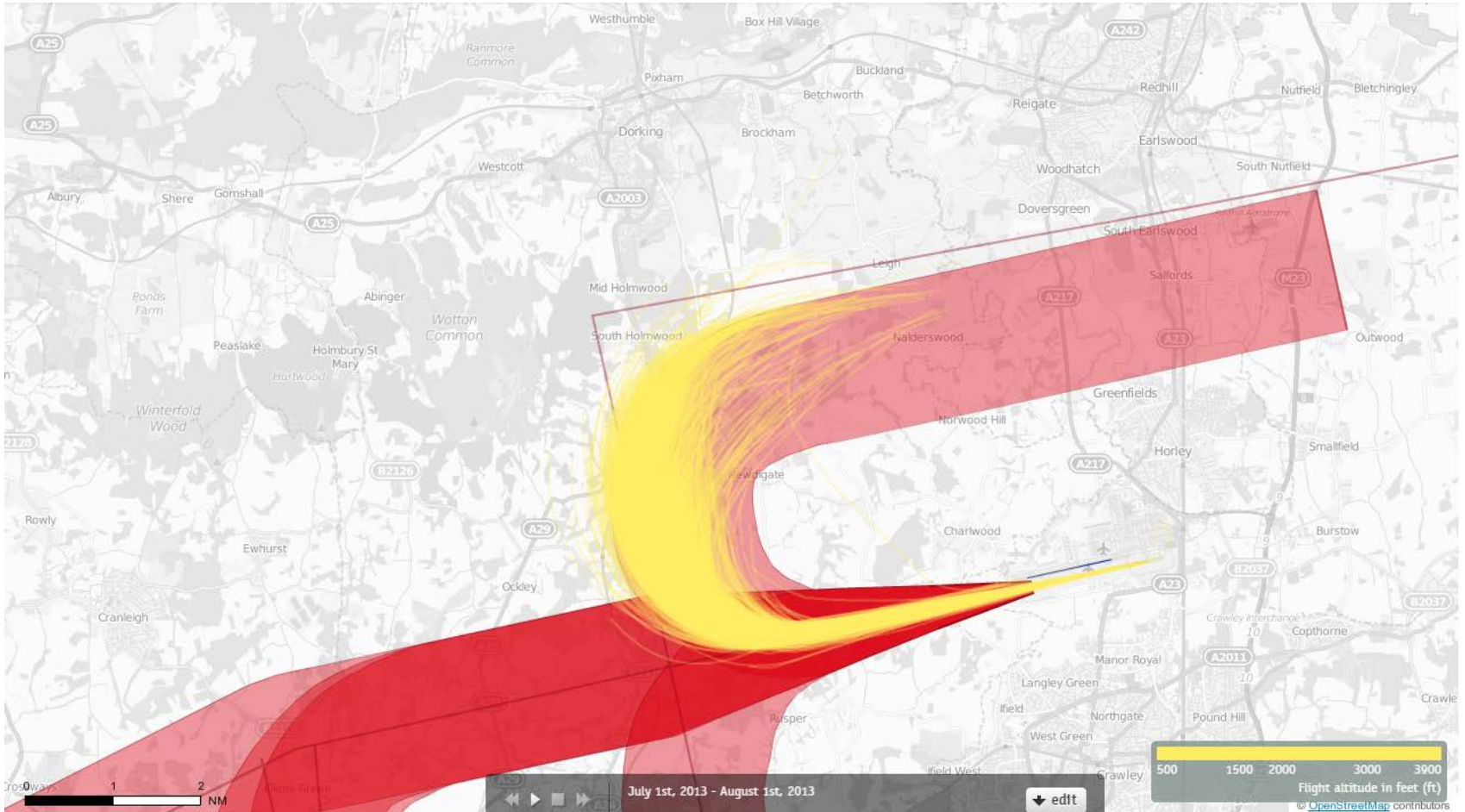
Route 4

Sample 2

Pre and Post P-RNAV

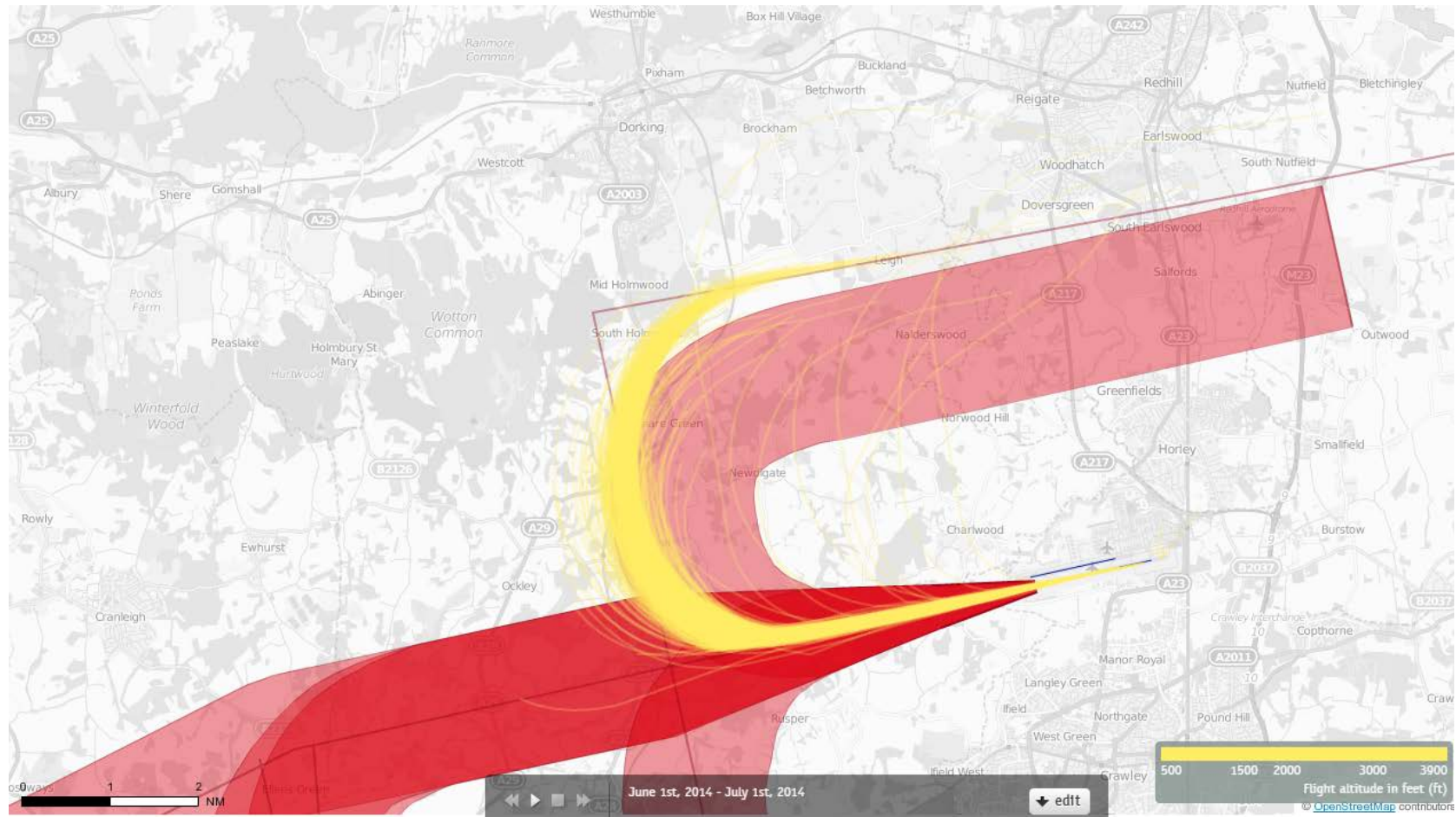


# 26LAMBOURNE July 2013 Aircraft Tracks Cut Off at 3900ft Altitude 2727 Aircraft – Showing