Hyde Park, Hayes:

Aviation Safeguarding Assessment for Planning

KLG183/R2/Issue 2

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K L Grant Consulting Ltd.

Authorisation Sheet

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Summary

Columbia Threadneedle Investments is submitting an outline planning application submission for a residential-led development at Hyde Park, Hayes, Uxbridge, UB3 4AZ.

The site lies approximately 2.6 km to the north of the eastern end of the northern runway at London Heathrow Airport, in an area subject to aerodrome safeguarding, the process by which airspace required for safe and efficient take-off and landing at airports is maintained free of new development. The site is also located within the safeguarding area for RAF Northolt.

Specific height limits apply at the site, according to international standards and recommended practices of the International Civil Aviation Organisation (ICAO), as implemented in the UK by the Civil Aviation Authority (CAA) and set out in Civil Aviation Publication (CAP) 168 on aerodrome licensing.

Two distinct height constraints associated with operations at London Heathrow Airport apply in the area of the proposed development:

- Aerodrome licensing requirements, prescribed in terms of the obstacle limitation surfaces (OLS) for the Airport;
- Operational requirements, prescribed by PANS-OPS criteria for instrument procedure design, employed for the design of operational procedures for take-off and approach that take account of the existing obstacle environment in the vicinity of the Airport and which generally lie above the OLS.

To support the design process and to assist in securing planning permission, an initial review of the aviation height constraints that apply across the site has been undertaken. An aviation safeguarding assessment of the proposed development has now been completed to confirm that it complies with all relevant aviation safeguarding requirements.

The following conclusions may be drawn from the aviation safeguarding assessment:

- Assessment of the site location in relation to London Heathrow Airport's OLS has determined that the site is located within the area covered by the inner horizontal surface (IHS) which is at a level height of 67.95 m AOD across the site. At a maximum height of 67.9 m AOD, the outline maximum heights parameter plan complies with the OLS.
- The site is also located within the conical surface for RAF Northolt Aerodrome. However, this gives rise to a less limiting constraint than the London Heathrow Airport OLS.
- A review of flight procedures and the existing temporary obstacle environment indicates that the airport is likely to accept temporary infringement of the inner horizontal surface by cranes. Cranes up to a maximum height of around 130 to 140 m AOD could be accommodated at the site with no impact on flight operations. Therefore, there will be plenty of headroom above the maximum identified building heights to accommodate construction cranes. The aerodrome is likely to require an Instrument Flight Procedure (IFP) check of cranes by their Approved Procedure Design organisation (APDO), secured by an appropriately worded planning condition or prior to issuing crane permits.
- In addition to the physical safeguarding of flight procedures, proposed development close to the airport has the potential to impact on-airport navigational aids. Preliminary assessment indicates that the proposed development is outside of the technical safeguarding frames indicated in CAA guidance to be areas of particular concern. It is

expected that development up to the OLS height limits at this location will not impact on-airport navigational aids.

- The potential for tall buildings in the area of the proposed development to impact on the H10 radar located at London Heathrow is identified. NATS has assessed the proposal and indicated that it deems it to have an unacceptable impact on the H10 radar in the form of radar reflections and therefore SSR false targets appearing on Air Traffic Control displays. While its position would normally be to object to a planning application, subject to timescales it may be supportive of a conditional consent. Following engagement and agreement with the applicant, it is anticipated that NATS would request planning conditions requiring a radar mitigation scheme to be agreed and implemented.

- Preliminary review of the potential bird hazard associated with the proposed development indicate that any issues can be addressed by the adoption of well-established management measures, if considered appropriate.

- Design of external lighting should be mindful of the requirements to ensure that lights are not dangerous, confusing or dazzling to pilots on approach or taking off from aerodromes. In addition to lights, PV panel installations or large glazed areas have the potential to cause glare towards pilots or ATC operators.

Contents

1 Introduction

Columbia Threadneedle Investments is submitting an outline planning application for a residential-led development located at Hyde Park, Hayes, Uxbridge, UB3 4AZ. The planning application seeks planning permission for the following description of development:

"Outline planning permission (with all matters reserved excluding access) for demolition of existing buildings (above basement level) and delivery of residential development (Class C3), flexible residential / commercial floorspace, new public realm, landscaping, play space, car parking, cycle parking and associated works."

The site lies approximately 2.6 km to the north of the eastern end of the northern runway at London Heathrow Airport, in an area subject to aerodrome safeguarding, the process by which airspace required for safe and efficient take-off and landing at airports is maintained free of new development. The site is also located within the safeguarding area for RAF Northolt. Specific height limits apply at the site, according to international standards and recommended practices of the International Civil Aviation Organisation (ICAO) [1], as implemented in the UK by the Civil Aviation Authority (CAA) and set out in Civil Aviation Publication (CAP) 168 on aerodrome licensing [2].

Two distinct height constraints associated with operations at London Heathrow Airport apply in the area of the Site:

- Aerodrome licensing requirements, prescribed in terms of the obstacle limitation surfaces (OLS) for the Airport [1,2];
- Operational requirements [3], prescribed by PANS-OPS criteria for instrument procedure design, employed for the design of operational procedures for take-off and approach that take account of the existing obstacle environment in the vicinity of the airport and which generally lie above the OLS.

To support the design process and to assist in securing planning permission, an initial review of the aviation height constraints that apply across the site has been undertaken [4]. An aviation safeguarding assessment of the proposed development has now been completed to confirm that it complies with all relevant aviation safeguarding requirements. The findings of this aviation safeguarding assessment are summarised in this report which comprises the following sections:

- An initial summary description of the site and its location relative to London Heathrow Airport and RAF Northolt;
- A specification for the runway characteristics at London Heathrow Airport and RAF Northolt which is used to determine the limiting height constraints across the development area.
- A physical safeguarding assessment of the development against the OLS criteria.
- A physical safeguarding assessment of the development against the operational criteria, in particular PANS-OPS instrument flight procedure design requirements.
- Further physical safeguarding assessment of the potential use of cranes above finished building height.
- An account of relevant technical safeguarding considerations.
- A brief consideration of other potential safeguarding considerations.
- A summary of the overall findings and conclusions to be drawn from the assessment.

2 Aerodrome Characteristics

2.1 London Heathrow Airport

For the purposes of the safeguarding assessment, it is necessary to work in terms of runway-aligned coordinates, referenced against the northern runway at London Heathrow Airport and these are as summarised in Table 1. The aerodrome reference point (ARP), located at the mid-point of Runway 07/25, is a further useful reference point and its coordinates are also given in Table 1.

Table 1: London Heathrow Airport Northern Runway Characteristics

Parameter	Runway 09L Threshold	Runway 27R Threshold	ARP
WGS84 Latitude	51°28'39.00"N	51°28'39.63"N	51°28'39"N
WGS84 Longitude	00°29'05.97"W	00°25'59.82"W	00°27'41"W
OSGB Easting	505308.29	508898.61	506947.32
OSGB Northing	176481.28	176576.37	176515.46
Elevation (ft AOD)	78.6	78.1	83
Elevation (m AOD)	23.96	23.80	25.30

2.2 RAF Northolt

For the purposes of the safeguarding assessment, it is also necessary to work in terms of runway-aligned coordinates, referenced against the runway at RAF Northolt Aerodrome. The coordinates of the two runway thresholds are provided in the military aeronautical information publication (MIL AIP) [5] and are as summarised in Table 2. The aerodrome reference point (ARP), located at the mid-point of Runway 07/25, is a further useful reference point and its coordinates are also given in Table 2.

Table 2: RAF Northolt Aerodrome Runway Characteristics

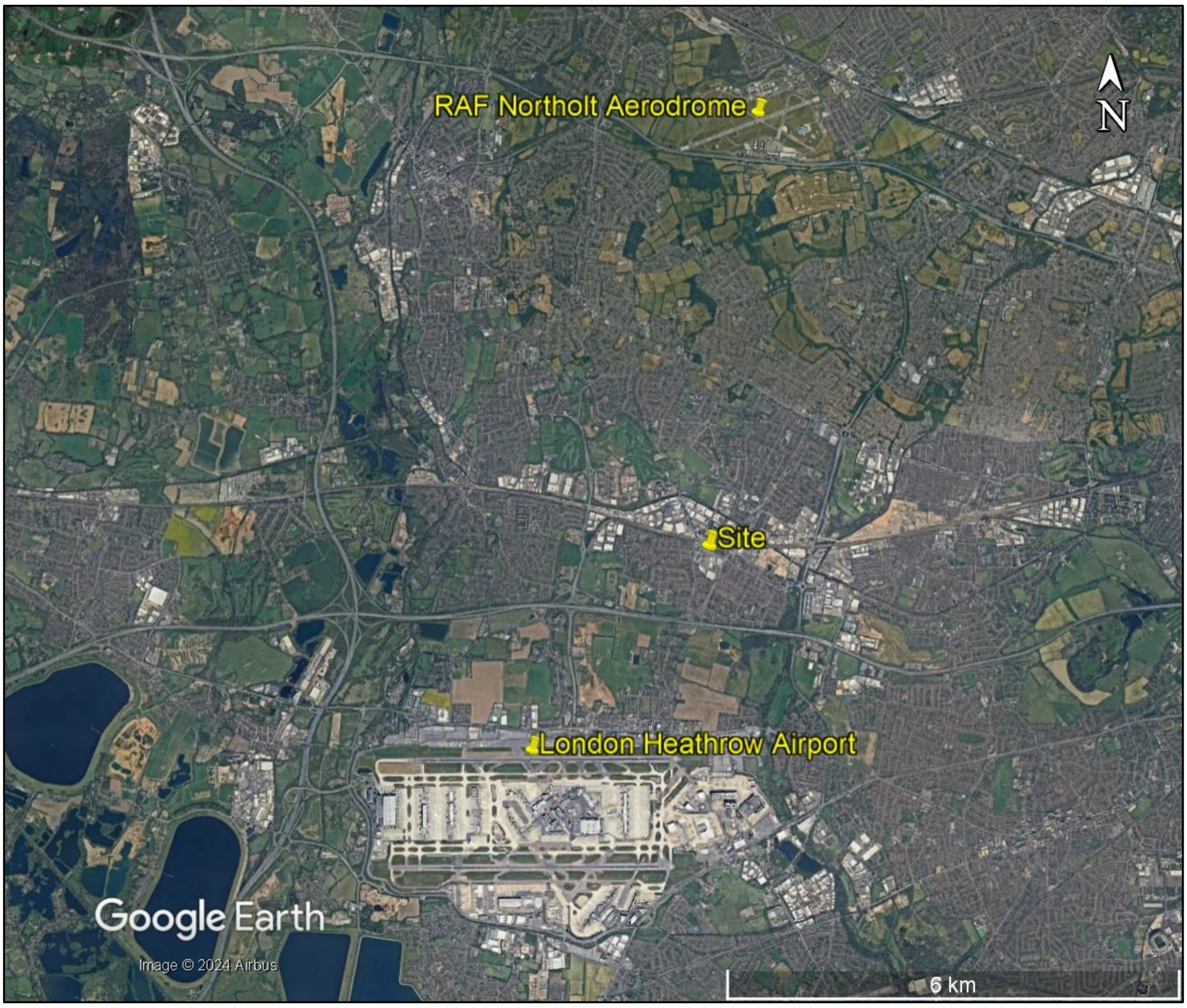
Parameter	Runway 07 Threshold	Runway 25 Threshold	ARP
WGS84 Latitude	51°33'01.43" N	51°33'19.16" N	51°33'09.77" N
WGS84 Longitude	00°25'46.99" W	00°24'29.53" W	00°25'10.55" W
OSGB Easting	508972.57	510452.44	509668.79
OSGB Northing	184668.82	185248.77	184941.57
Elevation (ft AOD)	113.99	124.29	126
Elevation (m AOD)	34.74	37.88	38.40

3 Site Description

3.1 Site Specification

The site lies approximately 2.6 km to the north of Heathrow Airport and approximately 11 km to the south-west of RAF Northolt Aerodrome, as shown in Figure 1.

Figure 1: Site location in relation to nearby aerodromes



The site lies to the north of the eastern end of the northern runway, Runway 09L/27R, at Heathrow Airport, adjacent to North Poyle road. The site boundary in relation to the airport runways is shown in Figure 2.

Figure 2: Site boundary in relation to London Heathrow Airport

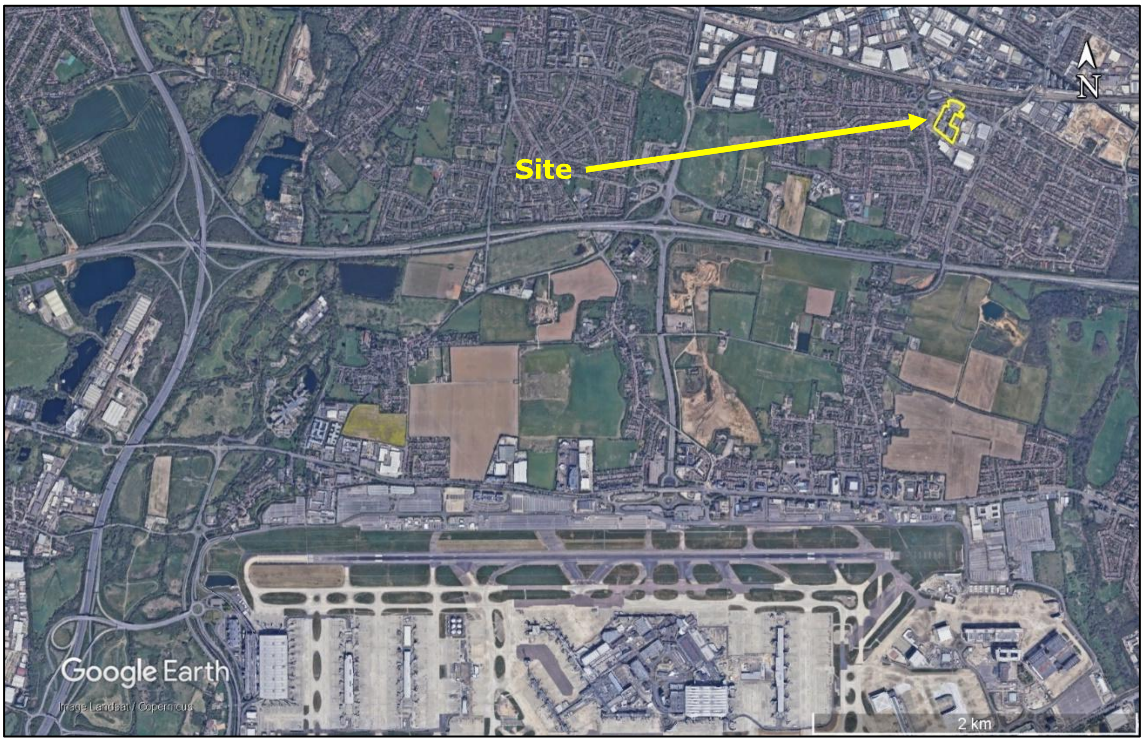


Figure 3 shows the outline maximum heights parameter plan for the proposed development. The maximum proposed height across all blocks is 67.9 m AOD.

To provide reference points for the assessment, the OS grid coordinates for the primary corners of each plot, as shown in Figure 3, are provided in Table 3 along with the maximum parameter heights for each block. For the purposes of this assessment, it is useful to work in terms of runway-aligned coordinates in which the site locations are specified with respect to their longitudinal distance, X, from the runway threshold and lateral distance, Y, from the runway extended centreline, with reference to the northern runway at Heathrow. These are also provided in Table 3.

