Solar glare assessment for the proposed development at

Heathrow Flightpath Car Park, Bath Road, Sipson UB7 0DU

Prepared for: LPH UK 1 Ltd ('Lysara')
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1. Executive summary

1.1. Scope

1.1.1. The Applicant is proposing to develop the site to deliver an electric vehicles ('EV') led facility with two principal components, proposed as a hybrid planning application:

- Phase 1 – Detailed element. 76 parking bays, food and beverage ('F&B') unit, welfare building, electric unit area and staff unit.
- Phase 2 – Outline element. Up to 123 parking bays.

1.1.2. The EV-ready parking bays are designed back-to-back to facilitate the future construction of solar canopy structures over the bays, pending a separate planning application. Photovoltaic (PV) panels affixed to the canopies will generate energy that can be utilised and stored on-site.

1.1.3. Hollis has been instructed by LPH UK 1 Ltd ('Lysara') (the Applicant) to assess the potential for solar glare on users of the flight paths adjacent to the development proposals at Heathrow Flightpath Car Park, Bath Road, Sipson Way (the "Development") in relation to the solar PV panels.

1.2. Assessment criteria

1.2.1. In both the UK and the USA, guidelines concerning the interaction between solar PV panels and aviation have been issued by the UK Civil Aviation Authority (CAA) and the US Federal Aviation Administration (FAA). However, the UK guidance provided by the UK CAA is relatively broad and does not outline a specific methodology. As a result, and in the absence of any detailed procedures, Hollis examined broader planning guidelines and relevant existing studies to develop its own approach for assessing glint and glare, utilising the Building Research Establishment's publications on the topic.

1.2.2. The Building Research Establishment (BRE) published information on calculating Solar Glare within paper IP 3/87 "*Solar dazzle reflected from sloping glazed facades*" (April 1987) (the BRE Report) and the methods contained within that Report have been used to establish the likelihood of unacceptable levels of glare occurring.

1.2.3. The BRE Information Paper IP 3-87 States that:

"Glare or dazzle can occur when sunlight is reflected from the glazed façade. For vertical facades this problem usually occurs only when the sun is low in the sky, but some types of modern design incorporate sloping glazed facades which can, under certain circumstances, reflect unwanted high altitude sunlight into the eyes of motorists, pedestrians and people in nearby buildings. Addressed to architects, consulting engineers, planning consultants and planners, this paper presents a new method which can be used at the design stage to calculate whether such solar dazzle will be reflected from a proposed building façade."

1.2.4. The International Commission on Illumination (CIE) 146:2002 Collection on glare also sets out guidance for the likely occurrence of disabling solar glare. This information is detailed in the Principles of Solar Glare within Appendix A of this report.

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1.2.5. The definition of glint and glare is as follows:

- Glint – a momentary flash of bright light typically received by moving receptors or from moving reflectors.
- Glare – a continuous source of bright light typically received by static receptors or from large reflective surfaces.

1.2.6. While the metal structures of a solar array may cause minor glint and glare, the primary source will be the panels themselves, which is the focus of this assessment. Solar panels are designed to absorb maximum light and minimize reflection. However, glint can occur as a brief reflection of the sun from the surface of the Photovoltaic (PV) panel, often described as a momentary flash. This could pose a visual impact and distract vehicle operators.

1.2.7. As no definitive quantitative metrics are provided by the BRE, a qualitative approach based on professional judgement has been applied to derive a measure of disabling glare (as opposed to distracting glare) likely to be caused by the PV panel surfaces of the proposed development reflecting the sun towards the receptors.

1.2.8. In assessing the likely occurrence of solar glare at any given viewpoint, the following metrics are considered:

A. The angle of glare relative to the field of view.
B. The height of the sun above the horizon.
C. The duration of glare expected.
D. Whether the angle of incidence is 'glancing' i.e., angle of incidence is greater than 60 degrees.

1.3. Assessment methodology

1.3.1. The glint and glare assessment methodology has been derived from the information provided Hollis through consultation with stakeholders and by reviewing the available guidance and studies. The methodology for this glint and glare assessment is as follows:

- Identify the receptors in the area surrounding the development
- Review direct solar reflections from the development towards the identified receptors by undertaking geometric calculations using our 3D model
- Consider the visibility of the PV panels from the location of the receptors. If the PV panels are not visible from a receptor, then no reflection can occur
- For the relevant receptors (i.e. those that can see the PV panels) calculate the time and date that a reflection can occur using MBS Solar Glare software within our 3D model.
- Review the analysis and evaluate whether disabling Solar Glare will occur for each receptor location

1.3.2. The assessment has been undertaken to establish when, or if, disabling solar glare will occur as a result of the proposed development and whether it will have any effect on users of the flight paths.

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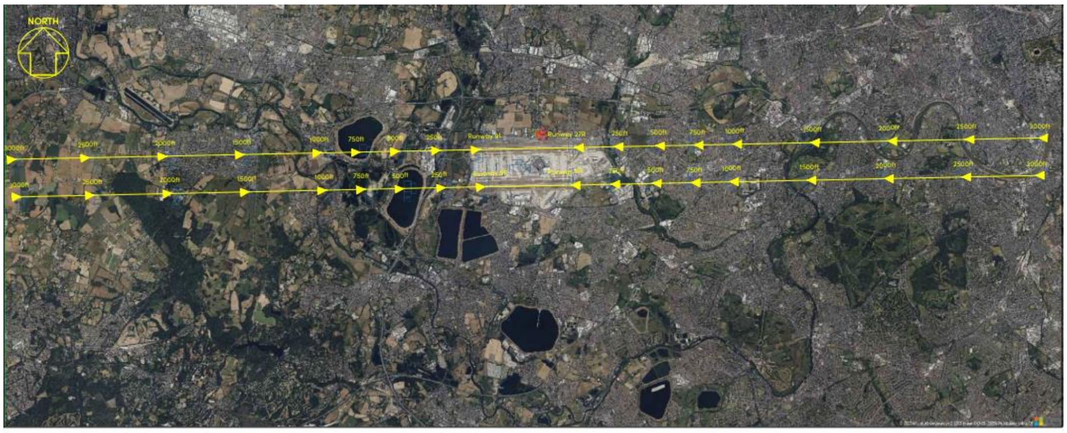
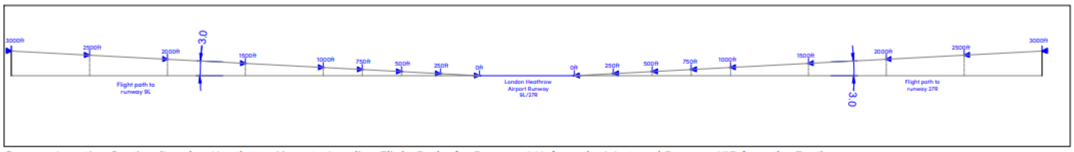
1.3.3. The assessment has been progressed by taking into consideration the movement of the sun in the sky, identifying key locations where solar glare might occur, preparing a three-dimensional CAD model of the structures on the Development Site and assessing the glare from the proposed development likely to be perceived at the assessment points.

<u>Aviation receptors</u>

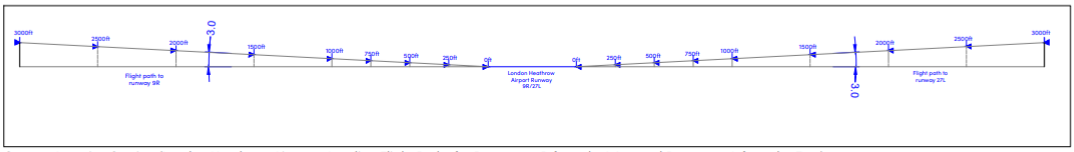
1.3.4. The assessment has been carried out at key locations so that the impact upon all approaches to the proposed development can be considered. The Heathrow Airport landing path locations have been approximately centred on the landing paths for both runways 09L and 27R with a landing angle of 3 degrees[1]. Locations corresponding to heights of 3000, 2500, 2000, 1500, 1000, 750, 500, 250 and 0 feet (runway level) in both directions have been assessed.



Camera Location Plan (London Heathrow Airport - Landing Flight Paths for Runways 09L and 09R from the West and Runways 27L and 27R from the East)



Camera Location Section (London Heathrow Airport - Landing Flight Paths for Runway 09L from the West and Runway 27R from the East)



Camera Location Section (London Heathrow Airport - Landing Flight Paths for Runway 09R from the West and Runway 27L from the East)

1.3.5. We have also undertaken a Solar Glare assessment for the Air Traffic Control Tower (ATCT) having been provided accurate eastings/northings. The height of the ATCT at London Heathrow Airport is 87m above ground level.

[1] https://www.heathrow.com/company/local-community/noise/operations/arrival-flight-paths#:~:text=Heights%20of%20arriving%20aircraft&text=The%20angle%20of%20landing%20for,(Find%20out%20more%20here).

1.3.6. The ATC Tower is approximately 1.5km to the south west of the proposed development site. This is shown on the mapping image below:

Google Maps plan view of distance between ATC Tower and proposed development site.

1.3.7. While we do not have access to a full suite of data regarding the operation of the ATCT, we have reviewed images from the control centre which are shown below:

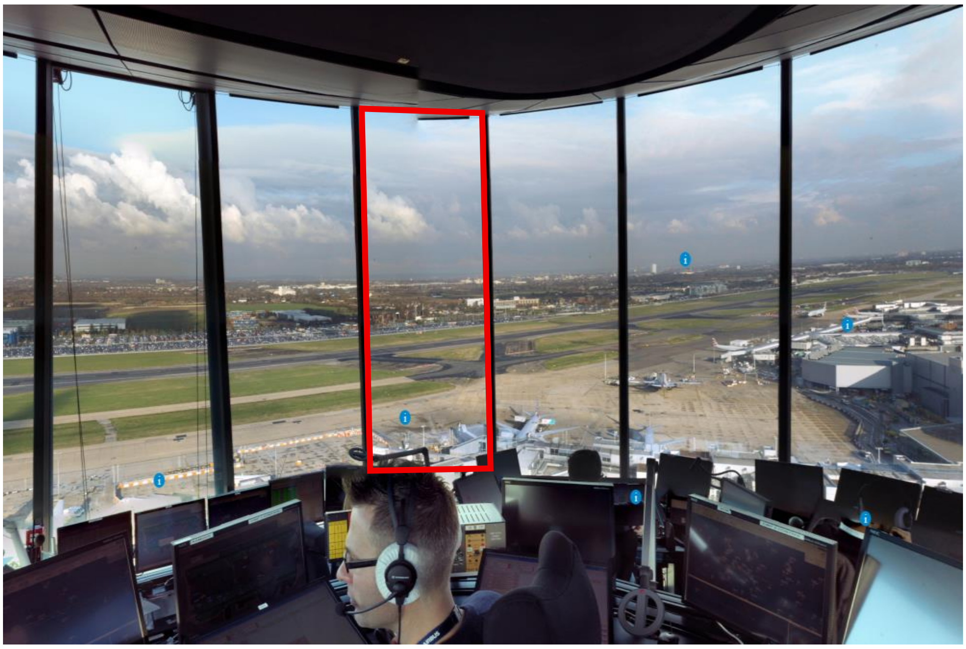


Image from Nats London Heathrow ATC Tower.

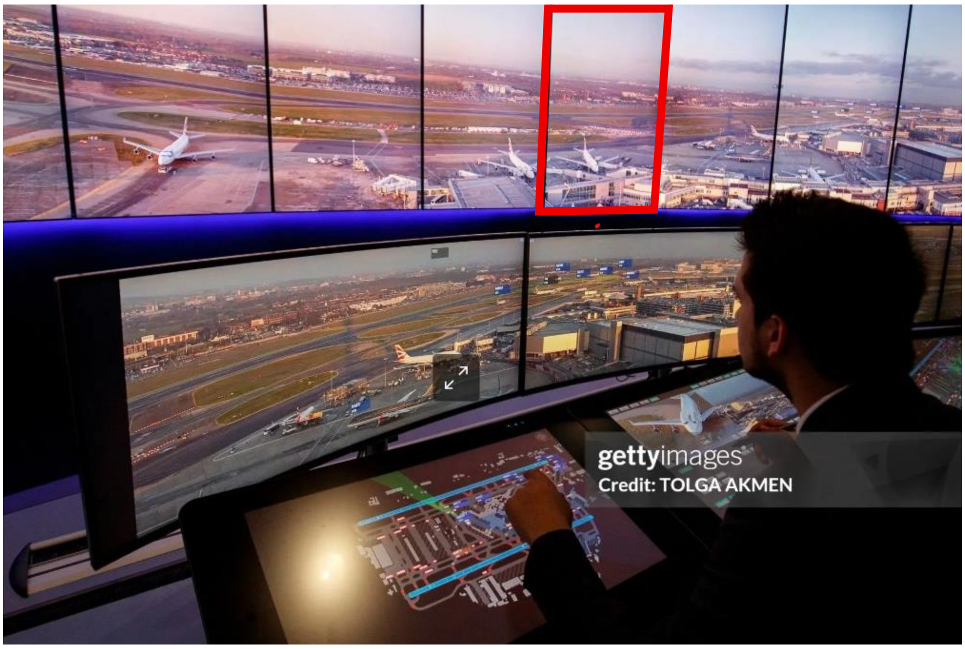


Image from Nats London Heathrow Digital ATC lab.

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1.3.8. These images, captured from the NATS Air Traffic Control Tower and Digital ATC lab at London Heathrow Airport, show the northward view. The red highlighted panels in the images contain the area of the proposed development site, showing the context for assessing the potential impact of solar glare on operational visibility for air traffic controllers and the surrounding flight paths.

1.4. Conclusion

1.4.1. The results of the assessment demonstrate that in overall terms the risk posed by potential solar glare ranges from negligible to low. This is because instances of solar glare arising from the PV panels on the identified receptors are very few in number and duration. Where there is potential for solar reflection, the distance between the receptor and the PV is considered to be far enough from the centre of the field of view to be deemed insignificant.

1.4.2. Based on our assessment, there should be no material instances of disabling glare for users of the flight paths or the ATC tower.

2. Introduction

2.1. Scope

2.1.1. Hollis has been instructed by Lysara to determine the potential for Solar Glare to be experienced by users of the flight paths adjacent to the proposed scheme at Heathrow Flightpath Car Park, Bath Road, Sipson (the "Development").

2.2. Solar glare principles

2.2.1. Glare is the discomfort or impairment of vision caused by excessive or large contrasts in luminance within the observer's field of view. Disabling or Distracting solar glare can occur when sunlight is reflected from a glazed façade. This can affect users outside and the occupants of adjoining buildings.

2.2.2. This is of particular importance when the proposed building is:

- Close to airports
- Adjacent to railways
- At busy road junctions

2.2.3. The International Commission on Illumination (CIE) 146:2002 Collection on glare states sets out guidance for the likely occurrence of disabling solar glare. The Guidance states:

2.2.4. "Disability glare is glare that impairs vision (CIE, 1987). It is caused by scattering of light inside the eye [...]. The veiling luminance of scattered light will have a significant effect on visibility when intense light sources are present in the peripheral visual field and the contrast of objects to be seen is low. "

2.2.5. "Disability glare is most often of importance at night when contrast sensitivity is low and there may well be one or more bright light sources near to the line of sight, such as car headlights, streetlights or floodlights. But even in daylight conditions disability glare may be of practical significance: think of traffic lights when the sun is close to them, or the difficulty viewing paintings hanging next to windows."

2.2.6. "The magnitude of the veiling luminance depends on the intensity and distance of the glare source which together determine the relevant parameter glare, the illuminance at the eye caused by the glare source, and the angle between the glare source and the line of sight."

2.2.7. Glare instances are exacerbated with the effects of age and eye pigmentation which can now be accounted for with more complex formulae. The closer the instance of glare to the line of sight of the viewer, the worse the veiling effect becomes.

2.2.8. There are two categories of glare defined as:

1) Distracting Glare: Excessive brightness of surfaces or luminaires within the field of view. Causes discomfort, does not directly impair vision.
2) Disability Glare: The presence of a high luminance source within a low luminance scene which impairs vision.

2.2.9. Maintaining the visibility of railway operatives, motorists and pilots is the key priority in this location, and therefore disability glare will be the focus of this study.

2.2.10. As stated above, the effect of disability glare impairing vision most noticeably occurs when the incoming ray is close to the line of sight (LoS) of the operative. In the design of road lighting in the UK, disability glare sources are ignored laterally passed 30 degrees of the central line of sight and vertically, past 20 degrees of the central line of site.

2.2.11. Peripheral glare outside of the field of view (FOV) is less likely to cause disability glare and therefore, glare beyond a 25-degree angle to the line of sight can usually be discounted.

2.2.12. The impact of solar glare depends on the level of reflective surfaces. While solar PV panels are designed to absorb sunlight, they can also act as a smooth reflective surface in some conditions. The angle of the sun also plays an important role in the determination of glare.

2.3. Assessment methodology

2.3.1. The potential for disability glare to occur from reflective surfaces has been assessed using bespoke specialist lighting software. The assessment will show the path of the sun for the entire year around the particular development in question.

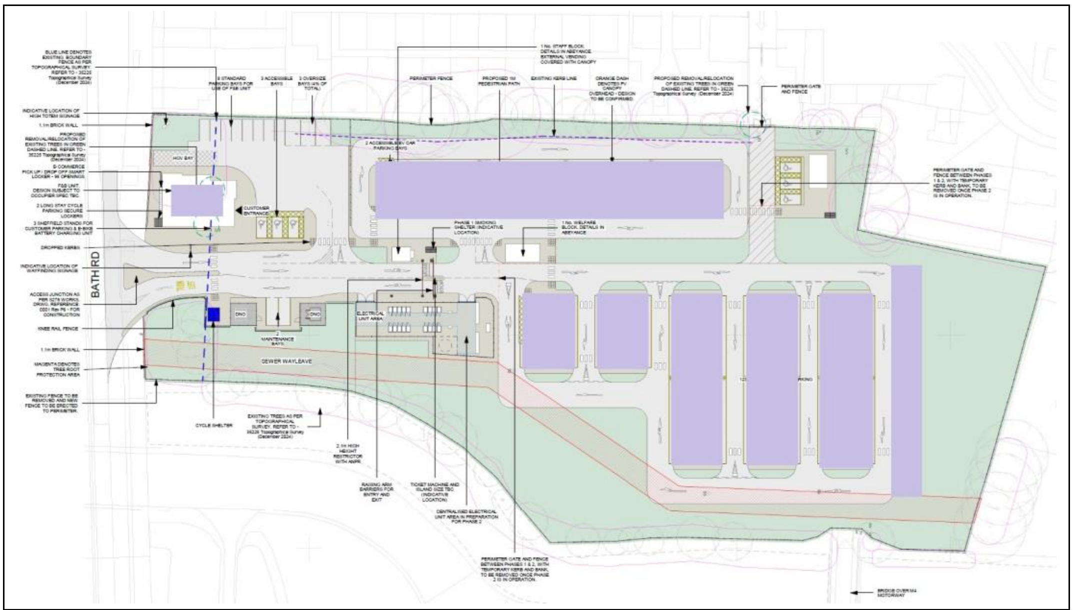
2.3.2. We have received the following documents which have been used in preparing this report:

Title	Date
SMR Architects	
7935-SMR-00-XX-M3-A-9001-S3-P1 SITE.rvt	28 May 2025
7935-SMR-01-XX-M3-A-9002-S3-P1 F&B.rvt	
7935-SMR-02-XX-M3-A-9004-S3-P1 STAFF BLOCK.rvt	
7935-SMR-03-XX-M3-A-9003-S3-P1 WELFARE BLOCK.rvt	
7935-SMR-00-ZZ-DR-A-2001-S3-P2.dwg	
7935-SMR-00-ZZ-DR-A-2002-S3-P3.dwg	
7935-SMR-00-ZZ-DR-A-2003-S3-P5.dwg	
7935-SMR-00-ZZ-DR-A-2004-S3-P6.dwg	
7935-SMR-00-ZZ-DR-A-2006-S3-P1.dwg	
7935-SMR-00-ZZ-DR-A-2007-S3-P1.dwg	
7935-SMR-00-ZZ-DR-A-2008-S3-P1.dwg	
7935-SMR-01-ZZ-DR-A-2101-S3-P1	
7935-SMR-01-ZZ-DR-A-2102-S3-P1.dwg	
7935-SMR-02-ZZ-DR-A-2103-S3-P1.dwg	
7935-SMR-02-ZZ-DR-A-2104-S3-P1.dwg	
7935-SMR-03-ZZ-DR-A-2104-S3-P1.dwg	
7935-SMR-03-ZZ-DR-A-2105-S3-P1.dwg	

2.3.3. Our study has been undertaken by preparing a three-dimensional computer model of the site and surrounding buildings and assessing the effect of the proposed Development at key assessment points.

2.3.4. To aid understanding of the analysis results, we have undertaken detailed computer-based renderings. These show the instances where the sun will be reflected by the proposed Development towards the identified receptors.

2.3.5. The location of the proposed PV arrays are shown on the site plan image below:



Location of PV canopy overhead parking bays

2.3.6. The PV arrays on the roofs of the canopies above the proposed EV parking bays have been assessed for potential glint and glare that may distract aircraft pilots utilising London Heathrow Airport. The BRE guide notes that PV panels are designed to absorb sunlight, so they are in reality less reflective than typical window glazing.

2.3.7. Analysis has been undertaken to establish when, or if, disabling solar glare might potentially occur and whether it will have any effect on neighbouring transport operations, including air traffic.

2.3.8. The assessment has been carried out at a number of key locations so that the impact upon all approaches to the proposed Development can be considered.

2.3.9. The London Heathrow Airport landing path locations have been approximately centred on the landing paths for both runways 09L and 27R with a landing angle of 3 degrees. Locations corresponding to heights of 3,000, 2,500, 2,000, 1,500, 1,000, 750, 500, 250 and 0 feet (runway) in both directions have been assessed.

