SAC 2023 Navigation Competition

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Exec Summary

- The animal is a penguin
- It is formed by a landscape/forest pattern/path at: 56°38'10.56"N   3°44'4.48"W
- It is visible from the end point of the second leg of the competition route.
- The positions of the turning point and the destination point were calculated on a spreadsheet using the Vincenty method.
- Three separate flights were made in Skyranger G-CDBO:
  - To identify the exact described position and its context in the landscape
  - A search pattern was flown around the described position to identify the 'animal'
  - A photographic sortie was flown to gather evidence.

Figure 1 – A Landscape Penguin

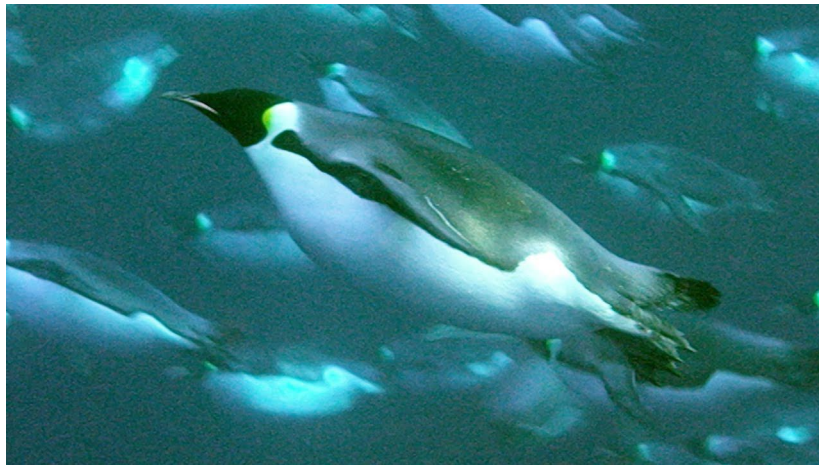*Figure 2 - A Landscape Penguin (emphasised)*

Figure 3 – Underwater Penguin

1 Navigation Planning

1.1 Rough Plot

The PTH reference point is the centre of the 03/21 runway. A rough plot of the two legs was made on a ¼ mil chart to identify the right area: - A hillside just south of Balnaguard.

Figure 4 - hand-plotting on a 1/4 mil chart

1.2 The Mathematical Bit

The positions of the endpoints of the two legs described (called Point 01 and Point 02 in this document) were determined by calculation. There are various mathematical approaches which can be used to calculate the destination point (point02) of the route from the description given. Since the degree of precision required was unknown, I decided to use the (extremely accurate) Vincenty[1] method on the WGS84 ellipsoidal model of the Earth. A spreadsheet was created to do the actual calculations.

The reference point of Perth Aerodrome was found in the AIP: (*562621N 0032220W*) and converted to decimal latitude/longitude (for ease of calculation):

Vincenty Direct Calculation						Result: point 2, reverse azimuth			
Perth to P01			56.4411			Point 2 - latitude	56.6074		56∞36'26.7136"N
			-3.3738			Point 2 - longitude	-3.3738		003∞22'25.6800"W
Distance [nm]	10.000		18520			Reverse Azimuth	180.0000		
Azimuth	0.0000								
P01 to P02			56.6074			Point 2 - latitude	56.6278		56∞37'39.9416"N
			-3.3738			Point 2 - longitude	-3.7339		003∞44'02.0556"W
Distance [nm]	12.000		22224			Reverse Azimuth	95.9998		
Azimuth	276.0000								

