

SOLAR PHOTOVOLTAIC GLINT AND GLARE ASSESSMENT

UNIT 1, ROYAL LONDON PARK

Longevity Power has been instructed to assess the possible effects of glint and glare from a rooftop solar photovoltaic (PV) development at Unit 1, Royal London Park, SO30 2FZ. The assessment pertains to the possible impact upon aviation activity associated with Southampton Airport. The runway approach paths and the Air Traffic Control (ATC) Tower have been assessed. This report contains the following:

- Solar development details.
- Overview of relevant guidance.
- Assessment methodology.
- Southampton Airport details
- Glint and glare results
- Electromagnetic Radiation

Solar Development Details

The proposed 100 kWp PV array will occupy the South-West corner of the roof of Unit 1, Royal London Park. The PV system will be installed flush to the roof sheet, which have a 5 degree South-West facing pitch.



Figure 1: Proposed PV Array

Solar Panel Details	
Azimuth Angle (°)	197 (South-facing)
Elevation Angle (°)	5
Assessed Height Above Ground (metres)	12.82

Figure 2: Solar Panel Details

Overview of Relevant Guidance

The Civil Aviation Authority (CAA) has published interim guidance on 'Solar Photovoltaic Systems', which identifies the key safety issues with regards to aviation. It is outlined that solar developers should be aware of the requirements to comply with the Air Navigation Order (ANO), published in 2009. In particular, developers should take particular note of the following articles of the ANO6, including:

Article 221 – *Lights liable to endanger* – “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 or from landing at an aerodrome; or*

b) *By reason of its liability to be mistaken for an aeronautical ground light liable to Endanger aircraft”*

Article 222 – *Lights which dazzle or distract* – “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.”

Article 240 – *A person must not recklessly or negligently act in a manner likely to endanger an aircraft, or any person in an aircraft.*

Assessment Methodology

The methodology followed was as follows:

1. Identify receptors situated in the vicinity of the proposed development.
2. Perform geometric calculations to evaluate the potential for direct solar reflections from the proposed development towards the identified receptors.
3. Assess the visibility of the reflectors from the receptor's location. If the reflectors are not visible to the receptor, then no reflection can occur.
4. Based on the results of the geometric calculations, determine whether a reflection can occur and determine the time at which it may occur.
5. Consider the intensity of the solar reflection.
6. Evaluate the solar reflection from the proposed development in relation to the receptor's position and the location of direct sunlight.
7. Consider the solar reflection in accordance with published studies and guidance.
8. Determine whether a significant detrimental impact is expected,

In the assessment process, the model defines the reflector area and relevant receptor locations, resulting in a chart that indicates whether a reflection can occur, the duration of the reflection, and the panels that can potentially produce the solar reflection towards the receptor.

If a solar reflection is identified for an aviation approach path receptor, intensity calculations are conducted using Sandia National Laboratories' Solar Glare Hazard Analysis Tool (SGHAT), as incorporated into the Forge Solar platform. Although originally applicable only to solar photovoltaic developments in the USA, the methodology and associated guidance are widely adopted by aviation stakeholders in the UK. The following excerpt is taken from the SGHAT model methodology:

"The tool determines the timing and locations where solar glare can occur throughout the year, based on a user-specified PV array as observed from user-prescribed observation points. It also assesses the potential ocular impact of the observed glare and predicts the annual energy production."

The outcome of this analysis is a chart that specifies whether a reflection can occur, the duration of the reflection, and the predicted intensity for aviation receptors.