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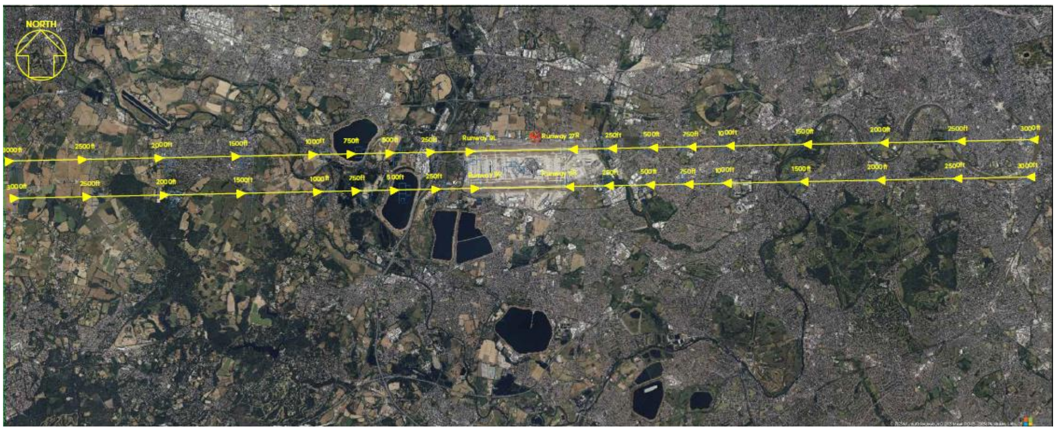
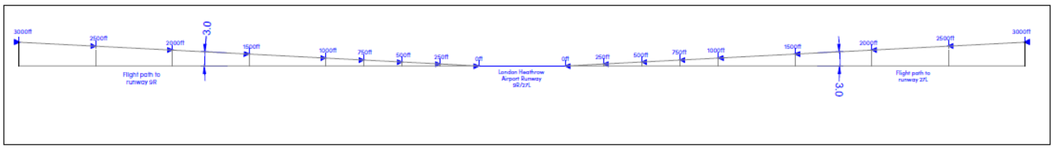
2.3.10. The below images show the selected points in more detail:



Camera Location Plan (London Heathrow Airport – Landing Flight Paths for Runways 09L and 27R)



Plan and elevation view of flight path assessment points.

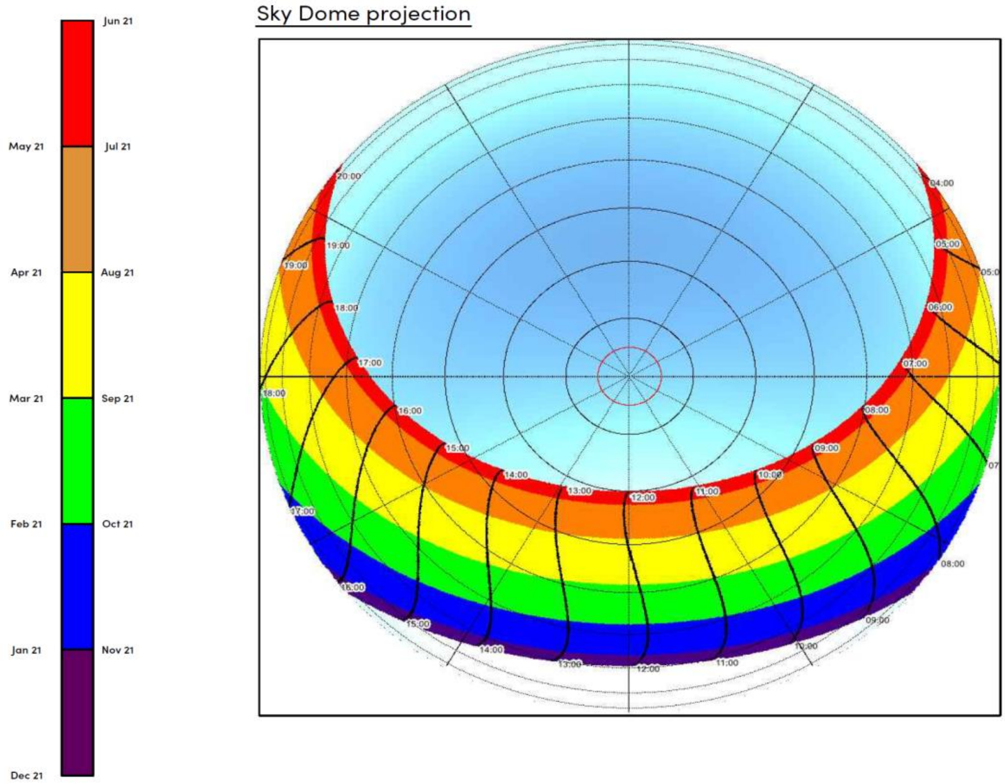
2.3.11. The results of our analysis (presented in Appendix B) have been obtained by plotting the sun's position at which solar reflection can occur onto a template sun-path indicator. The template shows the times of day and the time of year at which sunlight will be in alignment with the development's PV panels and the selected assessment points.

2.3.12. The sun path throughout the year is split into six coloured bands representing its rise from the winter solstice (Dec 21st) to the summer solstice (June 21st). The corresponding decline from mid-summer into winter is simply a reverse of this.

2.3.13. These coloured bands are then projected onto the sky dome, with straight black lines representing a set time interval. The circular black lines represent 10 degree increments from the centre of view, with the red inner circle representing 5 degrees.

2.3.14. The colours do not denote strength of intensity of potential solar glare, they are purely indicators of the months which they represent.

2.3.15. The format is shown on the below graphic:



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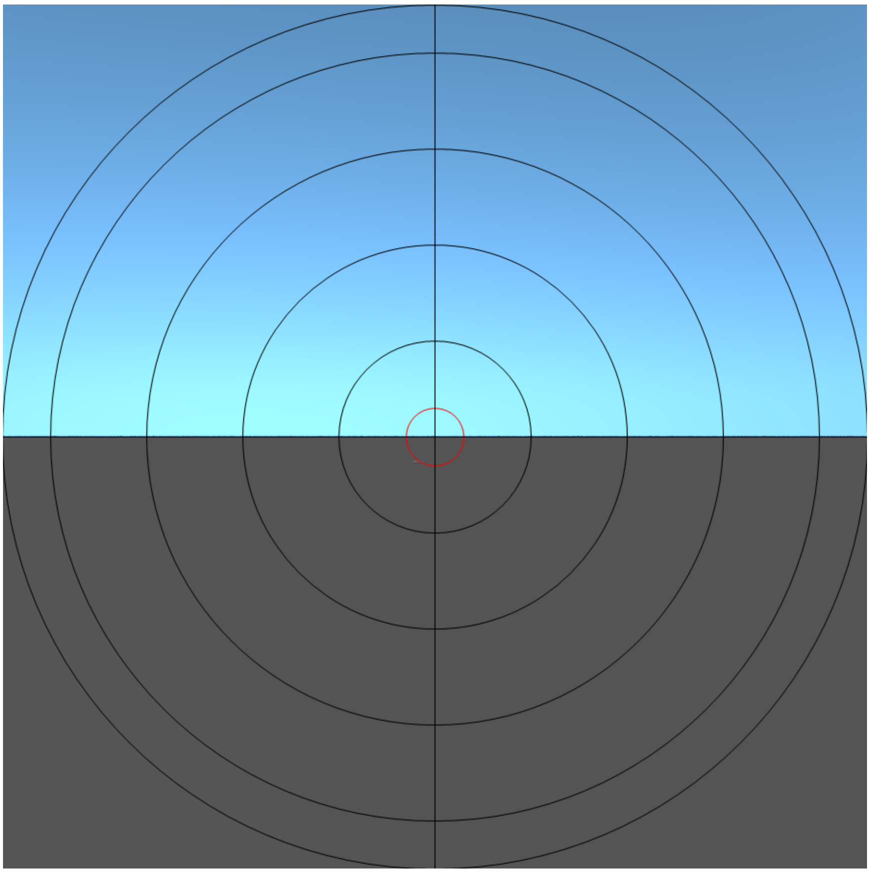
3. Assessment results

3.1. Results

Assessment Point 1 – Flight Path

3.1.1. This assessment point is located at a height of approximately 3,000ft with a landing angle of 3°, facing east approaching runway 09L. Below is an image from the model taken in this location:

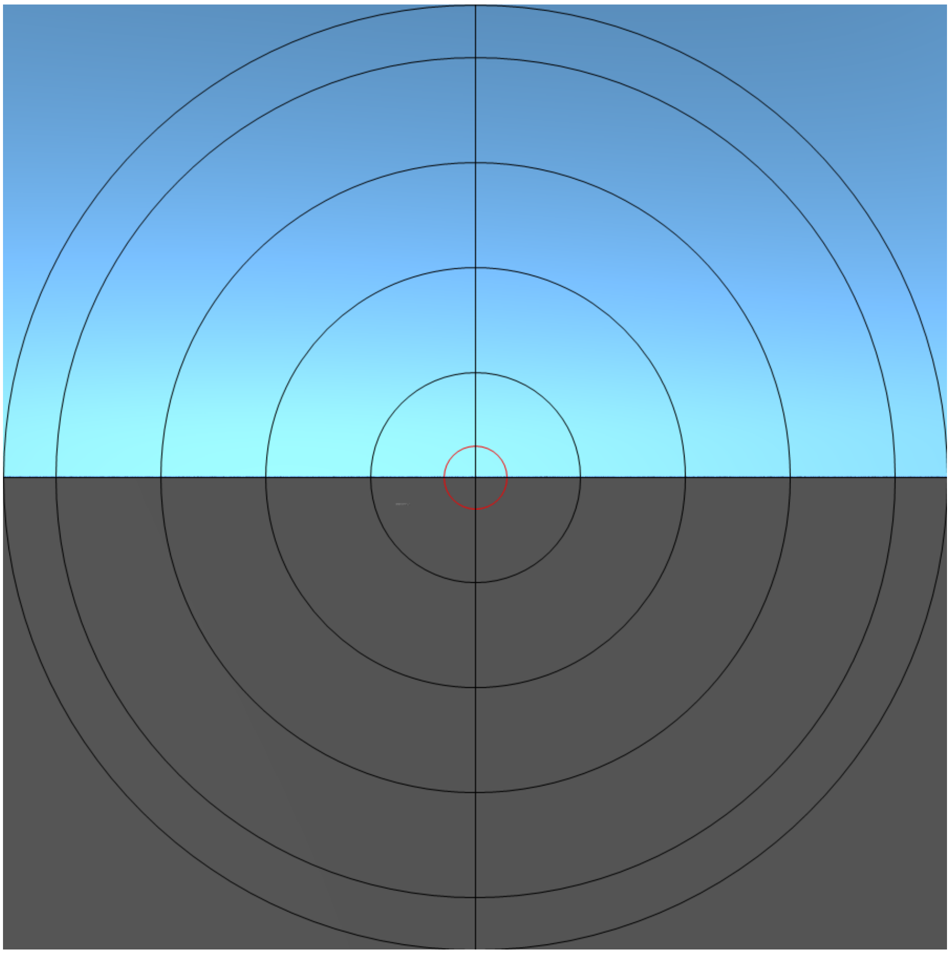


LHR 09L 3000ft

3.1.2. The above diagram shows the site within 10° of the centre of view/line of sight, however the distance to the PV panels is such that the chance of disabling glare is zero.

Assessment Point 2 – Flight Path

3.1.3. This assessment point is located at a height of approximately 2,500ft with a landing angle of 3°, facing east approaching runway 09L. Below is an image from the model taken in this location:

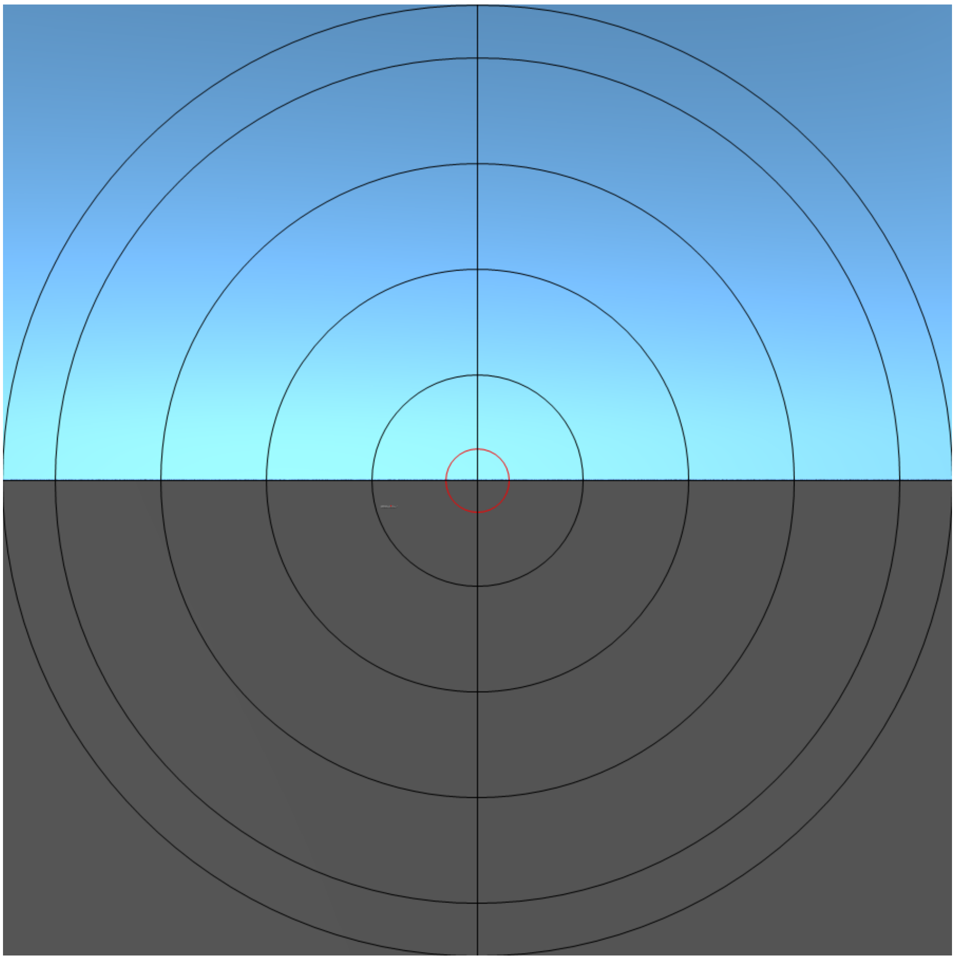


LHR 09L 2500ft

3.1.4. As with Assessment Point 1, the above diagram shows the site within 10° of the centre of view/line of sight, however the distance to the PV panels is such that the chance of disabling glare is zero.

Assessment Point 3 – Flight Path

3.1.5. This assessment point is located at a height of approximately 2,000ft with a landing angle of 3°, facing east approaching runway 09L. Below is an image from the model taken in this location:

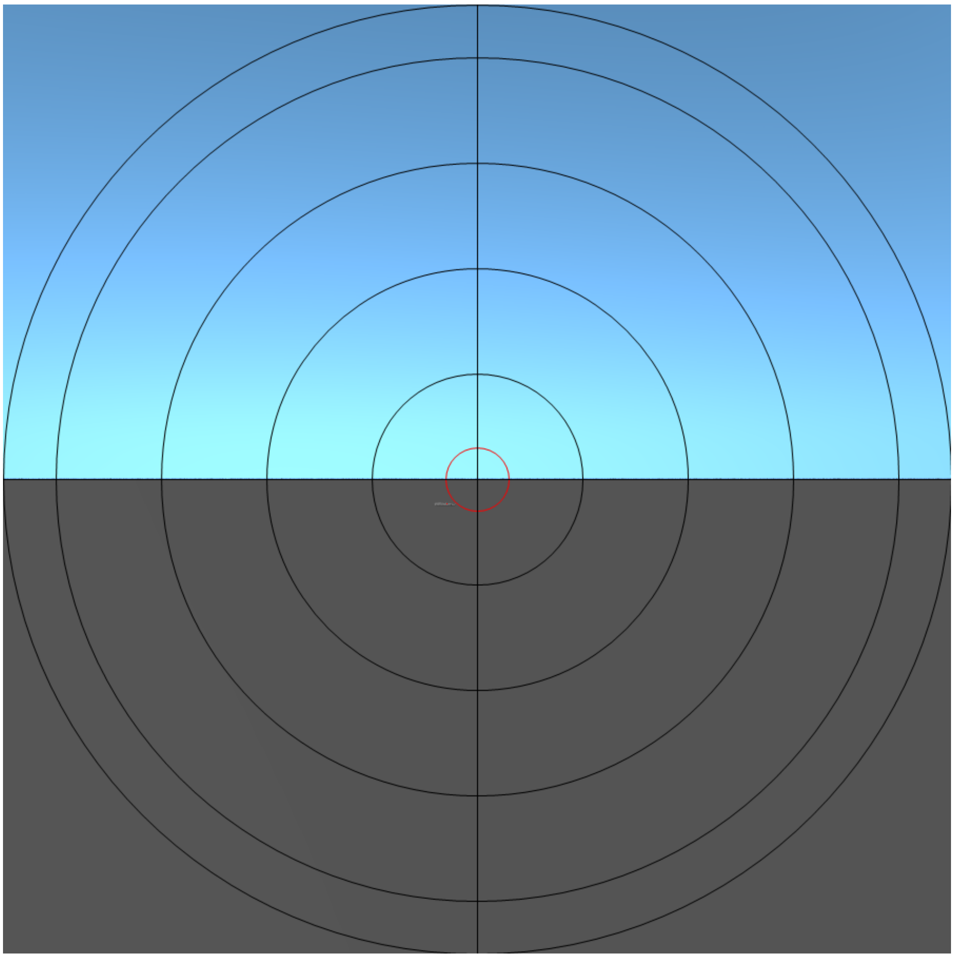


LHR 09L 2000ft

3.1.6. Again, the above diagram shows the site within 10° of the centre of view/line of sight, however the distance to the PV panels is such that the chance of disabling glare is zero.

Assessment Point 4 – Flight Path

3.1.7. This assessment point is located at a height of approximately 1,500ft with a landing angle of 3°, facing east approaching runway 09L. Below is an image from the model taken in this location:

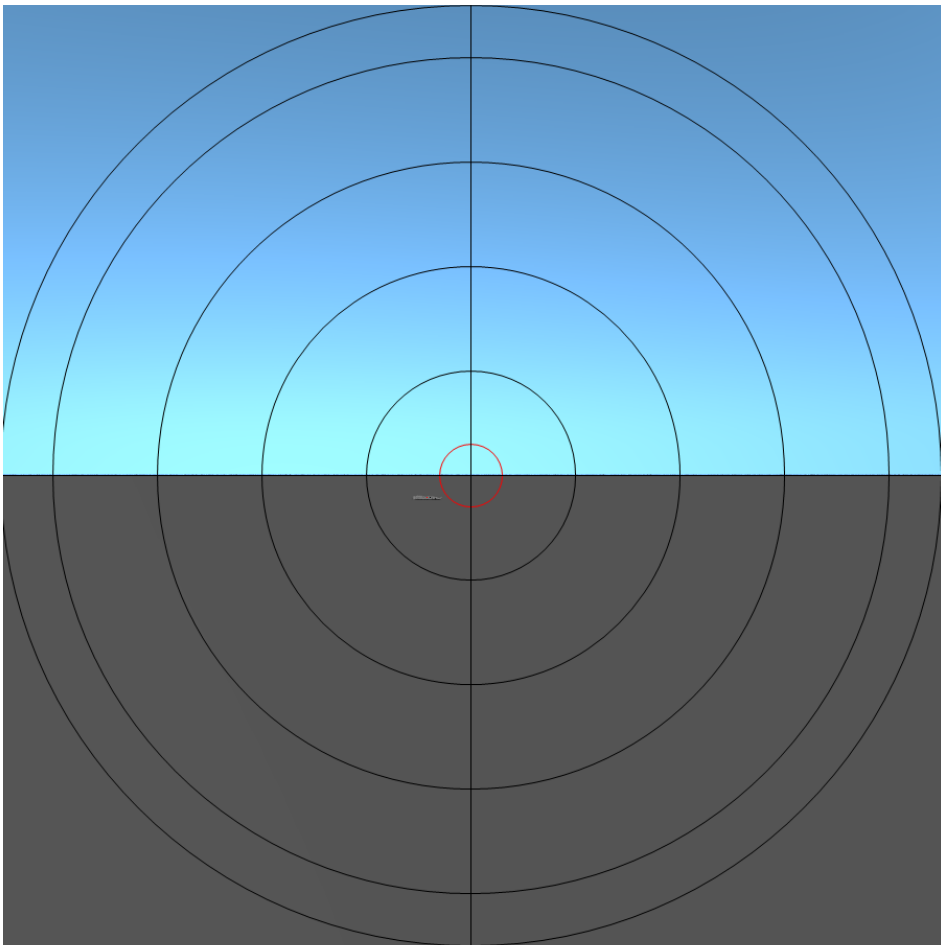


LHR 09L 1500ft

3.1.8. The above diagram shows that no potential solar glare exists at this point and therefore the proposed development will have no impact on visibility of the runway or the signals.

Assessment Point 5 – Flight Path

3.1.9. This assessment point is located at a height of approximately 1,000ft with a landing angle of 3°, facing east approaching runway 09L. Below is an image from the model taken in this location:

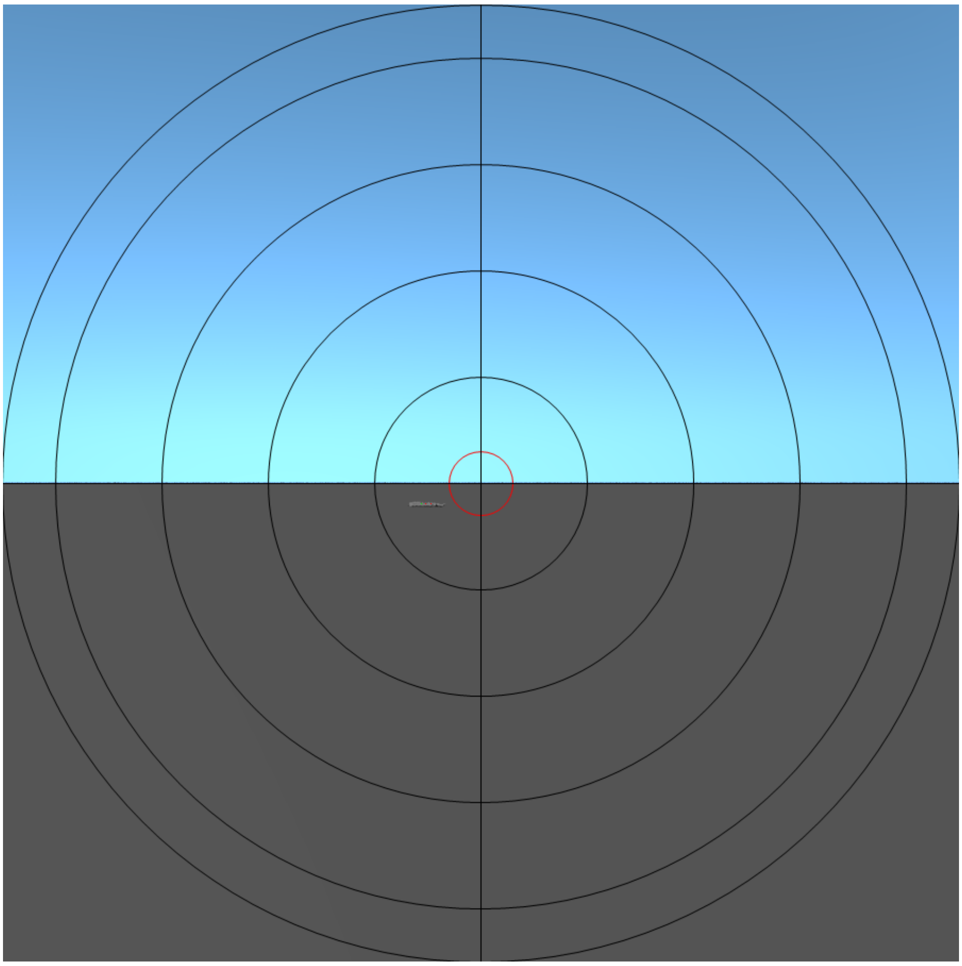


LHR 09L 1000ft

3.1.10. As with Assessment Point 4, the above diagram shows that no potential solar glare exists at this point and therefore the proposed development will have no impact on visibility of the runway or the signals.