Figure 5 – Spreadsheet

This allowed the route to be accurately plotted on SkyDemon and GoogleEarth:
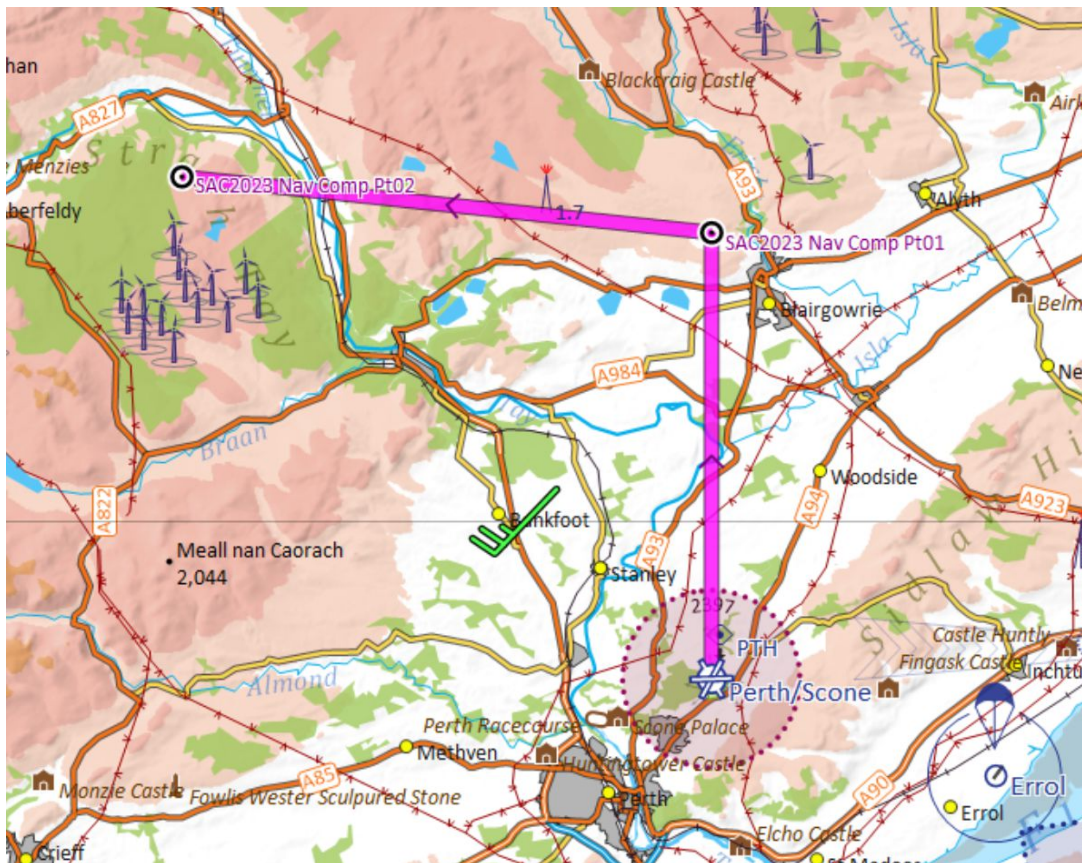
1.2.1 SkyDemon

Figure 6 – SkyDemon route plot with two custom waypoints

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1   http://www.ngs.noaa.gov/PUBS_LIB/inverse.pdf

1.2.2   Google Earth

GoogleEarth was used to examine the context of point02 from the armchair. Figures 7-10 show this context with increasing levels of 'zoom'.
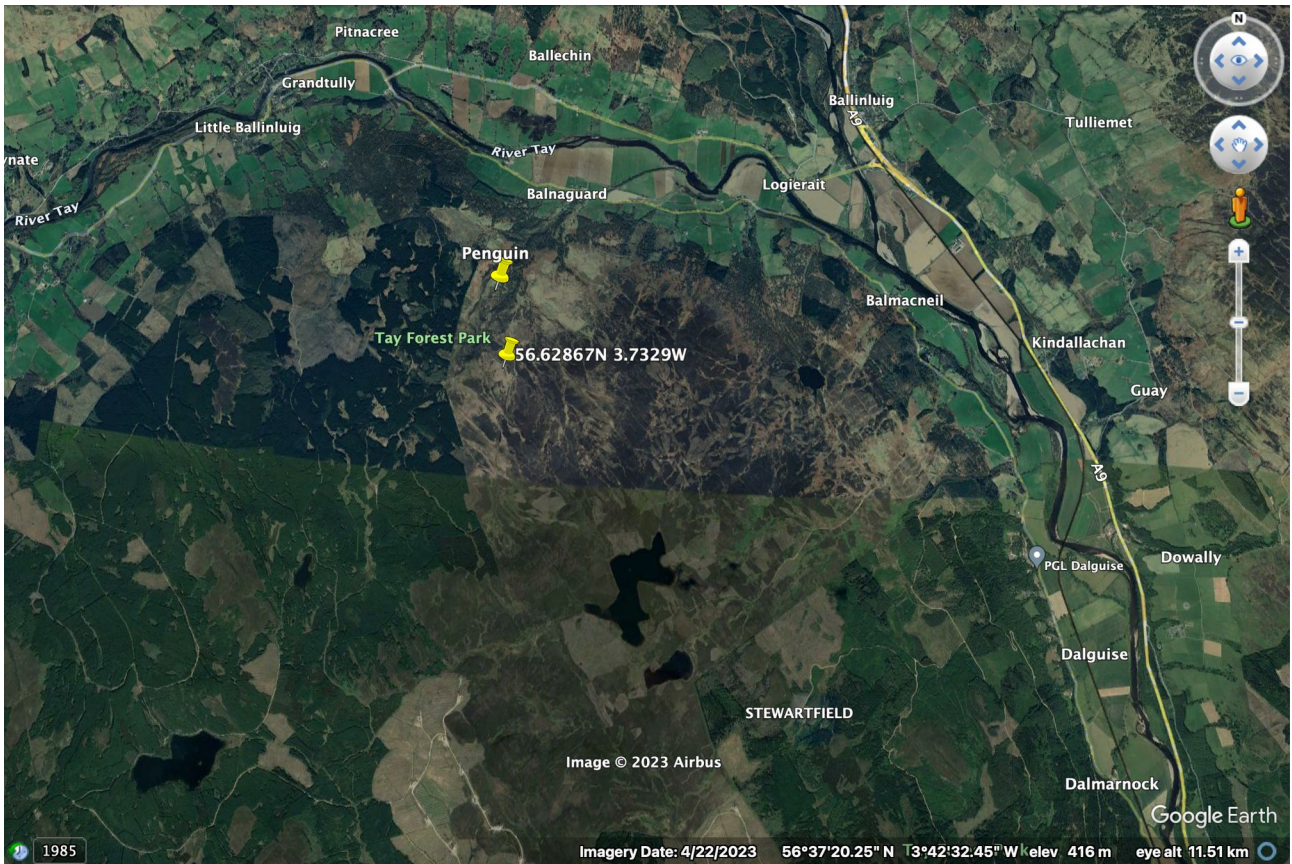

