Novel Sensor System for the Early Detection and Monitoring of Offshore Oil Spills (PI Wei-Chuan Shih)

Despite the pressing needs, effective detection and quantification of oil spills has not become a technological reality. Current detection methods employ manual identification using routine helicopter surveys, which are severely limited in their efficiency by weather conditions, cost, and safety considerations. The Gulf of Mexico (GOM) requires an efficient, reliable, automated and cost-effective method of monitoring for spills, especially given that 90% of the more than 6000 platforms in the GOM are unmanned and unpowered.

To this end, this project aims to develop an innovative sensor system to quantify oil film thickness using multispectral infrared (IR) imaging and computational reconstruction. Such a system can aid human observers in making objective and accurate decisions, or alternatively be installed on the platform as an automated and permanent sensor for 24/7 operations, replacing or greatly reducing the frequency of current helicopter surveys.

The team will exploit the novel ultrasensitive detection mechanisms in the spectral and thickness modulations of oil films recently modeled and experimentally confirmed by the PI. These novel contrast mechanisms will enable the measurement of oil film thickness with 24/7 detectability. The proposed system seamlessly integrates passive multispectral imaging with a computational core to exploit the benefits of data sparsity.

The system is potentially an extremely cost-effective permanent sensor installed on platforms for offshore oil spill detection. Alternatively, the proposed system could be integrated with a small unmanned aerial vehicle (UAV) for task-specific missions. Ultimately, many sensor systems can be installed on multiple platforms, forming a sensor network for oil spill trajectory monitoring and environmental forensics.