CONVENTIONAL Departures Only



# 26LAMBOURNE June 2014 Aircraft Tracks Cut Off at 3900ft Altitude < BACK

## 2538 Aircraft – Showing P-RNAV Departures Only



26 LAMBOURNE

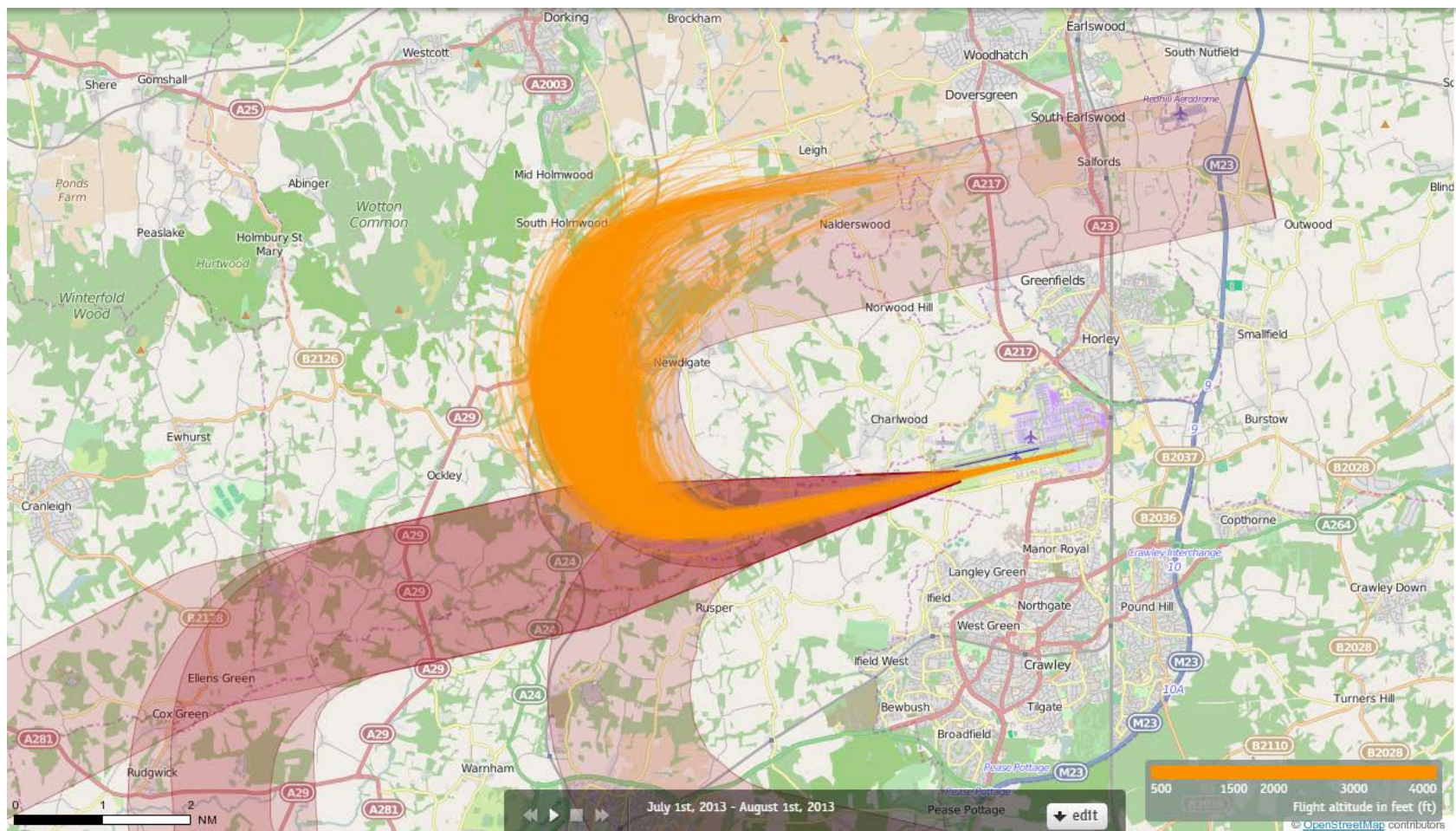