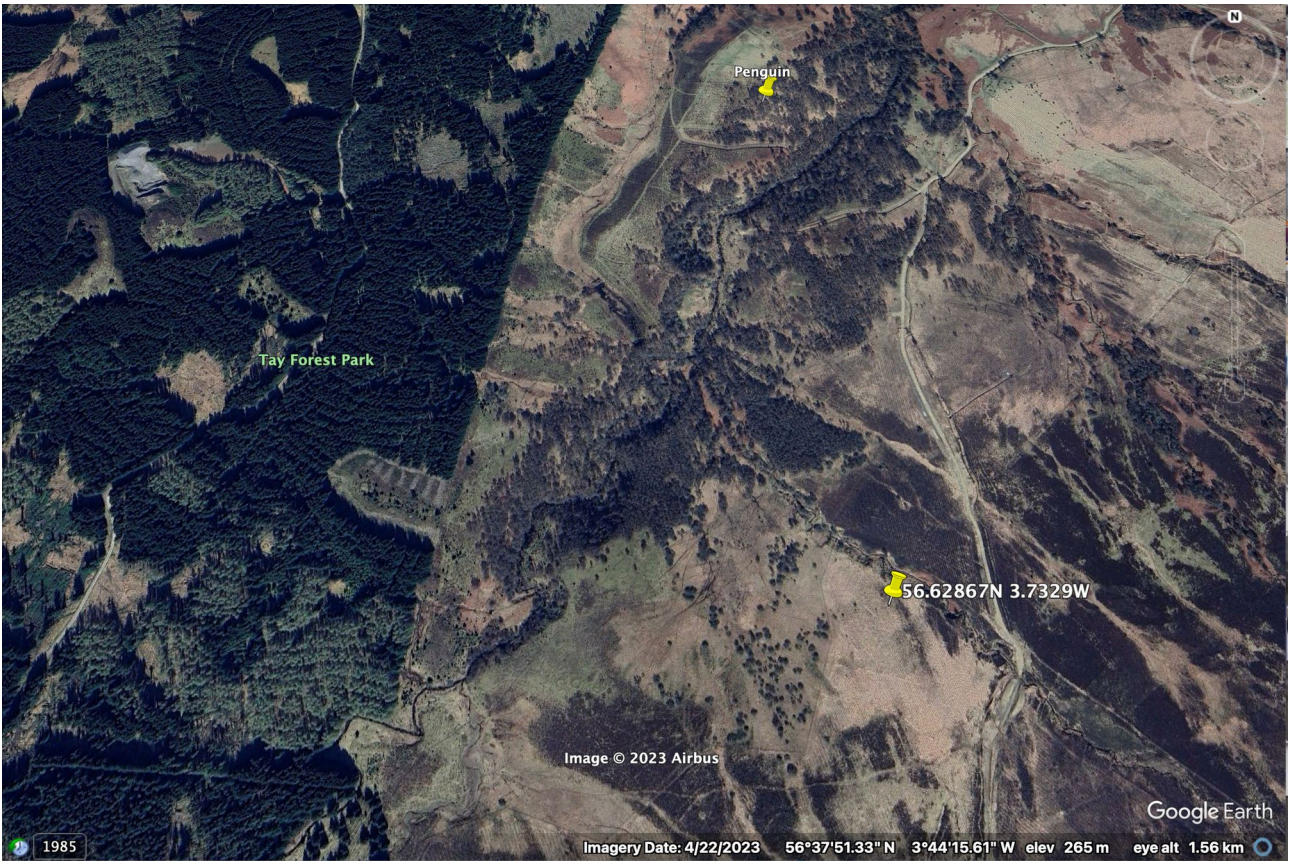*Figure 7 - GoogleEarth – Context view – Showing position of P2 to the south of Balnaguard*

