



CNS Technical Safeguarding Assessment

Atlas Business Park

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Author: Mark Outhwaite

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The Hub, Fowler Avenue, Farnborough Business Park, Farnborough, GU14 7JP

01420 520200 / enquiries@ospreycl.co.uk

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Glossary

Acronym	Meaning
AGL	Above Ground Level
AIS	Aeronautical Information Service
AMSL	Above Mean Sea Level
ATDI	Advanced Topographic Development, and Imaging
ATC	Air Traffic Control
CAA	Civilian Aviation Authority
CAP	Civilian Aviation Publication
Cat	Category
CNS	Communications, Navigation and Surveillance
DME	Distance Measuring Equipment
GP	Glide Path
G to A	Ground to Air
ICAO	International Civil Aviation Organisation
ILS	Instrument Landing System
LLZ	Localizer
LoS	Line of Slope
m	metres
MLAT	Multilateration
NM	Nautical Miles
OEM	Original Equipment Manufacturer
PSR	Primary Surveillance Radar
RF	Radio Frequency

SARPs	Standards and Recommended Practices
SMR	Surface Movement Radar
SSR	Secondary Surveillance Radar
VHF	Very High Frequency
VOR	VHF Omnidirectional Range
UHF	Ultra-High Frequency

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1 Introduction

1.1 Overview

Osprey Consulting Services Limited (Osprey) was commissioned to undertake an assessment of the potential risks to the performance of the Communications, Navigation and Surveillance (CNS) equipment operating at Manchester Airport, in relation to the Atlas Business Park proposed development for five buildings. The task, is summarised in this CNS Technical Safeguarding Assessment Report. This Report is supported by an Obstacle Limitation Surface Safeguarding report under sperate cover.

1.2 Purpose and requirement

The aim of this study was to determine the potential impact to the performance of the CNS equipment in relation to the building development which is roughly 1.2 kilometres away from Runway 23 of Manchester Airport, directly below the flight path.

Osprey conducted a Technical Safeguarding Assessment of the CNS equipment which can be used to begin dialogue with Manchester Airport Group for the development of fixed parameters for which you will be seeking approval via the outline planning application.

Additionally, Osprey conducted an intervisibility assessment of the co-mounted Primary Surveillance Radar (PSR) and Secondary Surveillance Radar (SSR) to provide further assessment of risk that the proposed building development poses to radio signal degradation.

1.3 Scope

This report includes:

- An assessment against the CNS equipment located at Manchester Airport.
- Assessment conclusion, identifying the impact to Manchester airports CNS systems.
- A list of assumptions that were identified as the plausible criteria by which to perform the intervisibility impact in Advanced Topographic Development, and Imaging (ATDI) HTZ Communications¹.

1.4 Assumptions

Osprey has made the following assumptions in the conduct of this assessment:

- The area of the proposed development varies in Altitude Above Mean Sea Level (AMSL) between 68 and 71 metres (m); thus, for the assessment the development area is assumed to be 71 m AMSL.

¹ ATDI HTZ Communications Version 23.6.0 x64 dated 31st May 2022.

- The location of the development area is shown in figure 1, with a 20 m buffer added to the location for modelling purposes.



Figure 1 – Atlas Business Park development location

- Units 1 and 5 along with 2, 3 and 4 are at an internal haunch height of 16 m and 12.5 m respectively². For the assessment, a conservative height of 20 m (91 m AMSL) for the whole development area has been used.
- The assessment was completed using the data provided by the client and application of Aeronautical Information Service (AIS) package³, ICAO and Civil Aviation Authority (CAA) Standards and Recommended Practices (SARPs) in lieu of Original Equipment Manufacturer (OEM) data.