Figure 3: Maximum Heights Parameter Plan

Table 3: Assessment Points

Ref	OS Grid Coordinates		RWY 09L Aligned		RWY 27R Aligned		Maximum Block Height (m AOD)
	Easting	Northing	X (m)	Y (m)	X (m)	Y (m)	
BZA1-NW	509194.0	179368.6	-3960.8	-2783.4	369.2	2783.4	67.90
BZA1-NE	509232.5	179368.6	-3999.3	-2782.4	407.7	2782.4	67.90
BZA1-SE	509232.5	179341.7	-3998.6	-2755.6	407.0	2755.6	67.90
BZA1-SW	509194.0	179341.7	-3960.0	-2756.6	368.5	2756.6	67.90
BZA2-N	509259.4	179351.7	-4025.7	-2764.8	434.1	2764.8	58.85
BZA2-E	509280.6	179335.2	-4046.4	-2747.7	454.8	2747.7	58.85
BZA2-S	509256.8	179304.8	-4021.9	-2718.0	430.3	2718.0	58.85
BZA2-W	509235.7	179321.3	-4001.2	-2735.1	409.6	2735.1	58.85
BZB-NW	509171.0	179334.8	-3937.0	-2750.2	345.4	2750.2	67.90
BZB-N	509210.1	179322.6	-3975.7	-2737.0	384.1	2737.0	67.90
BZB-NE	509229.9	179313.4	-3995.3	-2727.3	403.7	2727.3	67.90
BZB-E	509218.6	179289.1	-3983.3	-2703.3	391.7	2703.3	67.90
BZB-SE	509198.2	179257.0	-3962.0	-2671.8	370.4	2671.8	67.90
BZB-SW	509146.1	179281.3	-3910.6	-2697.4	319.0	2697.4	67.90
BZC-NW	509138.9	179265.9	-3903.0	-2682.2	311.4	2682.2	65.15
BZC-NE	509163.3	179254.6	-3927.0	-2670.2	335.5	2670.2	65.15
BZC-SE	509135.2	179194.3	-3897.4	-2610.7	305.8	2610.7	65.15
BZC-SW	509110.8	179205.6	-3873.3	-2622.7	281.8	2622.7	65.15
BZD-NW	509171.2	179224.2	-3934.2	-2639.7	342.6	2639.7	65.15
BZD-NE	509240.1	179192.1	-4002.2	-2605.8	410.7	2605.8	65.15
BZD-SE	509212.0	179131.8	-3972.6	-2546.3	381.0	2546.3	65.15
BZD-S1	509212.0	179143.2	-3972.9	-2557.6	381.3	2557.6	65.15
BZD-S2	509192.6	179153.6	-3953.7	-2568.6	362.1	2568.6	65.15
BZD-SW	509148.0	179174.4	-3909.6	-2590.6	318.1	2590.6	65.15

4 Physical Safeguarding Assessment

4.1 Outline of Constraints and Method

A number of distinct aviation-related height constraints apply in respect of the development site, associated with the safeguarding of operations at civil aerodromes:

- General safeguarding criteria, prescribed by the UK Civil Aviation Authority (CAA) in the context of aerodrome licensing and in accordance with International Civil Aviation Organisation (ICAO) standards, which are defined by a series of obstacle limitation surfaces (OLS) [1, 2, 6]. The OLS are a set of predominantly planar surfaces arranged about the runway and flight paths to and from it. Infringements of the OLS are generally not permitted but infringements of some surfaces may be allowed where it can be shown that these would not adversely affect the safety or regularity of aircraft operations.

- More specific criteria for the protection of flight procedures undertaken at individual airports, in accordance with ICAO standards and practices, as defined in ICAO PANS OPS [3]. These criteria take account of the existing obstacle environment during the design of specific instrument flight procedures at individual airports. They are quite often less restrictive than the OLS, allowing for the possibility that temporary infringements of the OLS, for example by cranes during construction, might be permitted without any adverse impact on operations.

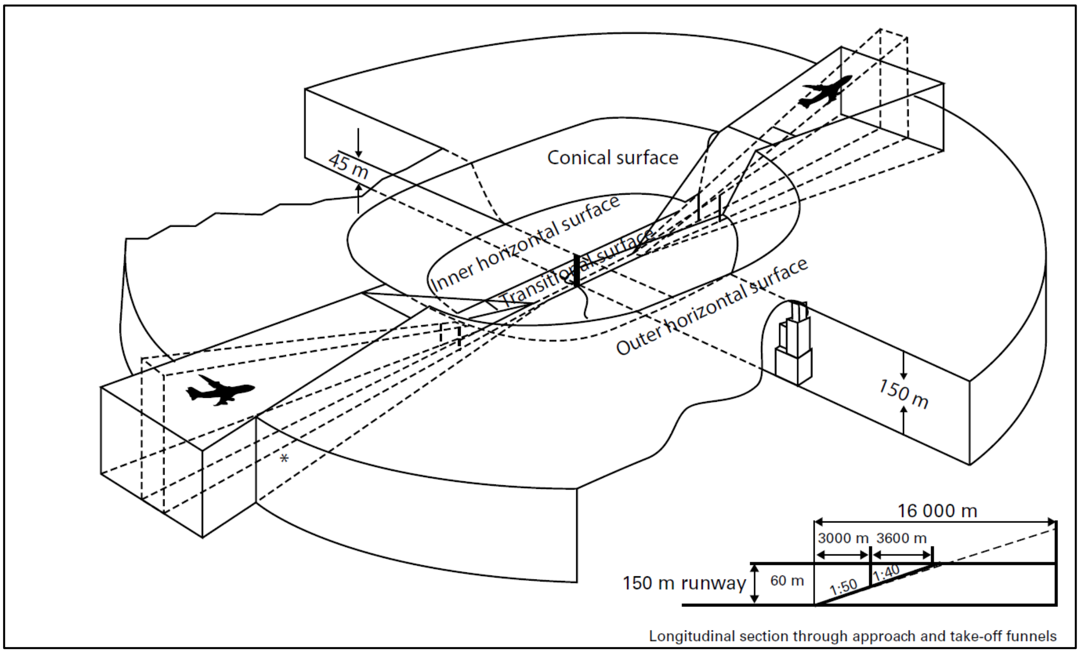
The Military Aviation Authority (MAA) adopts standards [7] for safeguarding at military aerodromes that are essentially equivalent to those applicable at civil aerodromes in accordance with UK and international standards [1,2].

4.2 London Heathrow Airport Safeguarding

4.2.1 Obstacle Limitation Surfaces

The obstacle limitation surfaces (OLS) are a set of predominantly planar surfaces arranged about the runway as shown schematically in Figure 4.

Figure 4: Schematic Representation of OLS



Referring to the runway aligned coordinates given in Table 3 and the surface specifications set out in Civil Aviation Publication (CAP) 168, the site is determined to be located within the area covered by the inner horizontal surface (IHS) for London Heathrow Airport.

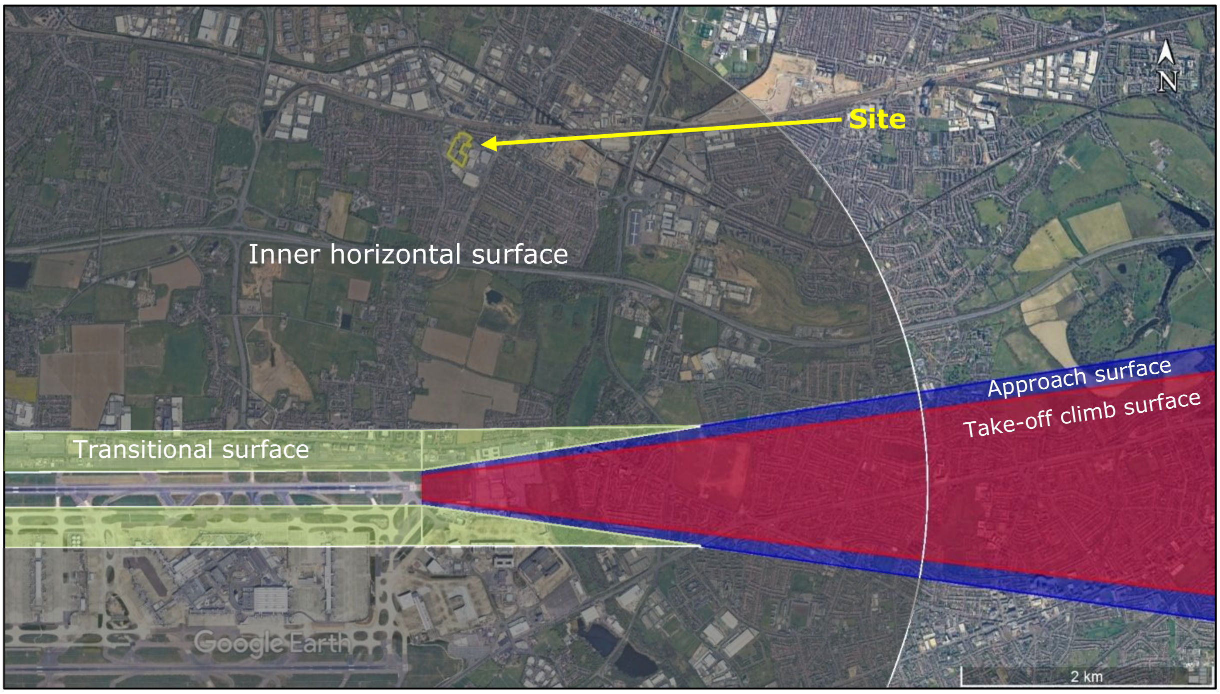
CAP168 identifies four runway reference categories depending on runway dimensions and the maximum aircraft wingspan that will use the runway. The northern runway at London Heathrow Airport is a Code 4F runway.

The IHS is contained in a horizontal plane located 45 m above the elevation of the lowest runway threshold existing or proposed for the aerodrome. At London Heathrow Airport, the lowest runway threshold elevation is identified as 22.95 m AOD for Runway 09R. Therefore, the IHS at London Heathrow Airport is at a height of 67.95 m AOD. For a Code 4 runway, the IHS extends out to a radius of 4,000 m from the ends of the runway strip, at 60 m beyond the Runway 09L and Runway 27R thresholds.

To the south of the site, the transitional surface (TRANS) rises with a 1:7 slope from the edge of the runway strip up to a height of 45 m above the runway threshold elevation to meet the IHS.

Figure 5 shows the location of the site in relation to these OLS. The OLS is determined to be at a height of 67.95 m AOD across the whole site. At a maximum proposed outline block height of 67.9 m AOD, the outline maximum heights parameter plan for the proposed development complies with the Heathrow OLS.

Figure 5: Site location in relation to Heathrow OLS



With the potential for a third runway at London Heathrow Airport in the future, it is prudent to consider the safeguarding of that possibility, taking account of the anticipated runway location to the north and west of the existing northern runway. Based on the available plans within the 2019 consultation documentation [8], a displacement of approximately 1.1 km to the north and around 1.7 km to the west of Runway 09L/27R is estimated. On this basis, the proposed development would be approximately 1.3 km to the east of the new runway eastern threshold and approximately 1.4 km to the north of the new extended runway centreline. Therefore, it is evident the proposed development would be outside the APPS, TOCS and TRANS surfaces defined around a third runway and remain within the inner horizontal surface so would not impact on the proposed future airport expansion.

4.2.2 Flight Operations

It is expected that proposed development up to the identified obstacle limitation surface height limits will not have any impact on operational criteria associated with the flight procedures, however, some general consideration of these to ensure that they are fully safeguarded by the OLS and there is sufficient headroom above the proposed development to accommodate construction cranes is prudent.

In the first instance, a review of the radar track data taken from the Heathrow 2023 annual noise report [9] confirms that there are no approach paths which result in flight over or near to the proposed development site, as shown in Figures 6 and 7.

Figure 6: 2023 radar track data: easterly arrivals

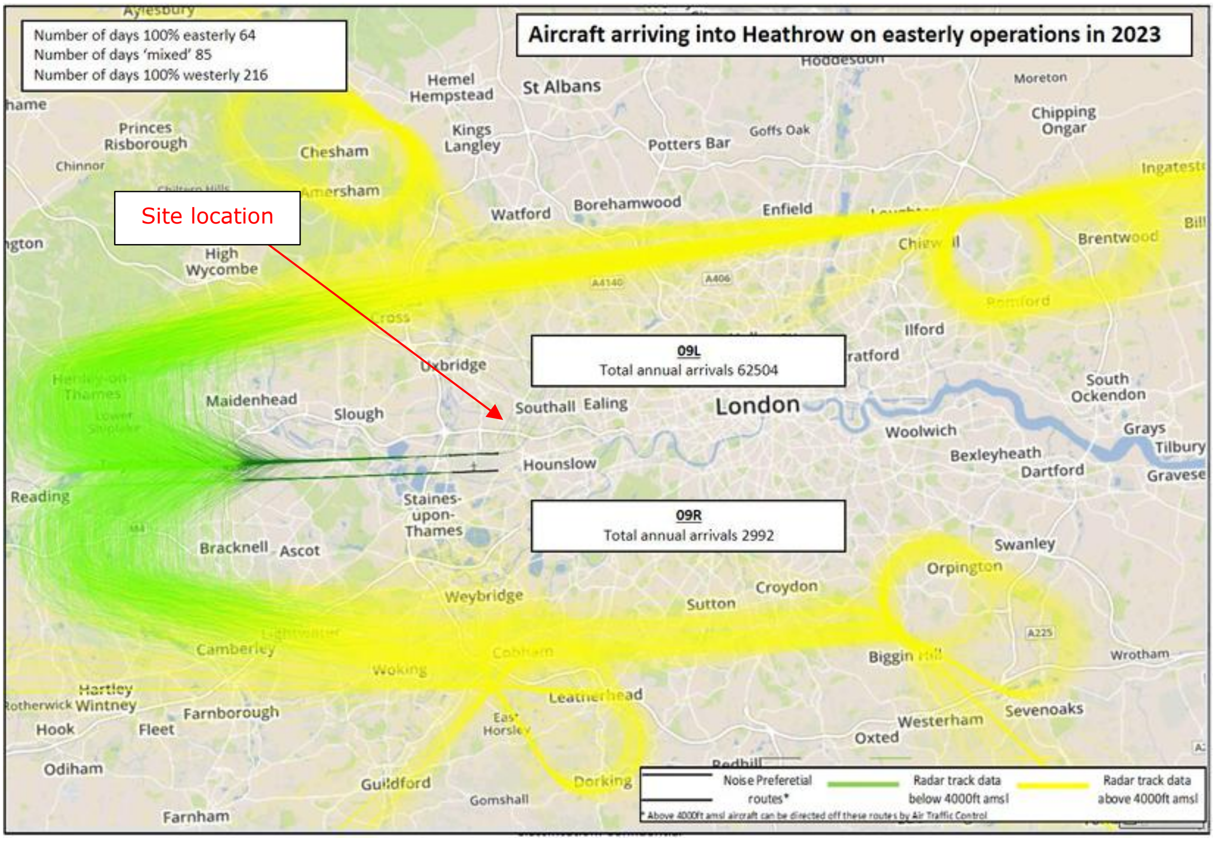
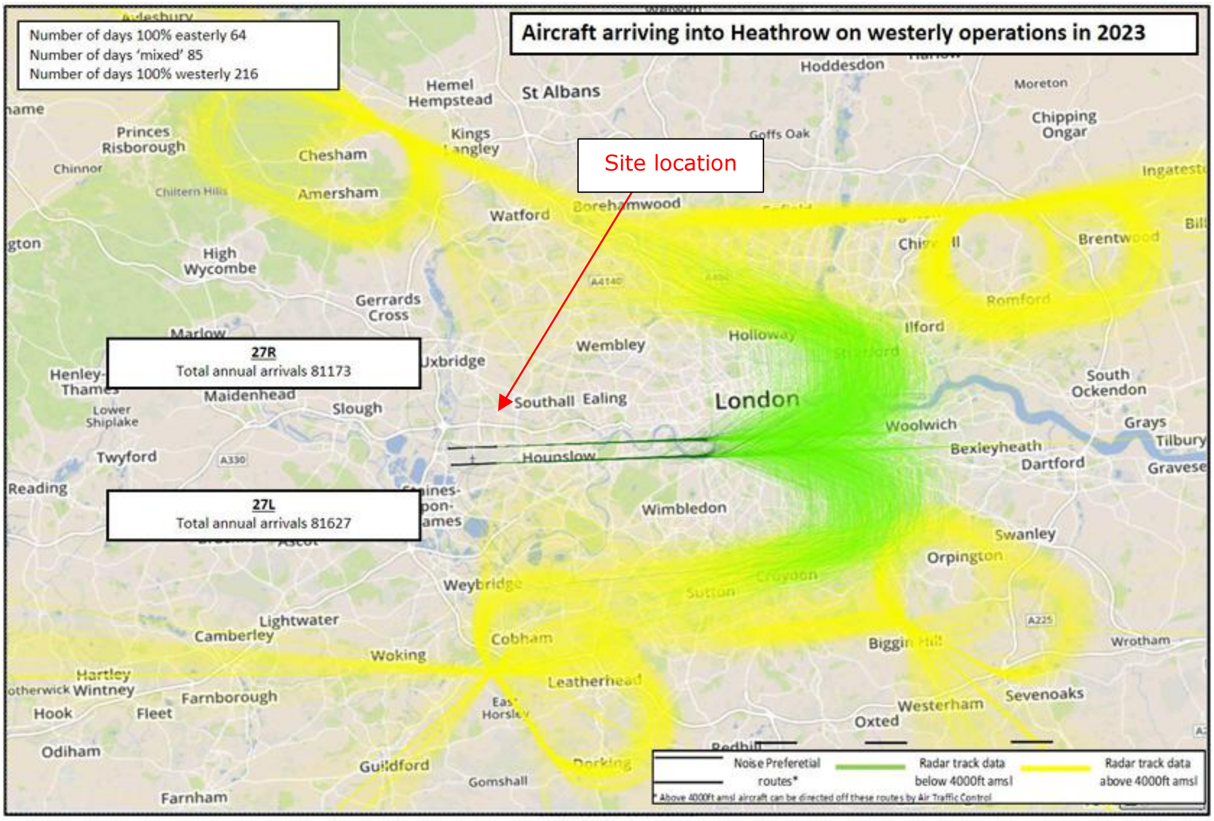


Figure 7: 2023 radar track data: westerly arrivals



The final approach segment of the Runway 09L and Runway 27R approach procedures involve descent along a standard 3° glide path, aligned with the runway extended centreline. ILS, RNP and localiser only approach procedures are identified. A detailed review of the ILS and localiser only approach procedures determines that the site is located outside of the PANS-OPS obstacle assessment surfaces (OAS) and obstacles at the site will not impact the final segment of this procedure design.