Route 4

Sample 2

Pre and Post P-RNAV



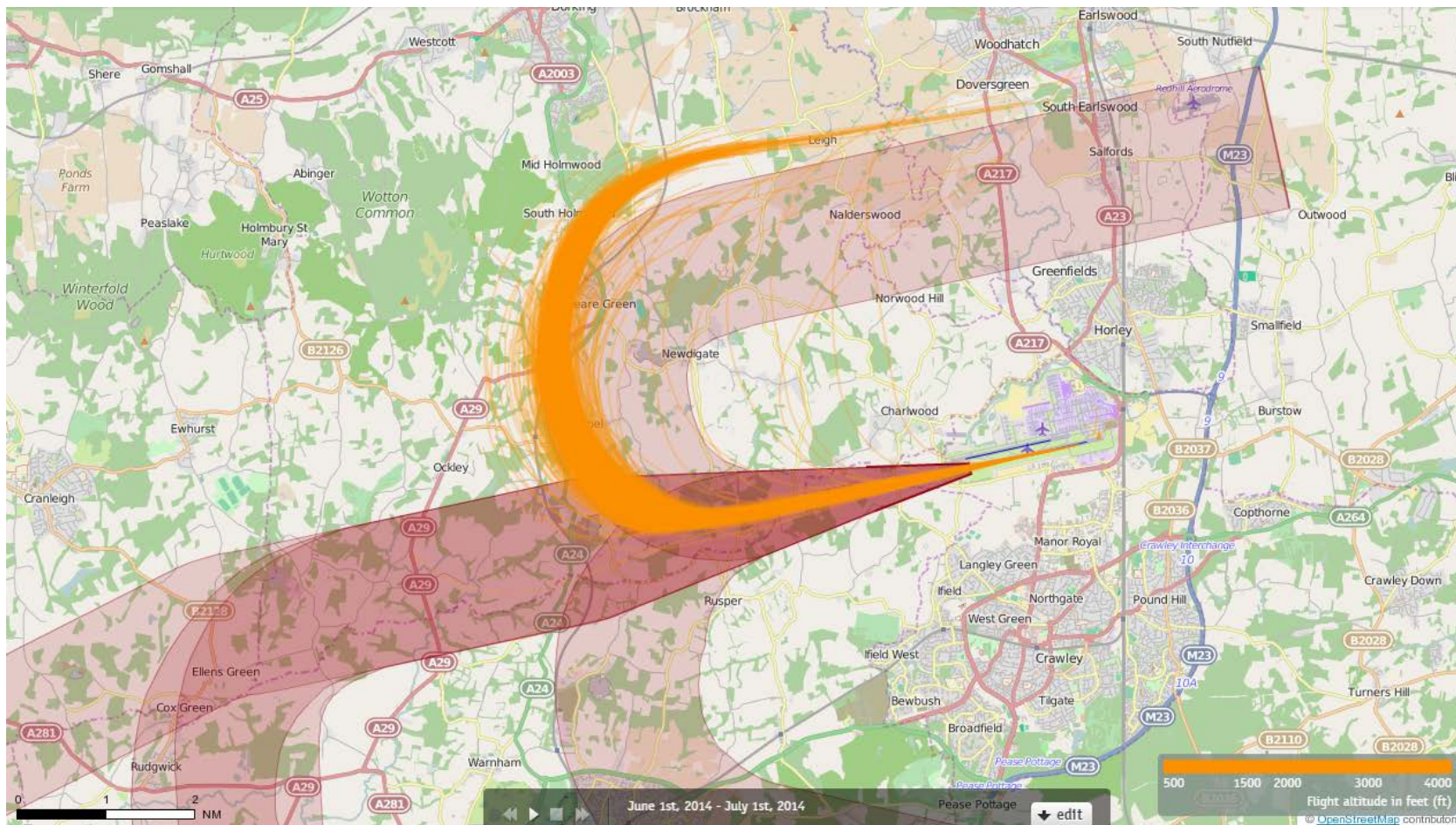
# 26LAMBOURNE July 2013 Aircraft Tracks Cut Off at 4000ft Altitude 2727 Aircraft – Showing CONVENTIONAL Departures Only





