



Schematic of the proposed field experiment

Goals

- In a real stratified ocean environment such as Monterey Bay, perform a series of field experiments on stratified wakes using USV-based observing system, consisting of a towed temperature sensor array, aimed to develop effective surveillance strategies in regions of national interest
- Conduct analysis of field data to determine how the signatures of interest can be characterized from background “noise” such as active internal and surface wave fields, external shears, eddies, and mixed layer turbulence

Background

- Development of non-acoustic submarine detection methods using unmanned systems require a comprehensive and systematic analysis of stratified wakes in realistic oceanic environments
- Recent findings suggest that the pattern of ocean stratification is critical for the detectability of signals emitted by propagating submersibles.
- USVs with towed temperature arrays may provide essential information about the evolving temperature field measured across stratified wakes to determine the intensity of its thermal signature and the temporal pattern of its decay

Motivation

- Interest in hydrodynamically-based detection systems has been motivated by: (i) continuous technological advances in sensor development which has led to improved measurement accuracy and (ii) proliferation of ultra-quiet air-independent propulsion submarines whose signal-to-noise levels fall significantly below passive acoustic thresholds.
- Major unresolved dynamical questions and technological challenges remain including high sensitivity of stratified wakes, both late and near-field, to the pattern of density stratification