

Attachment 1 – DAGSI Research Topic Template

NOTE: Under the Cooperative Agreement, Technical Directorates have three options for topics. First, a topic can strictly be considered in the pool for the state allocation of funding. DAGSI will work across the TDs for this allocation. Second, the TD can be prepared to be a funding partner with the State of Ohio. This would include: providing additional funds to support additional recipients of a topic, or expand the proposers team to include additional members on a topic. Third, the TD may elect to fully fund a topic not selected for State of Ohio funding or to pursue University teams outside the State of Ohio. Contact lindsay.kotouch.2@us.af.mil for questions.

1. **Research Title:** Realization of Time-evolving Dynamic Sea surface for Synthetic Aperture Radar (SAR) Imaging
2. **Individual Sponsor:**

Dr. Woo-Yong Jang, AFRL/RFD
AFRL/RF Bldg 620,
2241 Avionics Circle
WPAFB, OH 45433-7333
woo-yong.jang.2@us.af.mil

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

Electrical and Computer Engineering
Preferred focus on radar signal & image processing/ AI/ML (MS or PhD level)

4. **Objectives:** The objective of this work is to develop and validate the theory to model the ocean surface for SAR imaging to represent a time-evolving (dynamic/deterministic) sea surface. Main idea is to capture fine-grained coherent/dynamic radar effects such as Doppler shift, SAR azimuth smearing and ship-surface interactions.
5. **Description:** Conventionally, the sea surface is represented using an ensemble average - a statistical and analytical framework used to predict and analyze the average radar cross-section. While computationally efficient due to its reliance on fast analytical or high-frequency approximation methods, this approach cannot capture Doppler spectra or phase fluctuations because individual wave velocities are averaged out over infinite realizations of a random rough surface. Conversely, the time-evolving method explicitly models the spatial-temporal progression of ocean waves, naturally capturing surface height changes at each time step and the phase shifts of backscattered waves. This enables the precise prediction of Doppler shifts (induced by overall wave currents) and Doppler bandwidth (caused by the orbital motion of waves). Capturing these complex, time-varying scattering effects between a ship and dynamic ocean waves is highly critical for SAR applications and training automatic target recognition (ATR) algorithms.

6. **Research Classification/Restrictions:** Requesting U.S. citizen applicants. We remind the students/university that work completed under this DAGSI effort may not be released publicly until it is approved by the AFRL public release process and needs to be formally approved for public release.
7. **Eligible Research Institutions:** Any academic research teams in Ohio (e.g., the Ohio State Univ., Univ. of Dayton, Wright State Univ. etc.).
8. **NOTE: Topics submitted to DAGSI must be approved for public release. Need PA Approval #**