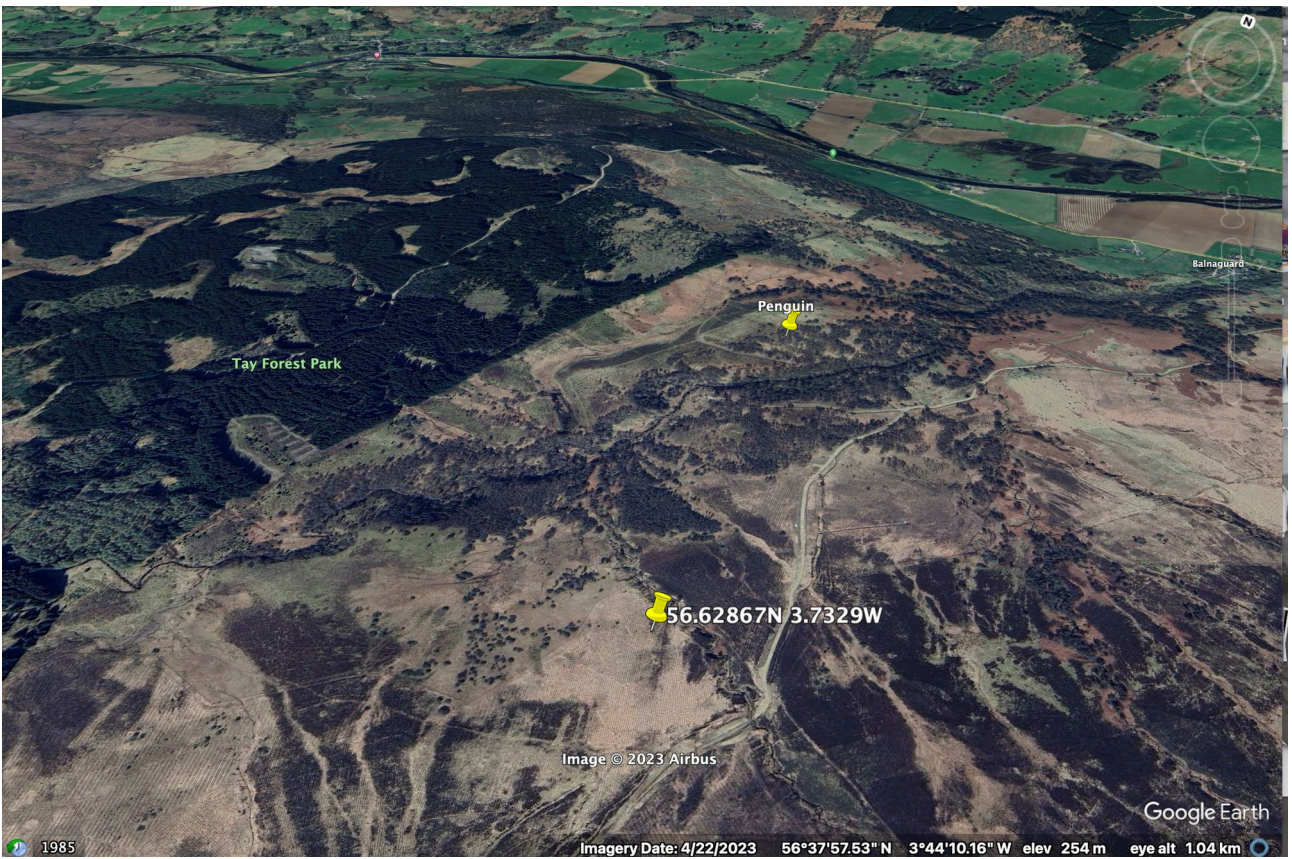*Figure 8 - GoogleEarth – Position of P2 between forest/plantation and moorland path*

