ACCE+ DLA Research Experience Placement: Avian spatial cognition: do birds plan their foraging trips?

NERC remit:
Understanding how animals navigate is key to predicting their responses to anthropogenic environmental changes, since it forms the interface between their internal state (e.g. motivations, breeding condition etc) and where resources are in the environment. As such, investigations of wild animal navigation fit within NERC's remit for climate change and ecology, biodiversity and systematics.

Introduction
Mobile animals must integrate experience and environmental cues to navigate over both small and vast spatial scales. The discovery of the cognitive map in mammals – a cognitive module which has evolved to record an animal's movement and provide it with direction and distance information – resulted in the 2014 Nobel Prize for physiology. It explained how rats might be able to learn where resources in their environment were, and the routes between them, allowing them to plan their movements in space and time. This project aims to look at route planning in Manx shearwaters, which breed on remote islands and feed far out at sea on pelagic fish. Do shearwaters allocate more time when they plan to go further, and are these plans evident early during foraging trips (which can last several days).

Objectives
To GPS-track foraging trips of Manx shearwaters and analyse these data to measure how they plan (i) outbound trips and; (ii) their return to the colony, to better understand shearwaters' resilience to environmental change.

Summary of proposed experimental work and timeline
8 weeks from 14th July – 8th September
1-week induction and background in Liverpool mid July

2-3 weeks' fieldwork on Skomer, Skokholm or Rum Island (or combination) with an experienced team in late July and early August. Deployment and retrieval of archival snapper GPS to record GPS tracks of shearwater foraging trips.

Mid-August to early September office-based
Weekly online lab meetings of the Liverpool and Oxford Navigation Research Groups.

Research training for the student
Fieldwork: preparation, permits, ethics and logistics with experienced team
Analysis: GPS data analysis in R and GIS. Circular statistics, general linear modelling with extensions to non-linear models and mixed models.

References
Guilford, T., Meade, J., Freeman, R., Biro, D., Evans, T., Bonadonna, F., ... & Perrins, C. M. (2008). GPS tracking of the foraging movements of Manx Shearwaters Puffinus puffinus breeding on Skomer Island, Wales. *Ibis*, *150*(3), 462-473.

Padget, O., Stanley, G., Willis, J. K., Fayet, A. L., Bond, S., Maurice, L., ... & Guilford, T. (2019). Shearwaters know the direction and distance home but fail to encode intervening obstacles after free-ranging foraging trips. *Proceedings of the National Academy of Sciences*, *116*(43), 21629-21633.

Harris, S. M., Bishop, C. M., Bond, S., Fernandes, P. G., Guilford, T., Lewin, P. J., ... & Cordes, L. S. (2025). Adjustable wind selectivity in shearwaters implies knowledge of the foraging landscape. *Current Biology*.