# 26LAMBOURNE June 2014 Aircraft Tracks Cut Off at 4000ft Altitude 2538 Aircraft – Showing P-RNAV Departures Only

< BACK



26 LAMBOURNE

Route 4

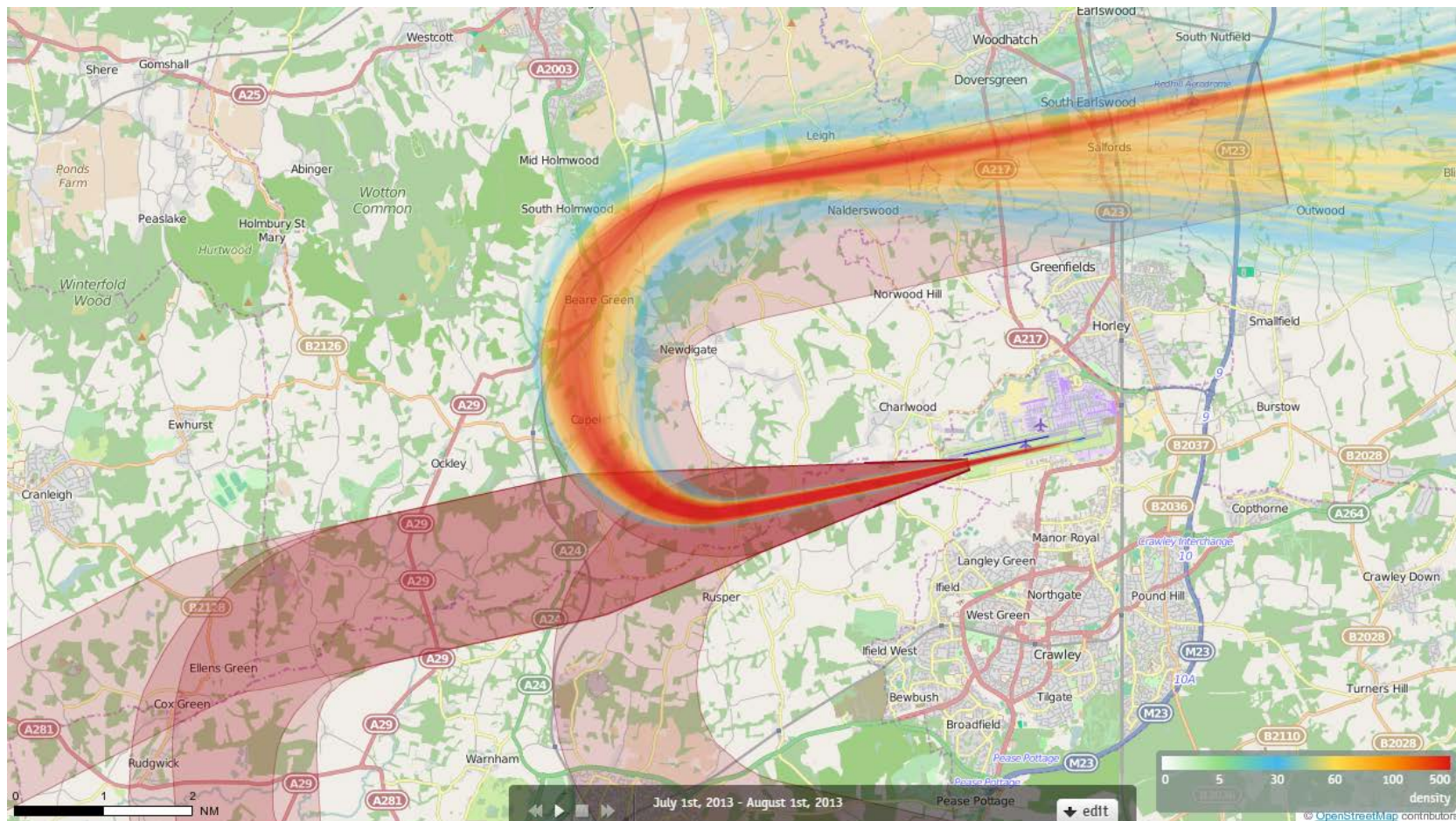
Sample 2

Pre and Post P-RNAV



# 26LAMBOURNE Density July 2013

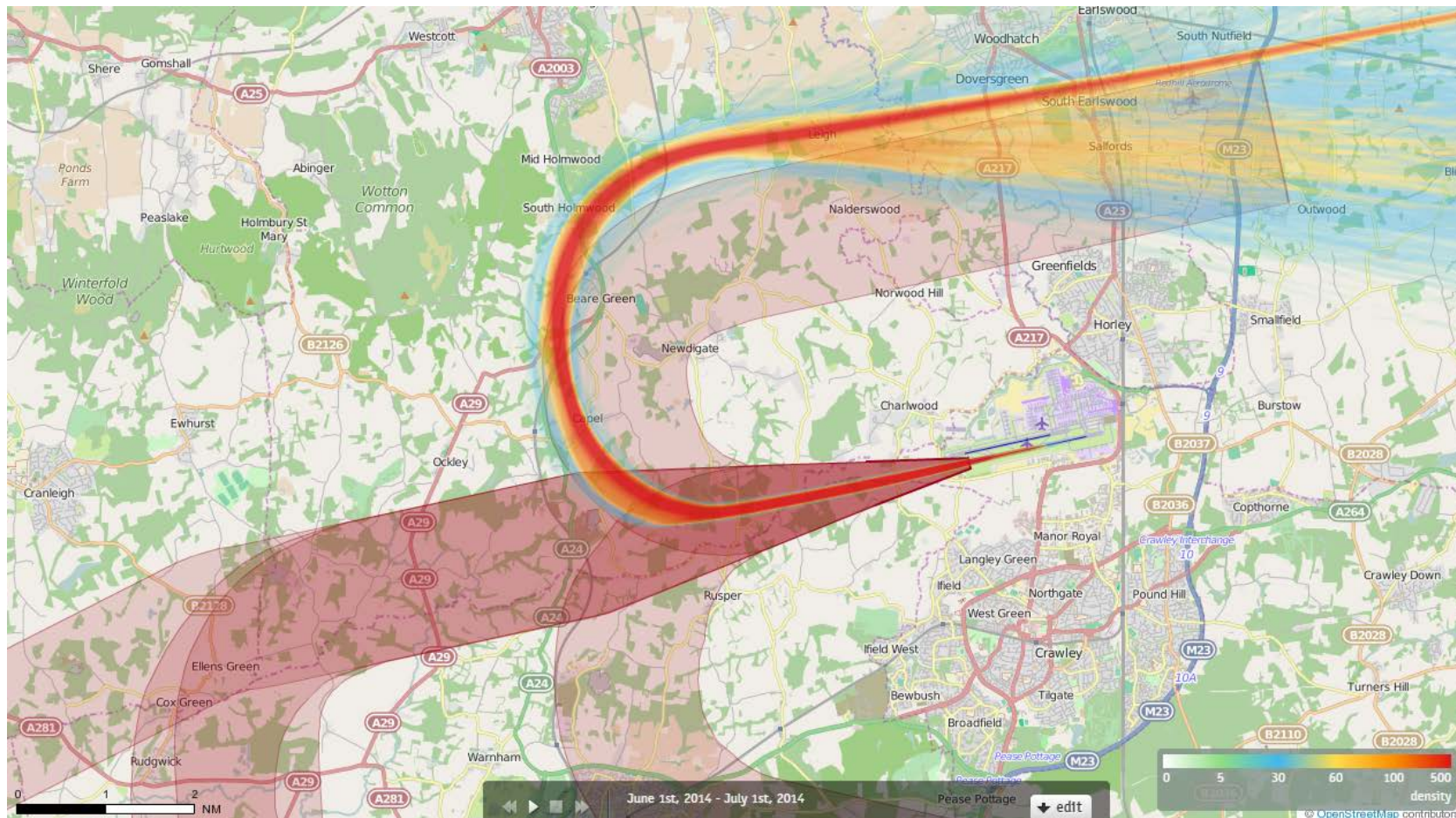
## 2727 Aircraft – Showing CONVENTIONAL Departures Only