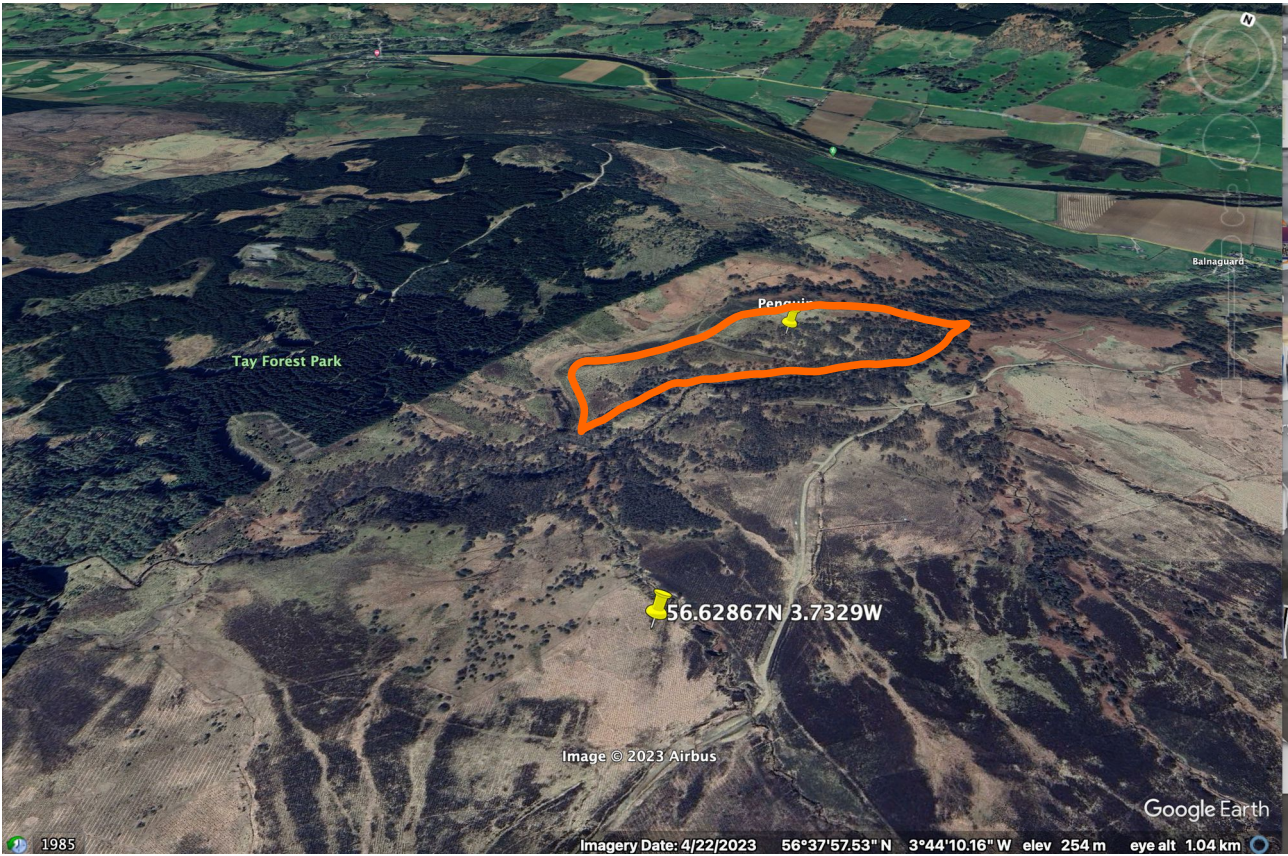*Figure 9 - Google Earth - P02 and the penguin*

Figure 10 - Google Earth - P02 and the penguin (emphasised)

2 The Flights

A series of three flights were undertaken on the 7th July, 17th July and the 9th August to 'find' the target.

Figure 11 – Log book entries

2.1 Flight 1 – Identifying the described position

Having identified the 'exact' point described, a flight direct to the point was made in the hope of a 'quick win' and easily identifying the 'animal'. Whilst locating the point on the ground was relatively easy (thanks to previously overflying it virtually on GoogleEarth) it soon became apparent that the animal was hiding, possibly due to the weather (low-cloud, strong wind, turbulence) which wasn't conducive to searching either, so the search was abandoned for the day.