Assessment Point 6 – Flight Path

3.1.12. This assessment point is located at a height of approximately 750ft with a landing angle of 3°, facing east approaching runway 09L. Below is an image from the model taken in this location:

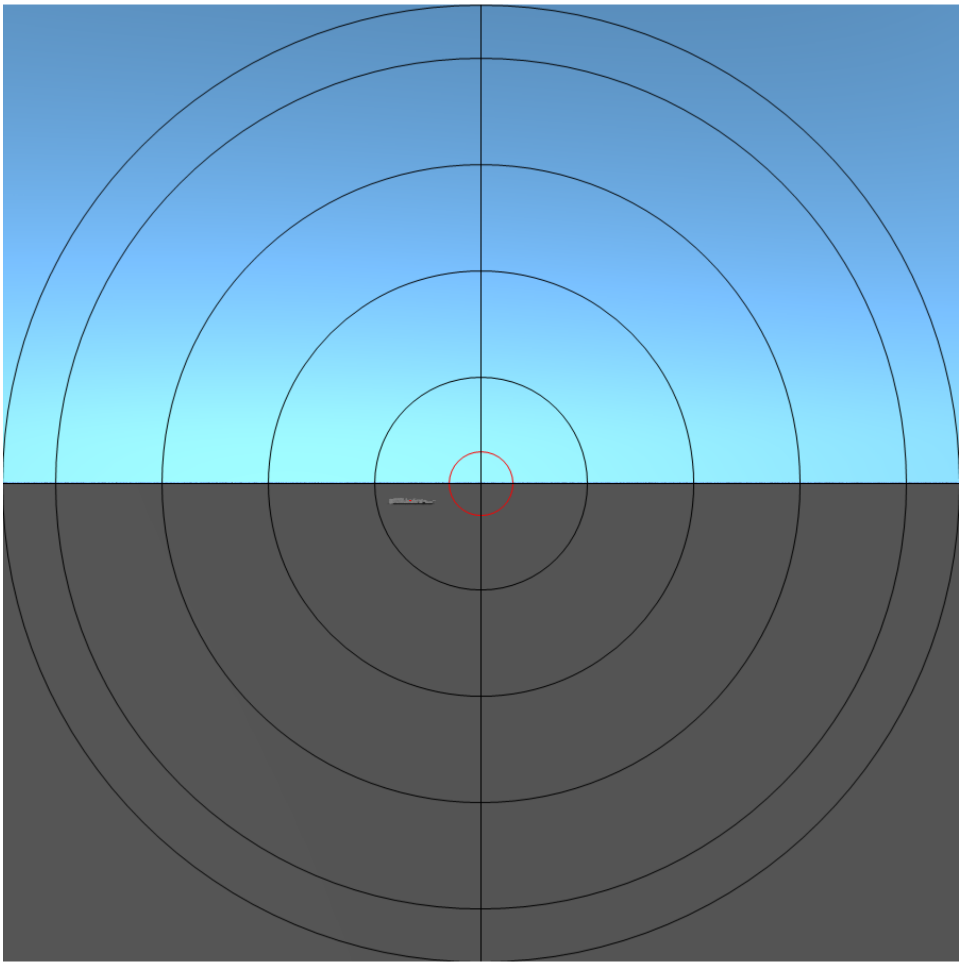


LHR 09L 750ft

3.1.13. The above diagram shows the site within 10° of the centre of view/line of sight, however the distance to the PV panels is such that the chance of disabling glare is zero.

Assessment Point 7 – Flight Path

3.1.14. This assessment point is located at a height of approximately 500ft with a landing angle of 3°, facing east approaching runway 09L. Below is an image from the model taken in this location:

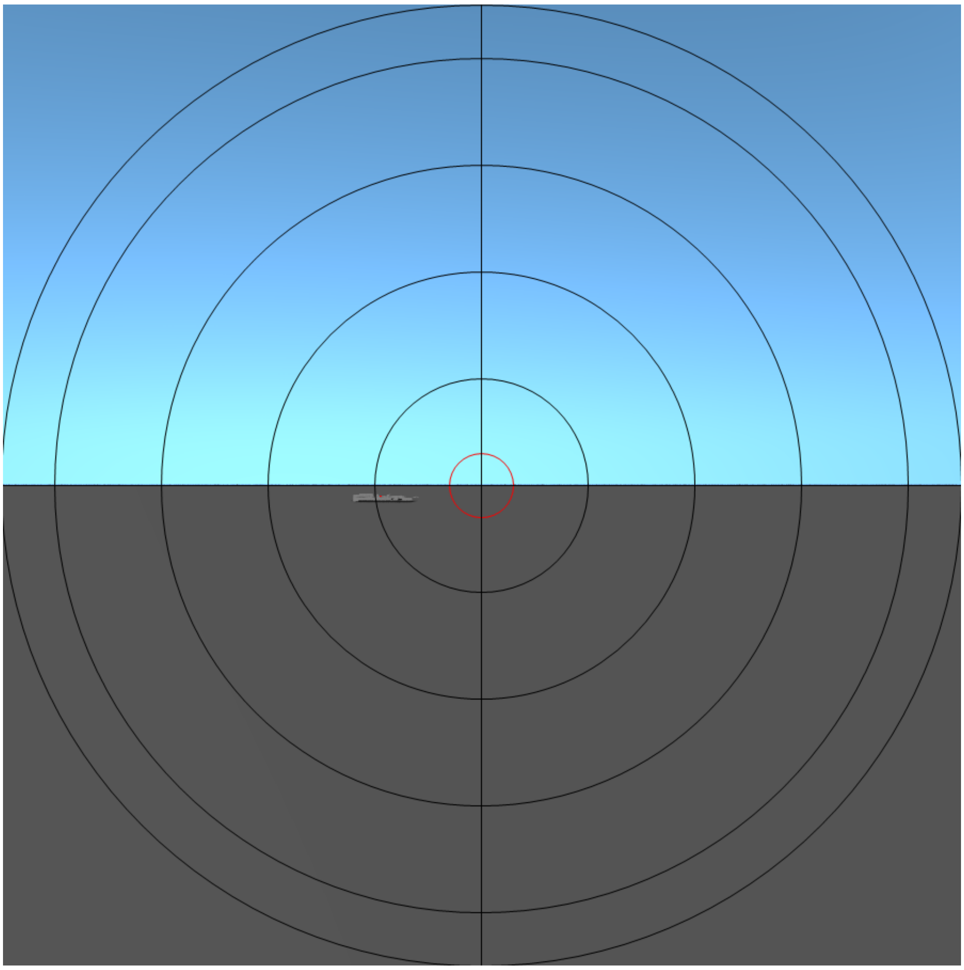


LHR 09L 500ft

3.1.15. Again, the above diagram shows the site within 10° of the centre of view/line of sight, however the distance to the PV panels is such that the chance of disabling glare is zero.

Assessment Point 8 – Flight Path

3.1.16. This assessment point is located at a height of approximately 250ft with a landing angle of 3°, facing east approaching runway 09L. Below is an image from the model taken in this location:

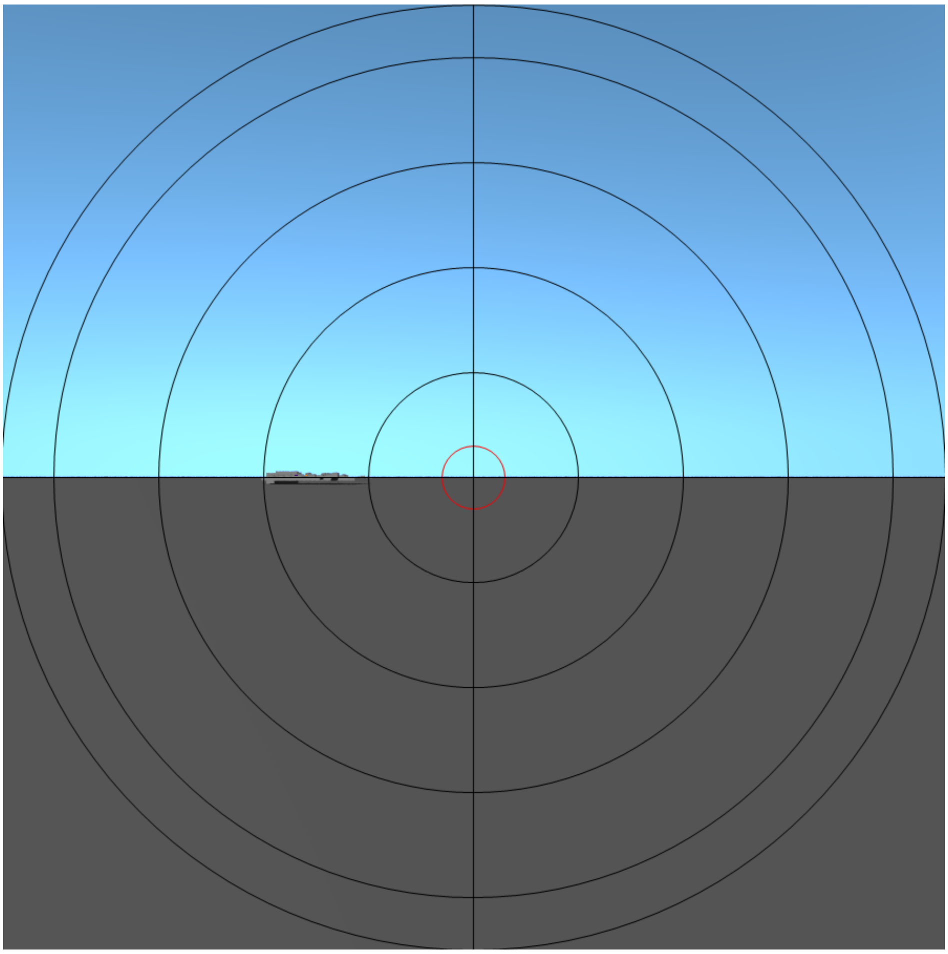


LHR 09L 250ft

3.1.17. The above diagram shows that no potential solar glare exists at this point and therefore the proposed development will have no impact on visibility of the runway or the signals.

Assessment Point 9 – Flight Path

3.1.19. This assessment point is located at a height of approximately 0ft (runway level) with a landing angle of 3°, facing east approaching runway 09L. Below is an image from the model taken in this location:



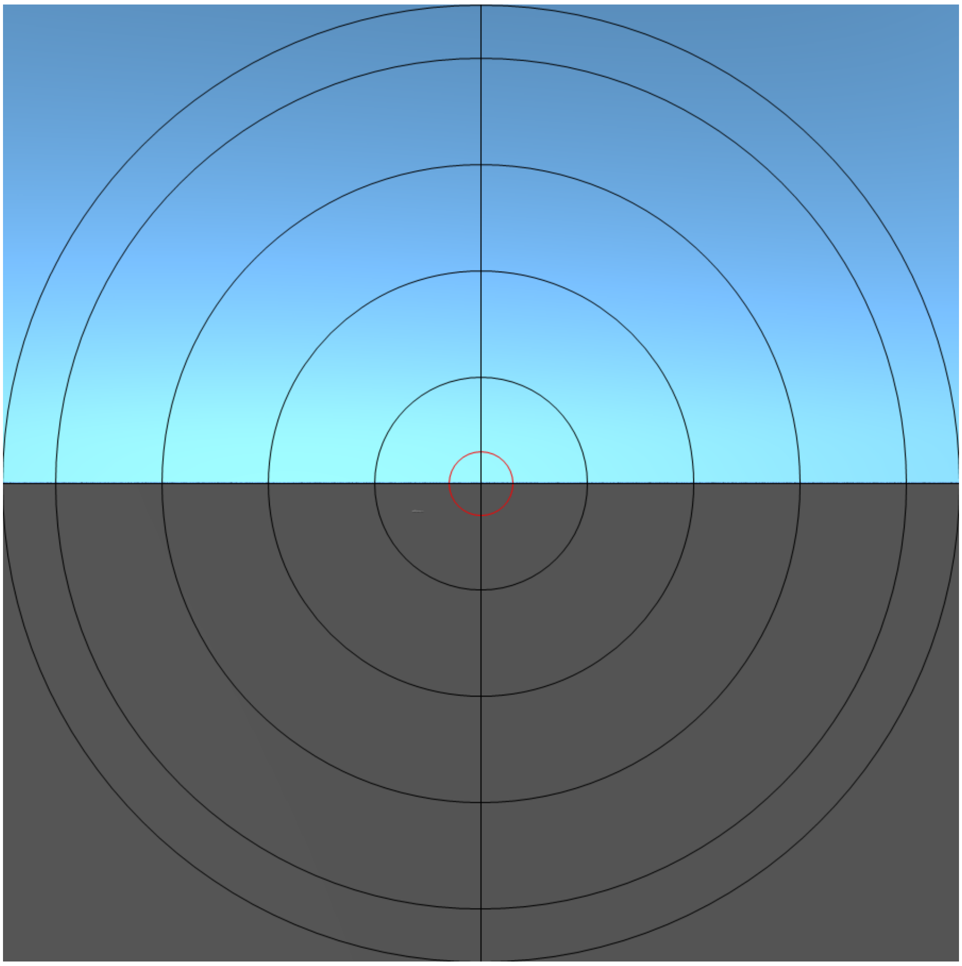
LHR 09L Runway Level

3.1.20. The above diagram shows the site within 10 to 20° of the centre of view/line of site, and the potential for solar glare between 5am and 6am in April and August for a total glare duration of 4 minutes based on a clear sky.

3.1.21. Given the duration of potential glare and the conditions required, the chance of disabling glare is small.

Assessment Point 10 – Flight Path

3.1.22. This assessment point is located at a height of approximately 3,000ft with a landing angle of 3°, facing west approaching runway 09R. Below is an image from the model taken in this location:

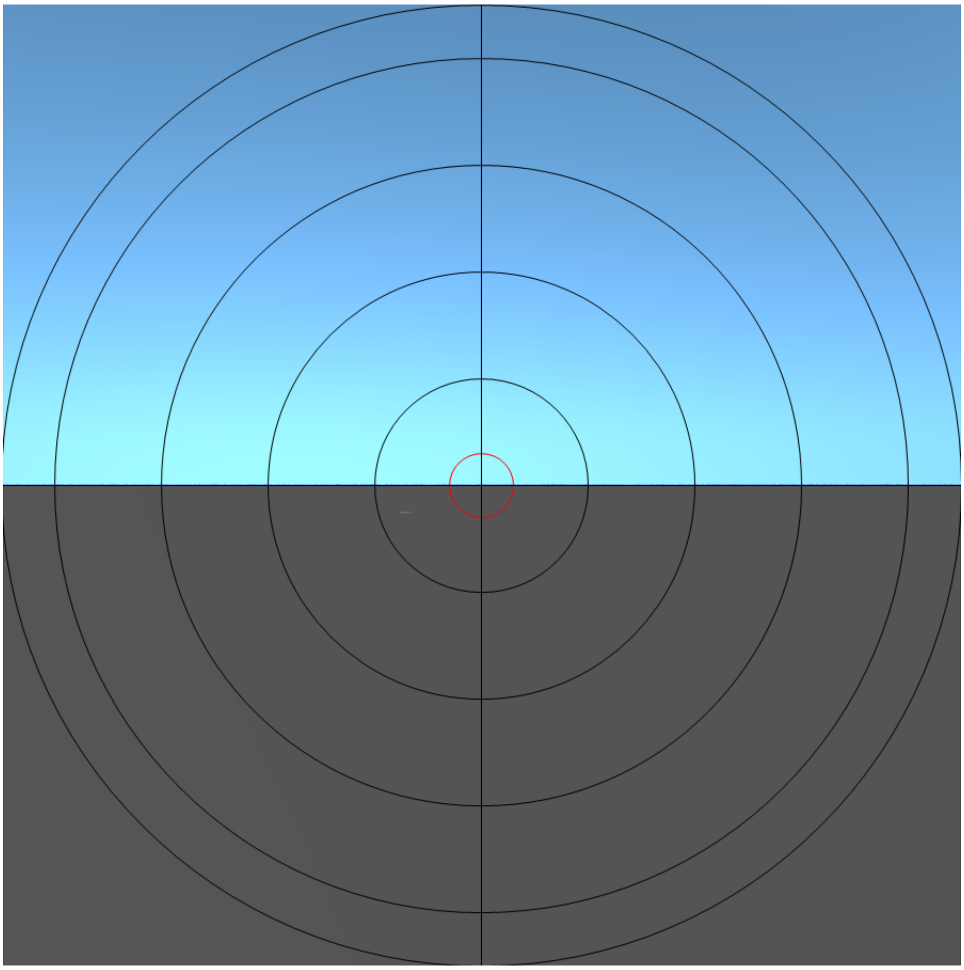


LHR 09R 3000ft

3.1.23. The above diagram shows the site within 10° of the centre of view/line of sight, however the distance to the PV panels is such that the chance of disabling glare is zero.

Assessment Point 11 – Flight Path

3.1.24. This assessment point is located at a height of approximately 2,500ft with a landing angle of 3°, facing west approaching runway 09R. Below is an image from the model taken in this location:



LHR 09R 2500ft

3.1.25. The above diagram shows the site within 10° of the centre of view/line of sight, however the distance to the PV panels is such that the chance of disabling glare is zero.

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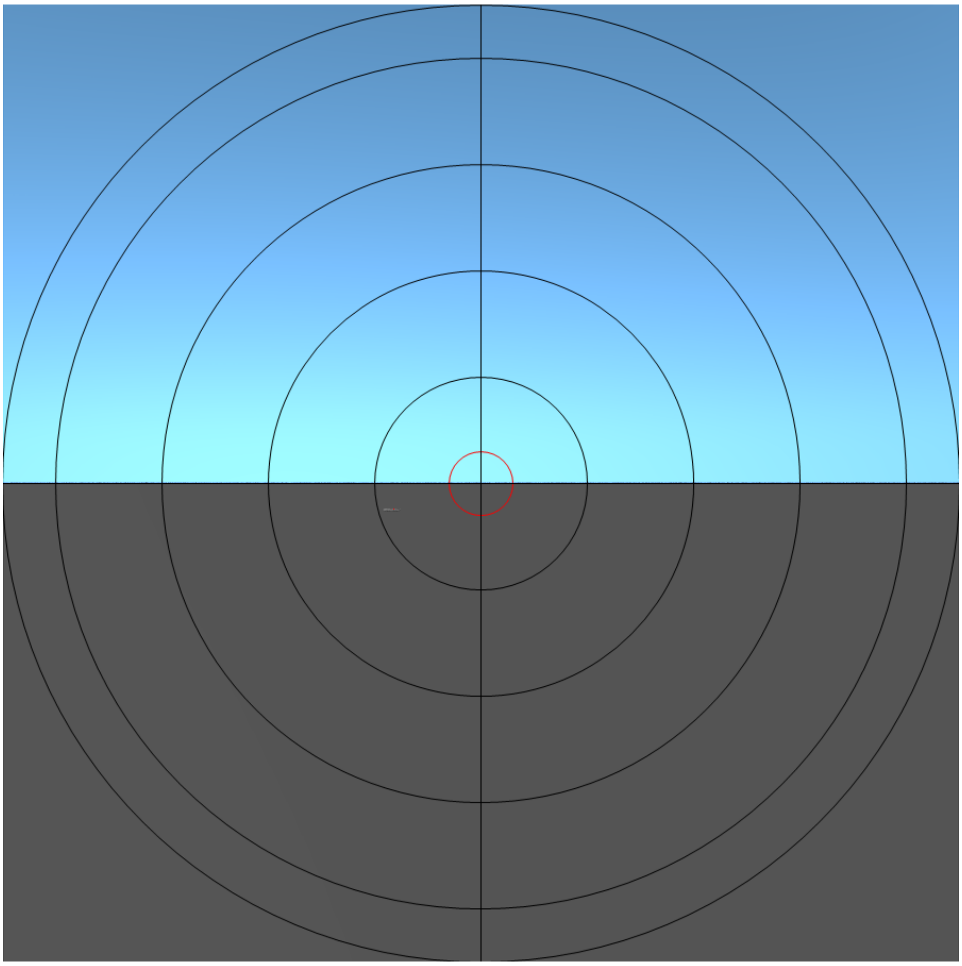
Assessment Point 12 – Flight Path

3.1.26. This assessment point is located at a height of approximately 2,000ft with a landing angle of 3°, facing west approaching runway 09R. Below is an image from the model taken in this location:

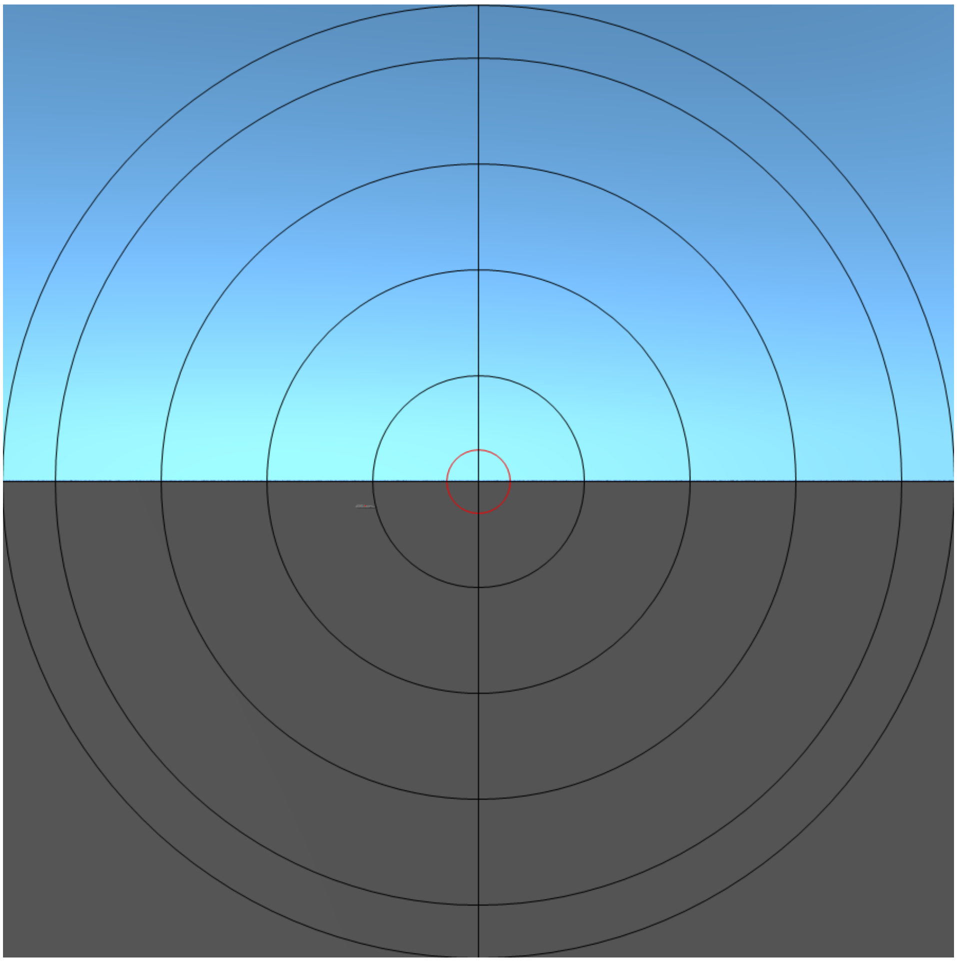


LHR 09R 2000ft

3.1.27. As with Assessment Points 10 and 11, the above diagram shows the site within 10° of the centre of view/line of sight, however the distance to the PV panels is such that the chance of disabling glare is zero.

