Attachment 1 – DAGSI Research Topic Template

1. **Research Title:** Enhancing Geo-location Accuracy of OTHR Systems
2. **Individual Sponsor:** List the AFRL research topic sponsor's contact information

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3. **Academic Area/Field and Education Level**

> Electrical Engineering and Physics (MS or PhD level)

4. **Objectives:** Describe the overall objectives for the proposed research
   The objective of this proposed research is to improve target geolocation accuracy of OTHR systems, via the assimilation and integration of existing signals of opportunity, including but not limited to GPS, ADS-B, AIS, and others. In Particular, advances in Artificial Intelligence and Machine Learning (AI-ML) will be leveraged to enhance the use of these opportunistic signals, resulting in enhanced geo-location accuracy.

5. **Description:** Provide a brief background and/or description of the proposed research topic
   There has been increased interest in High Frequency (HF) over the horizon radar (OTHR) for long-range wide area surveillance of targets of interest. The performance of such systems depends on several factors, including but not limited to radar location, look direction, season, and ionospheric conditions. Further, HF systems are bandwidth limited, resulting in poor range resolution and target parameter (range and Doppler) estimation. Geolocation of targets observed by OTHR is referred to as Coordinate Registration (CR). Good CR requires an accurate model of the real-time ionosphere as well as high-fidelity HF propagation calculations to convert radar-measured target signal delays and beam steers to geographical position. Traditional approaches use known reference points (KRPs) to aid with geo-locating detected targets. AFRL seeks novel research that leverages advances in AI-ML, and the large number of available sources (GPS, GNSS, AIS, ADS-B, and others) to improve the geo-location accuracy of OTHR systems.

6. **Research Classification/Restrictions:** Inform researchers about potential classification levels and restrictions associated with the research.
   US Citizenship is required, and the research will be done at the unclassified and potential CUI level.

7. **Eligible Research Institutions:** Indicate to what organizations this topic should be provided
   The topic is open to all Ohio universities.

8. **References**

[1] Nickisch, L.J. and Hausman, M. "CREDO: Coordinate Registration Enhancement by Dynamic Optimization," Ionospheric Effects Symposium (IES-96), pp. 1B2 1-9, May 1996.

[2] Cervera, M.A. and Harris, T.J., "Modeling the effects of ionospheric disturbances on quasi-vertically incident ionograms using 3-D magneto-ionic ray-tracing," Proc. of URSI General Assembly and Scientific Symp., Istanbul, August 2011.

[3] Anderson, R.H. and Krolik, J.L., "Over-the-horizon radar target localization using a hidden Markov model estimated from ionosonde data," Radio Science, vol. 33, no. 4, pp. 1199-1213, July-August, 1998.

[4] Krolik, J.L. and Anderson, R.H., "Maximum likelihood coordinate registration for over-the-horizon radar," IEEE Trans. on Signal Processing, vol. 64, no. 3, pp. 945-959, April, 1997.

[5] Li, L. and Krolik, J.L., "Radar target tracking in uncertain multipath environments using Viterbi data association," Proc. 14th Intl. Conf. on Information Fusion, Chicago, July 2011.

[6] Torrez, W.C. and Yssel, W.J., "Over-the-Horizon Radar Surveillance Sensor Fusion for Enhanced Coordinate Registration," 1999 Information, Decision, and Control Conf., Adelaide, Australia, pp. 227-230, Feb 1999.