For the Runway 09L RNP approach procedures, the site will be located towards the outer edge of the secondary area of the missed approach surface and the obstacle clearance altitudes are sufficiently high to ensure that the proposed development up to the OLS will not impact these procedures. Furthermore, aircraft undertaking a missed approach will have climbed sufficiently by the time they pass the site and this, combined with the lateral offset of the site from the runway will ensure that any reasonably foreseeable cranes will be able to be accommodated.

For the Runway 27R RNP approach procedures, the site is sufficiently laterally offset from the runway centreline to ensure that it is outside of the final approach surface, and obstacles at the site will not impact these procedures.

The approach procedures also specify circling minima to provide for visual circling of the aerodrome prior to landing. A minimum circling obstacle clearance altitude (OCA) for Category A and B aircraft of 770 ft (234.7 m) is identified. Circling OCAs for Category C and D aircraft of 940 ft (286.5 m) are also identified. Minimum obstacle clearances of 90 m and 120 m for Category A/B and Category C/D aircraft for circling are identified. The proposed development site is outside of the category A circling area, as determined using PANS-OPS criteria, but within the Category B, C and D areas. On this basis, a height constraint of 144.6 m AOD on obstacles located at the proposed development site is estimated for Category B aircraft to ensure the required minimum obstacle clearance for this procedure is preserved.

PANS-OPS also defines a visual segment surface (VSS) for to protect the visual segment of the approach procedures. The site is located outside of the area covered by this surface.

For departure operations, no direct flight over the site is expected, and the site is sufficiently laterally offset from the runway centreline to be clearly outside of the obstacle identification surfaces for both Runway 09L and Runway 27R. This is further confirmed by the 2023 radar track data for departures, shown in Figures 8 and 9.

Figure 8: 2023 radar track data: easterly departures

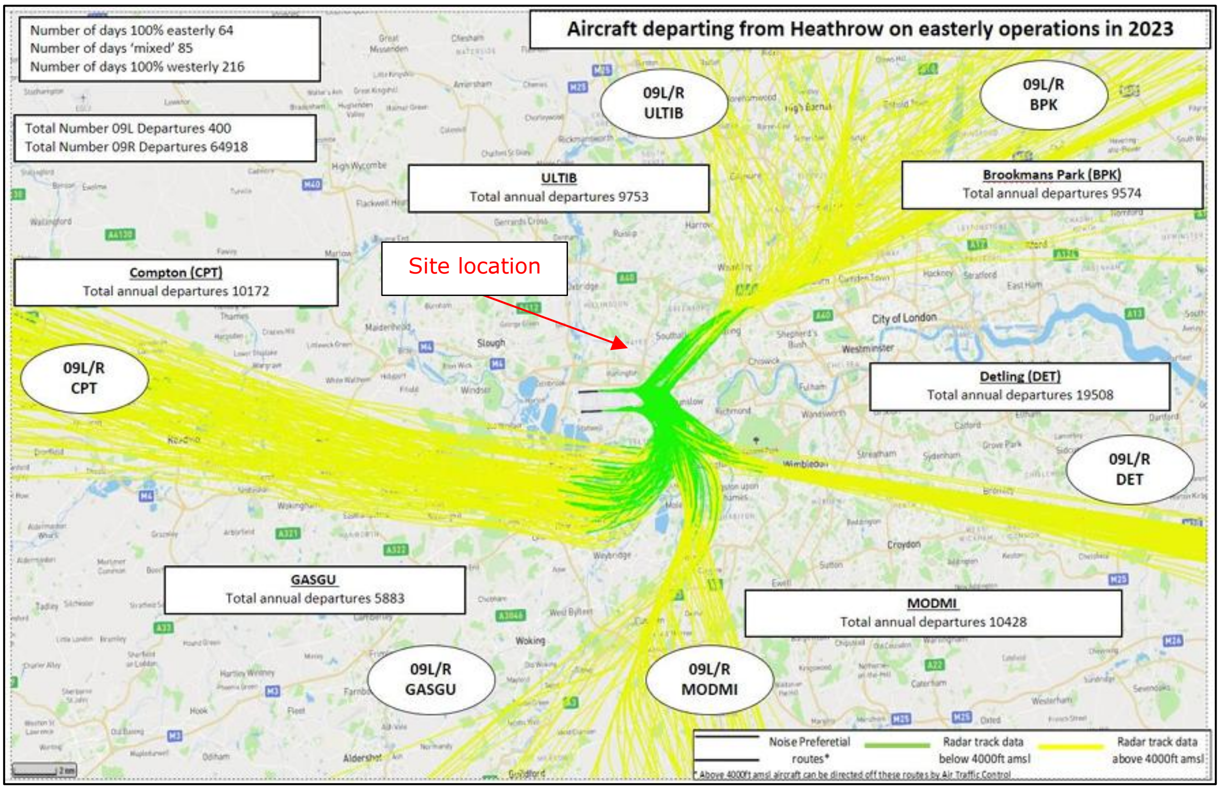
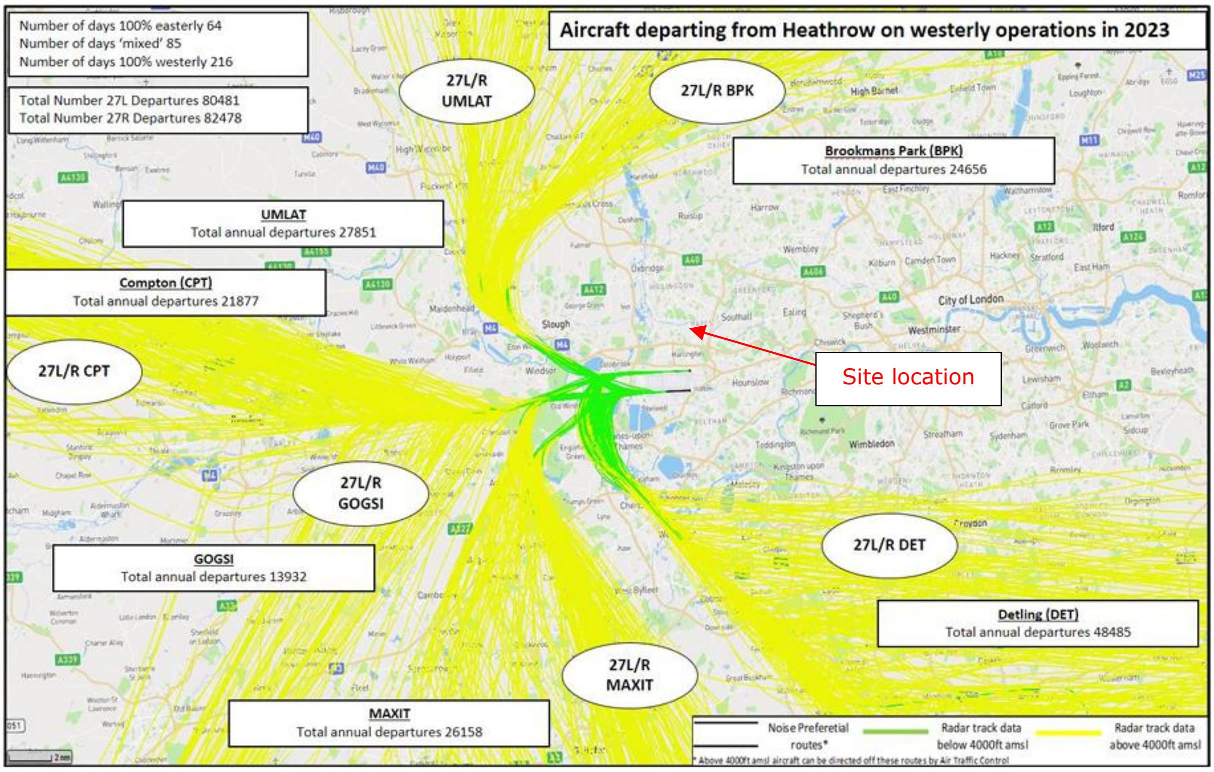


Figure 9: 2023 radar track data: westerly departures



In addition to normal operations, safeguarding constraints in relation to non-standard operations, such as one-engine inoperative take-offs, are a further consideration. Operational performance standards require that aircraft operators ensure that an adequate vertical margin is achieved during departure with respect to all obstacles in the take-off path with the critical engine of a multi-engine commercial transport aircraft inoperative. Under the IR-OPS Implementing Rules of the European Aviation Safety Agency (EASA), airlines must comply with the defined vertical clearance margin requirements with respect to existing obstacles along the departure path. These obstacles may limit the available payload during departure and, to maintain current levels of operational efficiency, it will be important that the introduction of more restrictive obstacles is avoided. In the event of an engine failure on take-off, or a late missed approach, the maximum climb rate of the aircraft may be compromised, and it may not be possible to gain sufficient height to clear the existing tall buildings, on a straight-out departure path, safely. It is to be expected that the take-off climb surface (TOCS) sufficiently safeguards these operations, and the site is located well outside of the TOCS and outside of any area where obstacles will need to be accounted for by these operational performance standards.

4.3 RAF Northolt Aerodrome Safeguarding

The main runway at RAF Northolt Aerodrome is a Code 3 precision approach runway (equal to or greater than 1,200 m and less than 1,800 m). The Military Aviation Authority (MAA) regulates all Defence Aviation activities. Regulatory requirements for aerodrome safeguarding are set out within Regulatory Articles (RA) series 3500 to 3599 of the MAA Regulatory Publications (MRP) which cover aerodrome design and safeguarding. The specification for the obstacle limitation surfaces at military aerodromes are set out in Annex A of RA 3512 [7] and these specifications are essentially consistent with the equivalent specifications for non-military aerodromes specified in ICAO Annex 14 [1].

Table 4 provides the distances of the proposed development block corners from the Northolt Aerodrome Reference Point (ARP) and locations of the identified assessment points in Runway 07 aligned coordinates, specified by their longitudinal distance, X, from the runway threshold and lateral distance, Y, from the runway extended centreline.

In accordance with the OLS specifications, the site is determined to be located within the area covered by the conical surface for RAF Northolt. The conical surface is a 5% sloping surface that extends beyond the periphery of the inner horizontal surface which is at a level height of 79.7 m AOD to a distance of 6.1 km from the aerodrome reference point where it reaches the height of the outer horizontal surface. Table 4 provides the heights of the conical surface at each of the identified assessment points which vary from 159 m AOD up to 172 m AOD across the site.

These height limits are significantly less constraining than the OLS for London Heathrow and, given the significant lateral offset of the site from the runway at RAF Northolt, it is evident that flight procedures in operation at RAF Northolt Aerodrome will not be impacted by the proposed development and cranes up to the identified Heathrow limits.

Table 4: RAF Northolt OLS Assessment

Reference Point	OS Grid Coordinates		Distance from Northolt ARP (m)	Runway 07 aligned coordinates (m)		OLS Height (m AOD)
	Easting	Northing		x	y	
BZA1-NW	509194.0	179369.6	5592.2	1727.4	5014.7	159.4
BZA1-NE	509232.5	179369.6	5589.0	1691.5	5028.7	159.2
BZA1-SE	509232.5	179342.7	5615.8	1701.3	5053.7	160.5
BZA1-SW	509194.0	179342.7	5618.9	1737.2	5039.7	160.7
BZA2-N	509260.3	179352.9	5603.6	1671.7	5054.4	159.9
BZA2-E	509281.5	179336.3	5618.6	1658.1	5077.5	160.7
BZA2-S	509257.7	179306.0	5650.6	1691.3	5097.2	162.3
BZA2-W	509236.6	179322.5	5635.7	1704.9	5074.1	161.5
BZB-NW	509171.0	179334.8	5628.8	1761.5	5038.7	161.2
BZB-N	509210.1	179322.6	5637.6	1729.5	5064.3	161.6
BZB-NE	509229.9	179313.4	5645.3	1714.4	5080.1	162.0
BZB-E	509218.6	179289.1	5670.3	1733.8	5098.6	163.3
BZB-SE	509198.2	179257.0	5704.0	1764.6	5121.0	164.9
BZB-SW	509146.1	179281.3	5684.3	1804.2	5079.4	164.0
BZC-NW	509138.9	179265.9	5700.4	1816.5	5091.1	164.8
BZC-NE	509163.3	179254.6	5709.4	1798.0	5110.6	165.2
BZC-SE	509135.2	179194.3	5772.0	1846.1	5156.4	168.3
BZC-SW	509110.8	179205.6	5763.0	1864.7	5137.0	167.9
BZD-NW	509171.2	179224.2	5738.9	1801.7	5141.7	166.7
BZD-NE	509240.1	179192.1	5765.4	1749.2	5196.8	168.0
BZD-SE	509212.0	179131.8	5827.7	1797.4	5242.6	171.1
BZD-S1	509212.0	179143.2	5816.4	1793.2	5232.1	170.6
BZD-S2	509192.6	179153.6	5807.5	1807.5	5215.2	170.1
BZD-SW	509148.0	179174.4	5790.6	1841.4	5179.6	169.3

5 Physical Safeguarding Summary

5.1 Proposed Development

The physical safeguarding assessment has identified that the site lies within Heathrow Airport's inner horizontal surface which has a height of 67.95 m AOD. The site also lies within the conical surface for Northolt Aerodrome but this is less constraining than the Heathrow OLS at this location. At a maximum height of 67.9 m AOD, the outline maximum heights parameter plan complies with the OLS.

As part of the conditions of their licence, airport operators are expected to provide a safe operational environment that meets certain international standards, including those associated with the OLS. However, in protecting airspace there is an internationally recognised need to strike an appropriate balance with other interests. In the context of aerodrome safeguarding, the need to give fair consideration to the rights of local property owners is recognised. Specifically, guidance from the International Civil Aviation Organisation (ICAO) states [10] that those responsible for the control of obstacles should *"ensure that the measures taken provide the greatest possible degree of safety and efficiency for aircraft operations, the maximum economic benefits to neighbouring communities and the least possible interference with the rights of property owners."*

In general, OLS falling into three separate categories can be identified as follows, according to their safety and operational significance:

- Those in which no obstacle penetrations whatsoever are normally permitted in order to ensure safe operation, for example those surfaces defining the obstacle free zone (OFZ).
- Those in which existing penetrations may be accepted but where no new penetrations are permitted except where these would be shielded by existing obstacles.
- Those in which new penetrations may be accepted either where they are shielded by existing obstacles or where it can be demonstrated by means of an aeronautical study that these would not adversely affect the safety or significantly affect the regularity of aircraft operations.