² Atlas Business Park, Brief Specification - Issue 2 220810

³ [eAIS Package United Kingdom \(nats.co.uk\)](https://www.nats.co.uk/eais)

2 Methodology

2.1 Overview

Osprey used the following methodology to conduct this assessment:

- Google Earth Pro: Set up CNS locations to be assessed using Google Earth Pro.
- Technical Safeguarding: Apply generic guidance detailed in Civil Aviation Publication (CAP) 670⁴ and ICAO⁵ to assess whether the proposed development presents an infringement to the CNS capabilities.
- In lieu of OEM data for the CNS equipment located at the airport, Osprey will apply the ICAO, CAA SARPs and AIS⁶; where no safeguarding data is available, application of best practice by Osprey's experienced personnel will be applied.
- ATDI modelling tool: Undertake an intervisibility assessment using ATDI software to determine if the proposed development will cause Radio Frequency (RF) signal degradation that may affect the radar systems coverage.

⁴ [CAP670 Issue3 Am 1 2019\(p\).pdf \(caa.co.uk\)](#)

⁵ ICAO Annex 10 Volume 1 Seventh Edition dated July 2018.

⁶ AIS Package United Kingdom ([nats.co.uk](#))

3 CNS Technical Safeguarding Assessment

3.1 Introduction

The section relates to CAP670, Part B, Section 4: GEN02 for CNS safeguarding. To maintain the integrity of the CNS equipment radio signals it is paramount to ensure that any planned physical objects in the vicinity of the CNS systems are assessed for their physical impact and potential to act as a reflector or diffractor.

All Aeronautical Radio Stations should have an obstacle free zone around them centred on the antenna location to ensure the transmitted signal is not affected by permanent or temporary objects.

Due to OEM siting criteria being unavailable for this assessment, Osprey used technical safeguarding guidance material in CAP670 GEN02 and ICAO Annex 10 to conduct reviews of the CNS equipment's physical protection against the proposed business parks location and height. Where generic guidance is minimal, in particular for PSR and SSR, Osprey applied safeguarding principles gained from experience.

The parameters that Osprey applied to the CNS equipment at Manchester Airport for this assessment are highlighted for each equipment in this document.

3.2 Communications Analysis

Very High Frequency (VHF) and Ultra High Frequency (UHF) Ground to Air (G to A) Communications

CAP 670 GEN02.25 provides the following safeguarding criteria for VHF/UHF Receivers and Transmitters which, in lieu of OEM data, Osprey have applied to the G to A sites sourced from '2021 CAP Survey Package'⁷.

- Ground level safeguarding of circle radius 91 m centred on the base of the main aerial tower (or equivalent structure). Additionally, from an elevation of 9 m on this circle a 2% (1:50) slope out to a radius of 610 m.

Air Traffic Control (ATC) Building

Figure 2 shows there is no infringement of the ATC building safeguarding criteria for VHF/UHF Receivers and Transmitters from the proposed building development.

⁷ Note: The survey package only highlights the Air Traffic Control Tower specifically as 'ATC Aerial,' the three other sites are highlighted within the '2021 CAP Survey Package' as Antenna Mast, and via Google Earth as possible G to A masts.



Figure 2 – Air Traffic Control VHF/UHF Communications safeguarding criteria

Antenna Masts 1, 2 and 3

Figure 3 shows there is no infringement of the Antenna Masts 1, 2 and 3 safeguarding criteria for VHF/UHF Receivers and Transmitters from the proposed building development.



Figure 3 – Antenna Masts 1, 2 & 3 VHF/UHF Communications safeguarding criteria

3.3 Navigation Analysis

3.3.1 Instrument Landing System (ILS)

CAP 670 GEN02.11, 02.12, 02.13, 02.14, provides the following safeguarding criteria for ILS Categories (Cat) I, II, III which, in lieu of OEM data, Osprey have applied to the Localiser sites sourced from the AIS⁸.

- Cat I/II: A sector of 750 m radius centred on the localiser and $\pm 60^\circ$ about the runway centreline at ground level, in the direction of the runway threshold.
- Cat I/II: A sector, centred on the localiser, $\pm 15^\circ$ about the runway centreline and 1500 m along the runway, at ground level, in the direction of the runway threshold.
- For Cat III: The above Cat I/II sectors plus two additional sectors:
 - A rectangle 300 m either side of and parallel to the extended runway centreline commencing 100 m behind the respective localiser and extending to 100 m beyond the end of concrete at the landing end of the respective runway. This area is defined at ground level.
 - A volume commencing 100 m from the end of concrete at ground level on a projected 1:50 slope to a range of 1000 m and ± 300 m about the extended runway centreline.

