Commercial Fishing Vessels as Platforms for Coastal Ocean Research, Monitoring, and Management

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LONG-TERM GOALS

This project, designated "FleetLink," will develop partnerships between commercial fishermen and researchers, educators, and coastal managers for the collection, real-time telemetry, analysis, assimilation, distribution, and use of environmental and fisheries data from coastal regions off the northeastern US. The FleetLink partners will equip participating commercial fishing vessels with integrated sensor systems (including navigational, hydrographic, and meteorological components), and link them via satellite to land-based centers for collection, management, analysis, and assimilation of data. We are working toward a goal of 100 or more fully-instrumented fishing vessels which may provide enhanced oceanographic and meteorological data collection capacity for coastal and offshore areas throughout the NW Atlantic.

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14. ABSTRACT

This project, designated ???FleetLink,??? will develop partnerships between commercial fishermen and researchers, educators, and coastal managers for the collection, real-time telemetry, analysis assimilation, distribution, and use of environmental and fisheries data from coastal regions off the northeastern US. The FleetLink partners will equip participating commercial fishing vessels with integrated sensor systems (including navigational, hydrographic, and meteorological components), and link them via satellite to land-based centers for collection, management analysis, and assimilation of data. We are working toward a goal of 100 or more fullyinstrumented fishing vessels which may provide enhanced oceanographic and meteorological data collection capacity for coastal and offshore areas throughout the NW Atlantic.

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OBJECTIVES

– To develop a collaboration between commercial fishermen, private marine industries, oceanographers, and coastal resource managers for the collection, real-time telemetry, analysis, assimilation, distribution, and use of environmental and fisheries data from coastal regions off the northeastern US.

– To design and produce an integrated sensor system (including navigational, hydrographic, and meteorological components) for use onboard commercial fishing vessels; assemble, integrate, and test prototype versions of the system on a small number of vessels; establish land-based centers for collection, analysis and assimilation of data.

– To develop strategies for incorporation of the environmental and fisheries data into the missions of the targeted end users, including: NMFS assessments, NOAA and Navy coastal modeling and prediction efforts, marketing strategies for commercial products, and oceanographic research programs.

APPROACH

Partnership Building: FleetLink is a partnership between researchers, engineers, entrepreneurs, and commercial fishermen. Leadership of FleetLink by New Hampshire Sea Grant ensures the extension of the results to a diverse group of end users. Sea Grant Extension staff at UNH and MIT are responsible for facilitating communication and coordination between the research and fishing communities. Fishermen's organizations, particularly the Northwest Atlantic Marine Alliance (NAMA), help build fishermen's interest in FleetLink and identify vessels for prototype demonstration.

FleetLink System Design and Operation: The FleetLink system consists of an on-board Pentium II based computer with LCD medium resolution screen; serial interfaces connect to oceanographic (sea surface temperature and temperature/pressure) and meteorological (wind speed and direction; air temperature, relative humidity, and pressure) sensors, an InmarSat satellite C communication Transmit/Receive unit, and a GPS receiver. Data from the FleetLink Sensor System are acquired by a PC-based system mounted in the vessel's pilothouse. MIT developed this system using commercially-available hardware, standard software modules, and a custom-developed software application referred to as "WheelHouse". The WheelHouse software application incorporates multitasking using several software packages, including Athena (a shipboard sensor interface program developed at Woods Hole Oceanographic Institution for its research vessels). Data on fishing activity and relevant observations are entered by the captain using custom graphic user interfaces (GUIs). The sensors' data streams are both telemetered and displayed on the WheelHouse computer. The receiving system is a LINUX-based PC located at WHOI which receives, serves, and stores the environmental and fisheries data. With the exception of the fishery catch data (which are confidential), the processed data are available to end users.

WORK COMPLETED

The FleetLink partnership has become an acknowledged player in the tangled world of cooperative (i.e., commercial fishermen and researchers) research programs in the Northeast US. The FleetLink concept has attracted interest from the National Weather Service, National Marine Fisheries Service, the Naval Oceanography Office, and state and quasi-governmental organizations (including the Massachusetts Marine Fisheries Recovery Commission). We have built a working relationship within this nexus of organizations, from which we expect to identify partners, funding sources, and customers for our data.