The inner horizontal surface falls into the third category and the following requirement is set out in Civil Aviation Publication (CAP) 168 on the licensing of aerodromes.

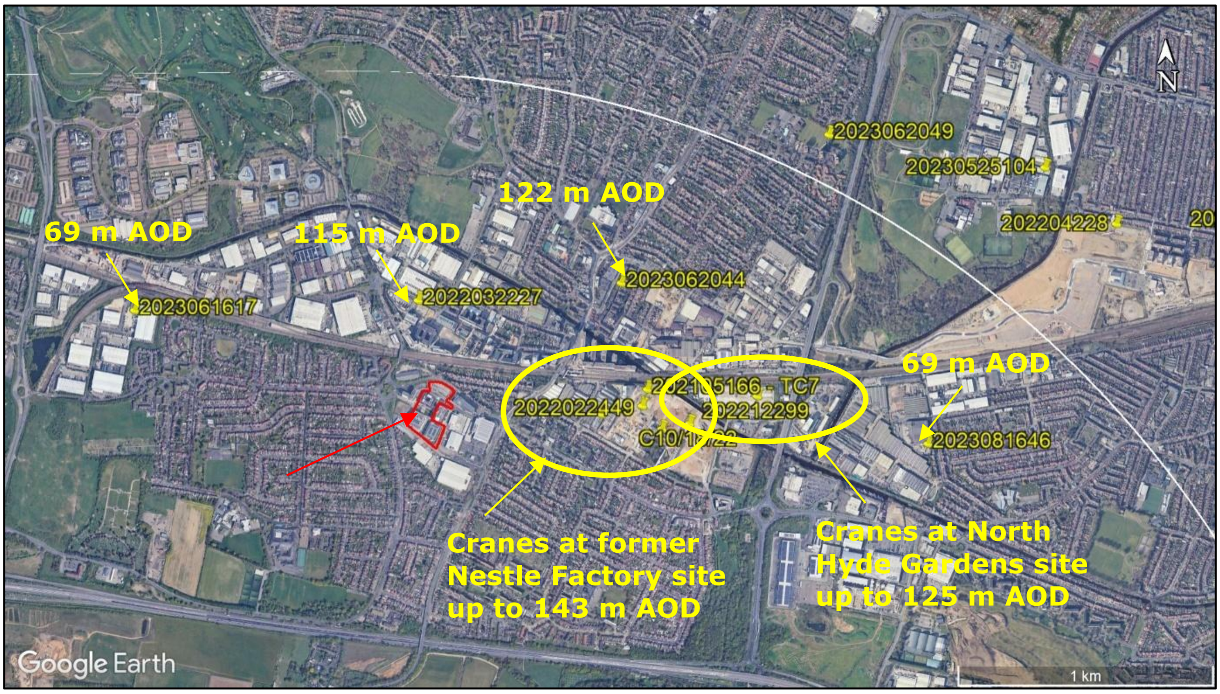
'New objects or additions to existing objects should not extend above an inner horizontal surface, a conical surface or an outer horizontal surface, except when in the opinion of the CAA the object would be shielded by an existing immovable object or it is determined that the object would not adversely affect the safety or significantly affect the regularity of aircraft operations'.

5.2 Use of Construction Cranes

The review of flight procedures in use at London Heathrow Airport has identified that the site is likely to be within the visual circling area for Category B aircraft giving rise to a height limit for obstacles at the site of approximately 144.6 m AOD. This limit will apply to both buildings and cranes. Therefore, it is evident there is scope for temporary infringement of the inner horizontal surface by cranes without impacting the safety or regularity of aircraft operations.

Whilst Heathrow Airport has been historically reluctant to accept permanent infringements of the inner horizontal surface, they have accepted temporary infringement of these surfaces by cranes. The Heathrow AIP [11] identifies a number of crane obstacles in the vicinity of the site which infringe the inner horizontal surface, as shown in Figure 10.

Figure 10: Heathrow AIP Crane obstacles in vicinity of site



Headroom of the order of 10 m to 12 m is typically required as a minimum for the use of a single saddle jib tower crane. A further 10 m would be required if a second saddle jib crane with an overlapping operating area were to be employed. Luffing jib cranes, which may be preferred to saddle jib cranes where there is limited scope for jib over sail across areas adjacent to the site, require more headroom, typically 40 m or more, according to the jib length.

Overall, it is evident from the review of flight procedures and the existing temporary obstacle environment that cranes up to around 130 to 140 m AOD can easily be accommodated in the vicinity of the site and therefore, there will be plenty of headroom above the OLS height limit of 67.95 m AOD identified to apply to buildings to accommodate construction.

It is expected that the aerodrome will require an Instrument Flight Procedure (IFP) check of the finalised proposals by an Approved Procedure Design organisation (APDO) to be undertaken to confirm these findings and the acceptability of proposed cranes at this location.

6 Technical Safeguarding

Technical safeguarding is the process employed to protect radio signals that support aircraft operations from being adversely affected by physical or electromagnetic changes in their transmission environment. Most physical objects act as potential reflectors or diffractors of radio signals. A combination of object size, material, proximity and incident radio wavelength determine the extent to which objects act as reflectors or diffractors.

In addition to the physical safeguarding of flight paths, there is a requirement for the technical safeguarding of airport operations to ensure that there are no adverse impacts on navigational aids. In general, it is expected that developments that comply with the limits defined by the OLS will not conflict with the requirements for the technical safeguarding of the relevant navigational aids located at Northolt and London Heathrow.

Navigational aids requiring protection include various instruments that provide direct guidance to aircraft and radar systems that support air traffic control. The technical safeguarding criteria for the protection of navigational aids are conceptually similar to those for physical safeguarding according to the OLS. A series of “frames” of defined geometry arranged about the different types of navigational aid are identified [12] in which it is considered that new structures may potentially lead to adverse impacts on these facilities. Frame sizes associated with specific types of equipment is provided and addresses the following types of equipment in use at aerodromes:

- ILS Localiser;
- ILS Glide Path;
- Distance Measuring Equipment (DME);
- Non directional beacon (NDB).

A proposal to locate a new structure inside the frame of a navigational aid would trigger a more detailed assessment to determine whether or not the proposed new structure would, in practice, adversely affect the signals concerned. The site is located outside the geometrical frames that apply to equipment located at Heathrow Airport and it is expected that development up to the OLS will not adversely impact these navigational aids.

In addition, consideration needs to be given to the safeguarding of radar equipment employed for the support of air traffic control. In that context, impacts of tall buildings on the operation of the H10 radar located on the south side of London Heathrow Airport are a recognised potential concern.

New tall buildings can give rise to two adverse impacts: interruption of radar coverage behind the buildings where airspace is shielded by them; reflections of signals from aircraft that lead to the generation of “false targets” along the line of the buildings.

The extent to which any new development may adversely impact the radar will be dependent upon the height of the structure relative to the radar and its distance from the radar, having regard to the curvature of the earth and the associated influence on sight lines. These parameters determine the extent to which a new structure may stand above its general surroundings and lead to additional restrictions on radar coverage. The presence of existing tall buildings that would shield sight lines from the radar are a further factor influencing the nature of impacts.

A review of the existing built environment between the H10 radar and the proposed development site indicates that development up to the OLS is likely to be visible to the radar and has the potential to impact the radar's function. Therefore, NATS were requested to undertake an assessment of the proposed development [13] in accordance with their Technical and Operation Assessment (TOPA) pre-planning service to resolve this issue in advance of the planning application being made. This assessment, provided in Appendix 1, determined that the proposed development was expected to give rise to significant reflections of secondary surveillance radar signals and would have an adverse impact on air traffic control operations supported by the H10 radar, in the absence of appropriate mitigation. They state *'The proposal is anticipated to degrade NATS's infrastructure, namely the H10 SSR radar. Accordingly, should a planning application be received for such a scheme, NATS would be likely to object. Notwithstanding the objection, subject to engagement with the Applicant, NATS would proceed to formally identify and confirm the required radar mitigation. Following this, it would be supportive of aviation planning conditions.*

A radar mitigation scheme would generally involve renumeration to NATS to enable them to implement a modification of the radar system software to suppress any false targets caused by reflected signals. Typically, planning consent would be granted with conditions which limit construction above a specified height until the RMS has been fully implemented and this can take several months as these software changes can only be made at certain times when the system can be temporarily taken offline. It is anticipated that the developer will look to secure a contract with NATS for the required mitigation and NATS will therefore be supportive of the planning application on the basis of an appropriately worded planning condition to ensure these modifications are enacted.

7 Bird Hazard Management

Under international standards, safeguarding in respect of bird hazards applies out to a defined radial distance of 13 km around airports. The proposed development is within this safeguarded area. Some preliminary guidance on bird hazard management is provided below.

ICAO guidance [14] identifies bird attractants falling within three general categories that should be minimised in development at or near airports, as follows:

- Food
- Water
- Shelter

Guidance provided by the UK CAA [15] identifies the same broad issues as primary considerations in bird hazard management near airports.

ICAO guidance states the following in respect of bird attraction associated with buildings:

"Structures. Architects should consult biologists during the design phase of buildings, hangars, bridges and other structures at airports to minimize exposed areas that birds can use for perching and nesting. When perching sites are present in older structures (such as rafter and girded areas in hangars, warehouses and under bridges) access to these sites can often be eliminated with netting. Anti-perching devices, such as spikes, can be installed on ledges, roof peaks, rafters, signs, posts and other roosting and perching areas to keep certain birds from using them. Changing the angle of building ledges to 45 degrees or more will deter birds. However, it is emphasized that incorporating bird exclusion or deterrence into the design of structures is the most effective, long-term solution."

The CAA provide the following general guidance on building design:

"When new buildings are being designed they should:

- *prevent wildlife gaining access to the interior and roof spaces*
- *use self-closing doors or plastic strip curtains or other mechanisms to prevent access by wildlife*
- *be without roof attractions - consider implications of green, flat and shallow pitched structures*
- *have minimal roof overhangs and be without ledges beneath overhangs or external protrusions*
- *allow easy access to rooftops in case it becomes necessary to take action against nesting gulls or waders that colonise large flat or shallow-pitched roofs. Gulls will also use steeply sloping roofs where the nests can be lodged behind vents, skylights, and in gullies etc."*

The CAA note further that sheltered ledges, access holes and crevices within and underneath structures can prove ideal nesting locations for feral pigeons, stock doves, pied wagtails and starling whilst rooftops themselves, including green roofs, may be attractive to gulls or wading birds such as oystercatchers, for nesting, loafing and roosting.

Water acts as a bird attractant and water features should be avoided in landscaping plans for development near airports. Management of water accumulations that may otherwise attract birds may be required during site preparation and construction activities.

Potential food attractants include food waste as well as landscaping features. Standard guidance recommends the avoidance of berry bearing plants that may attract birds and the avoidance of the creation of areas of dense cover for roosting by flocking species of birds. Careful attention to the management of wastes that might give rise to food sources is also recommended.

8 Lighting and Reflective Glare

Requirements in respect of potentially dangerous, confusing or dazzling lights are set out in the Air Navigation Order (ANO), as described in Civil Aviation Publication (CAP) 393 [16]. ANO Article 224 in respect of “Lights liable to endanger” states the following:

A person must not exhibit in the United Kingdom any light which:

(a) by reason of its glare is liable to endanger aircraft taking off from or landing at an aerodrome; or

(b) by reason of its liability to be mistaken for an aeronautical ground light is liable to endanger aircraft.

ANO Article 225 in respect of “Lights which dazzle or distract” states the following:

A person must not in the United Kingdom direct or shine any light at any aircraft in flight so as to dazzle or distract the pilot of the aircraft.

CAP 168 [2] provides some practical interpretation of these requirements, as follows:

Dangerous and Confusing Lights

6.10 The ANO states that a person shall not exhibit in the UK any light which is liable to endanger aircraft taking-off or landing or which is liable to be mistaken for an aeronautical light.

6.11 A light may endanger aircraft when:

1. the intensity causes glare in the direction of an approaching aircraft;

2. the colour (e.g. advertising signs) causes it to be mistaken for an aeronautical light;

3. viewed from the air, lights make a pattern (e.g. a row of street lights) similar to an approach or runway lighting pattern;

4. the overall amount of illumination near the approach to a runway detracts from the effectiveness of the AGL, particularly in poor visibility.

6.12 Lasers are a source of special concern because even brief exposure to the light from such devices can cause temporary blindness. Guidance on the use of lasers with regard to aviation safety has been produced by the CAA and is contained in CAP 736, Guide for the Operation of Lasers, Searchlights and Fireworks in United Kingdom Airspace.

6.13 The licence holder should ensure that arrangements exist whereby local planning authorities may receive appropriate advice about the lighting implications of planning applications before such applications are determined.

6.14 Particular attention should be paid to lights in the following areas:

1. For instrument approach runways

A rectangular area 750 m on each side of the centreline and extended centreline of the runway extending to a distance of 4,500 m before the threshold.

2. For non-instrument runways

An area 220 m wide equally disposed about the centreline of the runway and increasing in width along the extended centreline from 220 m at the threshold to 950 m wide at a distance of 3,000 m from the threshold.

In respect of lighting, it is evident that conventional building lighting can normally be designed so as not to be dangerous and confusing in the context of the regulations. The proposed development is unlikely to comprise any unusual lighting features and will be located outside of the area defined as requiring particular attention.

In addition to artificial lighting, large glass structures and roof-mounted PV panels might allow strong reflections of sunlight, and those located close to the approach path to a runway are of potential concern due to the possible impairment of visual reference that they might cause, in particular at a more critical time during landing. A sustained glare during the final approach phase of flight might affect a pilot's ability to maintain adequate visual reference to the runway and a short burst of intense light may affect visual function for some time after the event. Where vision is not impaired, reflections might still cause some level of distraction. Temporary impairment of the sight of ATC personnel due to this type of effect may also present a potential threat to safe airport operations. The airport may require a detailed glare impact assessment if PV panels were to form part of the planning proposals.

9 Conclusions

The following conclusions may be drawn from the aviation safeguarding assessment:

- Assessment of the site location in relation to London Heathrow Airport's OLS has determined that the site is located within the area covered by the inner horizontal surface (IHS) which is at a level height of 67.95 m AOD across the site. At a maximum height of 67.9 m AOD, the outline maximum heights parameter plan complies with the OLS.
- The site is also located within the conical surface for RAF Northolt Aerodrome. However, this gives rise to a less limiting constraint than the London Heathrow Airport OLS.
- A review of flight procedures and the existing temporary obstacle environment indicates that the airport is likely to accept temporary infringement of the inner horizontal surface by cranes. Cranes up to a maximum height of around 130 to 140 m AOD could be accommodated at the site with no impact on flight operations. Therefore, there will be plenty of headroom above the maximum identified building heights to accommodate construction cranes. The aerodrome is likely to require an Instrument Flight Procedure (IFP) check of cranes by their Approved Procedure Design organisation (APDO), secured by an appropriately worded planning condition or prior to issuing crane permits.
- In addition to the physical safeguarding of flight procedures, proposed development close to the airport has the potential to impact on-airport navigational aids. Preliminary assessment indicates that the proposed development is outside of the technical safeguarding frames indicated in CAA guidance to be areas of particular concern. It is expected that development up to the OLS height limits at this location will not impact on-airport navigational aids.
- The potential for tall buildings in the area of the proposed development to impact on the H10 radar located at London Heathrow is identified. NATS has assessed the proposal and indicated that it deems it to have an unacceptable impact on the H10 radar in the form of radar reflections and therefore SSR false targets appearing on Air Traffic Control displays. While its position would normally be to object to a planning application, subject to timescales it may be supportive of a conditional consent. Following engagement and agreement with the applicant, it is anticipated that NATS would request planning conditions requiring a radar mitigation scheme to be agreed and implemented.
- Preliminary review of the potential bird hazard associated with the proposed development indicate that any issues can be addressed by the adoption of well-established management measures, if considered appropriate.
- Design of external lighting should be mindful of the requirements to ensure that lights are not dangerous, confusing or dazzling to pilots on approach or taking off from aerodromes. In addition to lights, PV panel installations or large glazed areas have the potential to cause glare towards pilots or ATC operators.