Runway 23R Localiser Cat III.

Figure 4 shows the safeguarding sectors relevant to the Runway 23R localiser. The Cat I/II are shown in yellow for completeness and are not affected by the proposed development. The sector of interest in blue, commencing 100 m from the end of the landing end concrete on a projected 1:50 slope to a range of 1000 m straddles a portion of the development site. The ground level at the start of this sector is 79 m AMSL and due to the 1:50 slope the end of the sector Line of Slope (LoS) is 99 m AMSL. With the height of the building for analysis being 91 m AMSL the development area falls within the safeguarding sector from 850 m to 1000 m where the protected LoS ranges from 96 m to 99 m AMSL. This equates to this part of the development area being 5 m to 8 m below the protected LoS.

⁸ [eAIS Package United Kingdom \(nats.co.uk\)](https://nats.co.uk)



Figure 4 – Runway 23R ILS Localiser safeguarding criteria

Runway 23R Glide Path (GP)

- A sector of 750 m radius $\pm 60^\circ$ about a line originating at the base of the GP aerial parallel to the approach runway centreline

Figure 5 shows there is no infringement of the 750m sector on Runway 23R GP safeguarding criteria (in red) from the proposed building development.

It also shows the IACO Annex 10 Vol 1 worst case critical (blue) and sensitive (yellow) areas for the 23R GP of which there is no infringement on the safeguarding areas.



Figure 5 – Runway 23R ILS Glide Path safeguarding criteria

Runway 05R Localizer/Glide Path and Runway 05LR localizer/Glidepath

There is no impact to the ILS equipment on either the 05L or 05R runways due its orientation.

3.3.2 Distance Measuring Equipment (DME)

CAP 670 GEN02.15 provides the following safeguarding criteria for DME associated with ILS which, in lieu of OEM data, Osprey have applied to the DME sites sourced from the AIS⁹.

- An inverted cone of 500 m radius with a 2% (1:50) slope, originating at the base of the DME aerial.

Runway 05L and 23R DME

Figure 6 shows there is no infringement of the Runway 05L and 23R DME safeguarding criteria from the proposed building development.



Figure 6 – Runway 05L and 23R DME safeguarding criteria

Runway 05L DME

Figure 7 shows there is no infringement of the Runway 05L and 23R DME safeguarding criteria from the proposed building development.

⁹ eAIS Package United Kingdom (nats.co.uk)



Figure 7 – Runway 05R DME safeguarding criteria

3.3.3 Co-located VHF Omnidirectional Range (VOR) and DME

CAP 670 GEN02.18 provides the following safeguarding criteria for DME associated with VOR which, in lieu of OEM data, Osprey have applied to the DME sites sourced from the AIS¹⁰.

- At ground level a circle of 230 m radius from the site centre with a further slope at 2% (1:50) out to 900 m radially from the site centre.

Figure 8 shows there is no infringement of the Co-located VOR and DME safeguarding criteria from the proposed building development.

¹⁰ [eAIS Package United Kingdom \(nats.co.uk\)](https://www.nats.co.uk/eais-package)



Figure 8 – VOR and DME safeguarding criteria

3.4 Surveillance Analysis

3.4.1 Co-mounted PSR/SSR

Due to OEM criteria unavailability for this assessment Osprey supplemented the very generic CAP 670 guidance with technical safeguarding principles gained from experience. Figure 9 shows a typical PSR/SSR safeguarding criteria.