Assessment Point 13 – Flight Path

3.1.28. This assessment point is located at a height of approximately 1,500ft with a landing angle of 3°, facing west approaching runway 09R. Below is an image from the model taken in this location:

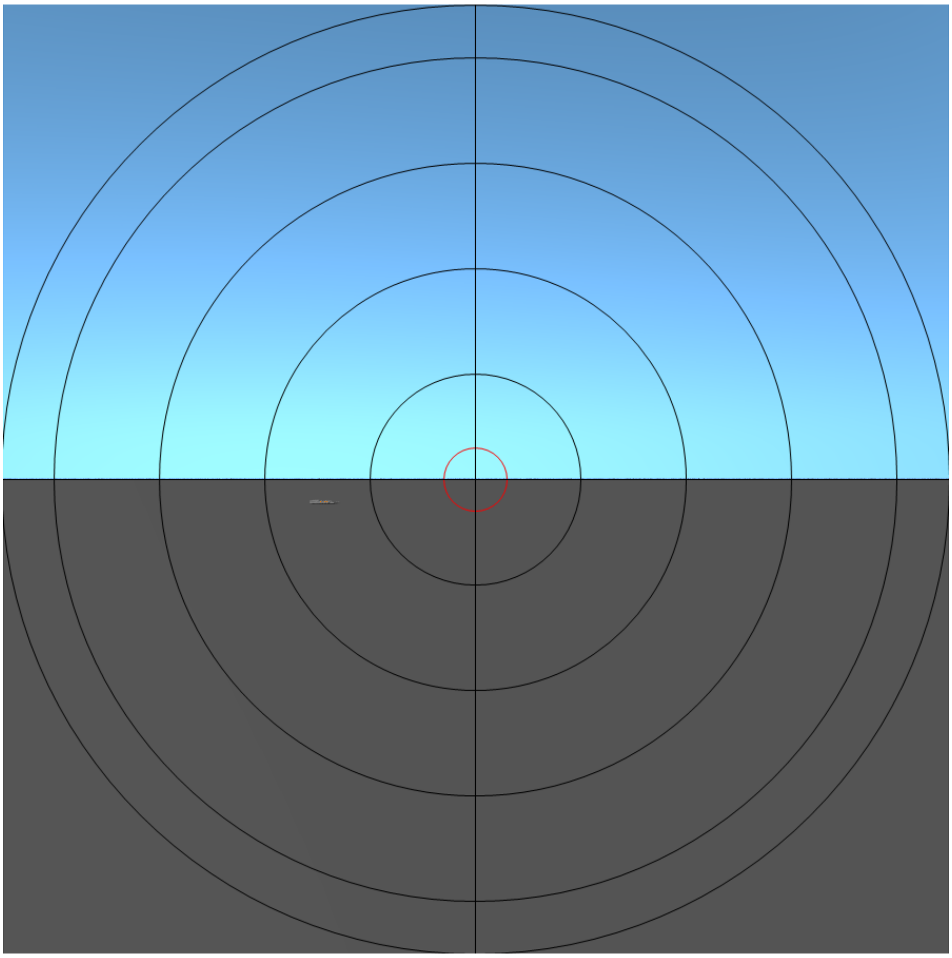


LHR 09R 1500ft

3.1.29. Again, the above diagram shows the site within 10 - 20° of the centre of view/line of sight, however the distance to the PV panels is such that the chance of disabling glare is zero.

Assessment Point 14 – Flight Path

3.1.30. This assessment point is located at a height of approximately 1,000ft with a landing angle of 3°, facing west approaching runway 09R. Below is an image from the model taken in this location:

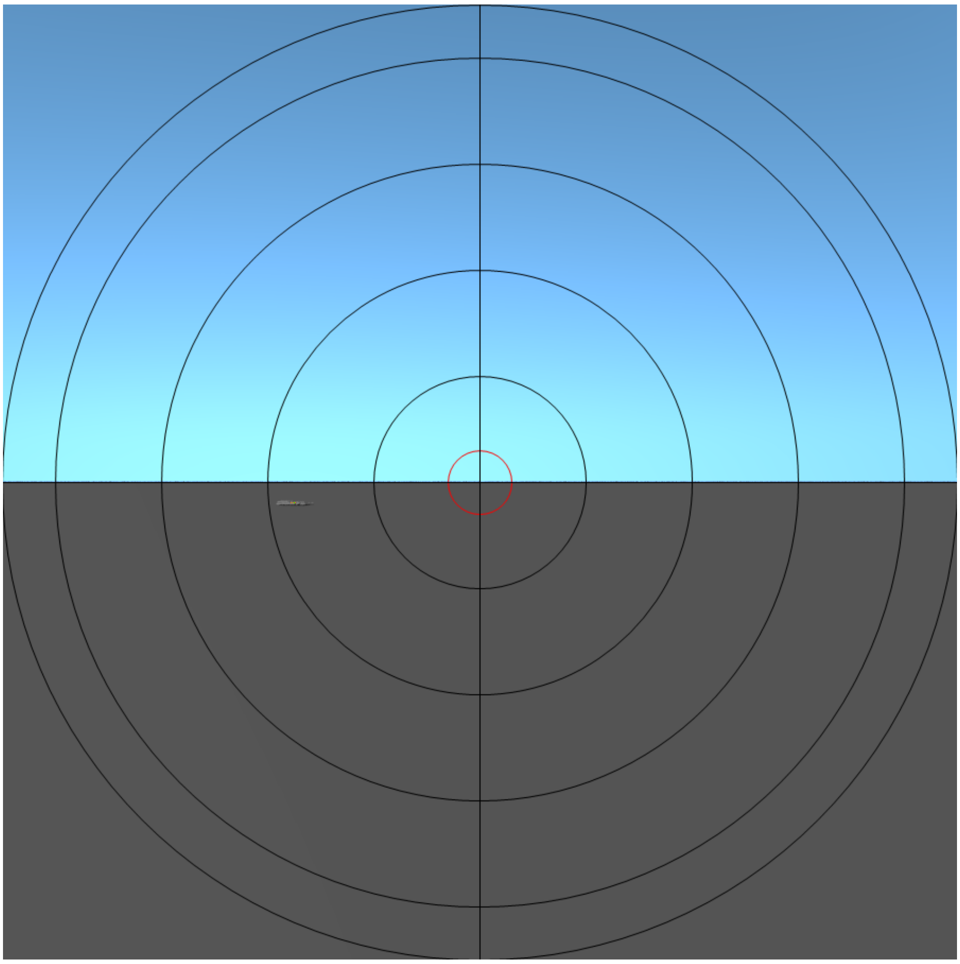


LHR 09R 1000ft

3.1.31. The above diagram shows that no potential solar glare exists at this point and therefore the proposed development will have no impact on visibility of the runway or the signals.

Assessment Point 15 – Flight Path

3.1.32. This assessment point is located at a height of approximately 750ft with a landing angle of 3°, facing west approaching runway 09R. Below is an image from the model taken in this location:

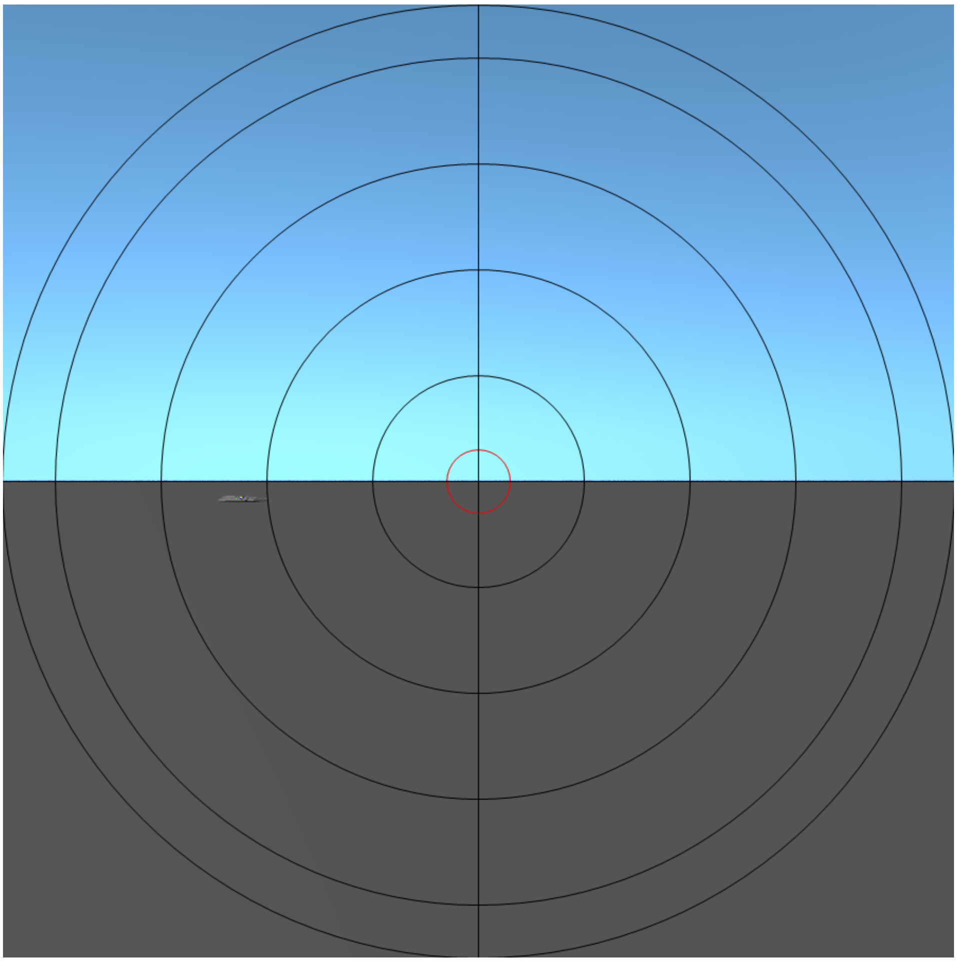


LHR 09R 750ft

3.1.33. The above diagram shows the site within 10-20° of the centre of view/line of sight, however the distance to the PV panels is such that the chance of disabling glare is small.

Assessment Point 16 – Flight Path

3.1.34. This assessment point is located at a height of approximately 500ft with a landing angle of 3°, facing west approaching runway 09R. Below is an image from the model taken in this location:

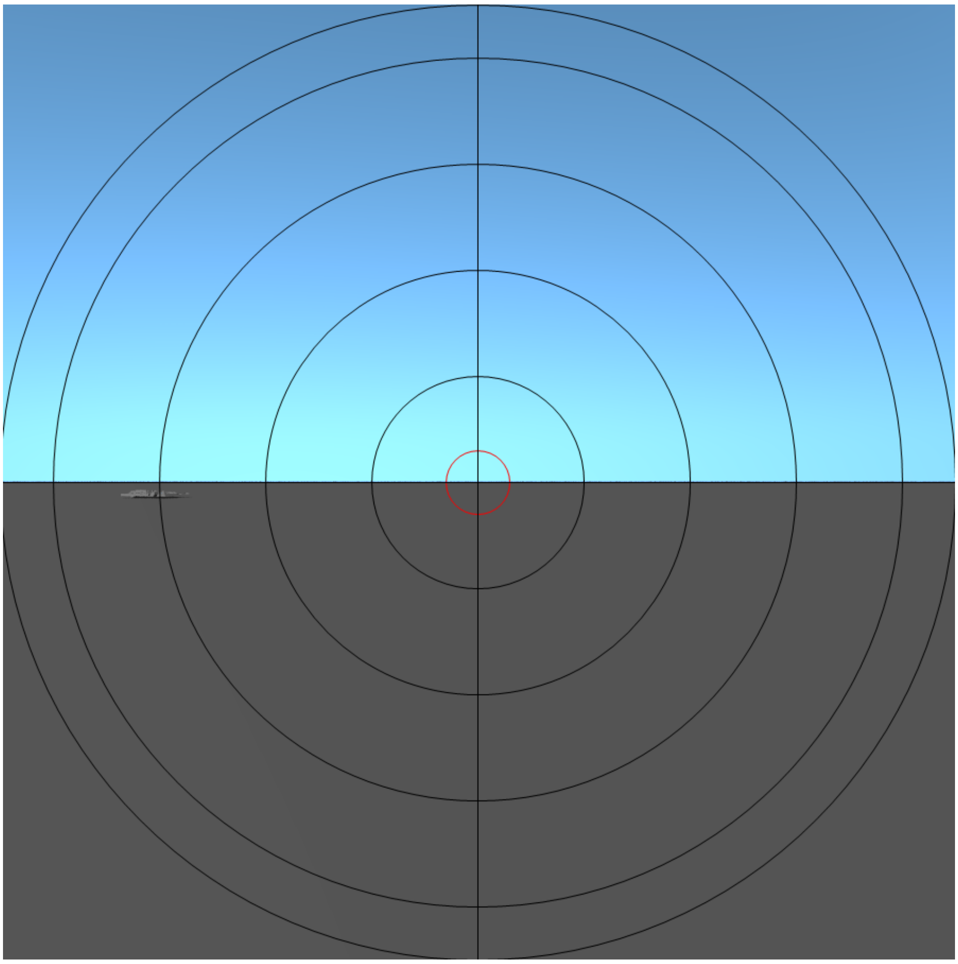


LHR 09R 500ft

3.1.35. Again, the above diagram shows that no potential solar glare exists at this point and therefore the proposed development will have no impact on visibility of the runway or the signals.

Assessment Point 17 – Flight Path

3.1.36. This assessment point is located at a height of approximately 250ft with a landing angle of 3°, facing west approaching runway 09R. Below is an image from the model taken in this location:

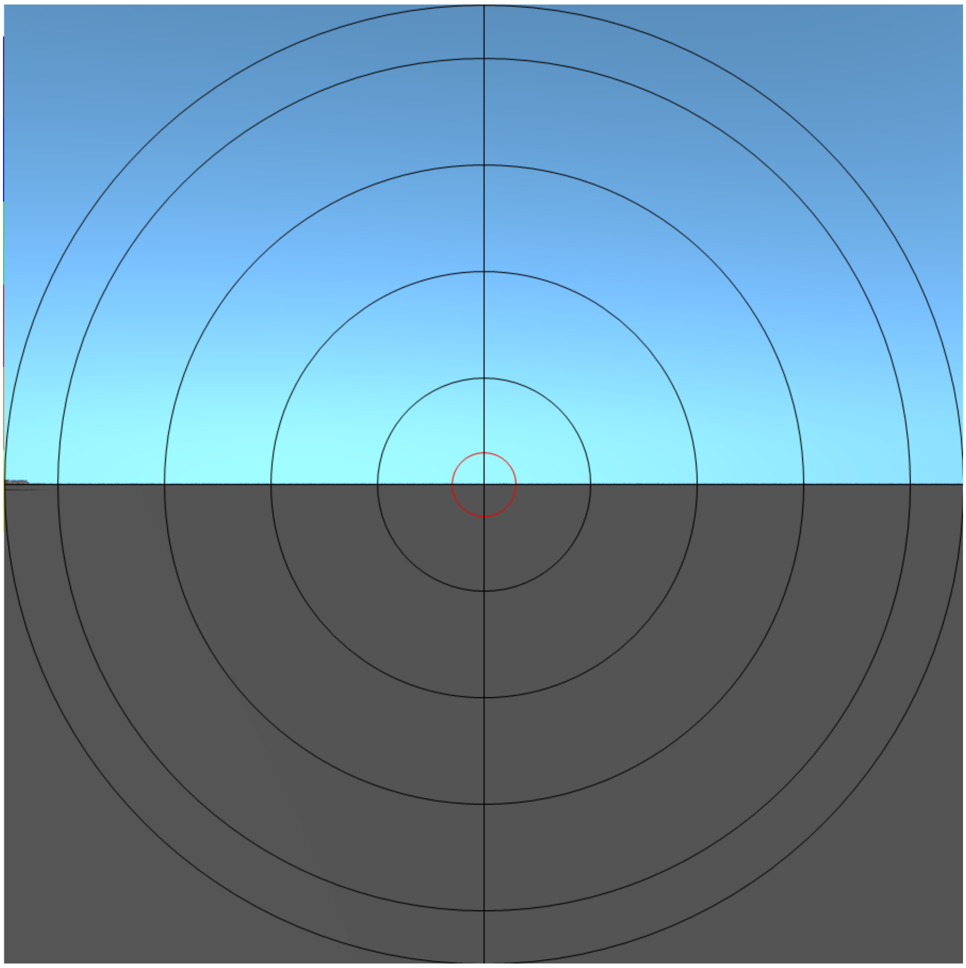


LHR 09R 250ft

3.1.37. The above diagram shows the site within 25 - 35° of the centre of view/line of sight, however the distance to the PV panels is such that the chance of disabling glare is zero.