# 26LAMBOURNE Density June 2014

## 2538 Aircraft – Showing P-RNAV Departures Only



26 LAMBOURNE

Route 4

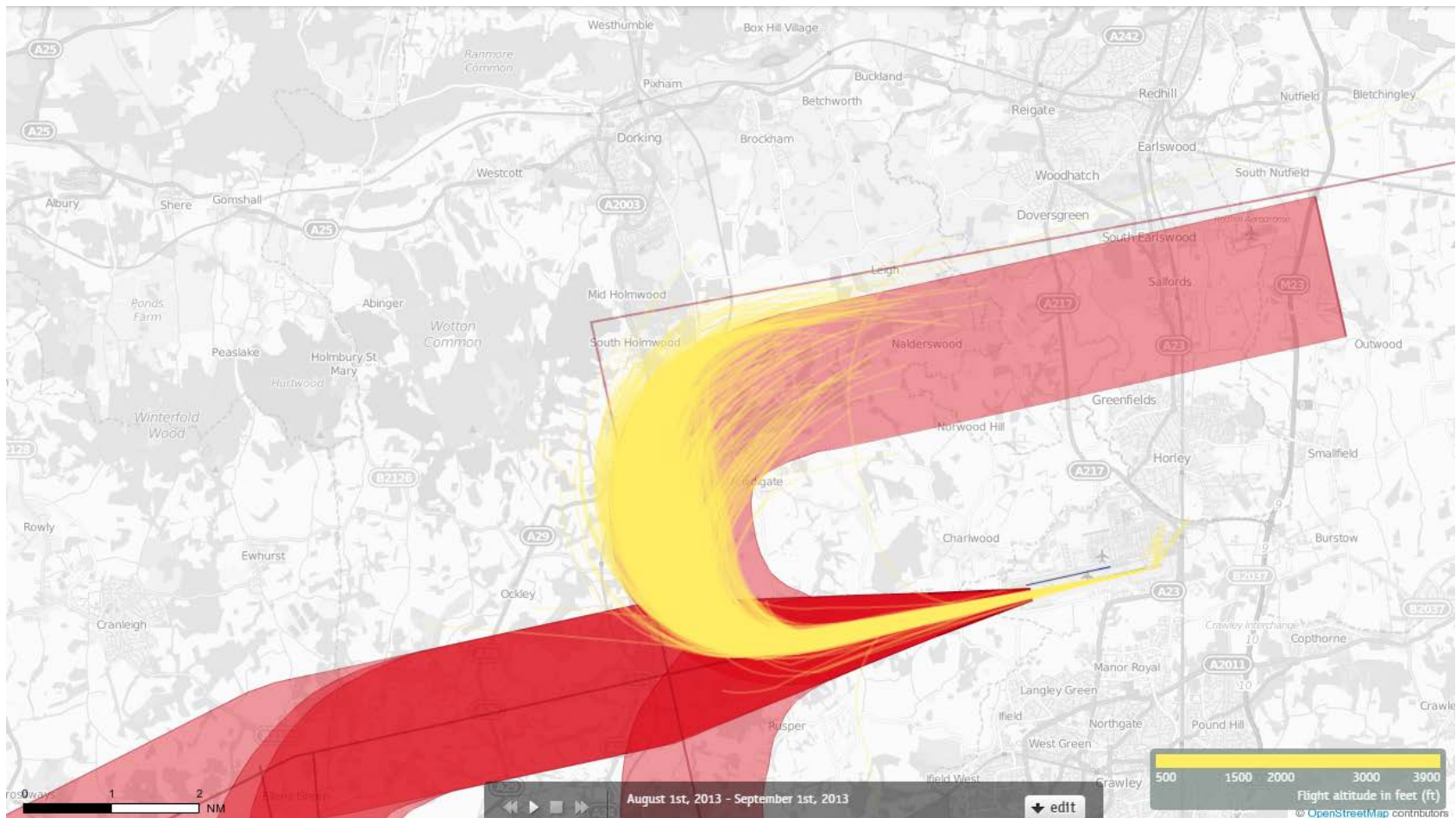
Sample 3

Pre and Post P-RNAV



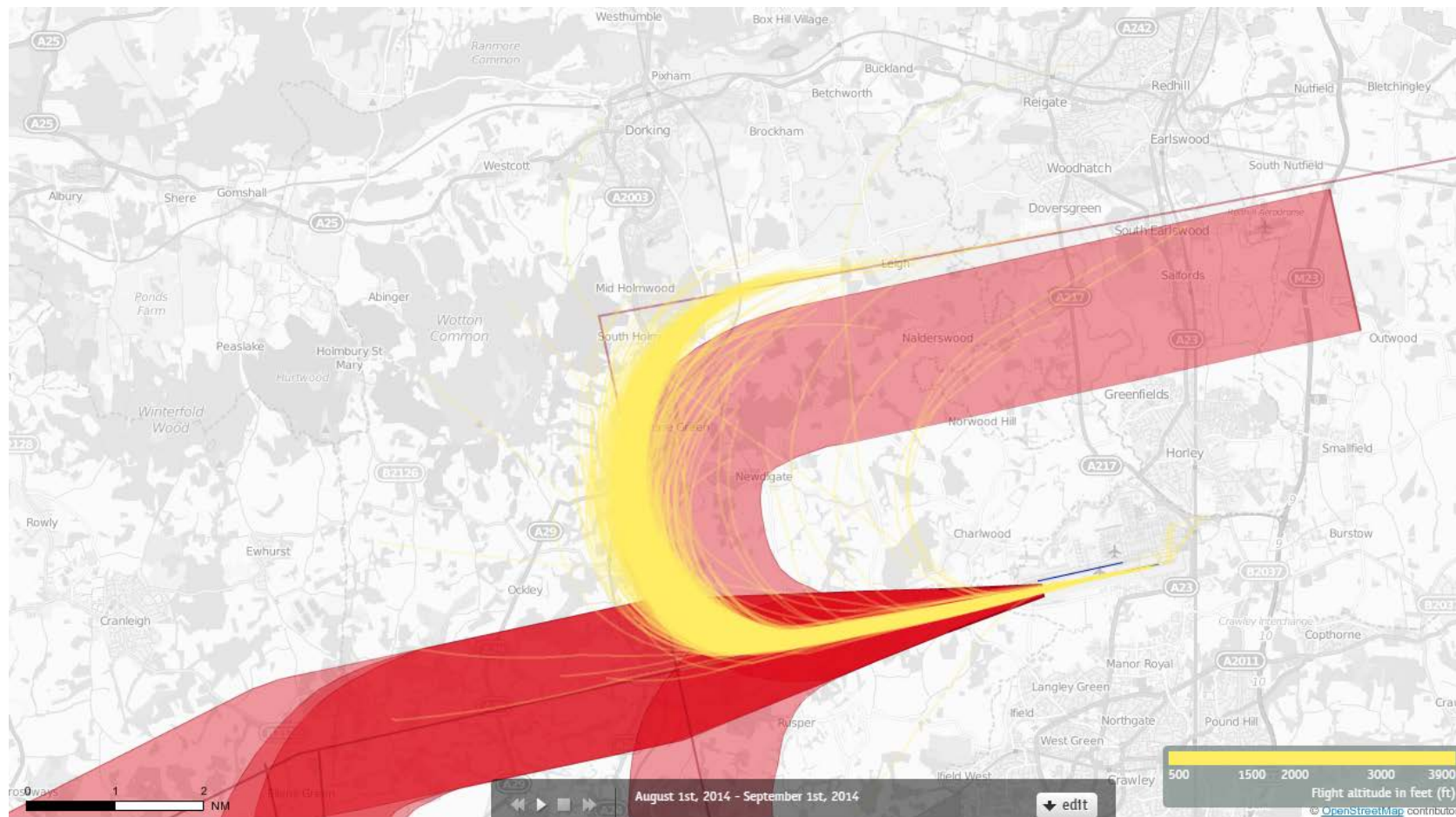
# 26LAMBOURNE August 2013 Aircraft Tracks Cut Off at 3900ft Altitude < BACK