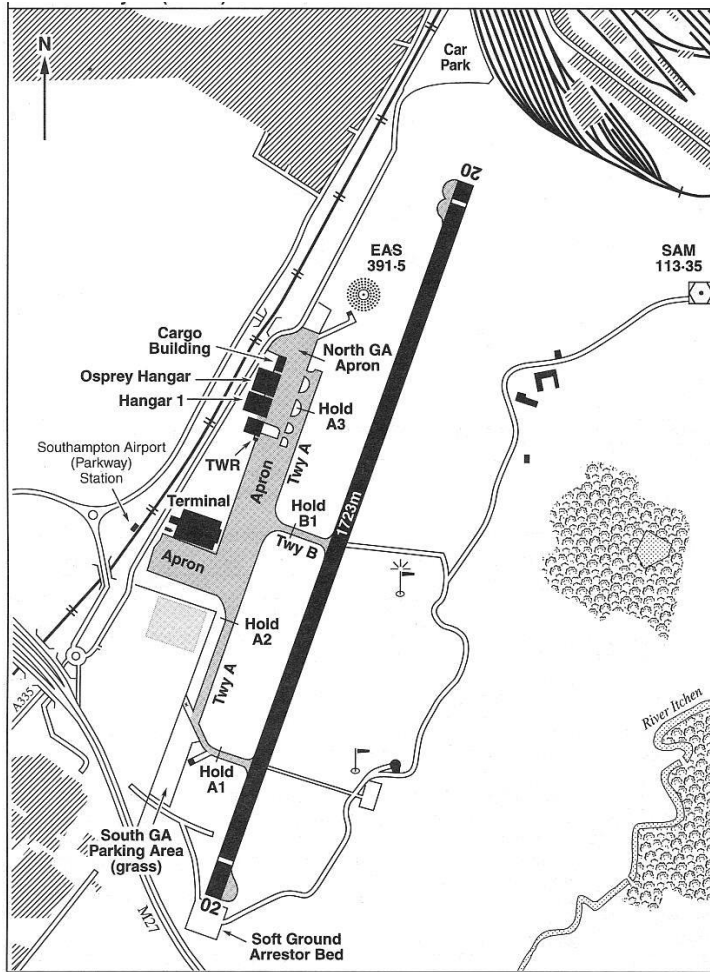
Both models (SGHAT and Forge Solar) have been employed in numerous aviation glint and glare assessments, producing similar results. Thus, when the geometric analysis indicates the geometric possibility of a solar reflection, an intensity calculation aligned with Sandia National Laboratories' methodology is also performed.

Southampton Airport Details

Southampton Airport is an international airport located in both Eastleigh and Southampton, Hampshire, in the United Kingdom. The airport is located 4.6 km North-West of Unit 1, Royal London Park and has a single existing runway which is 1.72 km in length. As of June 2023, construction is underway on an extension to the Northern end of the runway which would extend the runway by an additional 164 metres.



Figure 3: Distance between Southampton Airport and Unit 1, Royal London Park



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Figure 4: Map of Southampton Airport with runway and air traffic control tower marked (see 'TWR')

As part of Longevity's Glint & Glare assessment, we have considered a 2 mile flight path at either end of the runway, as well as analysing potential glare at the air traffic control tower.

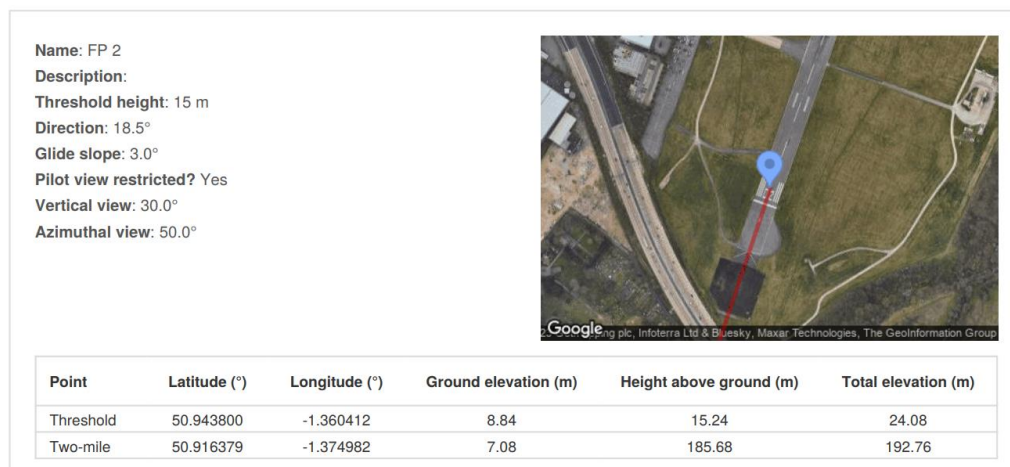
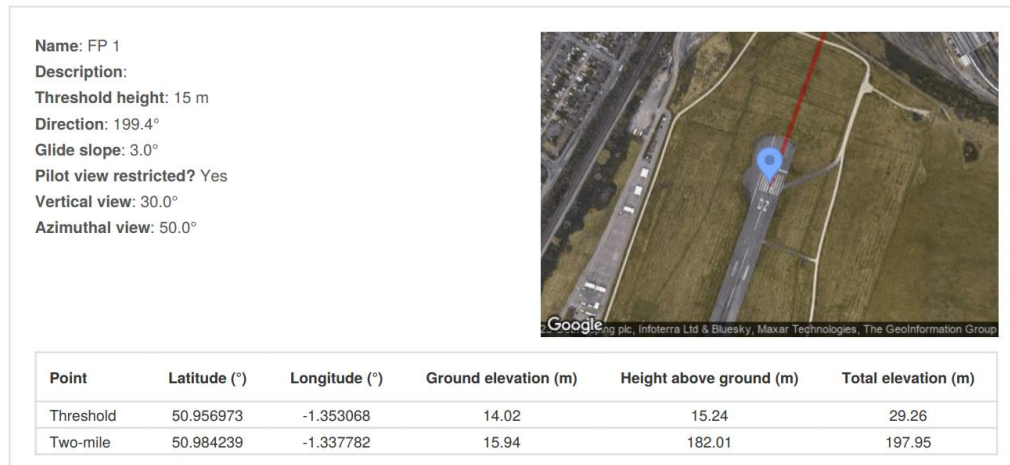