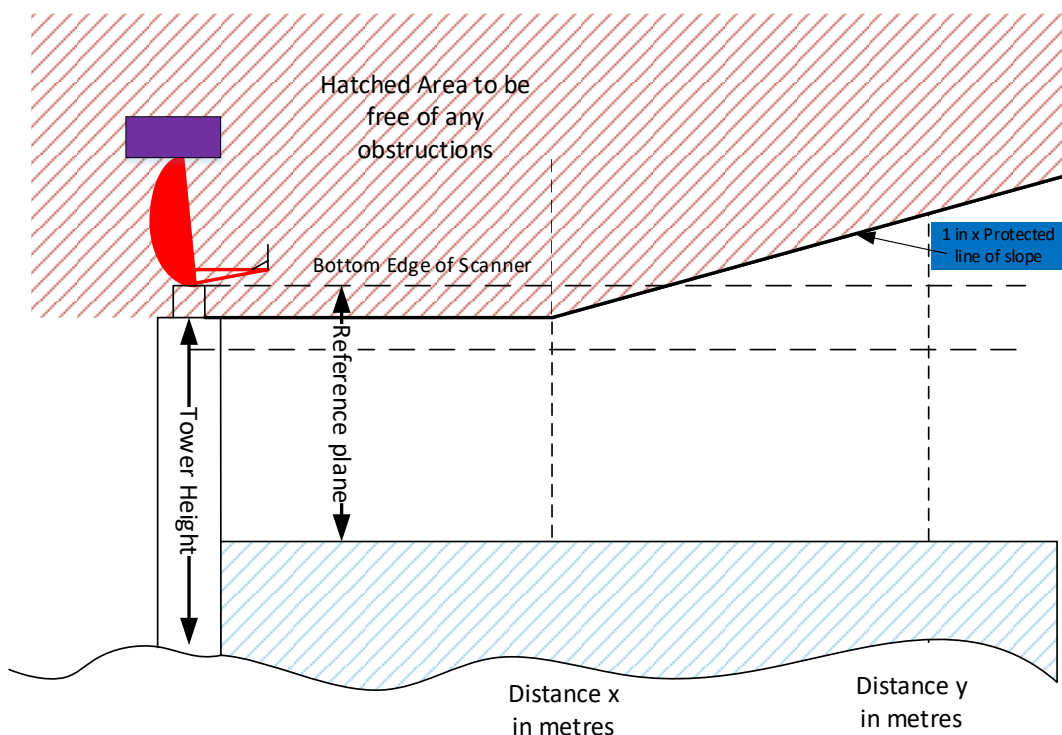


Figure 9 – Typical SSR Safeguarding Criteria

The parameters that Osprey applied to the co-mounted PSR/SSR are based on the siting restrictions highlighted in Figure 9.

From Figure 9 it can be seen the safeguarding criteria can be broken down in to three separate areas and two distances representing the radius of both the LoS origin and the distance out to which the Reference Plane extends. Table 1 below provides the data Osprey have applied to Figure 2.

Item	Explanation
Reference Plane	The Reference Plane starts 12m below the edge of the scanner and extends out horizontally to 240m (Distance Y). No buildings or obstacles with metal in their construction are to protrude above this plane.

Line of slope	The LoS extends out horizontally to 170m (distance X) before a LoS of 1:250 extends out to 240m (Distance Y). No vegetation or metal free buildings are to exceed the LoS. The LoS can extend out beyond 5000m.
Distance X	Radius of 170m
Distance Y	Radius of 240m

Table 1 – Radar Safeguarding Criteria

3.4.2 Radar site data.

Data taken from the Ofcom Protected Radar list¹¹ shows the radar height at 28 m Above Ground Level (AGL), and data from google earth shows the base of the radar is 68 m (AMSL), therefore the radar total height is 96 m (AMSL).

Using the assumed height of 71 m AMSL for the development area and applying the height of 20 m building height across the development area a total height of 91 m AMSL was used for the assessment.

The distance from the radar site to the front of the proposed development area is 3,987 m. The protected LoS at this distance is 111m AMSL; therefore, the height of the development is clear of the protected LoS by 20 metres.