References

1 Annex 14 to the Convention on International Civil Organisation: Aerodromes Volume 1, Aerodrome Design and Operations Ninth Edition, July 2022, International Civil Aviation Organisation

2 CAP 168 Licensing of Aerodromes, Edition 12, January 2022, Civil Aviation Authority

3 Procedures for Air Navigation Services: Aircraft Operations (Doc 8168), International Civil Aviation Organisation

4 Report KLG183/R1, Hyde Park, Hayes: Aviation Safeguarding Design Advice, Draft1 9th January 2025.

5 UK Military AIP, Northolt, AD-2-EGWU, 28 Nov 2024

6 Certification Specifications and Guidance Material for Aerodromes Design CS-ADR-DSN, Annex to ED Decision 2017/021/R, European Aviation Safety Agency, Issue 4, 8 December 2017

7 Regulatory Article (RA) 3512 Permanent Fixed Wing Aerodrome - Obstacle Environment, Military Aviation Authority https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/910938/RA3512_Issue_2.pdf

8 Heathrow Airport Expansion – Consultation Document June 2019, Heathrow Airport Limited

9 Heathrow Airport: Airspace Noise and ATM Performance, Annual Report 2023

10 Doc 9137-AN/898 Part 6 Airport Services Manual Part 6 Control of Obstacles, International Civil Aviation Organisation, 1983

11 Heathrow AIP, NATS, EGLL AD 2.10 AERODROME OBSTACLES, AIRAC/12/2024

12 Civil Aviation Authority CAP 670 Air Traffic Services Safety Requirements, version 3, including amendment 1/2019.

13 NATS Technical and Operational Report Ref SG39332, Hyde Park, Millington Road, Hayes, UB3 4AZ (Pre-planning Assessment), Issue 1, NATS Safeguarding Office, 29th May 2025

14 Airport Services Manual Part 3: Wildlife Control and Reduction, Fifth Edition, 2020, International Civil Aviation Organization

15 Wildlife Hazard Management at Aerodromes CAP 772, Civil Aviation Authority, Version 2, October 2017

16 Civil Aviation Authority, CAP 393: The Air Navigation Order 2016 and Regulations, Civil Aviation Authority, February 2021

Appendix 1: NATS Technical and Operational Assessment SG39332, Hyde Park, Hayes.

Prepared by:

NATS Safeguarding Office

Technical and Operational Assessment

NATS ref: SG39332

Hyde Park

Millington Rd, Hayes, UB3 4AZ

(Pre-planning assessment)

Issue 1.

Planning ref: N/A

Contents

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Publication history

Issue	Month/Year	Change Requests and summary
Issue 1	29th May 2025	First Version – Pre-planning Application

Document Use

External use: Yes

Referenced documents

1. Coordinates and kml files provided by K L Grant Consulting Limited as part of the pre-planning request.

1 Background

Under the licence granted to it through the Transport Act 2000, NATS (En-Route plc) "NERL" is a provider of Air Traffic Services and has the duty to ensure the safe and expeditious flow of traffic in the en-route phase of flight, for aircraft operating in controlled airspace in the UK. In order to provide its service, it operates a comprehensive infrastructure of radars, communication systems and navigational aids throughout the UK.

The operation of this infrastructure can be compromised by the construction and development of structures which can cause an obstruction or affect it in other ways.

NERL's licence requires it to ensure the integrity and safe operation of its infrastructure and to discharge this duty NATS is a statutory consultee for all wind turbine applications as well as other types of developments that are in proximity to its installations. NERL receives relevant consultations from Planning Authorities and assesses the potential impact of these across the UK.

NERL's role as a statutory consultee is defined within the Town and Country Planning (Safeguarded Aerodromes, Technical Sites and Military Explosives Storage Areas) Safeguarding Direction 2002.

2 Scope

This report provides NATS En-Route plc's view on the proposed application in respect of the impact upon its own operations and in respect of the application details contained within this report.

Where an impact is also anticipated on users of a shared asset (e.g. a NATS radar used by airports or other customers), additional relevant information may be included for information only. While an endeavour is made to give an insight in respect of any impact on other aviation stakeholders, it should be noted that this is outside of NATS's statutory obligations and that any engagement in respect of planning objections or mitigation should be had with the relevant stakeholder, although NATS as the asset owner may assist where possible.

3 Application Details

A pre-planning assessment request was submitted to NATS on the 28th April 2025 by K L Grant Consulting Limited. This was a request to assess the proposal for new development known as "Hyde Park" located in Millington Rd, Hayes, West London.

The Applicant submitted a comprehensive set of coordinates and a kml file representing the proposed blocks and their elevation.

The coordinates for the different blocks are listed in Table 1.

Structure Name	Latitude	Longitude	AOD Height (metres)
BZA1-67.9mAOD	51.50248321	-0.428177493	67.9
BZA1-67.9mAOD	51.50247576	-0.427622311	67.9
BZA1-67.9mAOD	51.50271709	-0.427614002	67.9
BZA1-67.9mAOD	51.50272454	-0.428169186	67.9
BZA2-58.85mAOD	51.50229301	-0.427569991	58.85
BZA2-58.85mAOD	51.50214035	-0.427270399	58.85
BZA2-58.85mAOD	51.5024088	-0.426919189	58.85
BZA2-58.85mAOD	51.50256147	-0.427218781	58.85
BZA2-58.85mAOD	51.50229301	-0.427569991	58.85
BZB-67.9mAOD	51.50199664	-0.427838649	67.9
BZB-67.9mAOD	51.50221235	-0.427668338	67.9
BZB-67.9mAOD	51.50229919	-0.427950674	67.9
BZB-67.9mAOD	51.50208431	-0.428117279	67.9
BZB-58.85mAOD	51.50194027	-0.42888561	58.85
BZB-58.85mAOD	51.50186823	-0.4286557	58.85
BZB-58.85mAOD	51.50234403	-0.428273409	58.85
BZB-58.85mAOD	51.50241607	-0.428509984	58.85
BZB-58.85mAOD	51.50194027	-0.42888561	58.85
BZB-52.4mAOD-N	51.50219795	-0.428390845	52.4
BZB-52.4mAOD-N	51.50210821	-0.428096489	52.4
BZB-52.4mAOD-N	51.50225241	-0.427981782	52.4
BZB-52.4mAOD-N	51.50234334	-0.428274052	52.4
BZB-52.4mAOD S	51.50186689	-0.428654109	52.4
BZB-52.4mAOD S	51.50171208	-0.428143609	52.4
BZB-52.4mAOD S	51.50201504	-0.427896137	52.4
BZB-52.4mAOD S	51.50208384	-0.428116602	52.4
BZB-52.4mAOD S	51.50191521	-0.428252029	52.4
BZB-52.4mAOD S	51.50200396	-0.428543254	52.4
BZC-65.15mAOD	51.50158533	-0.429165408	65.15
BZC-65.15mAOD	51.5014795	-0.428814724	65.15
BZC-65.15mAOD	51.50169648	-0.428646915	65.15
BZC-65.15mAOD	51.50180317	-0.42899385	65.15
BZC-58.85mAOD	51.50146455	-0.429192152	58.85
BZC-58.85mAOD	51.50147677	-0.429246641	58.85
BZC-58.85mAOD	51.50127044	-0.42941013	58.85
BZC-58.85mAOD	51.5011602	-0.429070288	58.85

Structure Name	Latitude	Longitude	AOD Height (metres)
BZC-58.85mAOD	51.50137354	-0.428900105	58.85
BZC-58.85mAOD	51.50139121	-0.428956756	58.85
BZC-58.85mAOD	51.50149443	-0.42887355	58.85
BZC-58.85mAOD	51.50156499	-0.429111026	58.85
BCD-65.15mAOD	51.50100997	-0.428076525	65.15
BCD-65.15mAOD	51.50090232	-0.427727663	65.15
BCD-65.15mAOD	51.50058387	-0.427982462	65.15
BCD-65.15mAOD	51.50112015	-0.427559082	65.15
BCD-65.15mAOD	51.50122561	-0.427906202	65.15
BCD-58.85 m AOD SE	51.50088726	-0.428103611	58.85
BCD-58.85 m AOD SE	51.50090446	-0.428161884	58.85
BCD-58.85 m AOD SE	51.50069066	-0.428332325	58.85
BCD-58.85 m AOD SE	51.50058235	-0.427986631	58.85
BCD-58.85 m AOD SE	51.50079594	-0.427810081	58.85
BCD-58.85 m AOD SE	51.50081581	-0.427870511	58.85
BCD-58.85 m AOD SE	51.50091832	-0.427784463	58.85
BCD-58.85 m AOD SE	51.50099087	-0.428023743	58.85
BCD-58.85mAOD-NW	51.5009794	-0.428891843	58.85
BCD-58.85mAOD-NW	51.50090918	-0.428664337	58.85
BCD-58.85mAOD-NW	51.50134885	-0.428307536	58.85
BCD-58.85mAOD-NW	51.50142246	-0.428542074	58.85
BCD-42.45mAOD N	51.50122589	-0.428409589	42.45
BCD-42.45mAOD N	51.50110228	-0.428002619	42.45
BCD-42.45mAOD N	51.5012236	-0.427904644	42.45
BCD-42.45mAOD N	51.50134883	-0.428311851	42.45
BCD-42.45mAOD S	51.50090784	-0.428664301	42.45
BCD-42.45mAOD S	51.50078379	-0.428255797	42.45
BCD-42.45mAOD S	51.50090333	-0.428159922	42.45
BCD-42.45mAOD S	51.50103061	-0.428563962	42.45

Table 1 - Coordinates for the nine towers

The proposed plot layout is shown in Figure 1, Figure 2 shows an outline sketch of the proposal while the proposal set amongst the wider local context, can be seen in Figure 3.

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Figure 1 – Location and outline of the proposed development

Google Earth Map data ©2015 Digital Globe, GeoInformation Group

Figure 2 – Outline illustration of the proposal

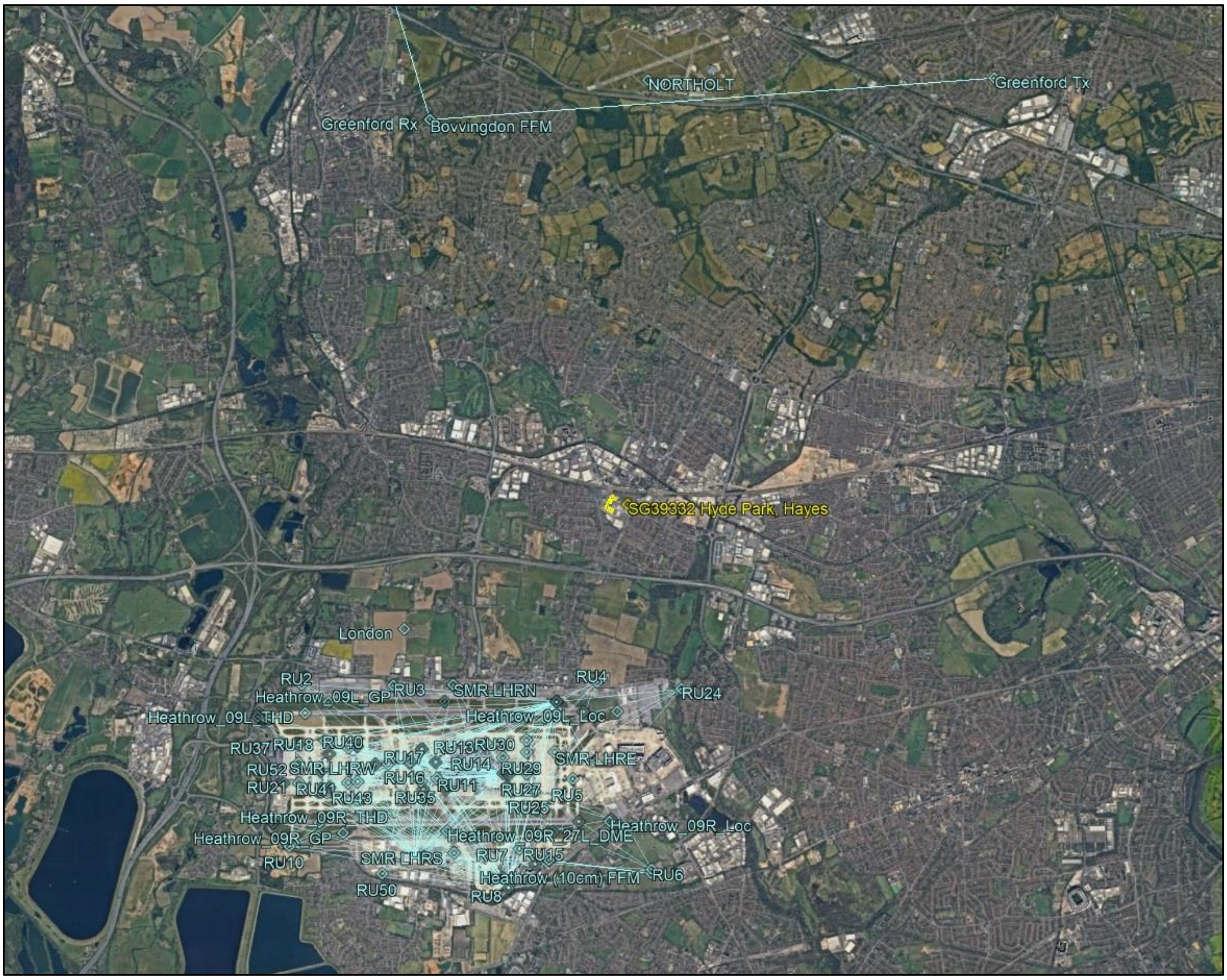
Google Earth Map data ©2015 Digital Globe, GeoInformation Group

Figure 3 – The proposal in the wider context

4 Impact Assessment Details

The proposed development was assessed against the following NATS infrastructure, as shown in Figure 4:

1) En-route Radar, 2) Navigation Aids, 3) Air-ground-air radio sites



Google Earth Map data ©2015 Digital Globe, GeoInformation Group

Figure 4 – The proposal in relation to NATS's infrastructure

Due to the location and scale of the proposal, the only assessments required were identified as those against the Primary and Secondary Radars, located at Heathrow airport.

This combined PSR/SSR, known as H10, provides a service to the NATS En-Route and Terminal Area air traffic controllers at the Swanwick ATC Centre in Hampshire. Data from this radar is also provided to a number of other airport and airspace users, including Northolt, Heathrow and London City Airport.

The proposed development plotted in relation to NATS's H10 radar can be seen in Figure 5.

Google Earth Map data ©2015 Digital Globe, GeoInformation Group

Figure 5 – The proposed development plotted in relation to NATS's H10

4.1 En-route Radar Assessment

The presence of a large obstruction in the radar beam has the potential to impair the performance of the radar.

The impairment can have two effects; the first can be in the form of a loss of cover. This can cause targets at a low elevation angle to be in an area where there is a lower probability of detection (i.e. radar detection is degraded). The second effect is where the obstruction reflects the radiated energy, which in turn can give rise to the generation of false aircraft targets. For an explanation of the two issues, refer to Appendix A.

Figure 6 illustrates the relative line of sight between the proposed development's location and the H10 radar.

Google Earth Map data ©2015 Digital Globe, GeoInformation Group

Figure 6 – Line of sight from NATS's H10 radar

4.1.1 Heathrow H10 Radar

The proposed development was assessed against the NATS En-route radar located at Heathrow airport, referred to as H10. This is a combined Primary and Secondary Surveillance radar (PSR/SSR).

The nearest part of the proposal is 2.45nm (~4.55km) away and the development is centred on a bearing of 009.8°T (Figure 5).

On this northerly azimuth (bearing), the terrain is flat in the direction of Hayes and beyond the airfield boundary. As such, the radar, with an elevation of 45m above ground looks over the top of airport structures and has a clear, unobstructed line of sight to the plot in question.