Three prototype FleetLink sensor systems have been produced; they were installed on three commercial fishing vessels: *F/V Susan & Caitlyn* (Portland, ME), *F/V Glenna & Jacob* (Fairhaven, MA), and *F/V Adventurer* (Portland, ME). Operation of the prototype FleetLink systems has been demonstrated since January, 2001, during usual fishing operations of all three vessels. During July, 2001, *F/V Glenna & Jacob* conducted high-resolution sampling of the sea surface and water column temperature in the tidal mixing front region on the southern flank of Georges Bank.

RESULTS

FleetLink meteorological and oceanographic data have been collected during fishing trips in the Gulf of Maine and over Georges Bank during 2001. The data are stored on the FleetLink server, and are available by request. A selection of data (anonymized by omitting the geographic coordinates) are displayed on the project website, www.FleetLink.net.

A survey of the tidal mixing front on the southern flank of Georges Bank was carried out during July, 2001 by the *F/V Glenna & Jacob* in order to demonstrate the use of fishing vessels and the FleetLink system for dedicated research purposes (in addition to autonomous collection of ocean and weather data during fishing operations). The experimental design and rationale are explained on the project website, www.FleetLink.net. Four cross-frontal transects were sampled, during which underway sea surface temperature (SST) was measured and vertical temperature profiles were taken at 5 km intervals (Fig. 1). Temperature profiles were taken using the FleetLink gear-based NetSensor / DeckMate temperature and pressure sensor.

The tidal mixing front is a persistent and predictable feature that defines both a physical boundary (between the shallow well-mixed waters of the Bank crest and the deeper seasonally-stratified waters of the flank; Garrett et al., 1978; Mountain and Taylor, 1996) and a biological boundary (defining domains of high primary production and prey availability for larval stages of commercial fish species ; O'Reilly et al., 1987). Based on up-casts of the FleetLink NetSensor, which records temperature and pressure, temperature ranged from 16.0^{o} C at the surface to 10.2^{o} C at bottom (Fig. 2). The transect captured the tidal mixing front accurately: a distinct thermocline centered at 20 m depth persisted through the offshore portion of the transect, and stratification broke down in shallower waters (40 to 60 m depth) over the Bank.

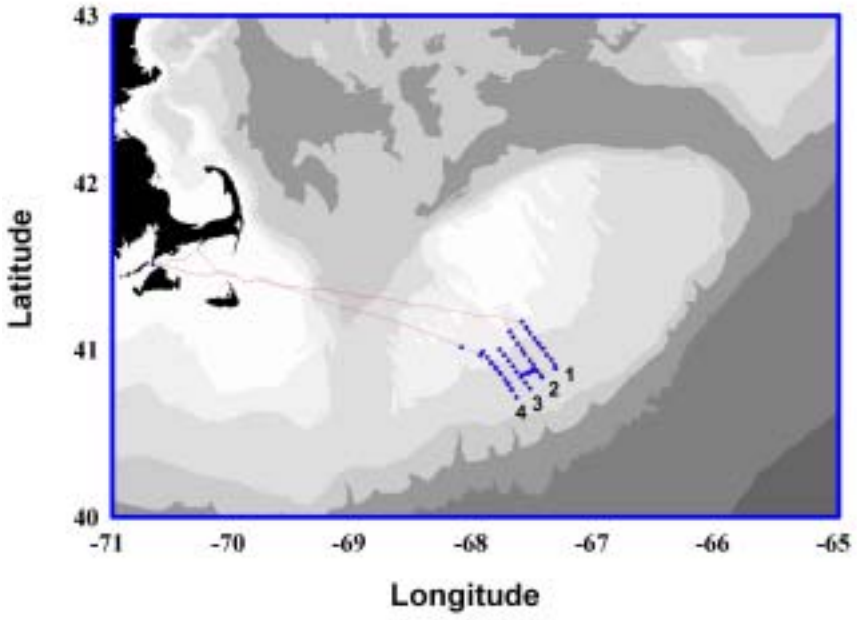

Figure 1. Position of four transects sampled by the FV Glenna & Jacob. The transects are parallel and all cross the 60 m isobath on the southern flank of Georges Bank.