Route

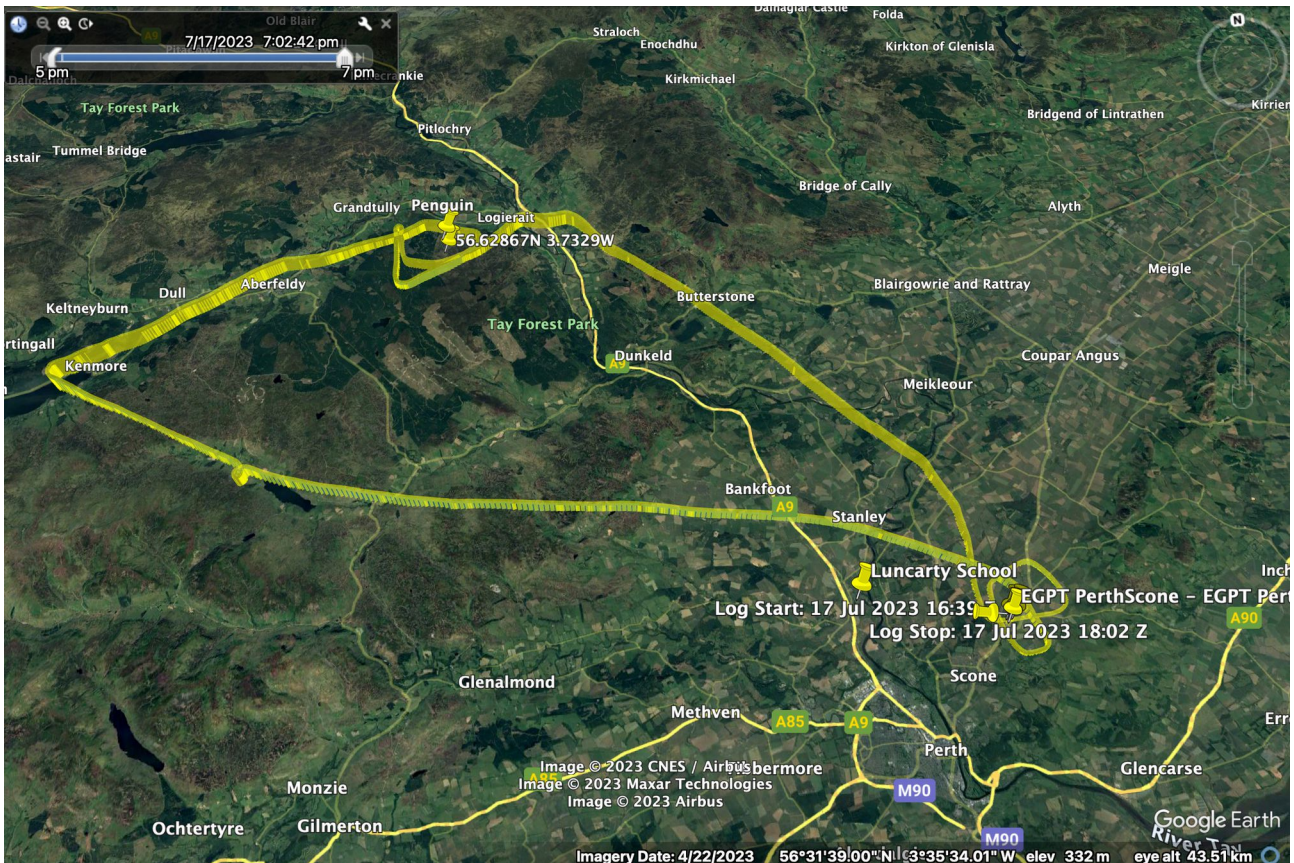| From	To	Alt	Track	Dist	Set	Time	ETA	Hdg	Endurance (hrs:mins)
		ft	(°T)	nm		min		(°M)	4:00
Perth	P01	3000	000	10		8		352	3:30
P01	P02	3000	276	12		12		268	3:18
P02	Perth	3000							
Perth									
				22nm	Duration:	00:19			

Figure 12 - Flight 1 Plog -

Figure 13 - Track of Flight 1 from SkyDemon displayed in GoogleEarth

2.2   Flight 2 – Searching for an animal

Point 2 seems to be a piece of bare moorland however during the first flight it was realised that if you approach the point following the given route – rather than flying direct from Perth – then a man-made forest with some distinctive planting patterns was dead-ahead on reaching the point. Flying a search pattern (ok, some very rough orbits) over the forest showed that someone with a rather warped imagination might just be able to pretend that some of the patterns might, in the right light (sufficient moonshine) be interpreted as animals, however no particular beastie leaped out.

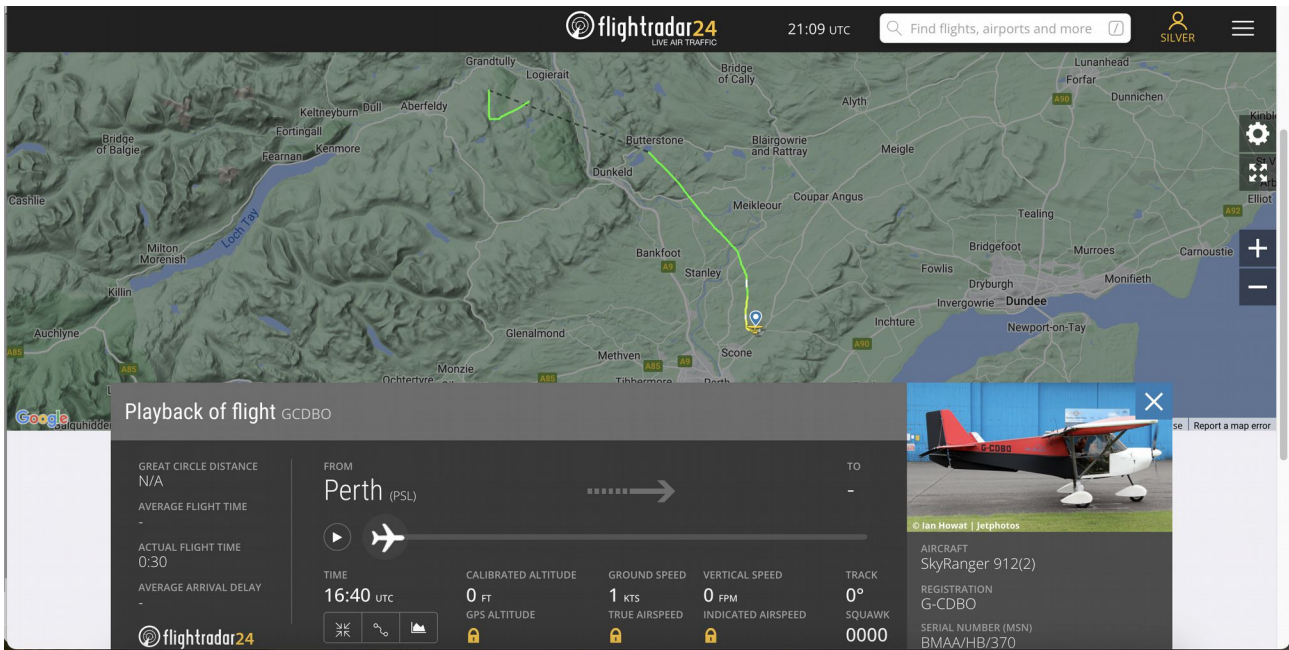| Route									
From	To	Alt	Track	Dist	Set	Time	ETA	Hdg	Endurance (hrs:mins)
		ft	(°T)	nm		min		(°M)	4:00
Perth	P01	3000	000	10		8		357	3:29
P01	P02	3000	276	12		11		272	3:18
P02	Perth	3000							
Perth									
		22nm Duration: 00:19							