3.4.3 Safeguarding Assessment

As previously stated, the safeguarding assessment is at best informative based on Osprey's experience of Safeguarding Aeronautical Radio Stations, ranging from radar sensors, navigational aids and V/UHF Ground to Air radios alongside the guidance provided in CAP670 GEN02.

To supplement this safeguarding assessment an Intervisibility assessment has been completed on the radar at section 4 of this document.

3.4.4 Surface Movement Radar (SMR)

CAP 670 GEN02.23 provides the following safeguarding criteria for SMR.

- The airport boundary from ground level.

As the development is outside of the airport boundary there is no infringement of the safeguarding criteria.

3.4.5 MLAT

Osprey was unable to locate any safeguarding criteria for the MLAT system within the reference documents. It is understood that the MLAT in use is mainly for ground movements and forms part of the Advanced Surface Movement Guidance and Control System.

¹¹ [Protected Radar list \(ofcom.org.uk\)](https://www.ofcom.gov.uk/consult/condocs/protected/protected.pdf)

Figure 10 shows the locations of the MLAT antennae of which the nearest to the proposed development is 800 m. Osprey assumes the MLAT system is not affected by the proposed development.



Figure 10 – MLAT Antenna System locations

4 Intervisibility Assessment

4.1 Introduction

This section identifies the intervisibility impact on the performance of the Manchester Airport PSR/SSR to the proposed Atlas Business Park Building Development using ATDI HTZ Communications Software. Osprey conducted a series of intervisibility assessments at 200ft AGL to provide further assessment on the potential risk the proposed development poses to radio signal degradation.

The PSR/SSR azimuth bearing range of 35° to 40° out to the proposed development has been included in the models to show the critical area.

4.2 Coverage Diagrams

Figure 11 shows the intervisibility coverage diagrams at 200ft AGL for the PSR/SSR at a height of 28 meters.

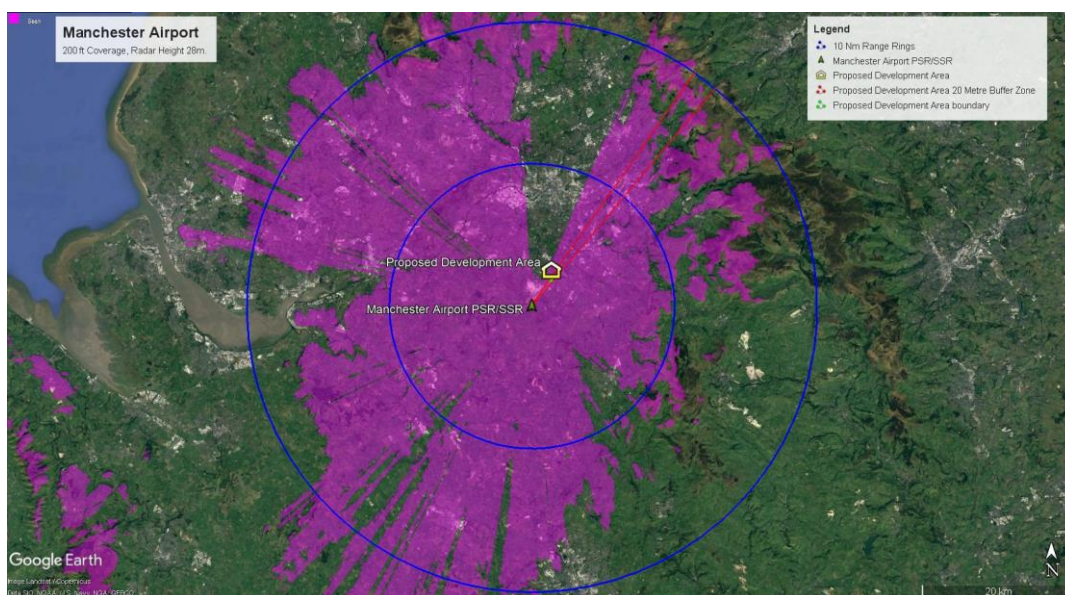


Figure 11 – 200 ft Coverage Without Building – Radar Height 28 m

Figure 12 shows the intervisibility coverage diagrams at 200ft AGL for the PSR/SSR at a height of 28 meters with the proposed development areas set to 91 m AMSL.