Figure 7 and Figure 8 depict photographical versions of the obstruction survey; these show how on an azimuth of 008°-010° any high rise development of this scale is mostly unshielded towards the radar.

Note: The radar obstruction surveys are aligned to "grid north" and are therefore ~ 1.25° less than True.

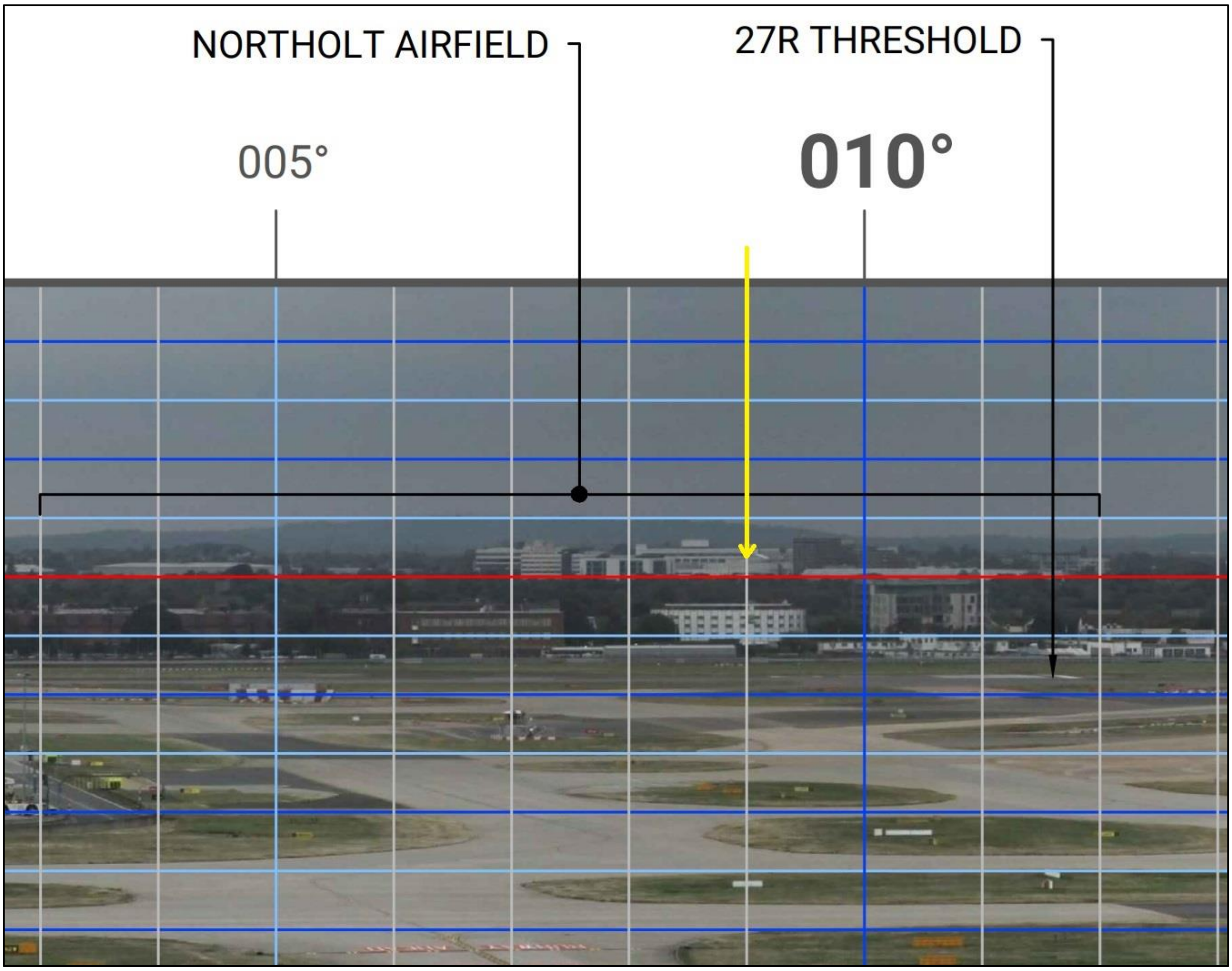


Figure 7 – Obstruction Survey from Heathrow H10 Radar (referenced to grid north)

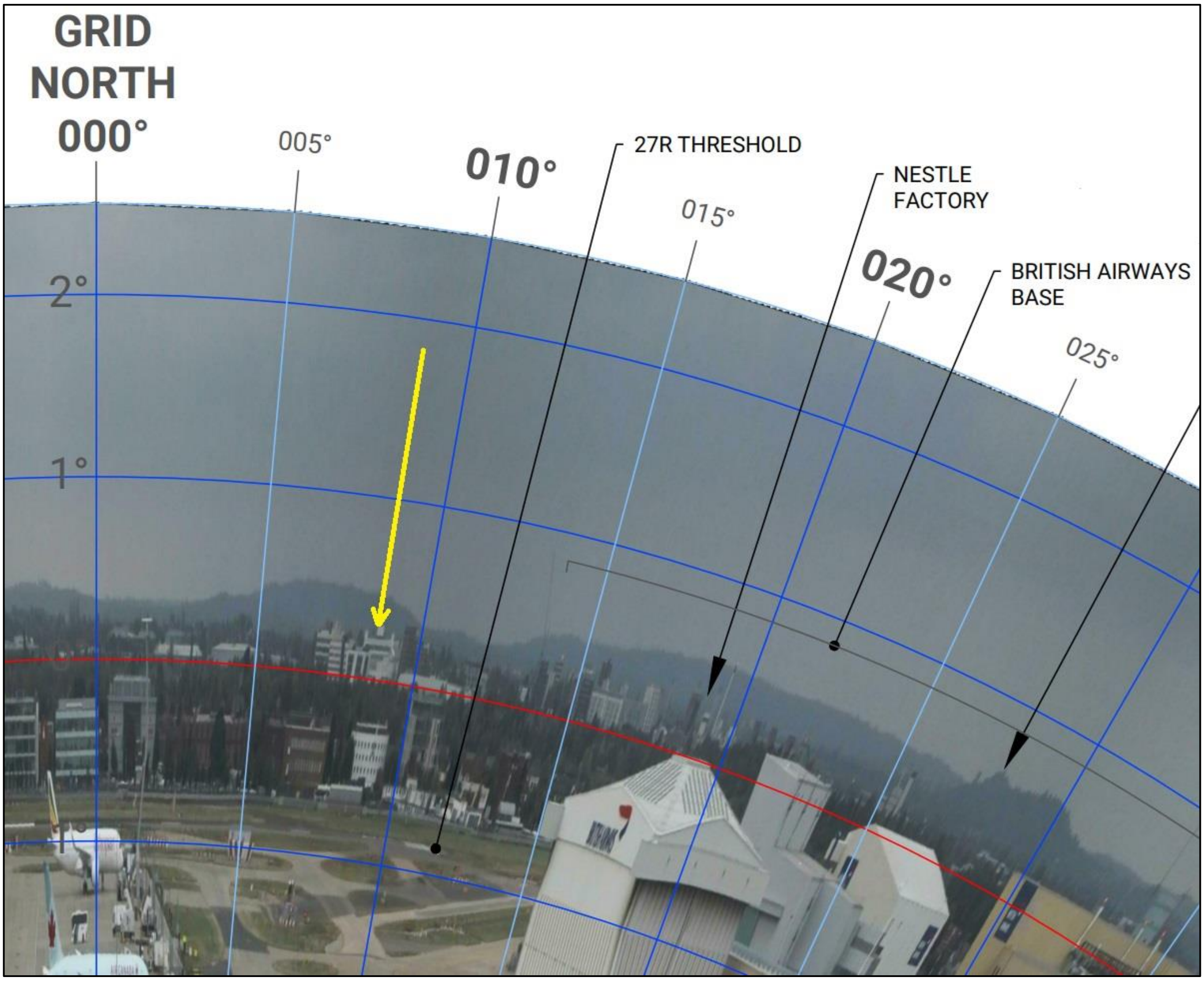


Figure 8 – Obstruction Survey from Heathrow H10 Radar

4.1.1.1 Loss of PSR/SSR cover

The proposal is not anticipated to cause any erosion of low level cover.

4.1.1.2 SSR reflections and false plots

If a building is of a sufficiently large scale and in proximity to the radar, it can have the potential to reflect sufficient power from the SSR transmitter. This signal can remain sufficiently strong to trigger an aircraft transponder to respond. This in turn can create a valid plot which the radar system would process as a real aircraft target.

This essentially causes an aircraft to be displayed in an additional (and false) position as well as being displayed in the true position, i.e. a duplicate aircraft would be created. The duplicate aircraft may be a significant distance away, in unrelated airspace on another controller's screen, and may not be obvious as being a false aircraft.

This scenario worsens, when a general aviation outside controlled airspace, gives rise to a false target in an airport control zone. This will often lead to a stop on departures, and missed approaches for landing aircraft coming into conflict with the reflection.

A further concern is that while many aircraft are now Mode-S equipped and thus easily identifiable as duplicate targets, the reflection processing algorithms can only work correctly when both real and false targets (the reflection) are detected.

NATS has ample evidence of reflections appearing when due to terrain or shielding, the real target, usually at a low altitude, is not detected by the radar yet the reflection is seen via a "bounce" off a building. Figure 10 illustrates the reflection mechanism.

An analysis of the current radar performance and configuration, shows that in this area, a number of facades of the existing development have caused transient reflections, as well as being historically adapted into the processing. This provides robust evidence that reflections are occurring and that regrettably they will increase in number when additional facades are created or extended in height.

The risk is compounded by evidence that most reflections are caused by general aviation/light aircraft operating to the North and South of London. In this area, there is a very busy general aviation environment in uncontrolled airspace yet adjacent to the extremely busy and complex controlled airspace that is the London Control Zone.

Accordingly, reflections are deemed likely and an unacceptable impact is anticipated from the proposal, on the H10 SSR Radar.

4.1.2 Cranes

Cranes can also cause reflections due their physical structure or the material/shapes being lifted. Their impact as with buildings can also be a degradation in cover.

At this range, no impact is anticipated from cranes or construction activities on radar. However, their impact on other aviation stakeholders should be considered.

4.2 Navigation Aids Assessment

No impact on NATS En-route navigation aids.

4.3 Air-ground-air radio sites Assessment

No impact on NATS En-route aeronautical radio sites.

5 Conclusions

5.1 Impact on H10 radar

5.1.1 Loss of PSR/SSR cover

No impact.

5.1.2 SSR reflections and false plots

An unacceptable impact is anticipated.

5.1.2.1 Mitigation

SSR radar mitigation, in the form of changes to the radar reflection processing software, is required.

5.2 Cranes

No impact on NATS. However, it is advisable to fully assess their impact, and engage with local airports to ascertain whether they have any specific requirements or advice. The CAA guidance[1] should also be followed to ensure that cranes are promulgated, where necessary, in the relevant Aeronautical Information Publication (AIP) and NOTAMs.

5.3 Planning

The proposal is anticipated to degrade NATS's infrastructure, namely the H10 SSR radar. Accordingly, should a planning application be received for such a scheme, NATS would be likely to object. Notwithstanding the objection, subject to engagement with the Applicant, NATS would proceed to formally identify and confirm the required radar mitigation. Following this, it would be supportive of aviation planning conditions.

[1] https://www.caa.co.uk/Commercial-industry/Airspace/Event-and-obstacle-notification/Crane-notification/

7 Appendix A – Principles of Radar

7.1 Loss of Cover

Figure 9 shows radar targets behind the proposed development will not be detected by radar. The effect is the same as shining a torchlight on an object – anything in the shadow behind the object will not be seen. The air traffic control service for any flight in the lost volume of radar cover will be degraded.

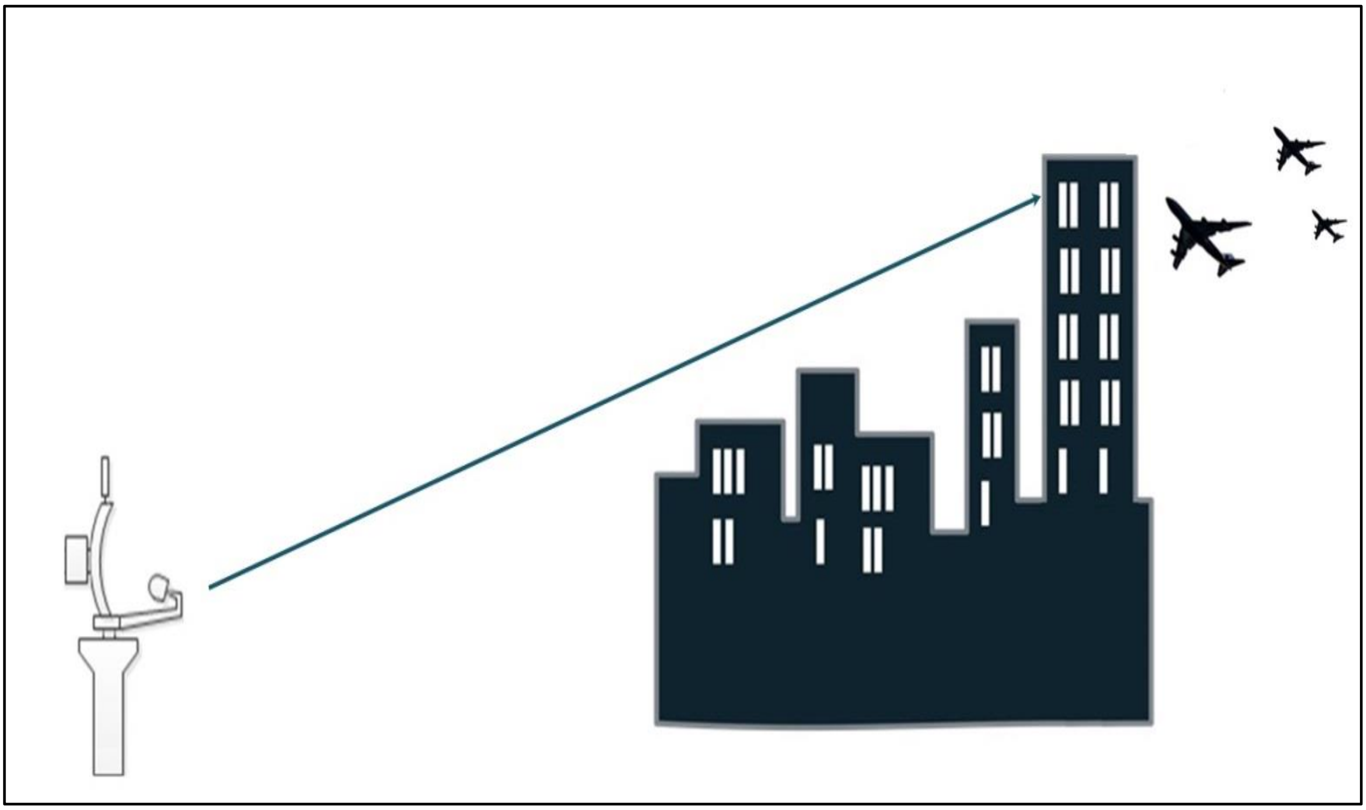


Figure 9: Loss of low radar cover due to the proposed development (not to scale)

7.2 Basic SSR Theory

Secondary Surveillance Radars (SSR) transmit Radio Frequency (RF) interrogations from a rotating antenna at the radar site, on reception of these interrogations by a transponder, RF replies are transmitted.

For NERL SSR, these replies primarily originate from airborne targets and are received at the radar using the same antenna.

A radar antenna is designed to focus RF energy to create the required beam pattern. The RF energy consists of alternating Electrical and Magnetic fields which interact close to the antenna. At a distance from the antenna the fields come together to form a stable wave front which creates the radar beam. A radar beam therefore requires a clear or 'sterile' area in which to form correctly; if there are obstructions within this area, the beam will not be the required shape.

A radar beam that is interrupted in the 'sterile' area and therefore is not the required shape can lead to the generation of false targets, inaccuracies in the reporting of real target positions or non-detection of real targets. All of these lead to a reduction in the quality of the air situation picture presented to air traffic controllers making the job of safely and efficiently controlling aircraft more difficult.