## 4092 Aircraft – Showing CONVENTIONAL Departures Only



# 26LAMBOURNE August 2014 Aircraft Tracks Cut Off at 3900ft Altitude < BACK

## 4364 Aircraft – Showing P-RNAV Departures Only



26 LAMBOURNE

Route 4

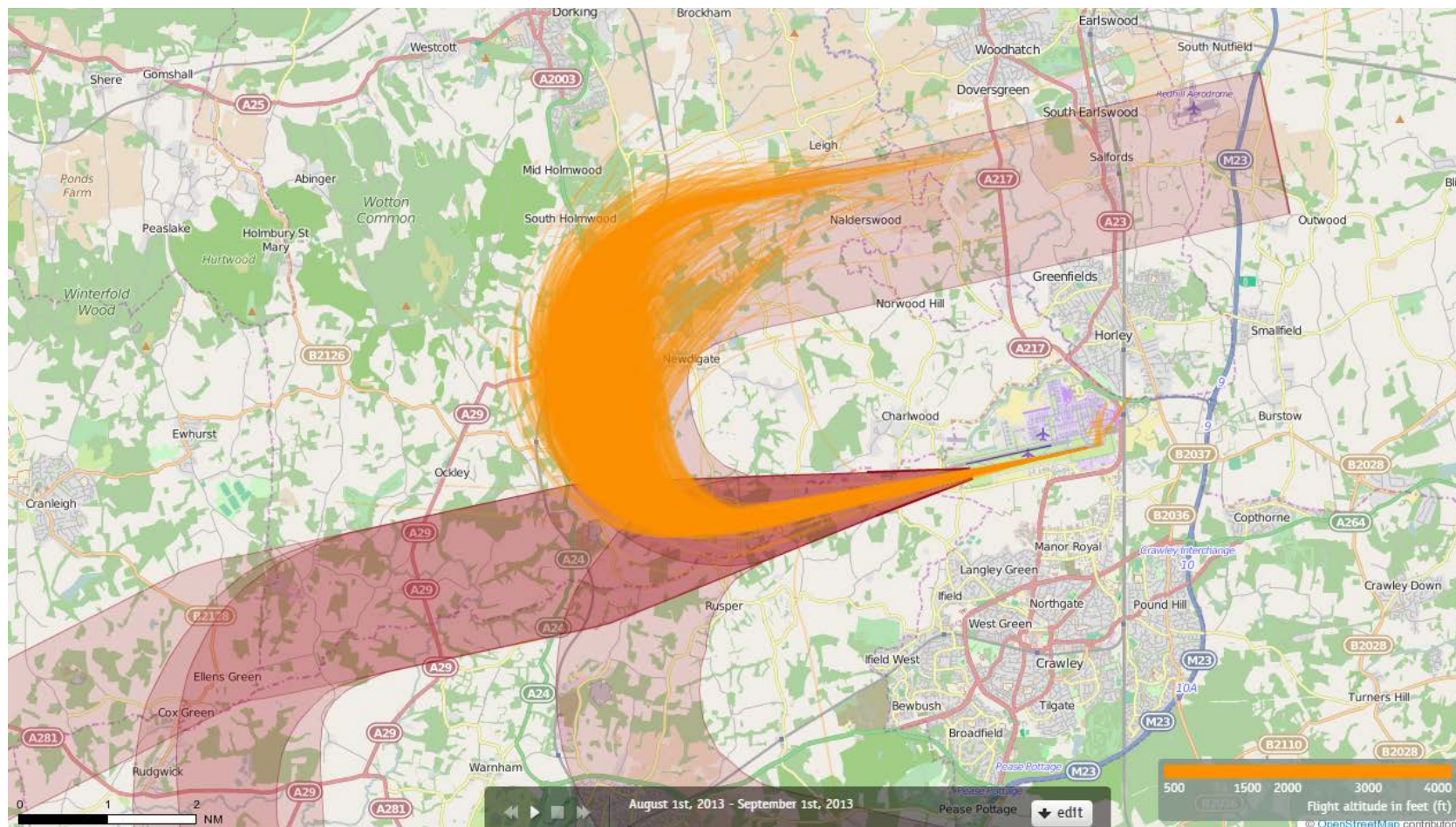
Sample 3

Pre and Post P-RNAV



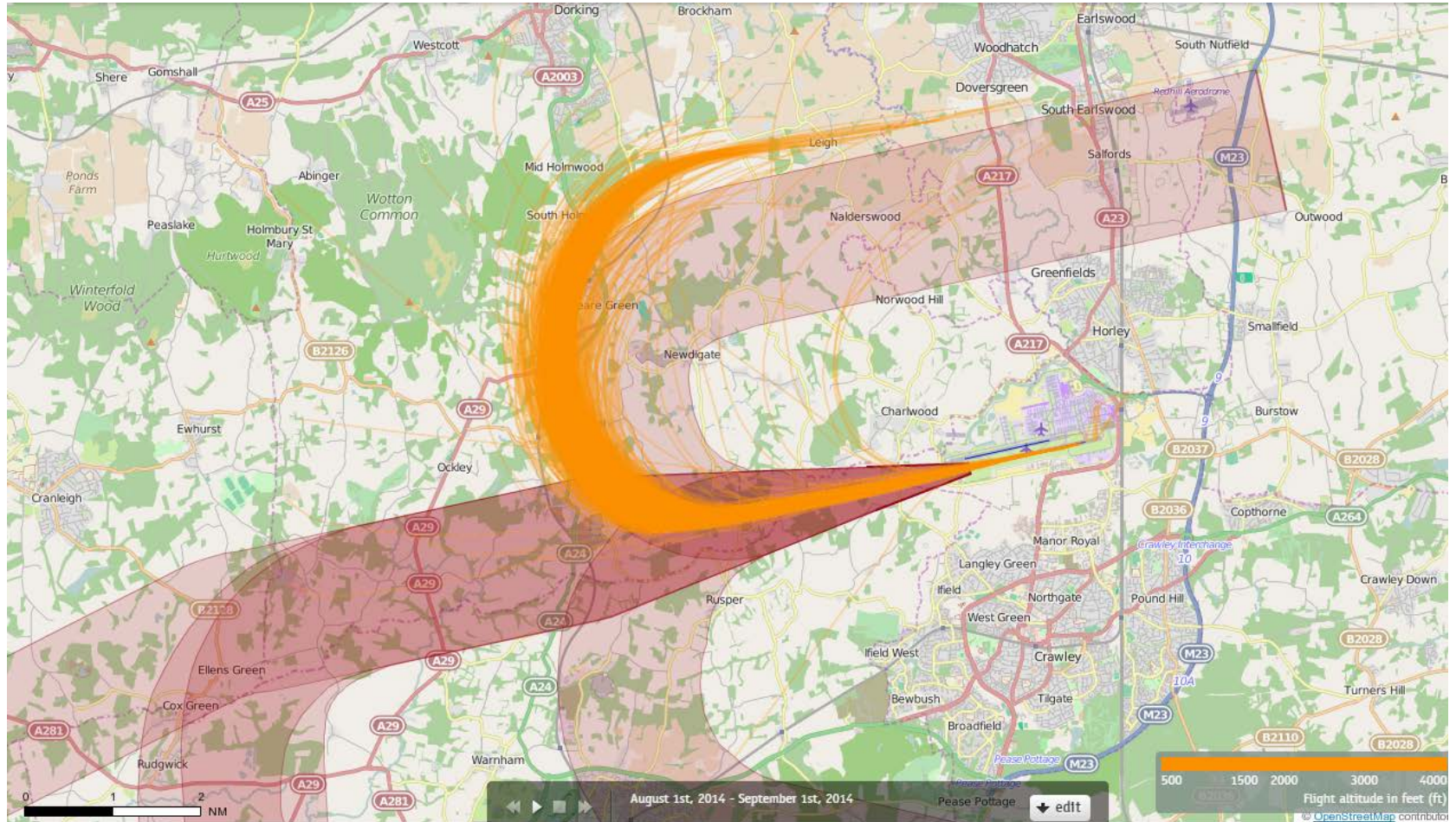
# 26LAMBOURNE August 2013 Aircraft Tracks Cut Off at 4000ft Altitude < BACK