Assessment Point 18 – Flight Path

3.1.38. This assessment point is located at a height of approximately 0ft (runway level) with a landing angle of 3°, facing west approaching runway 09R. Below is an image from the model taken in this location:



LHR 09R Runway

3.1.39. The above diagram shows that the proposed development is not in view, so no potential solar glare exists at this point. Therefore, the proposed development will have no impact on visibility of the runway or the signals

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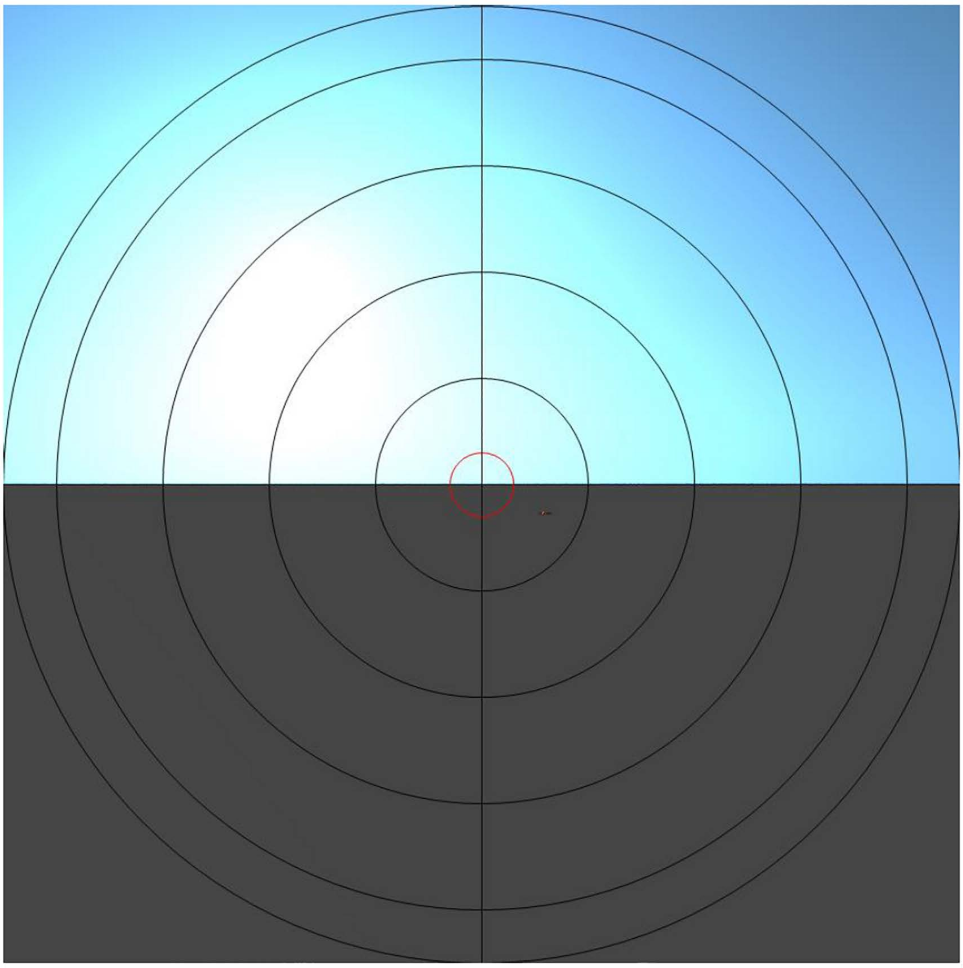
Assessment Point 19 – Flight Path

3.1.40. This assessment point is located at a height of approximately 3,000ft with a landing angle of 3°, facing west approaching runway 27L. Below is an image from the model taken in this location:

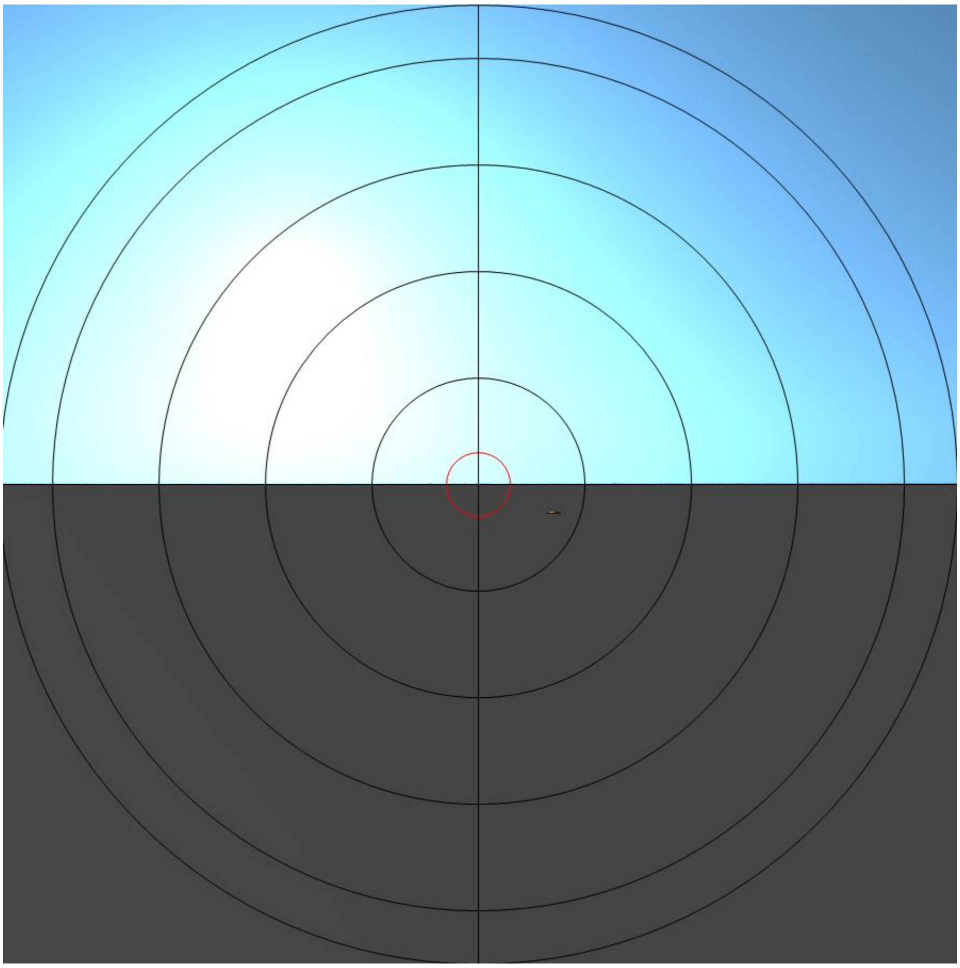


LHR 27L 3000ft

3.1.41. The above diagram shows the site within 10° of the centre of view/line of sight, however the distance to the PV panels is such that the chance of disabling glare is zero.

Assessment Point 20 – Flight Path

3.1.42. This assessment point is located at a height of approximately 2,500ft with a landing angle of 3°, facing west approaching runway 27L. Below is an image from the model taken in this location:

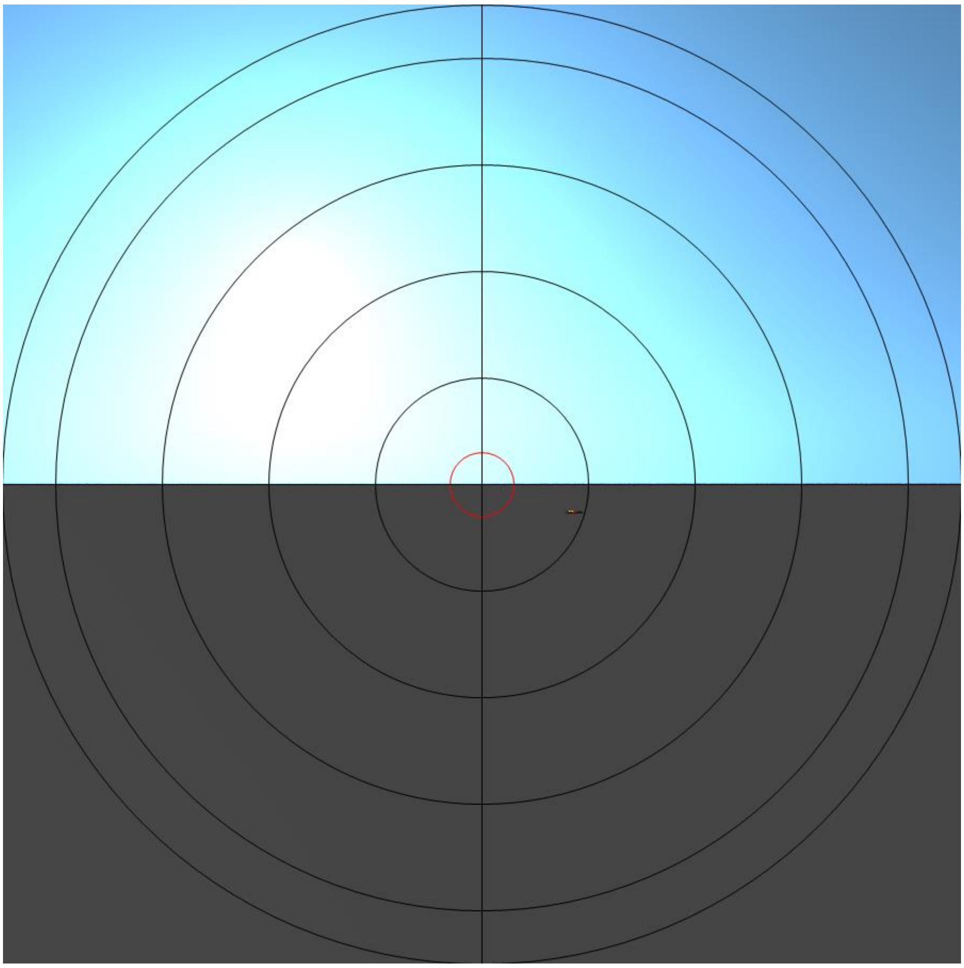


LHR 27L 2500ft

3.1.43. The above diagram shows the site within 10° of the centre of view/line of sight, however the distance to the PV panels is such that the chance of disabling glare is zero.

Assessment Point 21 – Flight Path

3.1.44. This assessment point is located at a height of approximately 2,000ft with a landing angle of 3°, facing west approaching runway 27L. Below is an image from the model taken in this location:



LHR 27L 2000ft

3.1.45. As with Assessment Point 19 and 20, the above diagram shows the site within 10° of the centre of view/line of sight, however the distance to the PV panels is such that the chance of disabling glare is zero.

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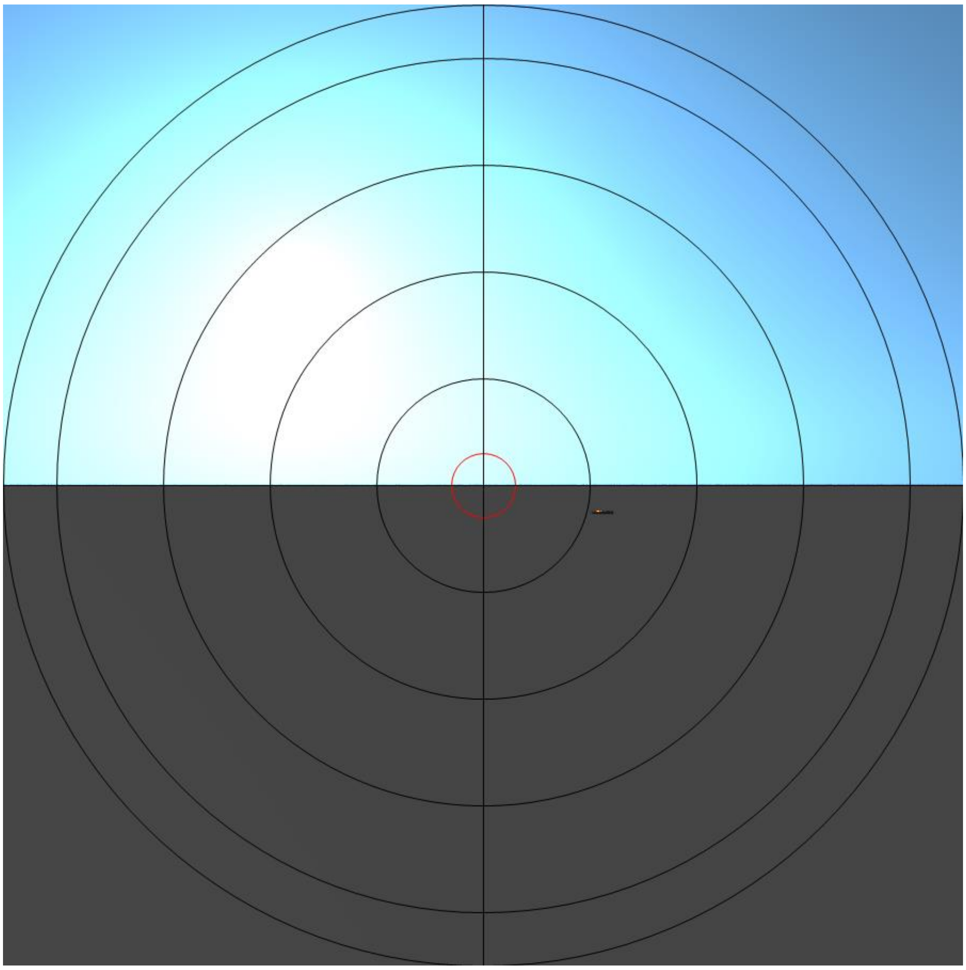
Assessment Point 22 – Flight Path

3.1.46. This assessment point is located at a height of approximately 1,500ft with a landing angle of 3°, facing west approaching runway 27L. Below is an image from the model taken in this location:

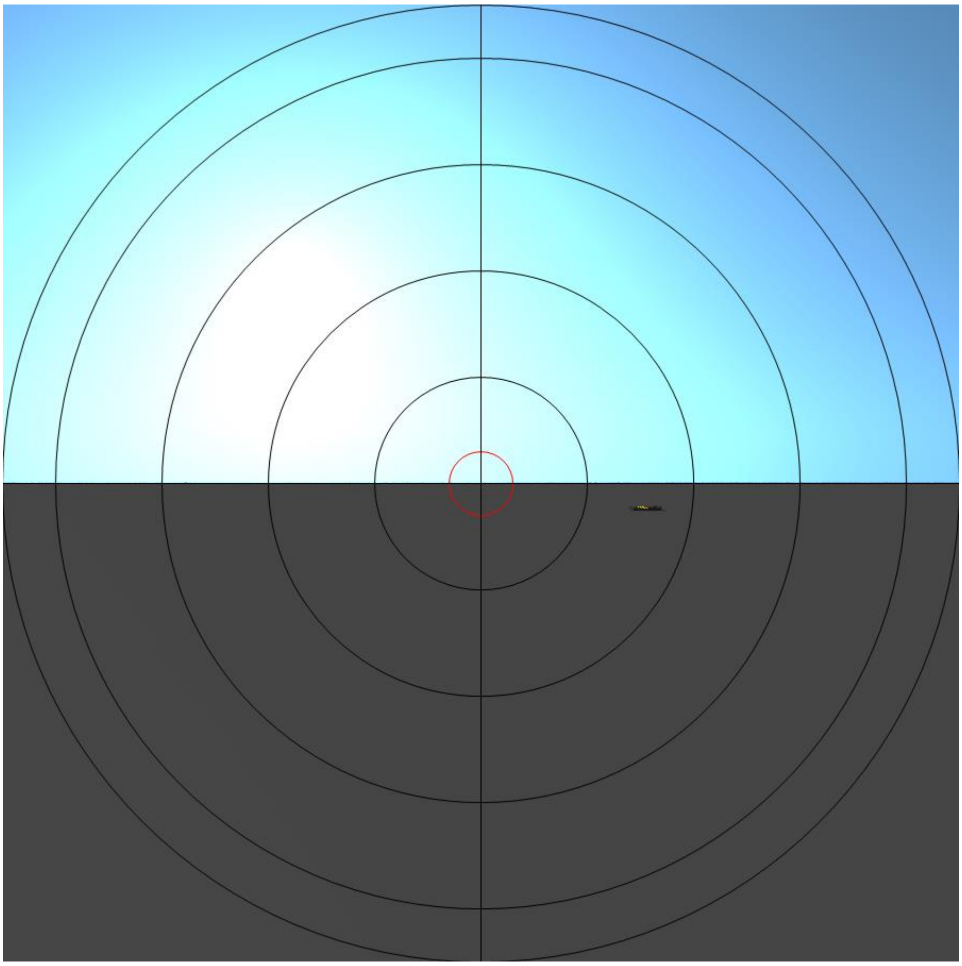


LHR 27L 1500ft

3.1.47. Again, the above diagram shows the site within 10 - 20° of the centre of view/line of sight, however the distance to the PV panels is such that the chance of disabling glare is zero.

Assessment Point 23 – Flight Path

3.1.48. This assessment point is located at a height of approximately 1,000ft with a landing angle of 3°, facing west approaching runway 27L. Below is an image from the model taken in this location:



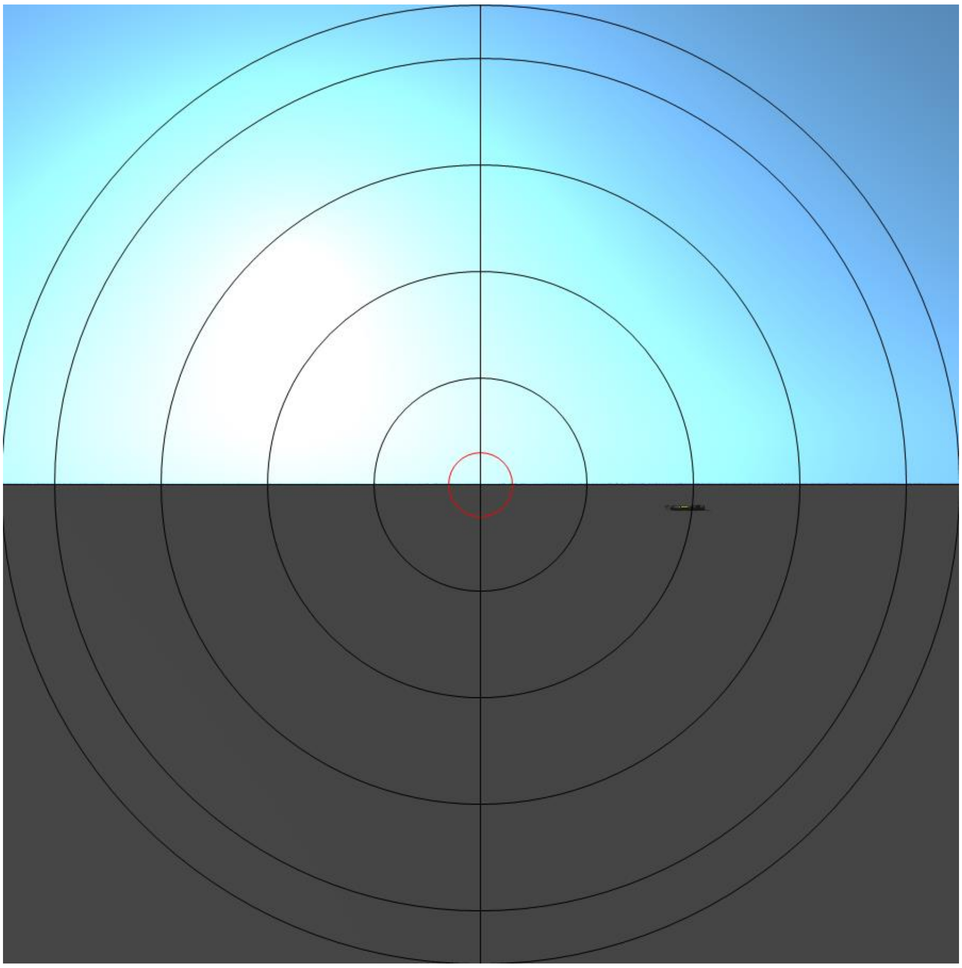
LHR 27L 1000ft

3.1.49. The above diagram shows the site within 10 -20° of the centre of view/line of sight, and potential for solar glare for 2 minutes in March / October.

3.1.50. Given the distance to the site and the speed at which the aircraft will be travelling (c.150mph), the chance of disabling glare is small.

Assessment Point 24 – Flight Path

3.1.51. This assessment point is located at a height of approximately 750ft with a landing angle of 3°, facing west approaching runway 27L. Below is an image from the model taken in this location:



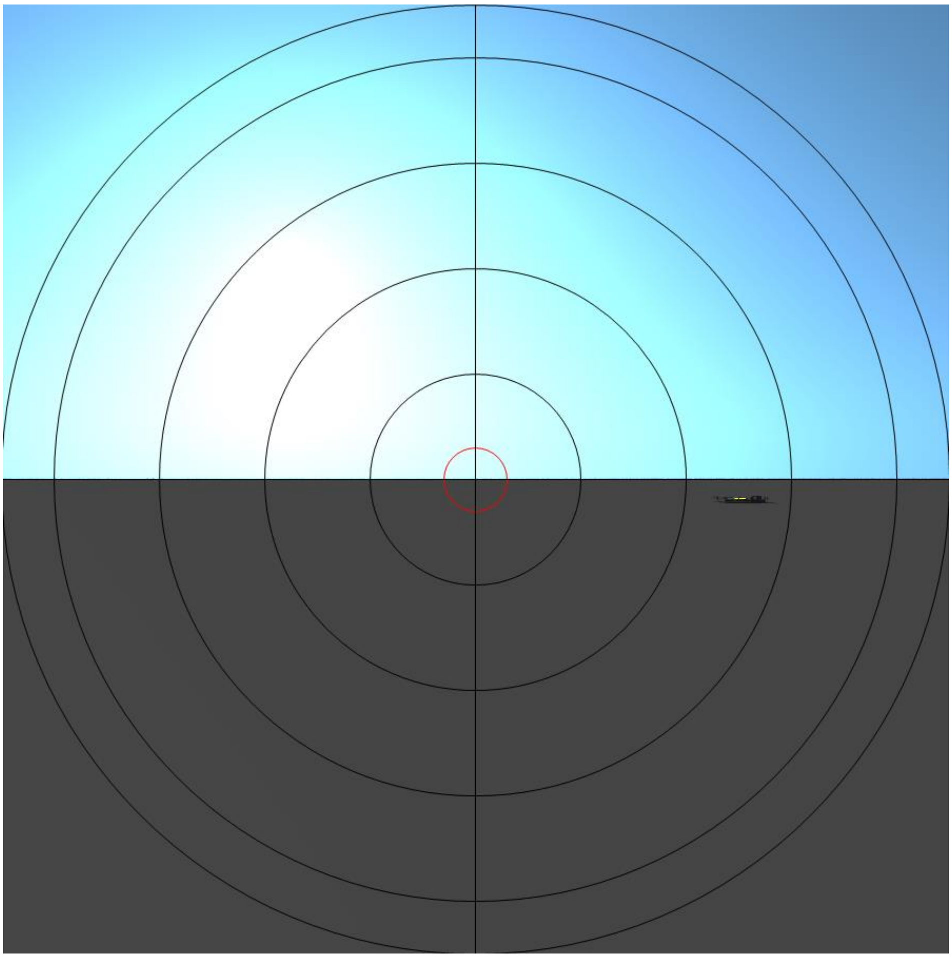
LHR 27L 750ft

3.1.52. The above diagram shows the site within 15-25° of the centre of view/line of sight, and potential for solar glare for 8 minutes in March / May / August and October.

3.1.53. As with Assessment Point 23, given the distance to the site and the speed at which the aircraft will be travelling (c.150mph), the chance of disabling glare is small.

Assessment Point 25 – Flight Path

3.1.54. This assessment point is located at a height of approximately 500ft with a landing angle of 3°, facing west approaching runway 27L. Below is an image from the model taken in this location:



LHR 27L 500ft

3.1.55. The above diagram shows the site within 20 - 30° of the centre of view/line of sight, and potential for solar glare for 12 minutes in May / July.

3.1.56. Again, given the distance to the site and the speed at which the aircraft will be travelling (c.150mph), the chance of disabling glare is small.