Figure 14 – Flight 2 Plog

Figure 15 - Track of Flight 2 from flightradar
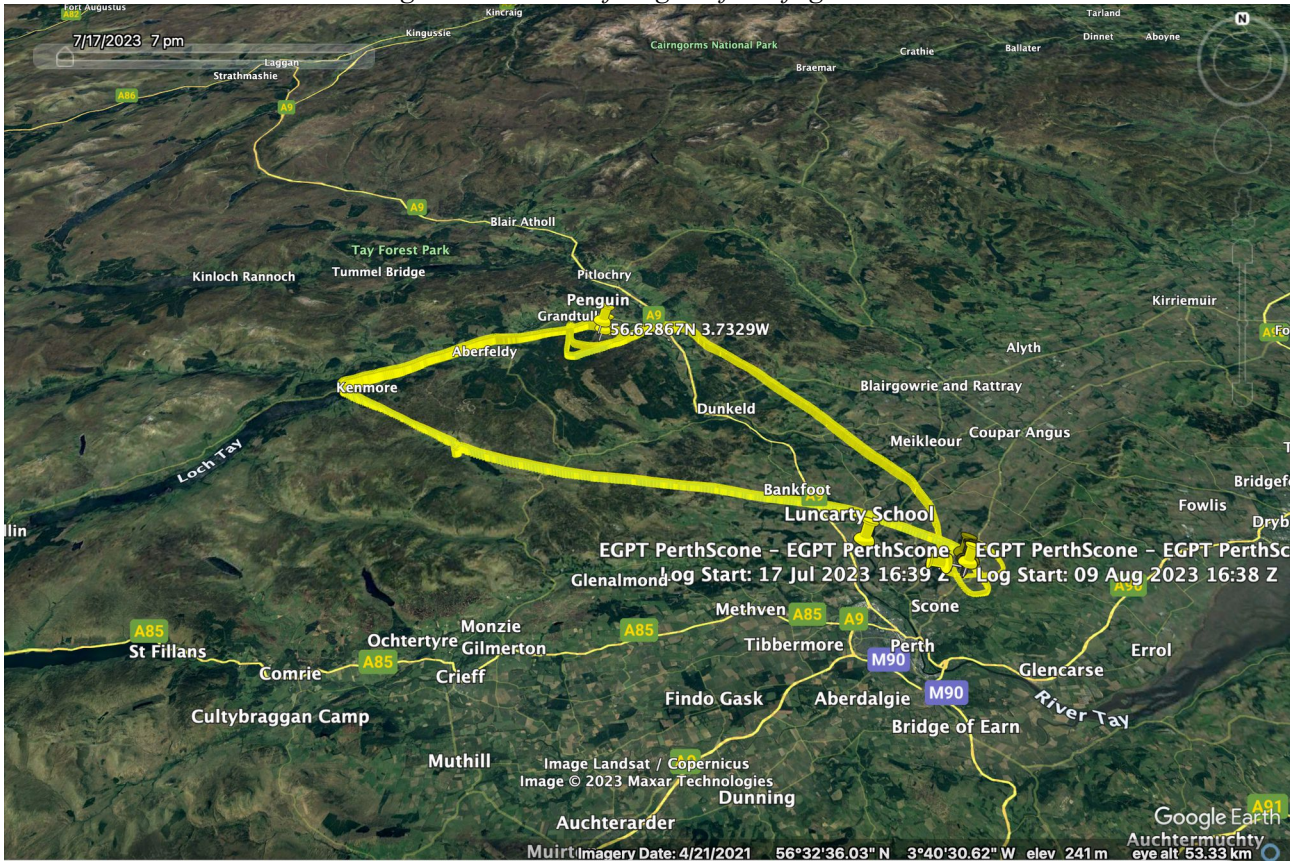
Figure 16 – Flight 2 from SkyDemon visualised in Google Earth