7.3 Plots and Tracking

For the purposes of accurate detection of valid targets, the radar system processes all transponder replies to decipher the real returns from false ones.

Verification of the presence of a target is made once per antenna revolution, even if several discrete detections are made during that scan. On the first antenna revolution that an apparently valid reply is received an initial plot is formed. This initial plot is then stored, and the system estimates a realistic zone from which the next reply should originate.

If a second valid reply is received from within the anticipated region on the subsequent revolution of the antenna, the location of this plot is also stored by the system. These two plots and their associated characteristics are now used by the system to predict the region from which the third reply should originate. On verification of this third reply, a radar track is established.

Every subsequent reply should then track directly because the chain of replies has already been verified to be real according to the predefined system parameters. It is radar tracks that are output to Air Traffic Control and appear on the radar displays.

7.4 Reflected Energy - Definition

A secondary radar reflection manifests as a second track report for the same aircraft. A radar reflection is caused when the interrogation is directed to an azimuth that is not the intended azimuth; the result is that an unintended interrogation occurs to an aircraft than is not in the direction the antenna is facing at that instant.

This is caused by large reflecting surfaces that direct the beam away from the azimuth of the antenna main beam. See Figure 10 for a pictorial representation of this situation.

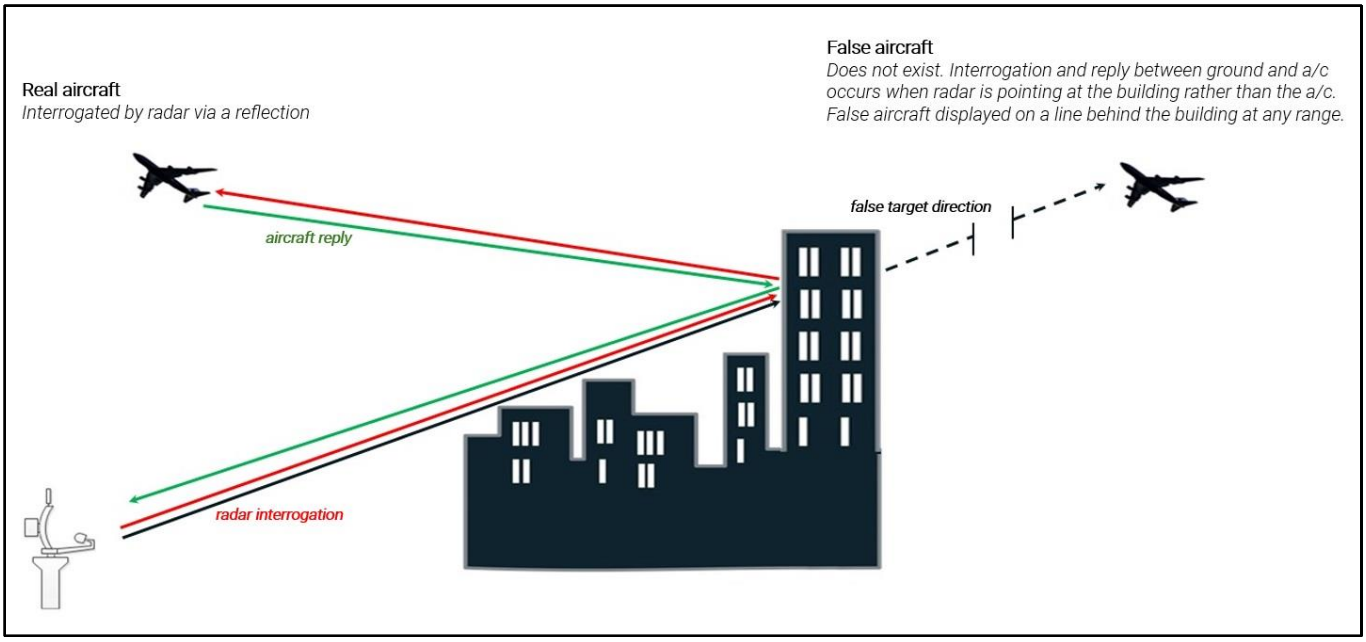


Figure 10: Simplified SSR Reflection Geometry

7.5 Characteristics of Reflections

Reflections are typically characterised by “ghost” targets that appear in a geographic location for a period of time and then vanish without trace, creating a very unstable and inconsistent air situation picture.

Reflections, although false, have all the characteristics of real replies, and so they will form plots and will track in the same manner.

Verification of the integrity of a reply is a fundamental part of the operation of the radar system. If there is any doubt surrounding the validity of a reply, the unverified target will be output on the ATC radar display, increasing workload as controllers see and react to false targets that may be in close proximity to real targets.

8 Case Study 1 – The Euston Tower – Heathrow Radar

The Euston Tower was chosen for investigation as maintenance logs show it to be heavily used to suppress false targets and as a 124m tower at 11.9nm from the radar it is similar in many ways to the developments being proposed in central Heathrow.

The Euston Tower was not adapted into the Heathrow radar as a known building, false plots identified during initial system optimisation were calculated as being generated by a surface at 11.9nm with a central azimuth of 70.7^{o} and an orientation of 341.5^{o}, it was only later that this was identified as aligning with the Tower.

For the purposes of this analysis the Tower has been estimated at 124m tall on a ground level of 25m and that the widest flat portion of the tower facing the radar has a width of 25m.

When a NERL radar suppresses a target it believes to be false, the details are recorded locally, this information is not retrieved routinely but has on occasion been extracted during specific investigations and a limited archive is available. Half an hour of such an archive was examined for this case study.

Within the half hour examined 14 suppressed plots were traced back to the Euston Tower and the real aircraft that led to their generation were determined. For this limited-data set the real aircraft were all tightly grouped around a point 2nm from approach on Heathrow's northern runway.

By using relative power levels corrected for the known signal path lengths many of the assumptions in the reflection analysis can be cancelled out in an attempt to isolate the magnitude of the reflected component, i.e. the magnitude of σ. The largest remaining unknown is probably the antenna pattern, $G_{rw,}$ of the aircraft transponder and given that the geometry remains relatively constant across the 14 instances this may lead to a systemic bias. The full track length for each of the real aircraft was examined and by eye the aircraft heading did not appear to a be correlated with any deviation in real/expected signal strength leading to the conclusion that this is not a significant factor.

Using the parameters estimated from the direct interrogations the indirect power levels were used to estimate the radar cross section, σ, of the Euston tower and the results averaged 87dBsm with a standard deviation of 3.2dBsm.

Using the formula for a perfectly conducting flat plate equivalent to the full height of the building and 25m wide gives a radar cross section of 92dBsm, reducing the height of the building by 21m to take into the account the shielding from adjacent 7 storey Santander building yields 90dBsm.

The above analysis suggests that although, as expected, the perfectly conducting flat plate assumption leads to an overestimate of the radar cross section this may be by as little as 3dB.

The relationship between the real aircraft position and the tower can also be used to examine the assumption of specular reflections in the horizontal plane in determining the volume of airspace within which real aircraft would potentially generated false plots as shown below (in all plots the scale is nm with the origin at the radar).

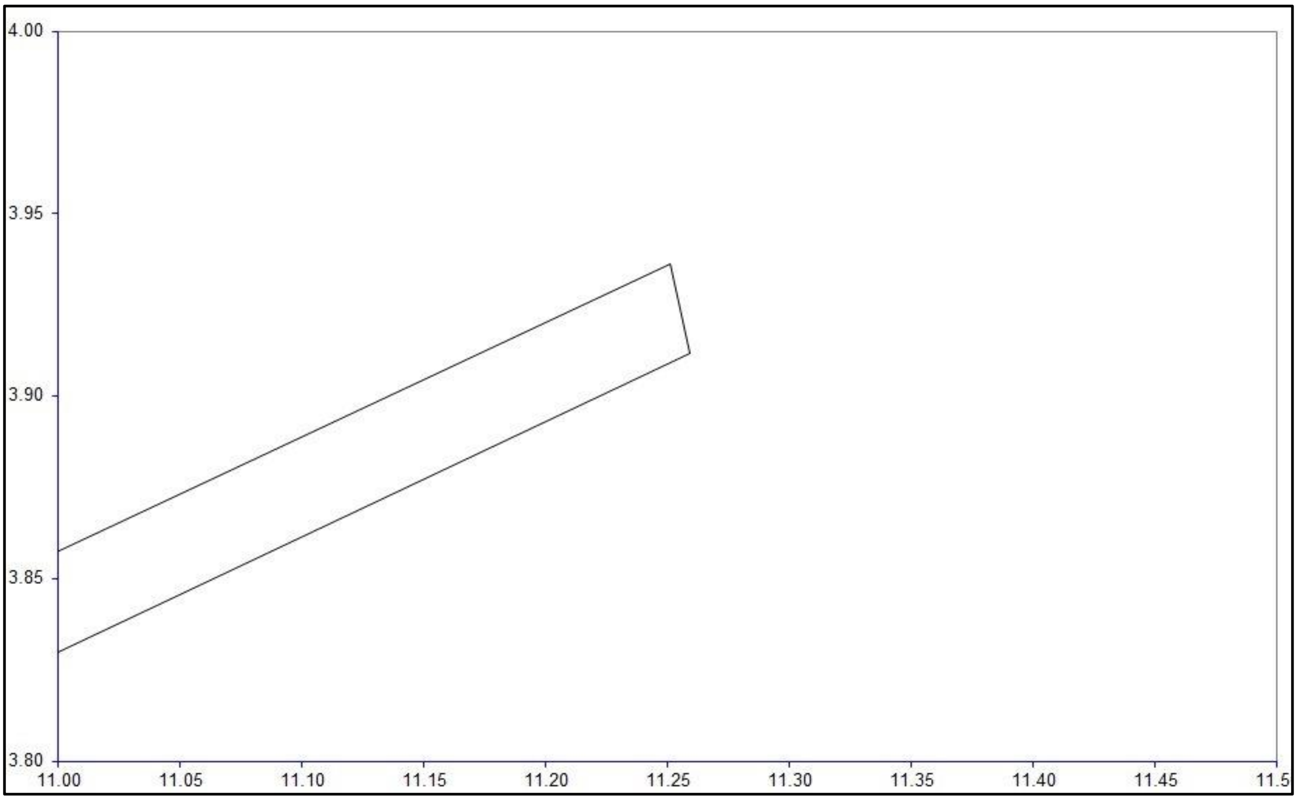


Fig CS1.1 Estimated zone of impact in the horizontal plane assuming specular reflections

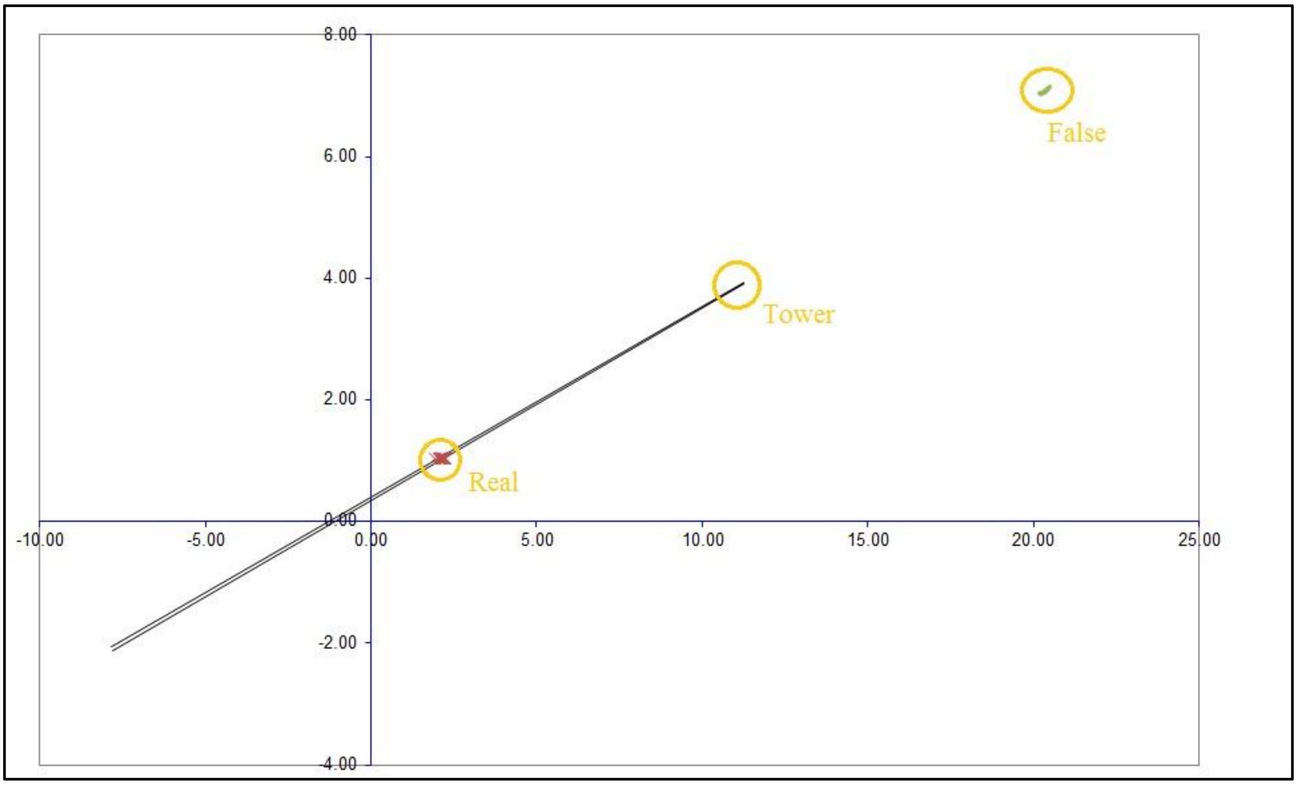


Fig CS1.2 Estimated zone of Impact alongside real and false plots

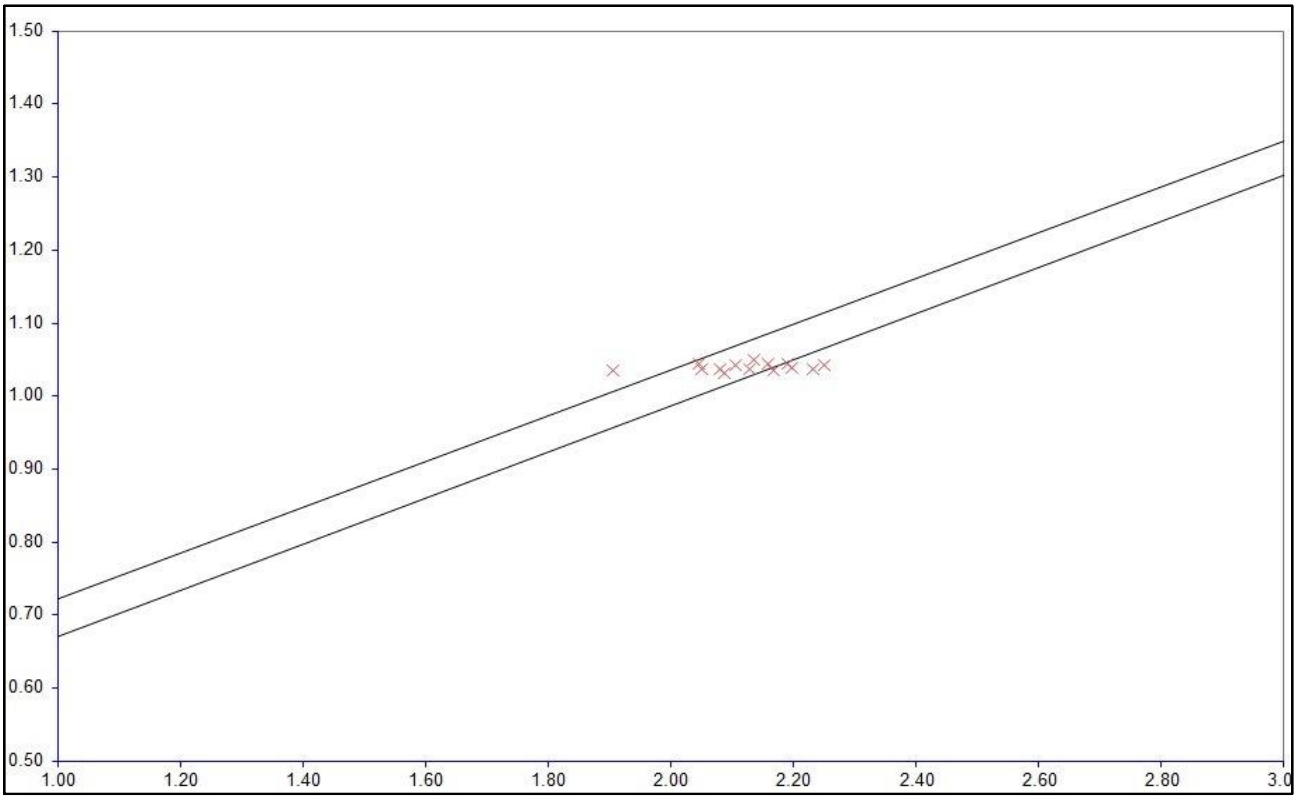


Fig CS1.3 Estimated zone of Impact alongside real plots

Given that there were a large number of real plots close the estimated zone of impact that did not give rise to false plots it can be assumed that although the assumption of specular reflection leads to an underestimation this is not a large effect.