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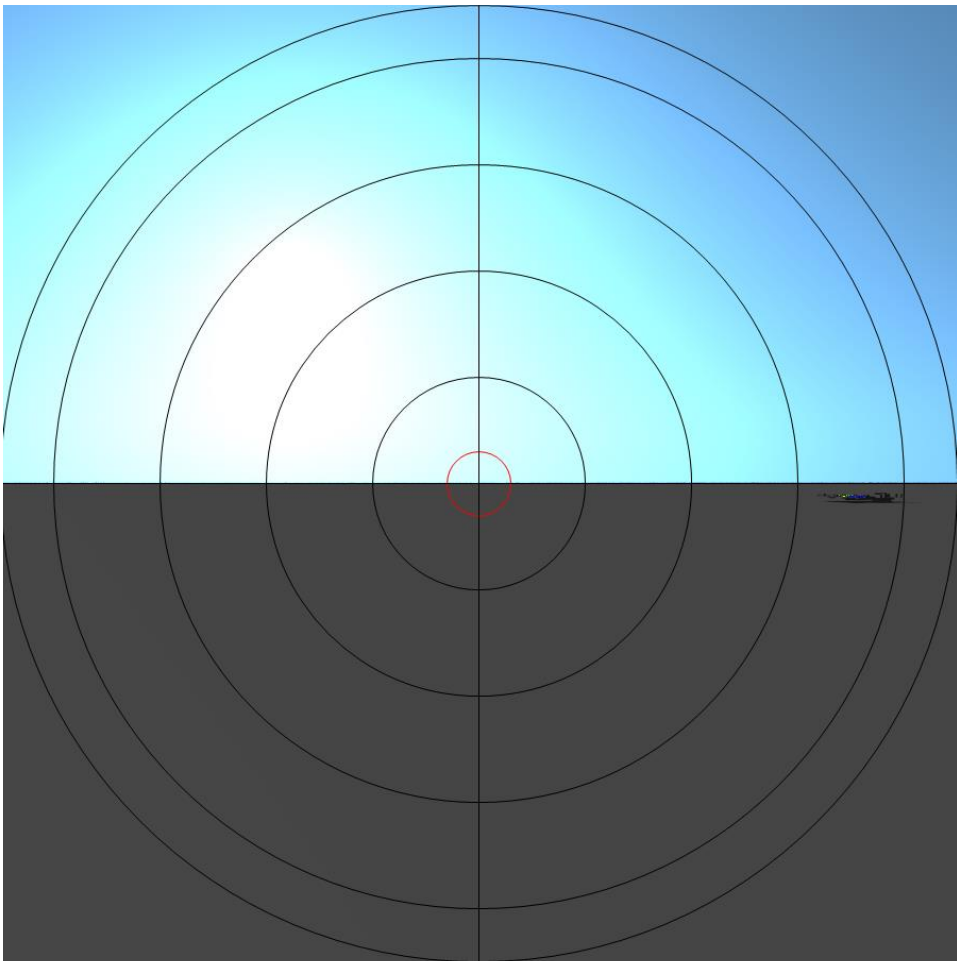
Assessment Point 26 – Flight Path

3.1.57. This assessment point is located at a height of approximately 250ft with a landing angle of 3°, facing west approaching runway 27L. Below is an image from the model taken in this location:



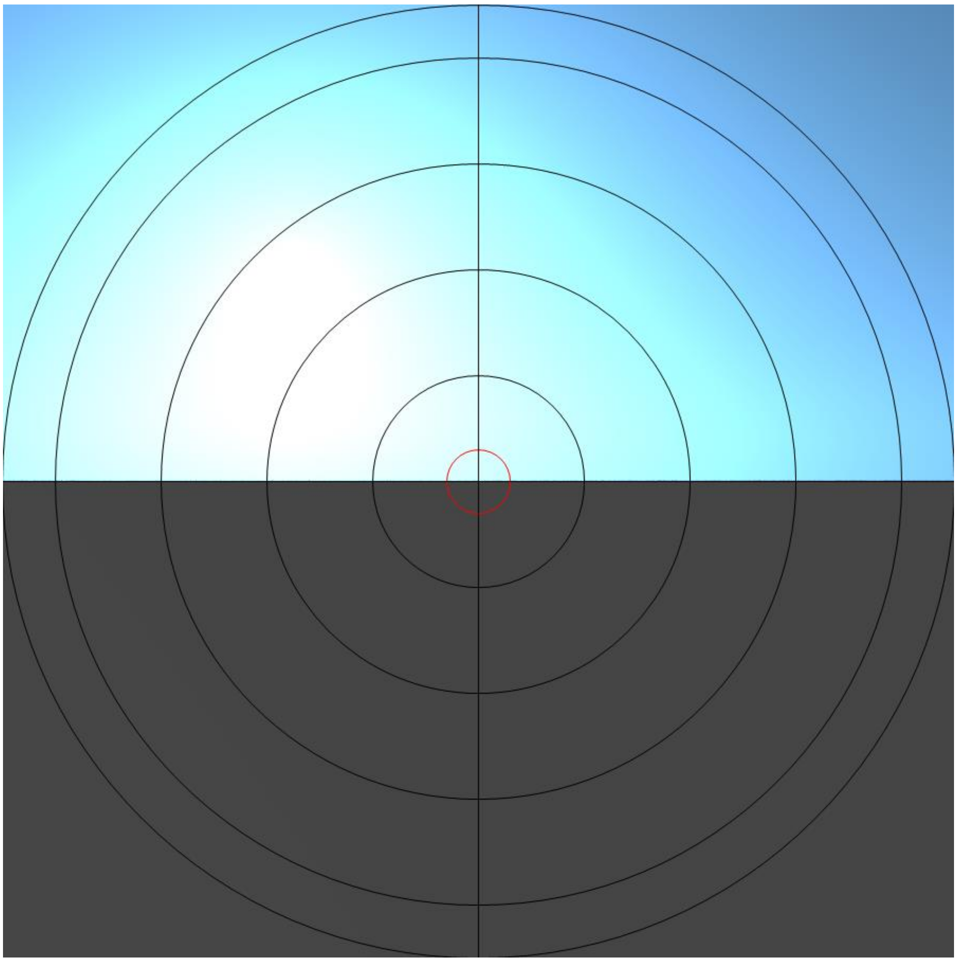
LHR 27L 250ft

3.1.58. The above diagram shows the site within 30 - 40° of the centre of view/line of sight, and potential for solar glare for 24 minutes in February / May / July and October.

3.1.59. Given the distance to the site and the speed at which the aircraft will be travelling (c.150mph), the chance of disabling glare is small.

Assessment Point 27 – Flight Path

3.1.60. This assessment point is located at a height of approximately 0ft (runway level) with a landing angle of 3°, facing west approaching runway 27L. Below is an image from the model taken in this location:

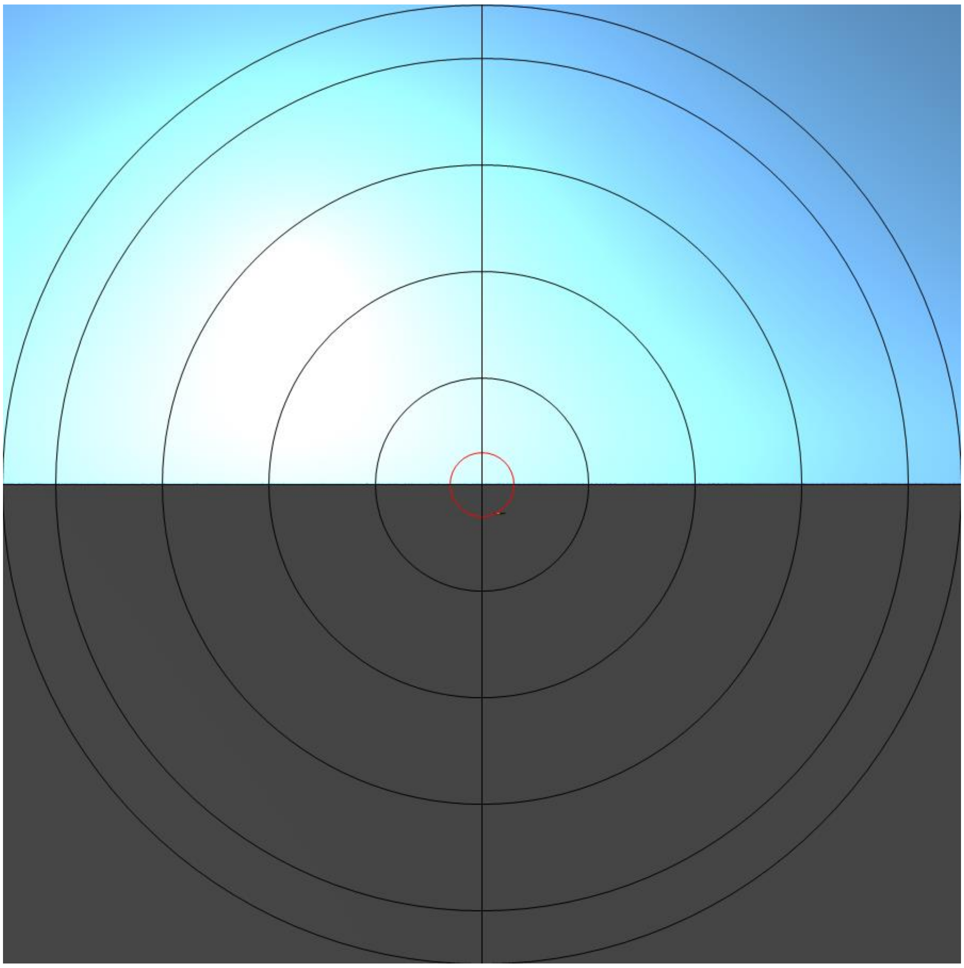


LHR 27L Runway

3.1.61. The above diagram shows that by this point, the PV panels cannot be seen within the field of view and no potential solar glare will occur.

Assessment Point 28 – Flight Path

3.1.62. This assessment point is located at a height of approximately 3,000ft with a landing angle of 3°, facing west approaching runway 27R. Below is an image from the model taken in this location:

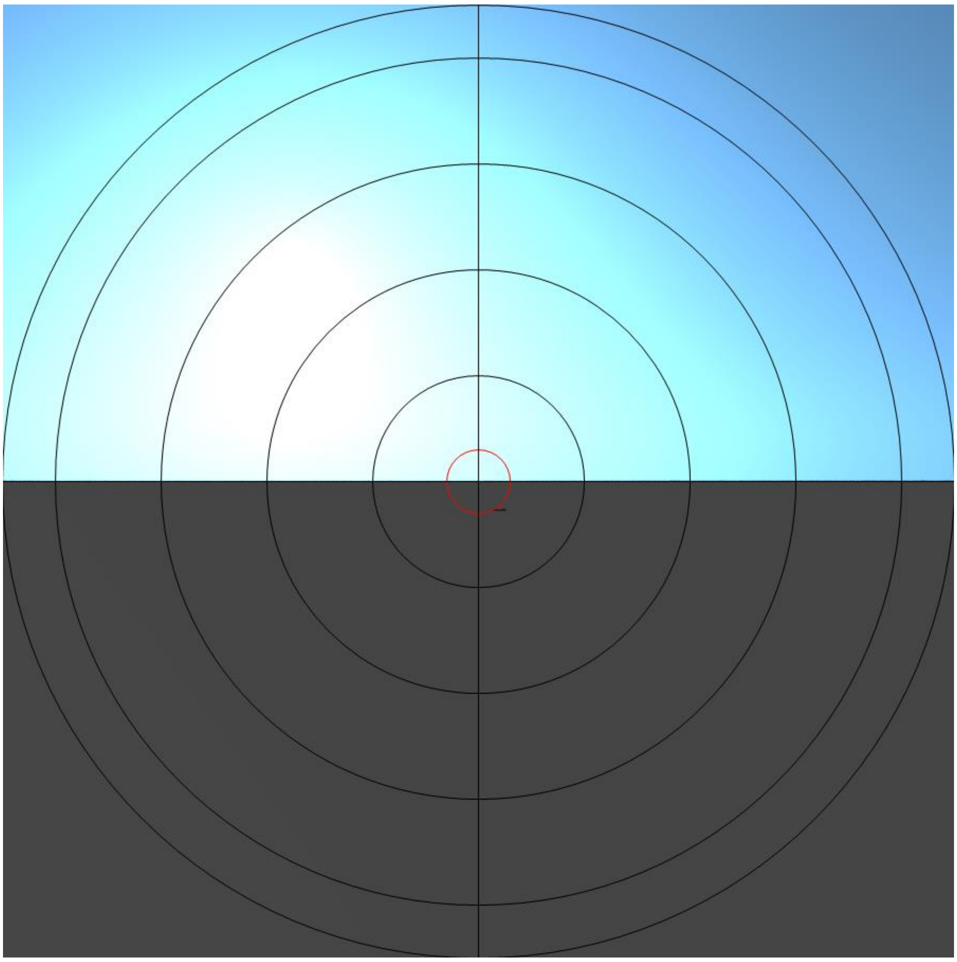


LHR 27R 3000ft

3.1.63. The above diagram shows the site within 10° of the centre of view/line of sight, however the distance to the PV panels is such that the chance of disabling glare is zero.

Assessment Point 29 – Flight Path

3.1.64. This assessment point is located at a height of approximately 2,500ft with a landing angle of 3°, facing west approaching runway 27R. Below is an image from the model taken in this location:



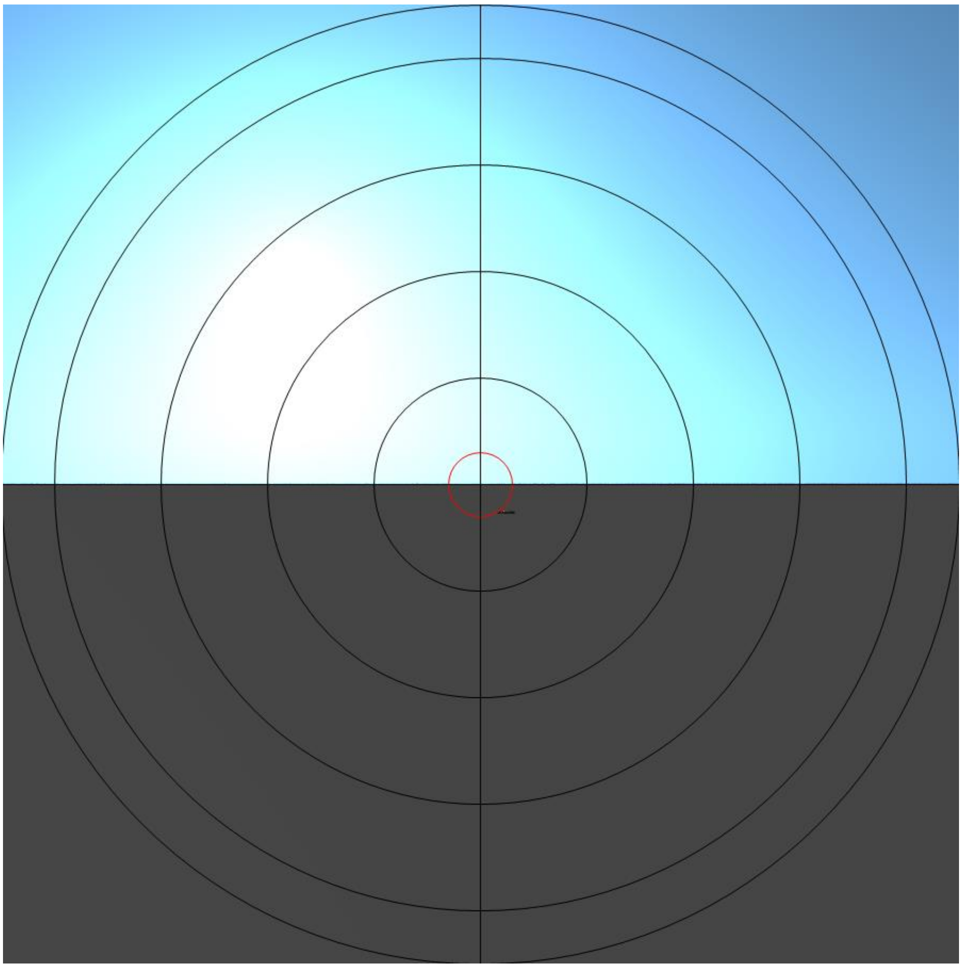
LHR 27R 2500ft

3.1.65. The above diagram shows the site within 10° of the centre of view/line of sight, and potential for solar glare for 2 minutes in March / September.

3.1.66. Given the distance to the site and the speed at which the aircraft will be travelling (c.150mph), the chance of disabling glare is small.

Assessment Point 30 – Flight Path

3.1.67. This assessment point is located at a height of approximately 2,000ft with a landing angle of 3°, facing west approaching runway 27R. Below is an image from the model taken in this location:



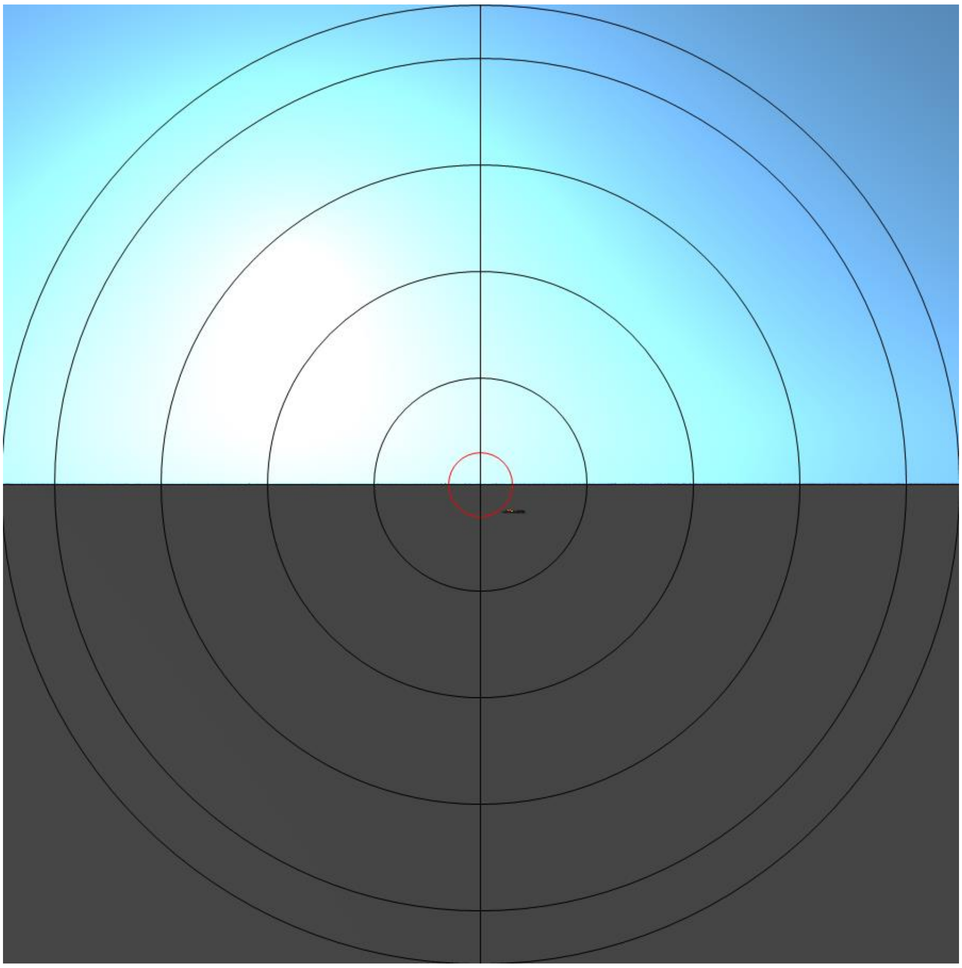
LHR 27R 2000ft

3.1.68. The above diagram shows the site within 10 -20° of the centre of view/line of sight, and potential for solar glare for 8 minutes in March / April / May / August and September.

3.1.69. Given the distance to the site and the speed at which the aircraft will be travelling (c.150mph), the chance of disabling glare is small.

Assessment Point 31 – Flight Path

3.1.70. This assessment point is located at a height of approximately 1,500ft with a landing angle of 3°, facing west approaching runway 27R. Below is an image from the model taken in this location:

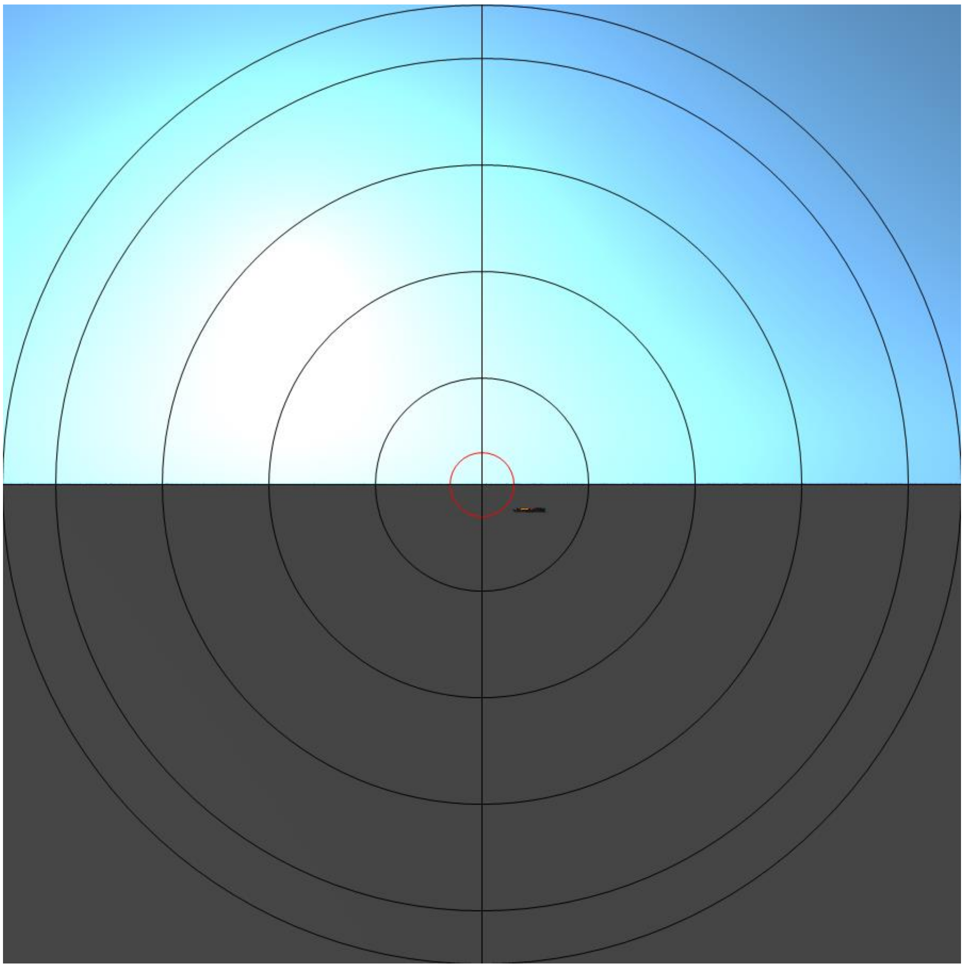


LHR 27R 1500ft

3.1.71. The above diagram shows the site within 10° of the centre of view/line of sight, however the distance to the PV panels is such that the chance of disabling glare is zero.