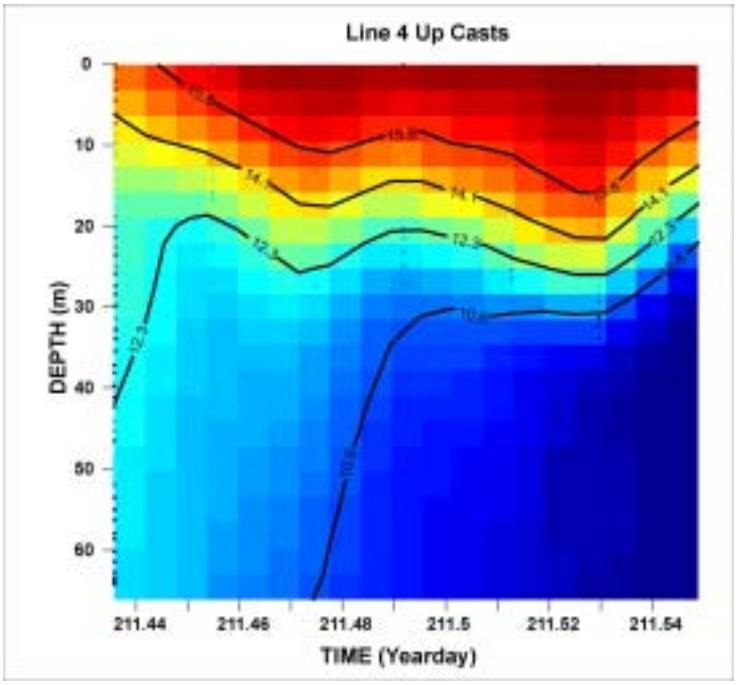

Figure 2. Water column temperature structure along transect Line 4 across the tidal mixing front based on up-casts of the FleetLink NetSensor. See text for explanation.

IMPACT/APPLICATIONS

The FleetLink partnership provides a mechanism for bringing together those involved in the fishing industry, the oceanographic community, and the federal agencies responsible for resource assessment and management. Successful completion will entail broad cooperation among coastal resource managers in programs and agencies across the Departments of Commerce, Defense, and Transportation.

This effort will result in better, largely automatic, and near real-time method of reporting offshore meteorological and sea conditions for use by a wide variety of communities, and for reporting commercial fish catch records to local cooperatives. Full implementation of the FleetLink concept will result in a low-cost, high-resolution, synoptic and strategic ocean observing system, based on autonomous collection and telemetry of data from commercial fishing vessels.

FleetLink outreach efforts have tapped a genuine interest and need in the fishing community for better ocean and meterological data, for near-real-time and open access to fisheries catch data, for confidential communication between vessels at sea and their home ports. We have identified fishermen in Maine, New Hampshire, and Massachusetts who are capable and willing of becoming equal partners in ocean monitoring and research.

TRANSITIONS

The FleetLink partnership is working toward commercial production of the FleetLink self-contained, autonomous, modular, and customizable sensor system for oceanographic and meteorological data collection. FleetLink systems are being designed so that they will be appropriate for installation and use on any vessel - regardless of size, activity, crew interest and capability, or purpose. FleetLink systems will provide new, cost-effective, efficient, and strategic opportunities for ocean observing in any coastal or ocean region.

RELATED PROJECTS

FleetLink is funded in association with the National Ocean Partnership Program (NOPP) under the NOPP mission area of ocean observing. The FleetLink project is one of several projects aimed at new approaches and technology for a comprehensive and integrated U.S. ocean observing system. Individual projects are described at www.NOPP.org.

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PATENTS

None to date