9 Case Study 2 – Vertical Component– Pease Pottage

Pease Pottage was chosen to investigate the vertical component of the reflection as it combines a hill-top site with close proximity to a built-up area.

The maintenance logs were examined and, excluding Gatwick Airport, the 3 reflectors used to suppress the most false targets were chosen for further investigation these were

1. A 6 storey Hotel on Southgate Ave, Crawley
2. A 4-storey office building at Pegasus Place Crawley
3. Farm buildings on Parish Lane

The geometric relationship between the radar and each of the buildings are shown in the following diagrams with the New Buildings Farm examined in more depth as it was by far the most heavily used reflector leading to the suppression of 2,400 false plots on one recent log file.

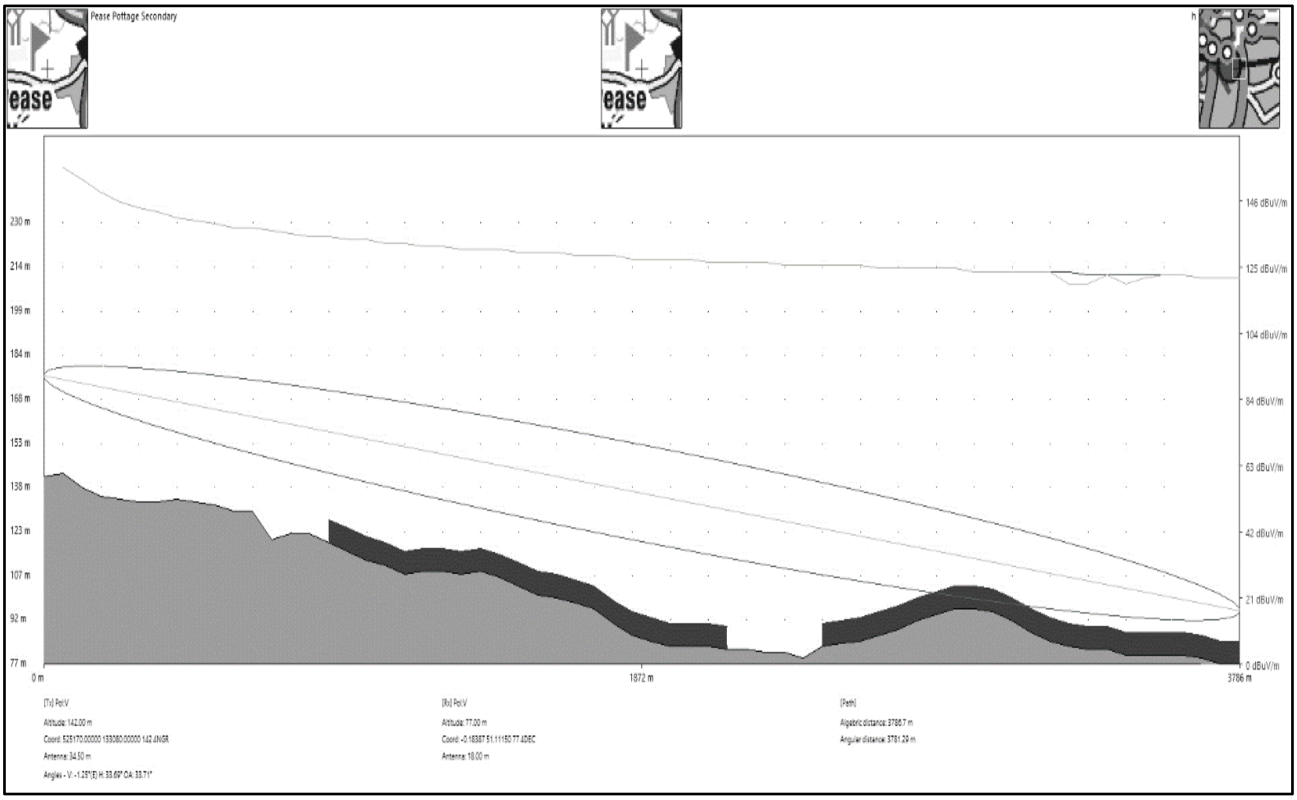


Fig CS2.1 Path from Pease to the Hotel

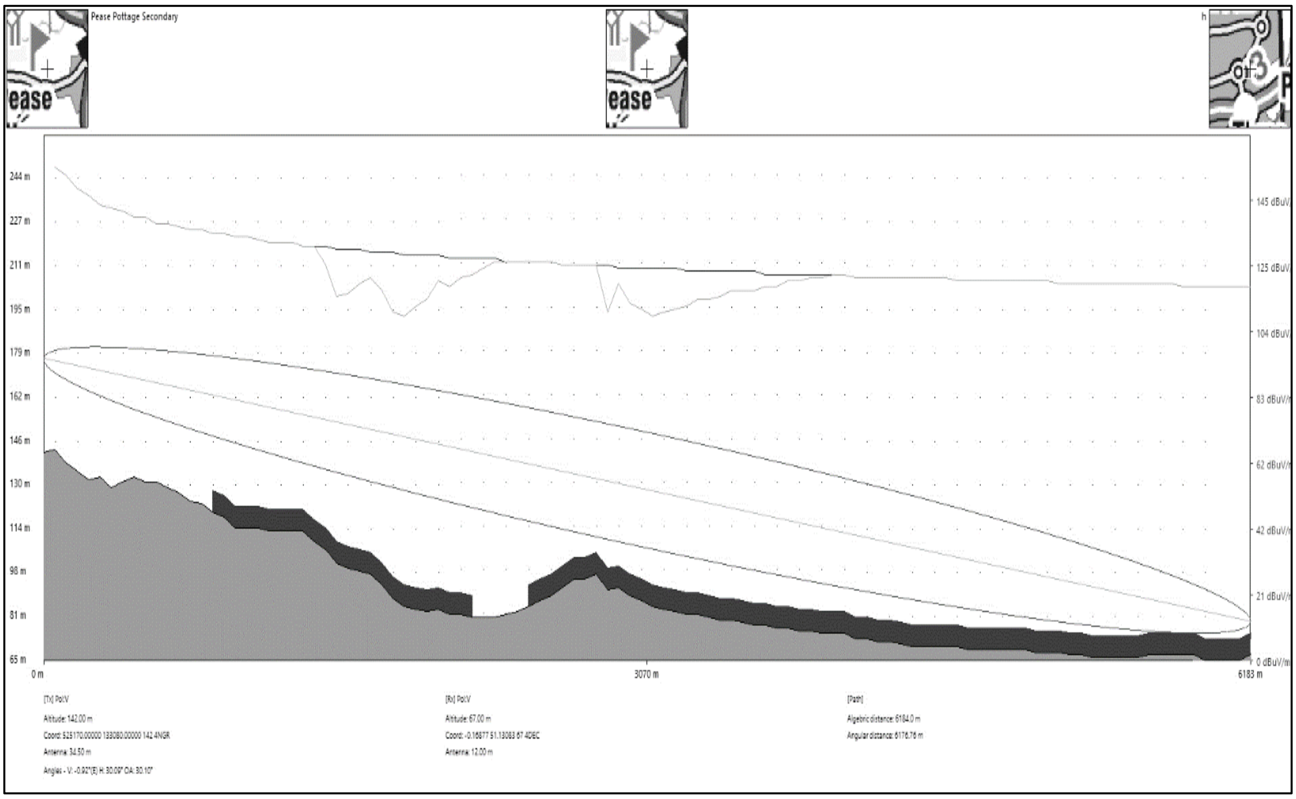


Fig CS2.2 Path from Pease to the office building

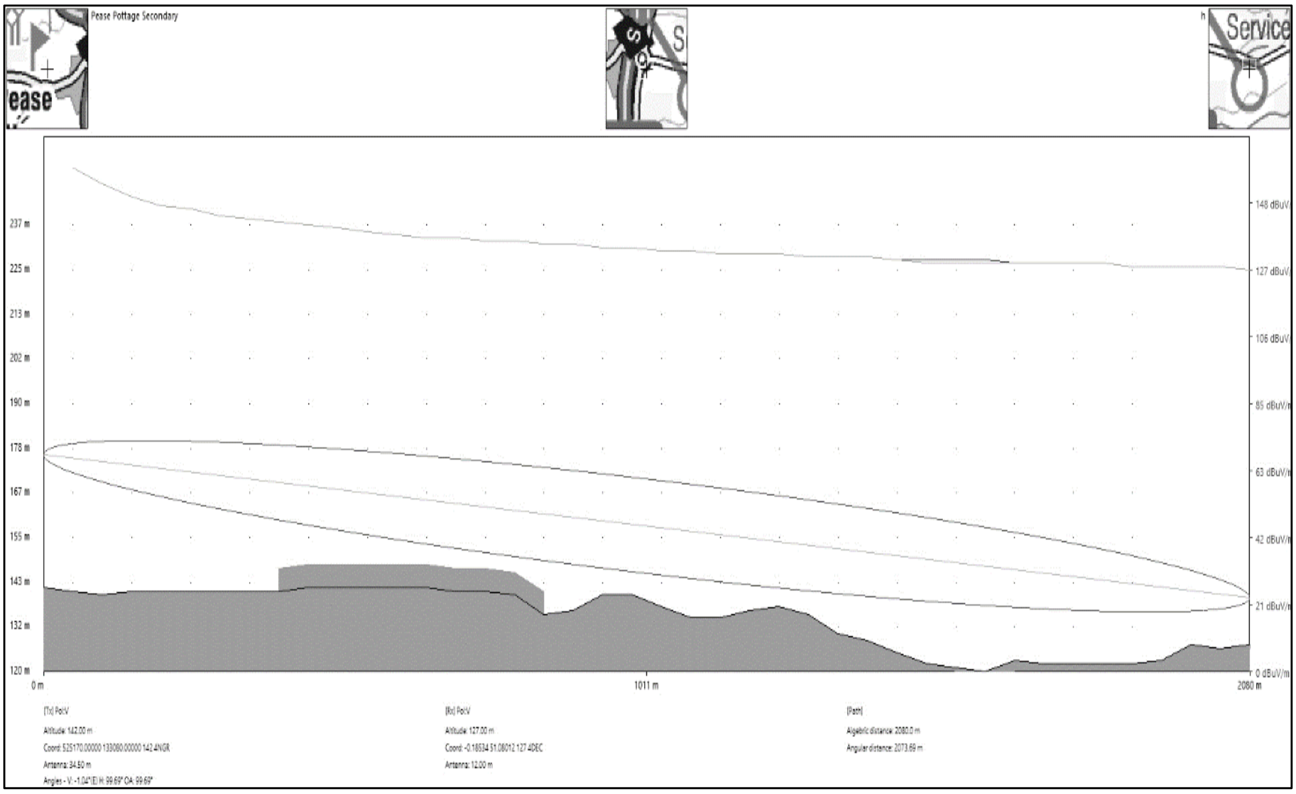


Fig CS2.3 Path from Pease to the Farm Buildings

Fig CS2.4 The Farm Buildings

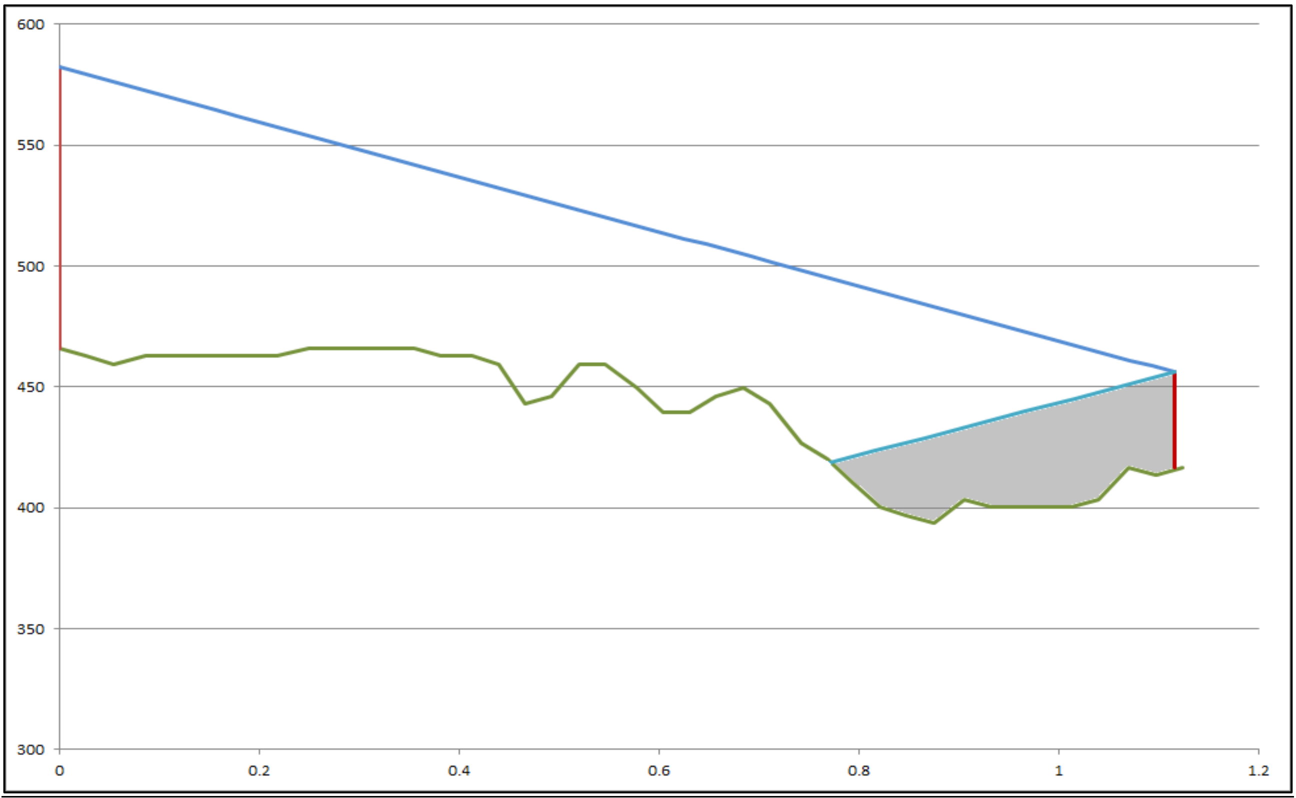


Fig CS2.5 Theoretical zone of impact using specular reflection assumptions

Due to the large negative angles in all three cases the theoretical zone of impact using specular reflection assumptions will be a negligibly small volume of airspace where it is very unlikely that any aircraft would transit.

The fact that these are heavily used reflectors suggests that specular reflection assumptions are not valid in the vertical plane and if thousands of false plots are to be generated by a surface such as the Farm Buildings then the assumption is not simply a slight underestimate but is actually of little use.

Until further work can ascertain limits to the vertical extent of SSR reflections the assumption is that aircraft at all altitudes could be interrogated via a reflecting surface.