## 4092 Aircraft – Showing CONVENTIONAL Departures Only





# 26LAMBOURNE August 2014 Aircraft Tracks Cut Off at 4000ft Altitude 4364 Aircraft – Showing P-RNAV Departures Only



26 LAMBOURNE

Route 4

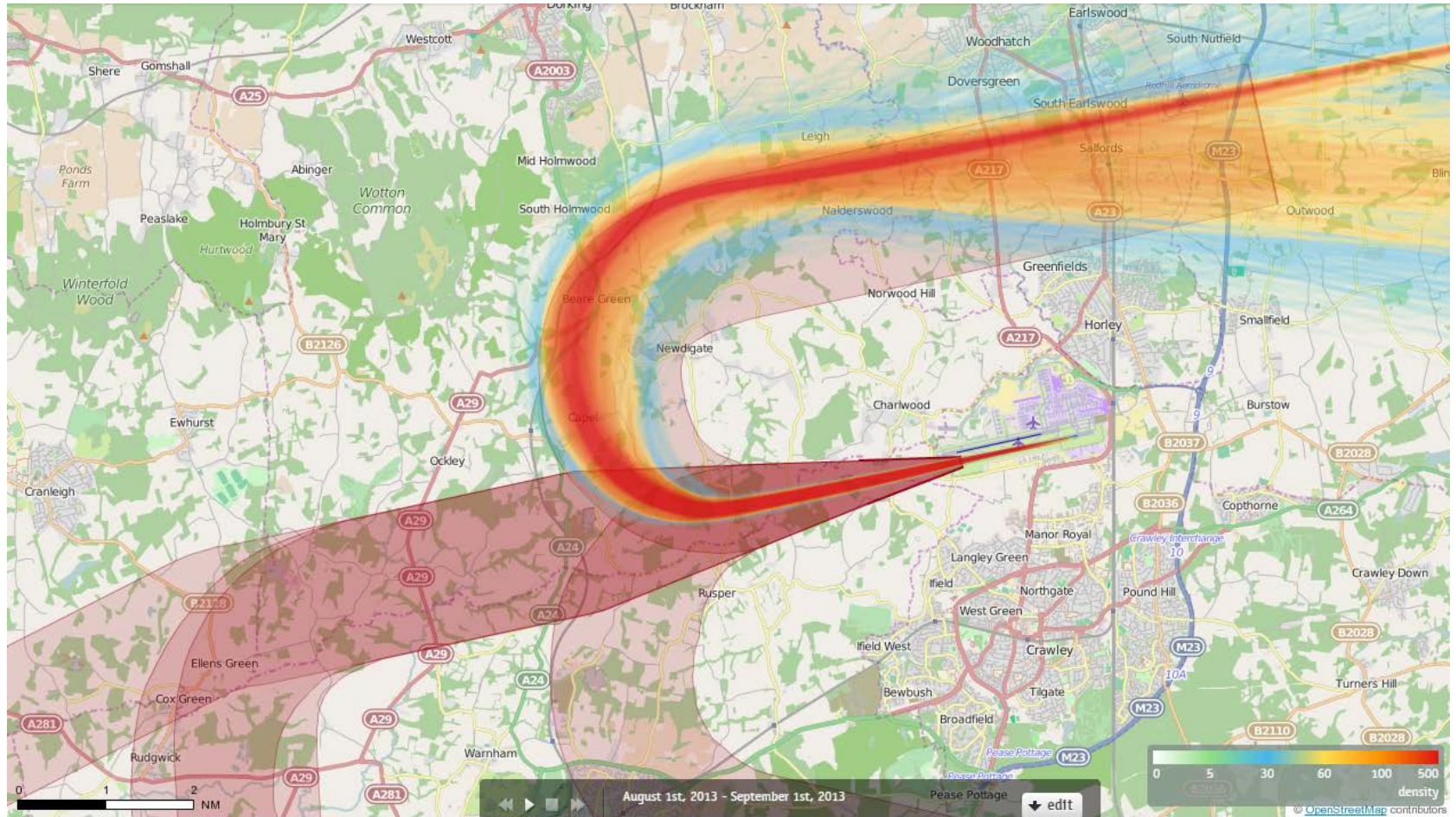
Sample 3

Pre and Post P-RNAV



# 26LAMBOURNE Density August 2013

## 4092 Aircraft – Showing CONVENTIONAL Departures Only





# 26LAMBOURNE Density August 2014

## 4364 Aircraft – Showing P-RNAV Departures Only