Assessment Point 32 – Flight Path

3.1.72. This assessment point is located at a height of approximately 1,000ft with a landing angle of 3°, facing west approaching runway 27R. Below is an image from the model taken in this location:



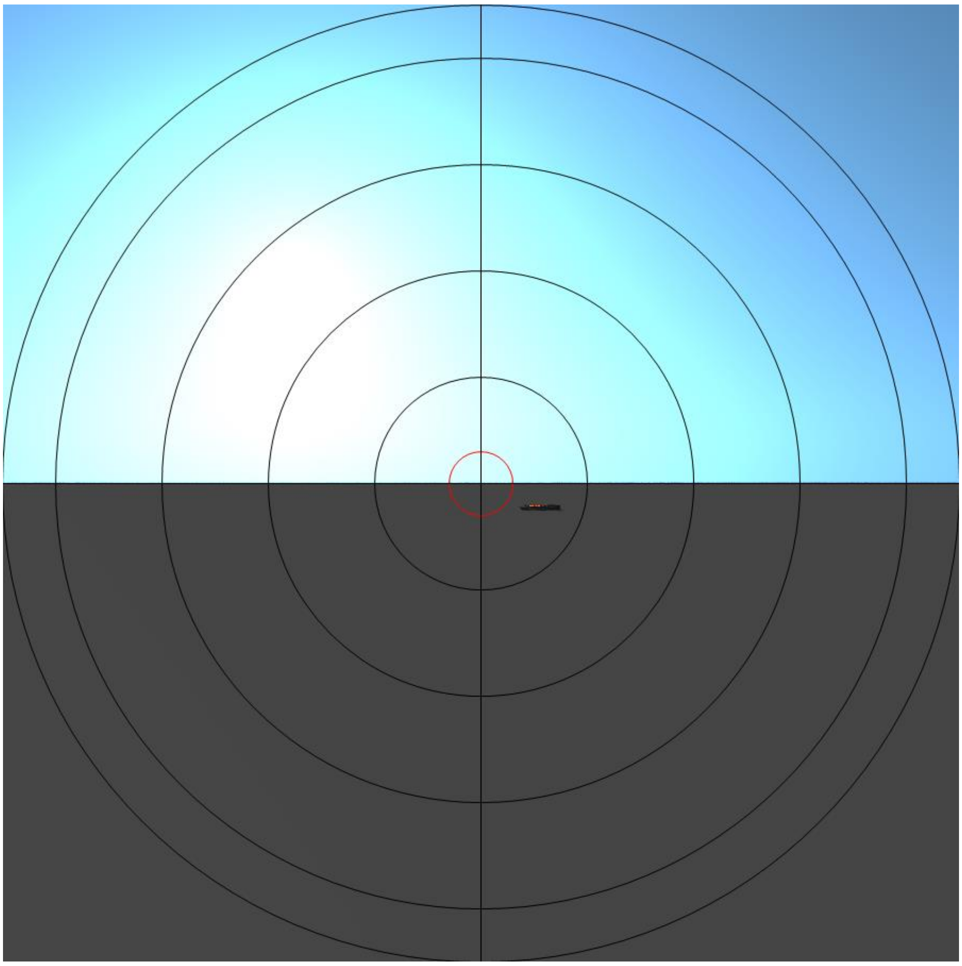
LHR 27R 1000ft

3.1.73. The above diagram shows the site within 10° of the centre of view/line of sight, and potential for solar glare for 2 minutes in April / September.

3.1.74. Given the distance to the site and the speed at which the aircraft will be travelling (c.150mph), the chance of disabling glare is small.

Assessment Point 33 – Flight Path

3.1.75. This assessment point is located at a height of approximately 750ft with a landing angle of 3°, facing west approaching runway 27R. Below is an image from the model taken in this location:



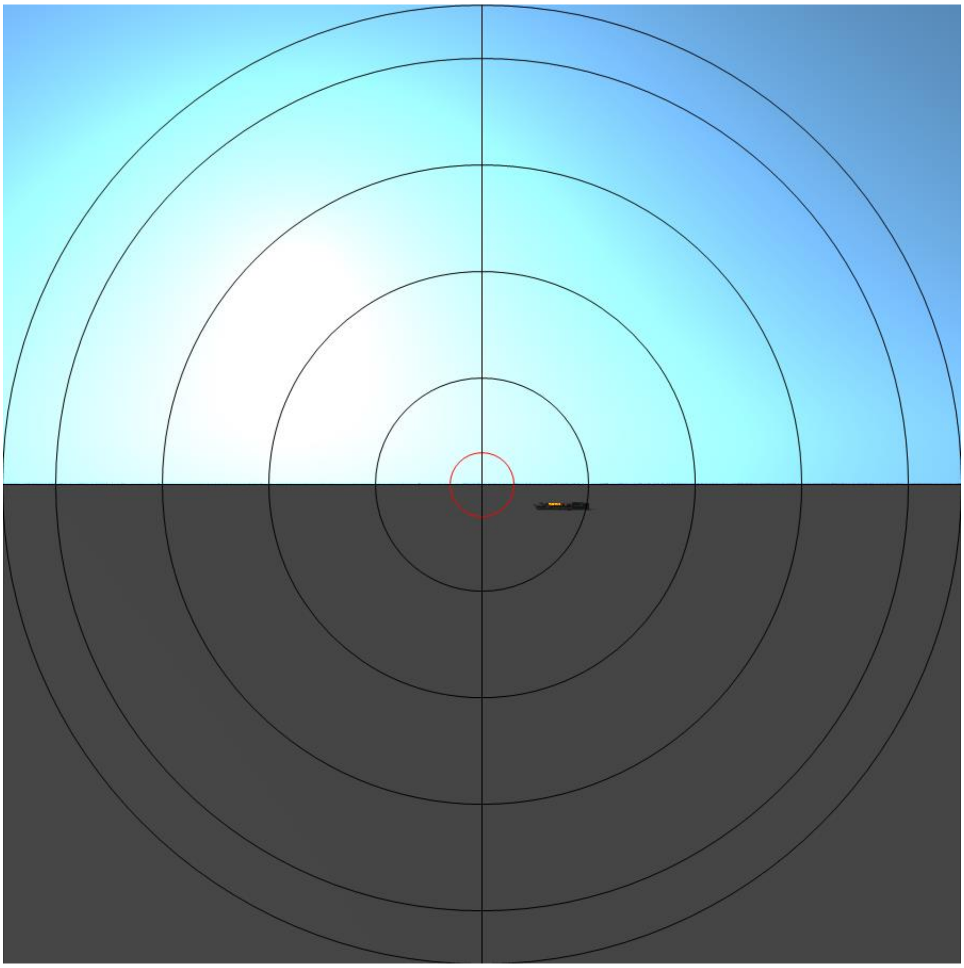
LHR 27R 750ft

3.1.76. The above diagram shows the site within 10° of the centre of view/line of sight, and potential for solar glare for 10 minutes in April / May / July / August and September.

3.1.77. Given the distance to the site and the speed at which the aircraft will be travelling (c.150mph), the chance of disabling glare is small.

Assessment Point 34 – Flight Path

3.1.78. This assessment point is located at a height of approximately 500ft with a landing angle of 3°, facing west approaching runway 27R. Below is an image from the model taken in this location:



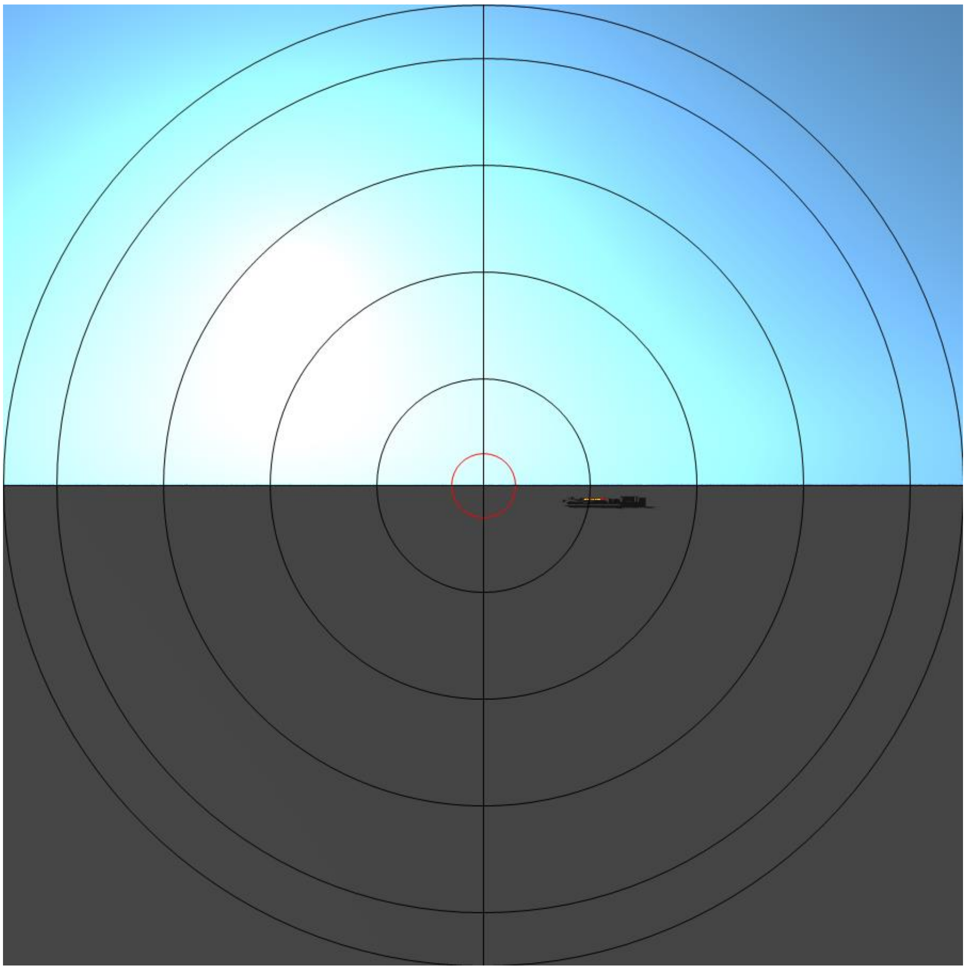
LHR 27R 500ft

3.1.79. The above diagram shows the site within 10° of the centre of view/line of sight, and potential for solar glare for 2 minutes in April / September.

3.1.80. Given the distance to the site and the speed at which the aircraft will be travelling (c.150mph), the chance of disabling glare is small.

Assessment Point 35 – Flight Path

3.1.81. This assessment point is located at a height of approximately 250ft with a landing angle of 3°, facing west approaching runway 27R. Below is an image from the model taken in this location:



LHR 27R 250ft

3.1.82. The above diagram shows the site within 10 - 20° of the centre of view/line of sight, and potential for solar glare for 18 minutes in April / May / July / August and September.

3.1.83. Given the distance to the site and the speed at which the aircraft will be travelling (c.150mph), the chance of disabling glare is small.

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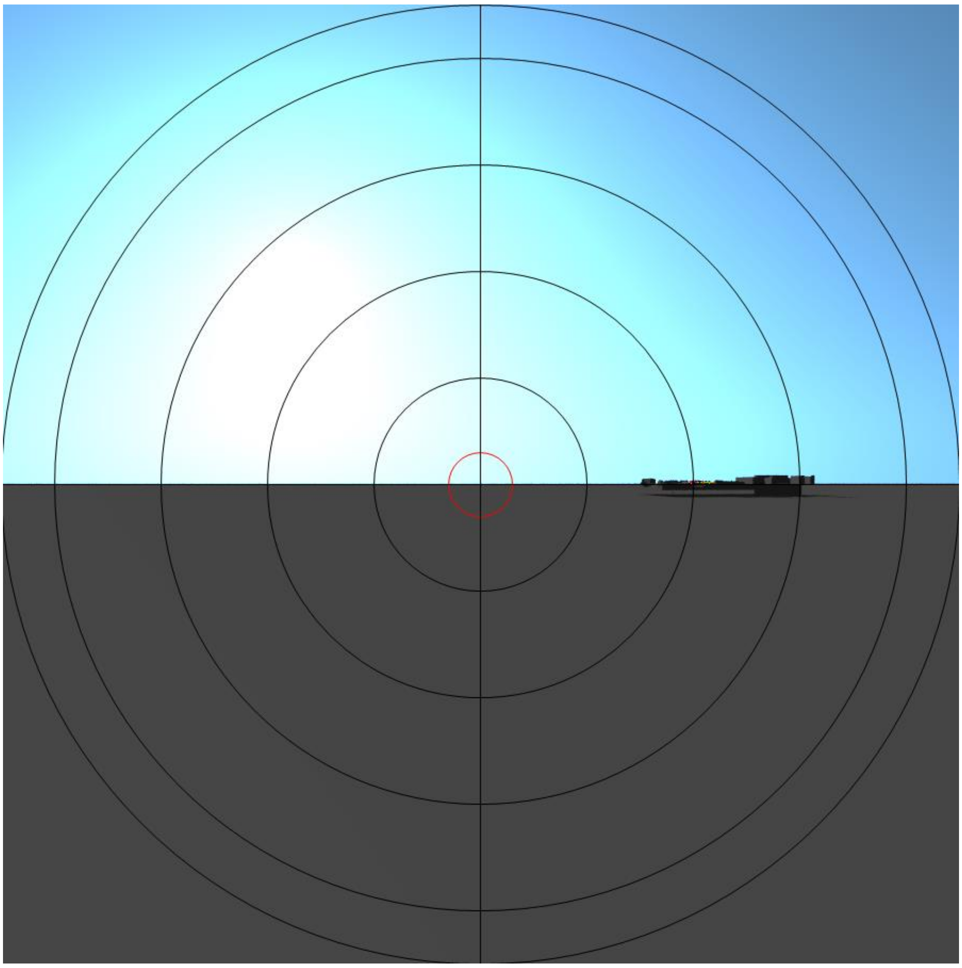
Assessment Point 36 – Flight Path

3.1.84. This assessment point is located at a height of approximately 0ft (runway level) with a landing angle of 3°, facing west approaching runway 27R. Below is an image from the model taken in this location:



LHR 27R Runway

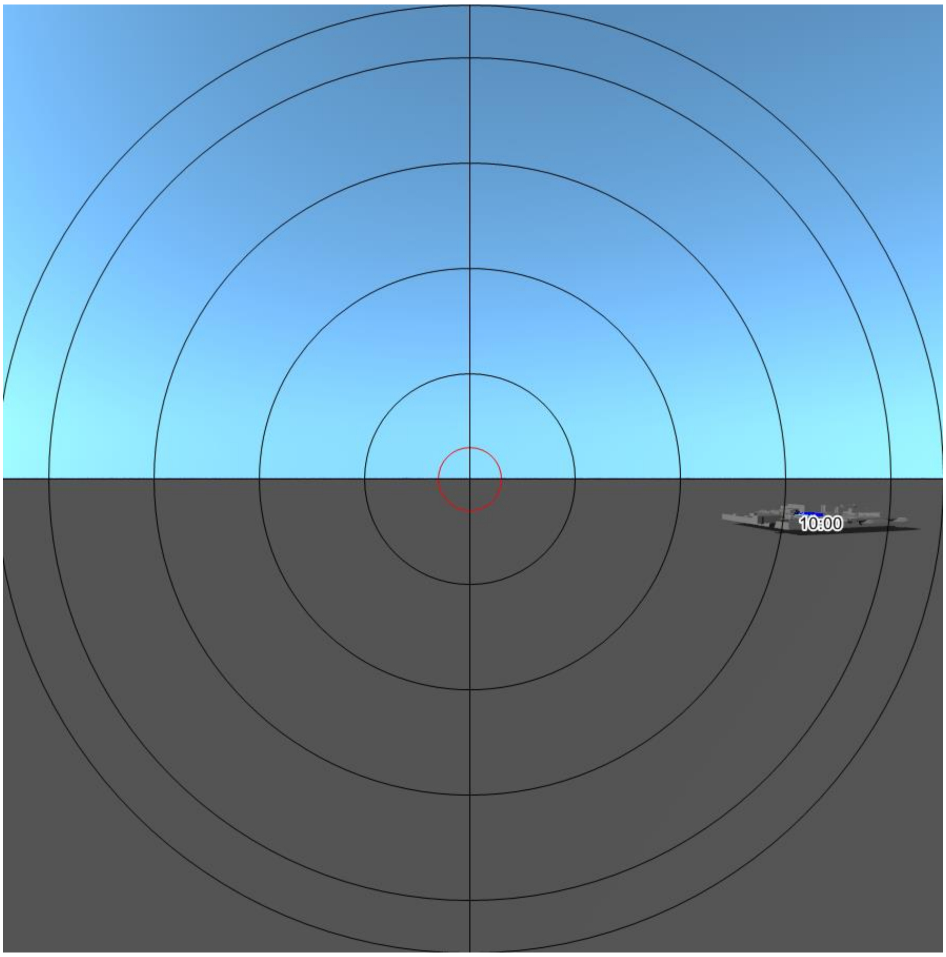
3.1.85. The above diagram shows the site within 15 - 30° of the centre of view/line of sight, and potential for solar glare for 34 minutes in February / March / April / May / August and October.

3.1.86. The instances of glare take place between 5.00 – 7.00am and 18.00 – 19.00pm with a maximum duration of 6 minutes based upon a clear sky.

Assessment Point 37 – Air Traffic Control Tower

3.1.87. This assessment point is located at a height of approximately 87m, facing north. We understand that the tower offers 360° views and for the purpose of this assessment, we have assumed a position where the camera directly faces the proposed development site.

3.1.88. The ATC tower is approximately 1.35km south of the proposed development. Below is an image from the model taken in this location:



LHR ATC Tower

3.1.89. The above diagram shows that a small potential for glare may be present during the spring and winter months at 7.00 am and 10.00 pm.

3.1.90. However, the position of the proposed development, relative to the operator's view, is offset at least 40 degrees from the line of sight and therefore glare should not impede the operator's view of the runway or the signals.

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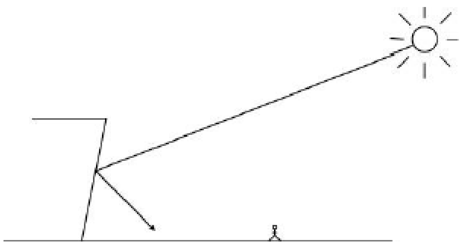
Appendix A

Principles of solar glare

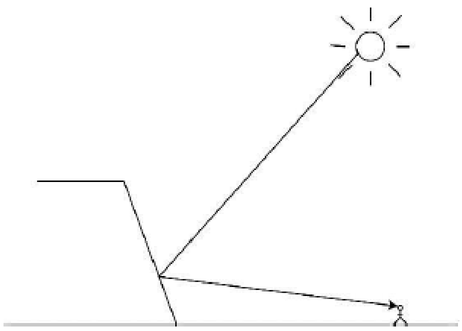
Causes of solar glare

Solar glare can occur either when there are large areas of reflective glass or cladding on the façade, or when there are areas of glass or cladding which slope back so that high altitude sunlight can be reflected along the ground. Photovoltaic panels tend to cause less glare because they are designed to absorb light.

The slope of the glass is important. With a vertical façade, the worst disability glare normally occurs when the sun is low in the sky.



A façade that slopes forward, so that the top of the building forms an effective overhang, is unlikely to cause significant reflected solar glare.



A façade or canopy that slopes back from the vertical can reflect high angle sun along the ground. This is of particular concern as motorists will not be expecting it, the high angle sun is brighter, and the sun is less likely to be intercepted by other buildings before it reaches the glass.

The severity of glare depends on the type of glazing or cladding. The glare caused depends on the specular reflectance of the glazing. This is the mirror-like direct reflection of sunlight. For glasses, the reflection is nearly all specular. Metals often combine specular reflection with diffuse reflection (where the reflected light is scattered in all directions). Surfaces like brick or matt cladding give mainly diffuse reflection, which is unlikely to cause disability glare.

It is therefore possible to reduce reflected glare by choosing glazing or cladding with a low specular reflectance. For glare, the visible light reflectance is important, rather than the total solar reflectance. Glass manufacturers quote the reflectance at normal incidence, with the sun assumed to be directly opposite the façade. Under these circumstance, standard low emissivity double glazing has a specular reflectance of around 13%, which can be enough to cause glare. Solar control glasses used to reduce overheating in buildings can have higher reflectance, typically in the 15-40% range.

When the sun reaches the building at a glancing angle, more of it is reflected. For clear double glazing, the reflectance rises to 15% if the sun is at 45 degrees to the glazing, 22% at 60 degrees, and 49% at 75 degrees. Glare also depends on the angle of the sun and the angle at which the building is viewed.

Solar glare on a sloping facade

The photo to the left shows reflection of sunlight at the bottom of a sloping façade. The sun was high in the sky when the picture was taken. Flat facades reflect the sun without concentrating it. Facades which are concave can focus the sunlight and create areas of concentrated solar radiation. A separate Planning Advice Note 'Solar Convergence' gives advice on this issue.

The photo to the left shows reflection of sunlight at the bottom of a sloping façade. The sun was high in the sky when the picture was taken. Flat façades reflect the sun without concentrating it. Facades which are concave can focus the sunlight and create areas of concentrated solar radiation. A separate Planning Advice Note 'Solar Convergence' gives advice on this issue.

Assessment of solar glare

New buildings with extensive areas of glaring, highly reflective glass or metal cladding, or areas of sloping glass may present a risk of solar glare if they are visible from roads or railways. The exact scale of the problem should be evaluated at the planning stage. Solar glare is a specialist issue and expert advice should be sought.

The first stage in the assessment is to identify key locations from which the building could be seen and where solar glare could be an issue. These could include road junctions, traffic lights, pedestrian crossings and railway lines at the approach to signals, The most important locations are those where drivers will be travelling directly towards the building; glare is much less likely if the building is well to one side of the field of view. Normally, one way streets where traffic is going away from the building need not be analysed, unless there are side roads joining them where drivers will have to look up the street to check if it is safe to proceed.

The choice of viewpoints should take into account potential future developments near to the proposed reflective façade. In most cases, future buildings would be expected to block the sun's rays and reduce the potential for flare from a specific proposed development. However, if nearby buildings are to be demolished prior to new ones being constructed, there could be a period of time when the proposed development would be visible over the demolition site, and reflected glare might result.

The next stage is to work out whether sunlight can be reflected to these viewpoints, and if so at which times of year. A BRE Information Paper IP 3/87 'Solar dazzle reflected from sloping glazed facades' (HIS BRE Press, Bracknell, 1987) gives details on how to carry out the calculations.

