MIT Multi-static Acoustic Modeling and Simulation Framework

Henrik Schmidt
MIT

To develop and evaluate the multi-static, autonomous sonar framework, it is the experience from GOATS, that a complete *Sonar System Simulation* framework must be applied, incorporating both the complex dynamics of the off-board platforms, the environmental acoustics, and the sonar processing. MIT has developed a fully bistatic acoustic simulation code that employs high-fidelity legacy acoustic propagation models, such as OASES and CSNAP, and accurately represents the effects of vehicle motion, surface roughness, evanescent wave propagation, elastic properties of the seabed, temporal nonstationarity, and acoustic scattering from proud or buried, simple elastic objects. With this real-time, end-to-end system modeling framework, multi-platform missions can be simulated and analyzed for area search coverage and detection and classification performance measures that are identified in the signal processing section of this work. This simulation capability will not only be used to study the physics of the total sonar concept under various environmental conditions but will also be able to map out specific scenarios involving adaptive sampling of the acoustic field, and run these cases as surrogate trials. Under SWAMSI the simulation framework will be expanded to incorporate the time-reversal insonification. Further, in collaboration with Burnett from SACLANTCEN the modeling framework will be coupled with the FESTA target scattering code, to incorporate scattering from more complex, elastic targets of realistic geometry, to determine the specific bi-static scattering characteristics of such targets which may be explored for concurrent detection and classification of such targets.