This paper discusses how the LSTS open-source communication and autonomy software (http://www.lsts.pt/toolchain) will enable networked vehicle systems to find, track, and sample dynamic features of the ocean. The software toolchain includes the following components:

- Ripples – Web application including a communications hub and tools for remote visualization, tasking, and supervision enabling remote collaborative planning and execution control, as well as outreach and education activities.
- Neptus – Distributed off-board command and control framework supporting planning, execution control, and post-mission analysis for networked vehicle systems.
- IMC – Protocol for networked vehicle systems operating in communications challenged environments. There is a discovery mechanism using different broadcasting mechanisms to identify end-points exposed in the network (over UDP, TCP, HTTP, acoustic modem, Iridium, etc.) The links among devices are dynamically created during execution.
- Dune – Onboard software framework providing logging, communications, navigation, and control functions for all supported vehicles, with a small memory and computational footprint to run virtually on any POSIX-compliant system.
- TREX – Onboard deliberative planning software enabling autonomous decision-making without human intervention integrated with the LSTS-UP tool chain.
- EUROPTus – Shipboard mixed-initiative planning and execution controller for multi-vehicle oceanographic field experiments and Neptus front-end. These components endow a dynamic set of physical assets with system level properties targeted at adaptive volume observation and sampling of interacting ocean processes. The approach builds on experience in large ocean experiments with multi-vehicle systems and on advances in: 1) standardized vehicle onboard software, including autonomy software; 2) delay and disruptive tolerant networking communications; 3) adaptive sampling of ocean features; 4) mixed initiative planning and execution control; 5) inter-operability protocols for heterogeneous vehicles; and, 8) visualization software for integrated situational awareness and planning and control.

The LSTS vehicles and software toolchain will, for the first time, allow effective inter-disciplinary study of fronts and other oceanographic features of high mobility at fine spatial and temporal scales. Field trials are being performed with the LSTS unmanned vehicle systems (http://www.lsts.pt/vehicles/). AUVs in several configurations equipped with several types of sensors (CTD, fluorometer, holographic camera, turbidity, O2, cameras, and micro-turbulence), WiFi and satellite communications, acoustic modems, and battery packs enabling up to 36h endurance; fixed-wing UAVs capable of up to 1h of flight time equipped with several types of video cameras (including IR), WiFi, and capable of bent Line of Sight (LOS) communications; and, multi-copters/vertical takeoff and landing (VTOL) equipped with WiFi communications and cameras, and capable of bent LOS, of deploying drifters, and of collecting water samples.