The Building Research Establishment (BRE) published information on calculating Solar Glare within paper IP 3/87 "Solar dazzle reflected from sloping glazed facades" (April 1987) (the BRE Report) and the methods contained within that Report have been used to establish the likelihood of unacceptable levels of glare occurring.

The BRE Information Paper IP 3-87 States that:

"Glare or dazzle can occur when sunlight is reflected from the glazed façade. For vertical facades this problem usually occurs only when the sun is low in the sky, but some types of modern design incorporate sloping glazed facades which can, under certain circumstances, reflect unwanted high altitude sunlight into the eyes of motorists, pedestrians and people in nearby buildings. Addressed to architects, consulting engineers, planning consultants and planners, this paper presents a new method which can be used at the design stage to calculate whether such solar dazzle will be reflected from a proposed building façade."

The International Commission on Illumination (CIE) 146:2002 Collection on glare states sets out guidance for the likely occurrence of disabling solar glare. The Guidance states:

"Disability glare is glare that impairs vision (CIE, 1987). It is caused by scattering of light inside the eye [...]. The veiling luminance of scattered light will have a significant effect on visibility when intense light sources are present in the peripheral visual field and the contrast of objects to be seen is low. "

"Disability glare is most often of importance at night when contrast sensitivity is low and there may well be one or more bright light sources near to the line of sight, such as car headlights, streetlights or floodlights. But even in daylight conditions disability glare may be of practical significance: think of traffic lights when the sun is close to them, or the difficulty viewing paintings hanging next to windows."

"The magnitude of the veiling luminance depends on the intensity and distance of the glare source which together determine the relevant parameter glare, the illuminance at the eye caused by the glare source, and the angle between the glare source and the line of sight."
Glare instances are exacerbated with the effects of age and eye pigmentation which can now be accounted for with more complex formulae. The closer the instance of glare to the line of sight of the viewer, the worse the veiling effect becomes.

<u>**Mitigation measures**</u>

At the design stage, solar glare can be remedied in various ways:

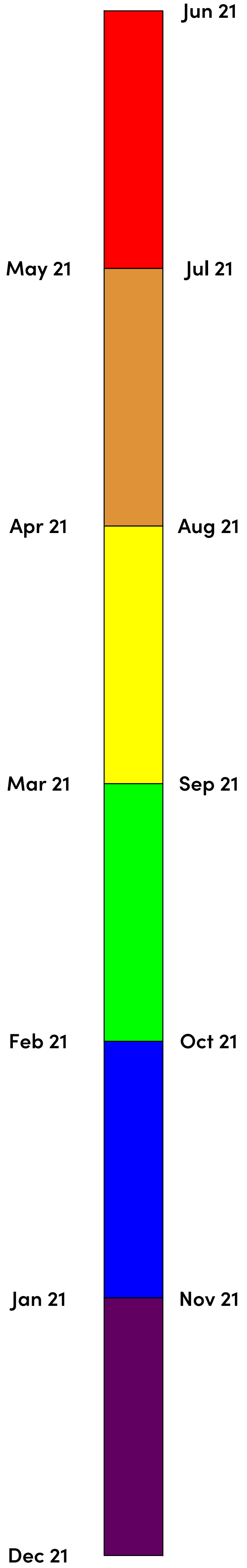
- By reducing areas of glazing, using matt cladding instead;
- Reorienting elements of the building to avoid reflection;
- Replacing areas of titled glass by either vertical or nearly horizontal glazing;
- Changing the glazing or cladding to a less reflective type. Special low reflectance glass is available;
- Using low reflectance film or fritting (a ceramic coating on the glass);
- Using sandblasted or other diffusing glass, for example for balustrades;
- External shading such as louvers or motorised blinds. Vertical fins may be effective in situations where the sun is reflected off a building at a glancing angle;
- Some form of opaque screening at street level, though this will usually need to be large;

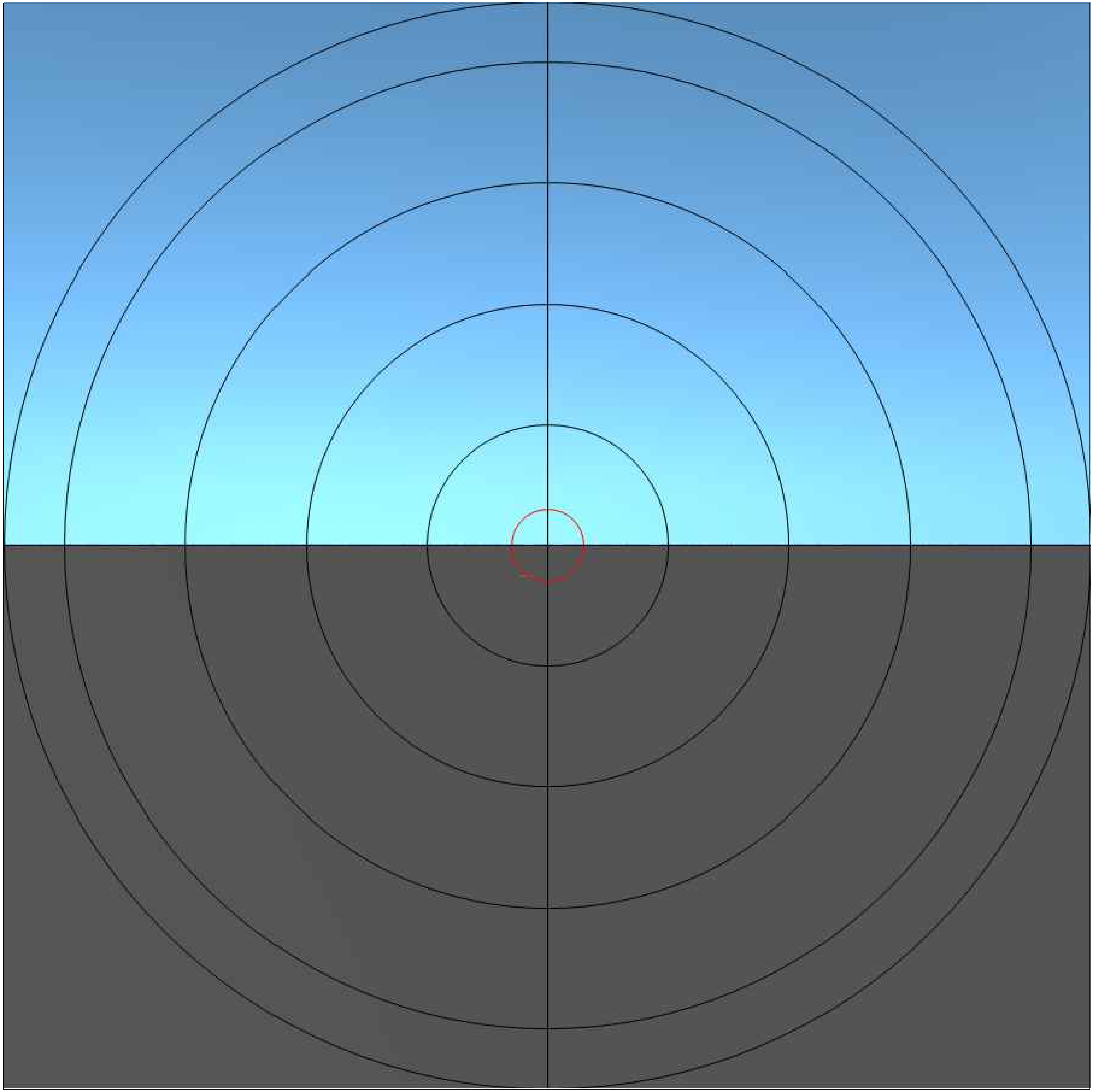
- Plating trees, though the type of tree will depend on the times of year when glare occurs. Glare may occur in the winter when deciduous trees will not be in leaf;
- Where discomfort glare is an issue, providing shading devices in the affected building or other location (such as a canopy above a security post).

These mitigation measures can provide additional benefits such as reducing overheating in buildings, improved carbon reduction and resilience to climate change.

Appendix B

Assessment point location images





SOURCES OF INFORMATION:

SMR ARCHITECTS

7935-SMR-00-XX-M3-A-9001-S3-P1 SITE.rvt
7935-SMR-01-XX-M3-A-9002-S3-P1 F&B.rvt
7935-SMR-02-XX-M3-A-9004-S3-P1 STAFF BLOCK.rvt
7935-SMR-03-XX-M3-A-9003-S3-P1 WELFARE BLOCK.rvt
7935-SMR-00-ZZ-DR-A-2001-S3-P2.dwg
7935-SMR-00-ZZ-DR-A-2002-S3-P3.dwg
7935-SMR-00-ZZ-DR-A-2003-S3-P5.dwg
7935-SMR-00-ZZ-DR-A-2004-S3-P6.dwg
7935-SMR-00-ZZ-DR-A-2006-S3-P1.dwg
7935-SMR-00-ZZ-DR-A-2007-S3-P1.dwg
7935-SMR-00-ZZ-DR-A-2008-S3-P1.dwg
7935-SMR-01-ZZ-DR-A-2101-S3-P1.dwg
7935-SMR-01-ZZ-DR-A-2102-S3-P1.dwg
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Received 28 May 2025

PROMAP

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Received 28 June 2022

INTERLOCKS SURVEY LTD

210833 3D.dwg
Received 04 January 2022

ACCUCITIES 3D MAPPING

002343_112936-Heathrow NCP Car Park_HD_MASTER.dwg
Received 02 December 2021

Rev.	Date	Amendments	Initial

HOLLIS SHALL BE INFORMED IN WRITING OF ANY DISCREPANCIES.
ALL DIMENSIONS ARE IN METRES ONLY.
NO DIMENSIONS TO BE SCALED FROM THIS DRAWING.

TITLE

Solar Glare Study
LHR Runway 09L
Camera Position 3000 ft

CLIENT

Lysara

PROJECT

2-3 Heathrow Flightpath
West Drayton
UB7 0DU

DRAWN BY	CHECKED
SK	SL/BSC
SCALE	**DATE**
NTS	May 2025

HOLLIS

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DRAWING NO.	RELEASE NO.
129855_SG_03	1

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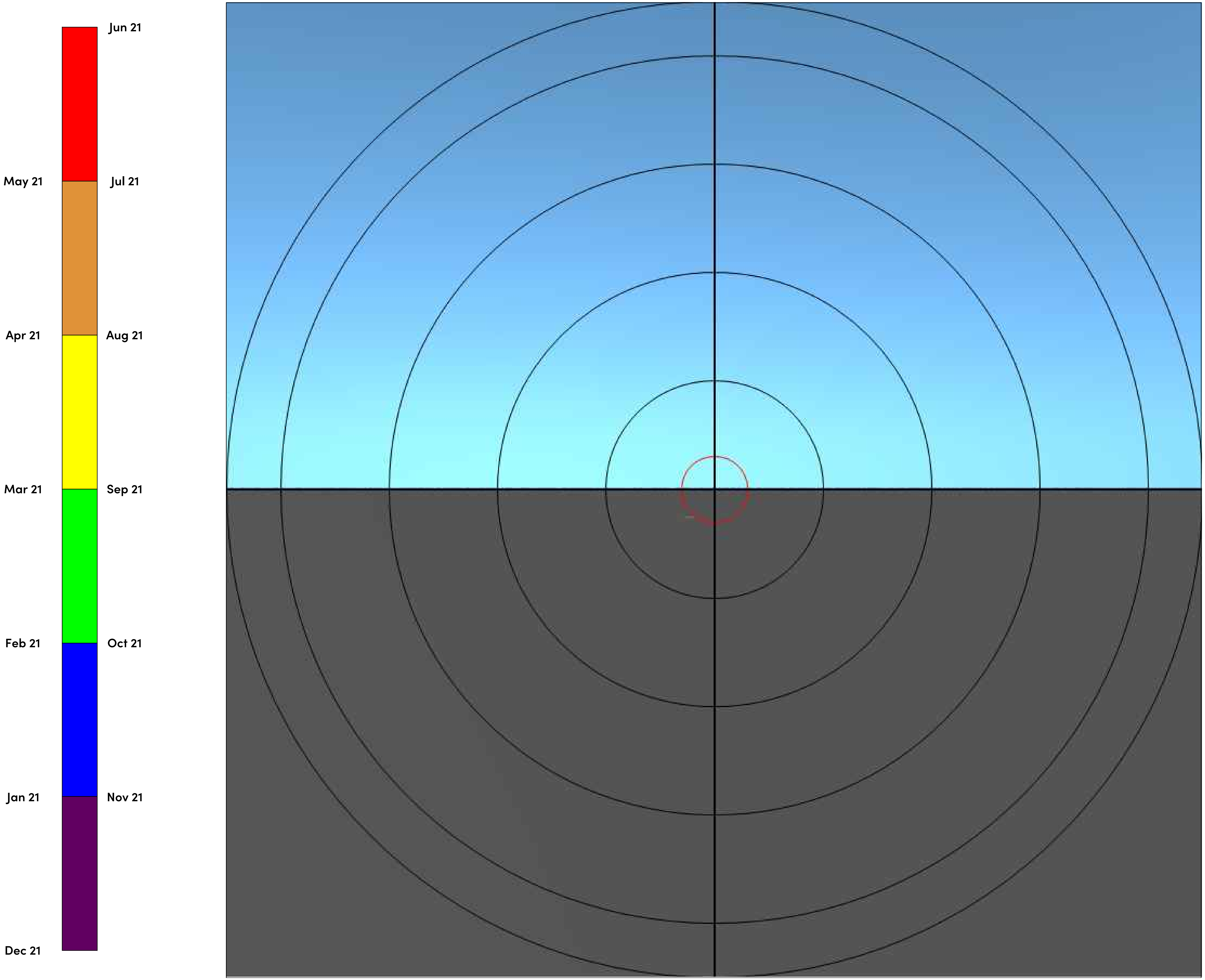

SOURCES OF INFORMATION:

SMR ARCHITECTS

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ACCUCITIES 3D MAPPING

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TITLE

Solar Glare Study
LHR Runway 09L
Camera Position 2500ft

CLIENT

Lysara

PROJECT

2-3 Heathrow Flightpath
West Drayton
UB7 0DU

DRAWN BY	CHECKED
SK	SL/BSC
SCALE	DATE
NTS	May 2025

HOLLIS

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DRAWING NO.	RELEASE NO.
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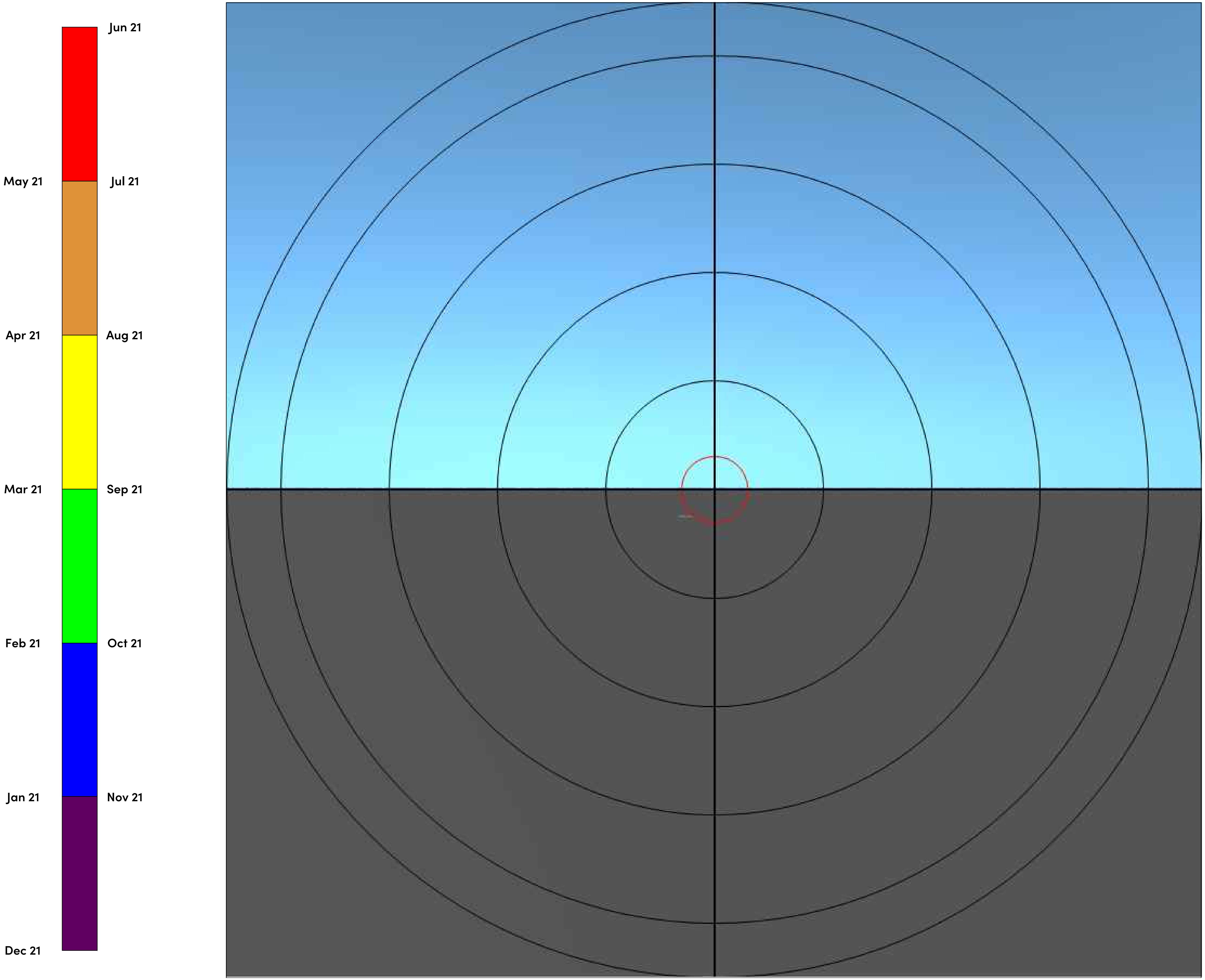

SOURCES OF INFORMATION:

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TITLE

Solar Glare Study
LHR Runway 09L
Camera Position 2000ft

CLIENT

Lysara

PROJECT

2-3 Heathrow Flightpath
West Drayton
UB7 0DU

DRAWN BY	CHECKED
SK	SL/BSC

SCALE	DATE
NTS	May 2025

HOLLIS

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DRAWING NO.	RELEASE NO.
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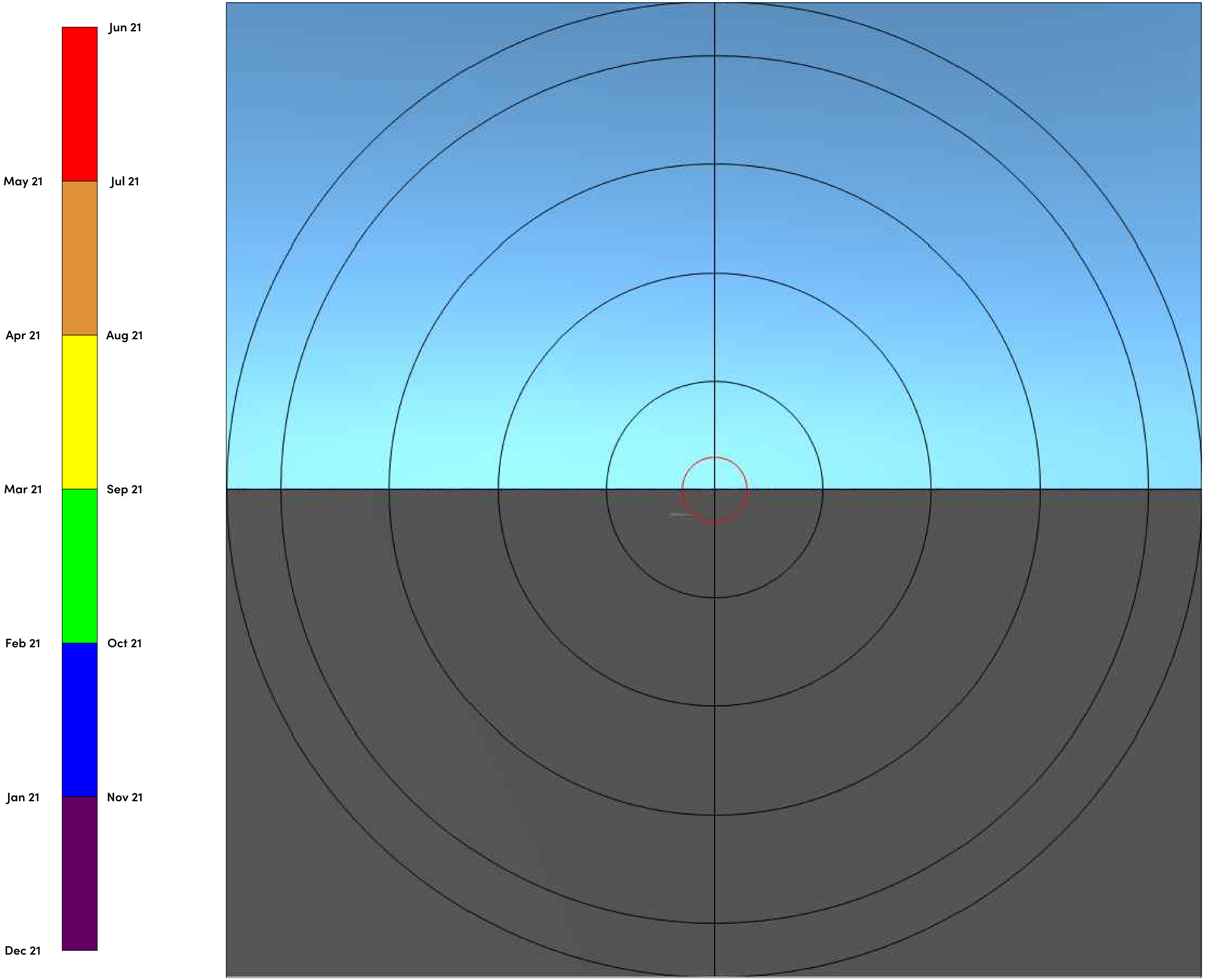

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TITLE

Solar Glare Study
LHR Runway 09L
Camera Positin 1500ft

CLIENT

Lysara

PROJECT

2-3 Heathrow Flightpath
West Drayton
UB7 0DU

DRAWN BY	CHECKED
SK	SL/BSC
SCALE	DATE
NTS	May 2025

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