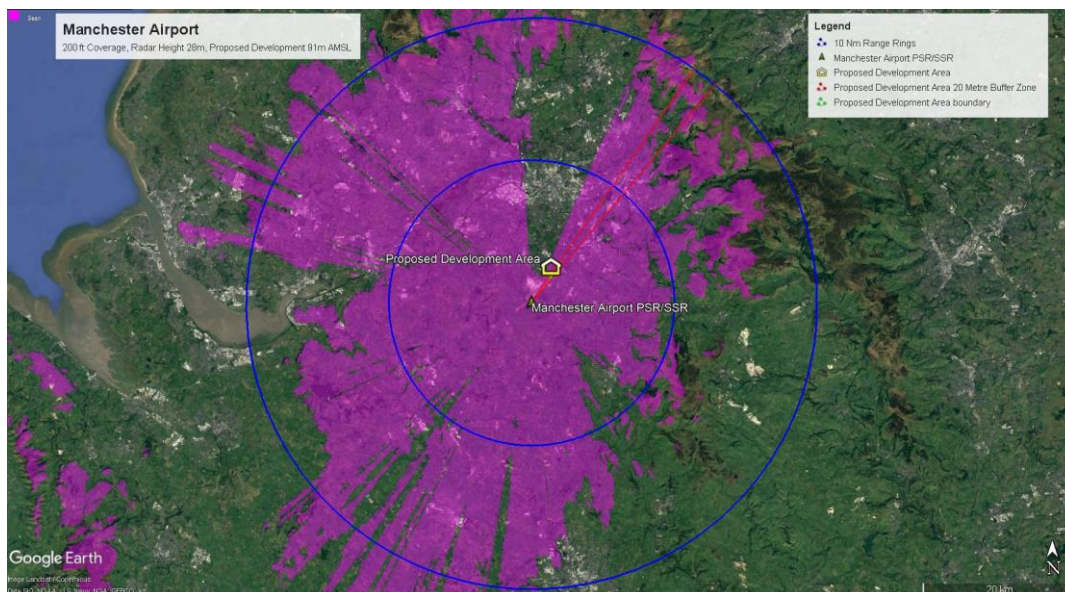


Figure 12 – 200 ft Coverage With Building 91 m AMSL – Radar Height 28

Figure 13 shows the intervisibility coverage diagrams at 200ft AGL for the PSR/SSR at a height of 28 meters with the proposed development areas set to 95 m AMSL.