Figure 5: Flight paths 1 & 2, as modelled on Forge Solar

Name	ID	Latitude (°)	Longitude (°)	Elevation (m)	Height (m)
1-ATCT	1	50.952290	-1.359477	13.18	13.00

Map image of 1-ATCT

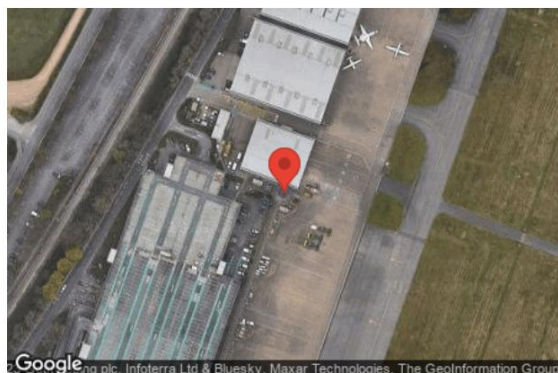


Figure 6: Air Traffic Control Tower, as modelled on Forge Solar

Glint & Glare Results

The following section presents an overview of the solar reflection modelling for the identified receptors. The SGHAT model has been used to determine whether reflections are possible, and where solar reflections have been predicted, intensity calculations in line with the Sandia National Laboratories methodology have been undertaken.

Where glare is predicted, the intensity model calculates the expected intensity of a reflection with respect to the potential for an after-image, or retinal burning (Figure 7).