2.3 Flight 3 – Photographing the target

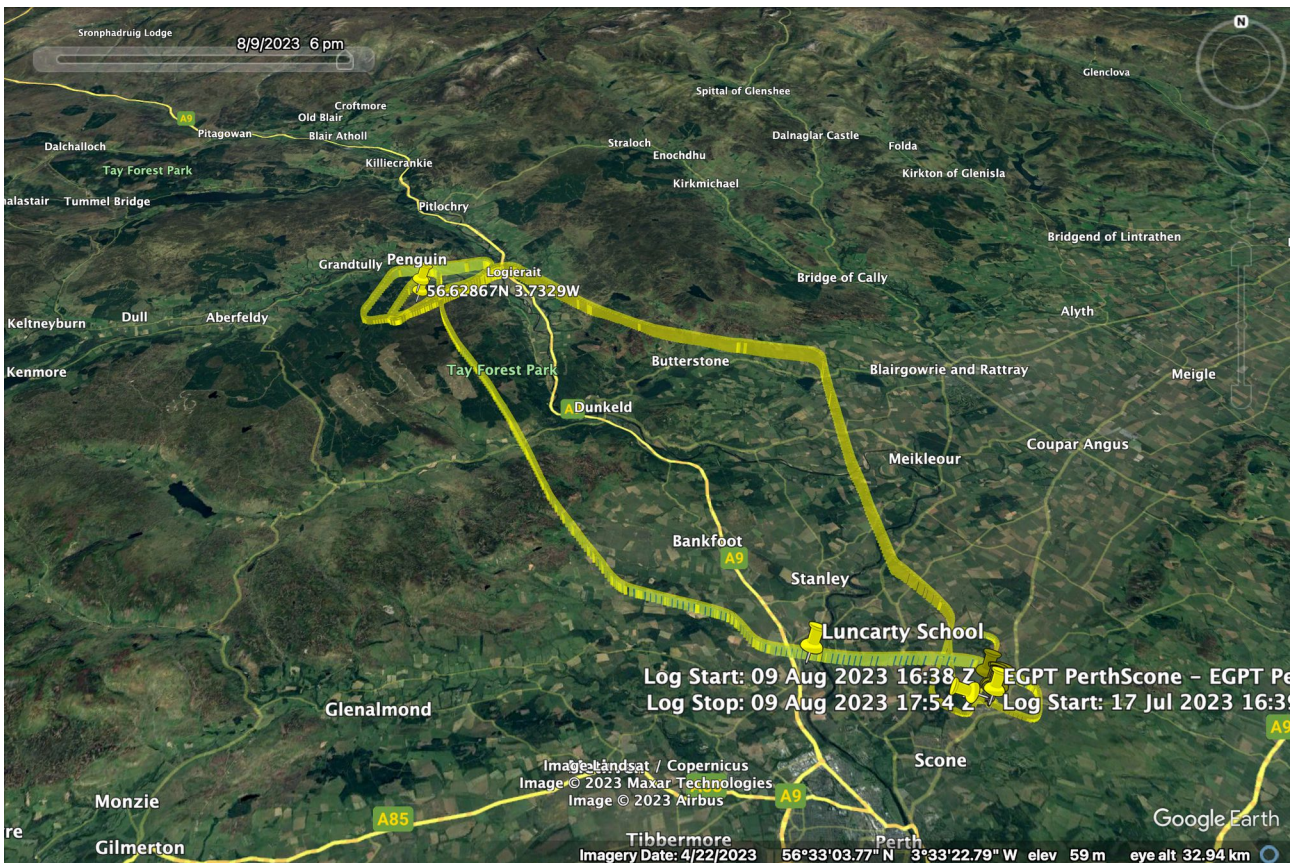| Route									Endurance
From	To	Alt	Track	Dist	Set	Time	ETA	Hdg	(hrs:mins)
		ft	(°T)	nm		min		(°M)	4:00
Perth	P01	3000	000	10		8		358	3:29
P01	P02	3000	276	12		11		274	3:18
P02	Perth	3000							
Perth									
			22nm Duration: 00:18						

Figure 17 - Flight 3 Plog

Figure 18 - Flight 3 – Track from SkyDemon – displayed in Google Earth

Having insufficient imagination (and no night-rating for flying under the influence of moonshine) I decided to separate the tasks of flying and imagining and brought along an observer/photographer (my daughter - Kathryn). On flying the competition route and arriving at point 2, the observer soon called 'Visual with the penguin' (Figure 18. below) and took the photo at the top of this document (Figure 1).

Figure 19– Approaching search area – "Visual with the Penguin"

3 Conclusion

We are by no means certain that this is the intended animal (let's face it – we haven't a clue really), but a lot of fun was had tackling the competition so the crew of G-CDBO would like to say, 'Thank you' to the organiser(s).

Figure 20– Crew of G-CDBO during Flight 3

No penguins, other than chocolate ones, were harmed in the production of this entry.