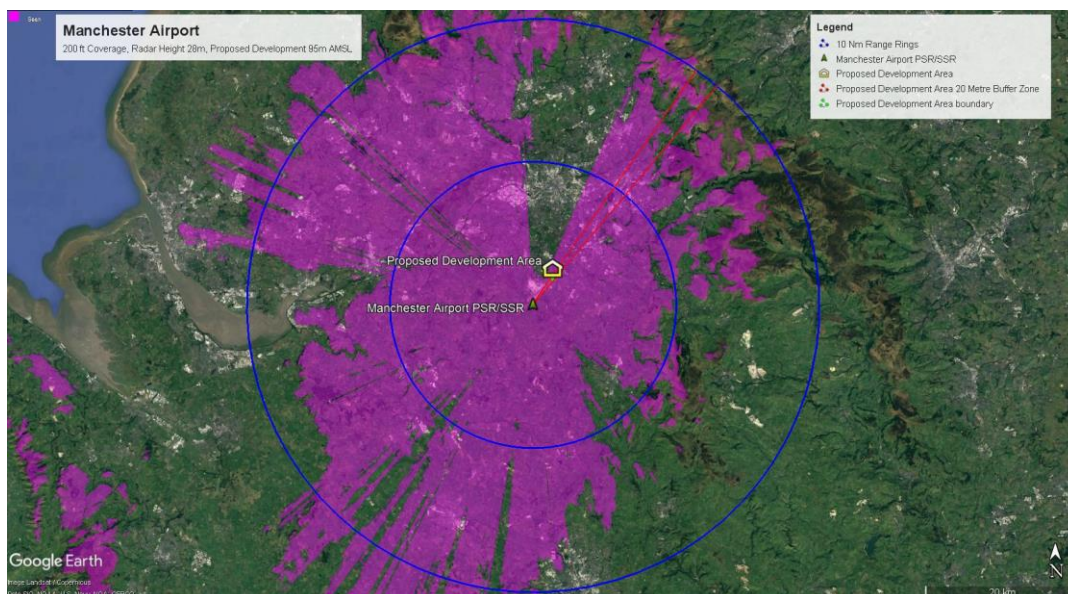


Figure 13 – 200 ft Coverage With Building 95 m AMSL – Radar Height 28 m

Figure 14 shows the intervisibility coverage diagrams at 200ft AGL for the PSR/SSR at a height of 28 meters, zoomed in.

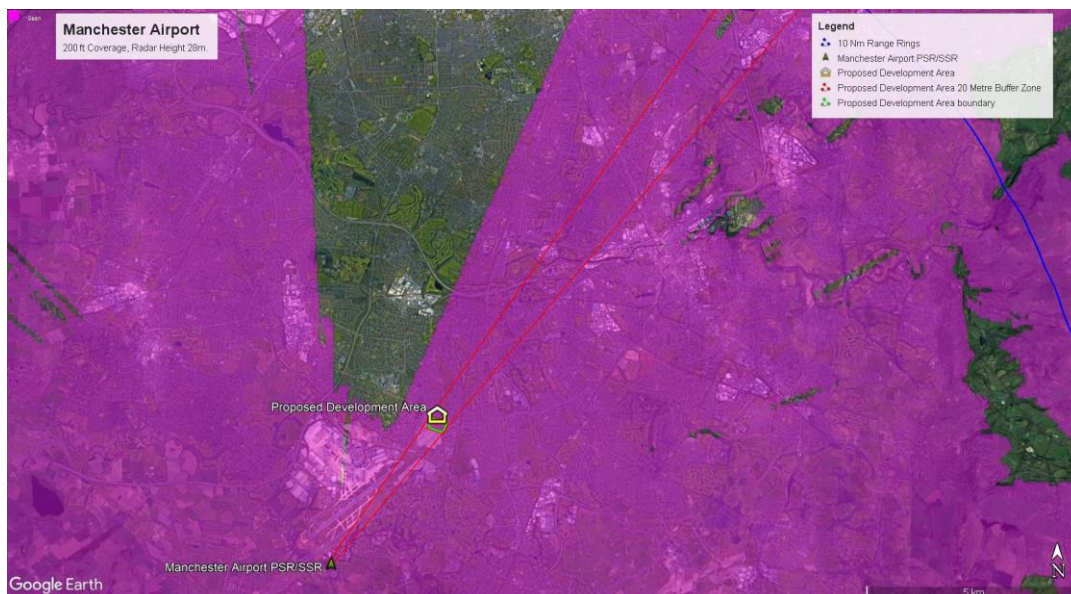


Figure 14 – 200 ft Coverage Without Building – Radar Height 28m zoomed in

Figure 15 shows the intervisibility coverage diagrams at 200ft AGL for the PSR/SSR at a height of 28 meters with the proposed development areas set to 101 m AMSL.