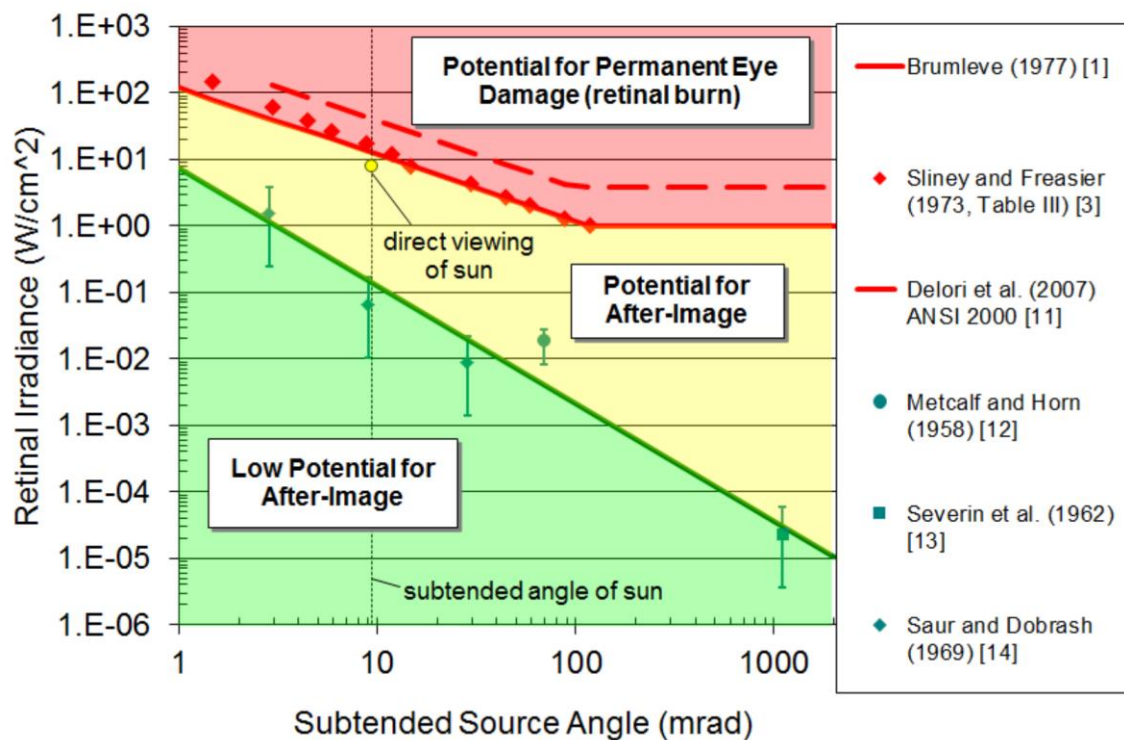


Figure 7: Glare intensity designation

As indicated in Figure 8, the proposed PV array will not generate any green or yellow glare for any period of time for Flight Path 1 and 2 nor the air traffic control tower. The PV system should not therefore be considered to be in contravention of Articles 221, 222 or 240 of the ANO.

PV: PV array 1 no glare found

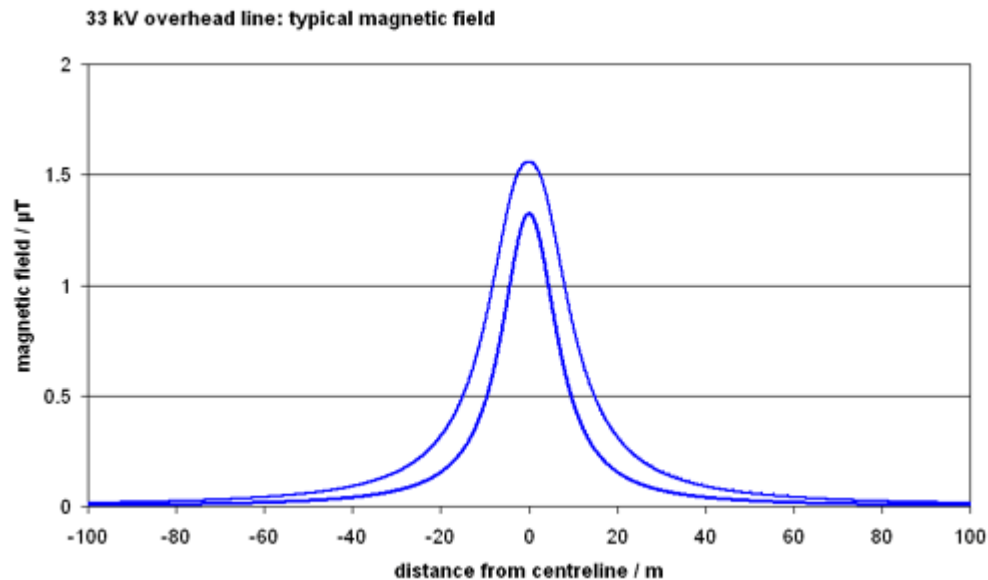
Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
FP 1	0	0.0	0	0.0
FP 2	0	0.0	0	0.0
1-ATCT	0	0.0	0	0.0

Figure 8: Results of Glint & Glare Analysis

Electromagnetic Interference

All electrical equipment emits electric and magnetic radiation. However, Southampton Airport is located over 4 km from Unit 1, Royal London Park, and it is therefore considered to be highly unlikely that any electro-magnetic radiation from the DC cabling associated with the rooftop solar PV array will disrupt any of the equipment at the airport. To give an indication of how electro-magnetic radiation decreases with distance, Figure 9 demonstrates the magnetic field associated with a 33 KV overhead electrical line with distance. Over a period of 100 metres, the magnetic field is negligible.



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