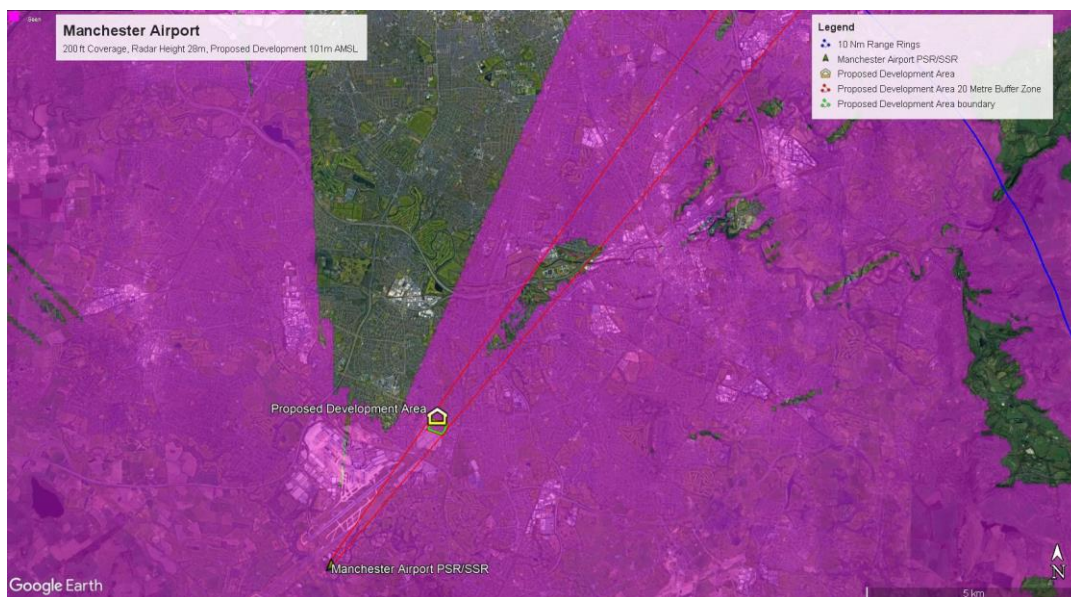


Figure 15 – 200 ft Coverage With Building 101 m AMSL – Radar Height 28m zoomed in

4.3 PSR Coverage Assessment

The intervisibility coverage shown in figures 11-13 indicates that there will be no affect on radar coverage 200ft AGL with the proposed development between 91 m and 95 m AMSL.

Figures 14 and 15 indicate intervisibility differences between the azimuth bearing range of 35° to 40° of the proposed development altitude of 101 m AMSL against no building, for coverage 200ft AGL.

In addition to the effects the hangars will have on the transmitted signal there is also an increased risk to disruption of the received signal in the form of multipath, where multiple targets can be displayed of the same aircraft at different ranges and bearings.

Although it can influence both PSR and SSR, it is more prevalent in SSRs and should also be included as a considering factor during dialogue with Manchester Airport Group.

5 Conclusion and Recommendations

5.1 Conclusion

Osprey concludes that when applying the CAP 670 and ICAO principles described in this document the proposed development does not infringe the safeguarding criteria of the equipment located at Manchester Airport. This indicates the development should have no effect on radar coverage or radio signal degradation.

The report demonstrates that the proposed development is close to infringing the CAP670 safeguarding criteria for Runway 23R ILS Cat III Localiser.

The Intervisibility assessment discussed in section 4 further supports the technical safeguarding assessment in section 3.4 of the development area clearing the protected LoS by 20 metres. It can be clearly seen that the proposed development indicates that there will be no effect on radar coverage, 200ft AGL, with the proposed development area between 91 m and 95 m AMSL. At an altitude of 101m AMSL the development is seen to affect the intervisibility at 200ft AGL coverage.

5.2 Recommendation

Due to the ILS providing precision approach services to aircraft and the development is under the extended runway centre line, where it is close to infringing the CAP670 safeguarding criteria, Osprey recommends that the Runway 23R ILS be reviewed against the OEM criteria with Manchester Airport Group.

If the development moves to the construction phase it should be noted that any machinery that exceeds the agreed safeguarding criteria will require assessment.

The proposed development at Atlas Business Park will comprise of Photovoltaic Panels (PV) at a min of 10% of the outline to the full extent of the roof. Solar panels pose a potential hazard to Air Traffic Control and pilots in the form of glint and glare, depending on the solar panel angle and orientation relative to the sun.

Even though the PV are outside the boundary of Manchester Airport, Osprey recommends that a glint and glare assessment is undertaken.