

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

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LONG-TERM GOALS

This project, designated AFleetLink@, 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

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vessels which may provide enhanced oceanographic and meteorological data collection capacity for coastal and offshore areas throughout the NW Atlantic.

OBJECTIVES

UNH/UM Sea Grant Extension will ensure that the all aspects of the project are undertaken with full participation of the commercial fishing industries of New Hampshire, Maine, and Massachusetts. Commercial fishermen will be consulted on design of the sensor system and user interface, types of data to be collected, and uses of environmental and catch data for improvement of fishing practices and product marketing. UNH Sea Grant will also interface with federal and state agency and programs involved in environmental assessment, coastal resource management, marine policy, navigation and public safety, and regulatory and/or enforcement aspects of resource management.

The MIT Sea Grant Center for Fisheries Engineering Research will integrate the on-board FleetLink system that will provide enhanced navigation functions and collect continuous meteorological and oceanographic measurements; confidential fisheries catch data will be entered by the vessel captain. The sensor systems will be developed by Clearwater Instrumentation from commercial off-the-shelf products. Clearwater will also develop a rugged sensor unit to facilitate subsurface measurements for deployment on fishing gear. The data telemetry and data serving hardware and software required for data collection and dissemination will be designed and implemented by WHOI. Two prototype sensor/control/telemetry systems will be fabricated, bench-tested, and installed on two commercial fishing vessels.

An extended at-sea demonstration phase will include performance of the entire system, including integration with standard vessel navigation and electronic functions, telemetry of environmental data to the U.S. GLOBEC Program Service and Data Management Office, telemetry of meteorological data to the National Weather Service, and exchange of confidential fisheries catch data between the vessels and their home ports. Follow-up outreach efforts will evaluate the responses of the vessel captains and the personnel of the Auction and Exchange who oversee product marketing efforts. Additional interviews will be conducted as needed to explore uses of real-time telemetered catch and market data to improve fishing practices and optimize marketing strategies.

WORK COMPLETED

Coordination of the project: Regular meetings among all FleetLink partners have been held since June 1998. In addition to email traffic and communication via private and public websites, these meetings have been crucial to developing a working partnership characterized by mutual respect and shared goals.

Partnership building with federal agencies and programs: During our FleetLink partnership meetings, we have worked to identify individuals, agencies, and programs that have missions consistent with our partnership goals in fisheries management and regulation, coastal monitoring and prediction, climate research, and other concerns. We have maintained regular contact with a number of colleagues and potential customers via telephone conversations, email exchanges,

participation in meetings of mutual interest, and especially through invitations to our partnership meetings.

Outreach to commercial fishing community: FleetLink outreach workers meet frequently with fishermen on their turf@ - individually, in small groups, informally on the docks, and at scheduled fishermen=s meetings. We have designed and administered a questionnaire to assess attitudes and specific wishes of commercial fishermen with regard to the project goals. Our survey concentrated on ports with large ocean-going vessels that fish for days to weeks at a time. We learned that fishermen attach the highest priority to obtaining bottom water temperature data after each gear deployment. Fishermen were very interested in working with researchers to establish a database for fisheries catch data; some individuals thought the data would be useful for independent analysis and research, but others were concerned about use of these data for regulatory purposes. A large number of fishermen placed high value on the telemetry of oceanographic and weather information to shore stations.

Sensor system design concept: Working together by consensus, we have designed a flexible, customizable sensor system that may be used for simple environmental measurements (e.g., just water temperature) or for more complicated sensor packages for collection of climate-quality data. We have agreed that the vessel-based system will be designed for the following sensors: wind speed, wind direction, barometric pressure, humidity, air temperature, short wave radiation, long wave radiation, precipitation, sea surface temperature (SST), ship=s position (GPS), time of observation, and ship heading. The sensors will interface with the shipboard vessel controller; the gear-based sensors will detect pressure and subsurface temperature.

Hardware and software development: Components for the vessel-based hardware have been identified and our first prototype system is ready for the planned installation on the F/V Susan and Caitlyn in November, 1999. The components of the Fleetlink system are: large-screen panel PC, inverter, uninterruptible power supply, and Inmarsat transceiver. Software developed by MIT runs the system; polls the sensors; and facilitates operator input, data logging, and the transmission of data packets to the WHOI-based dataserer. The fish catch data, tow info, vessel status and trip report graphical user interfaces (GUIs) are complete, and telemetry debugging is in process. Software is nearly complete for the presentation of the vessel=s sensor data to the operator via strip chart display.

Telemetry: Several options for telemetry of digital and binary data and information have been reviewed. Our current working model is to use the Inmarsat-C system which supports an email-like data transmission protocol and enables us to transmit information to and from the fishing vessel on an hourly basis. However, our architecture and implementation will necessarily be flexible, since suitable alternative systems are on the horizon. We have purchased one Inmarsat-C system to facilitate system implementation, which will be deployed on the F/V Susan & Caitlyn for testing and evaluation. Two additional systems will be purchased shortly: one will be installed on a second fishing vessel and the other used for continued development ashore.

Data are telemetered as e-mail messages to a computer at WHOI. The Unix-based procmail utility is used to handle the incoming mail, saving them to appropriate directories depending on the type of message received: data or messages. A Perl script, called process_email.pl, is used to extract the

meteorological and other data from the e-mail messages, and these are reformatted into data files for the trip, catch, and meteorological data. We are coordinating with the National Weather Service to ensure that these data will meet all NWS requirements.

Data Management: By consensus of all partners, the JGOFS Data Management System will be used ashore to store data and provide open on-line access to the database. We have established a temporary web site at <http://nopp.whoi.edu:8180> for public access to FleetLink information. During the demonstration phase, data will be received from fishing vessels, extracted from the telemetered data, and placed in a password-protected website for use by the Portland Fish Exchange and designated others. The data will be served with the JGOFS Data Management System via the temporary server, <http://pfe.whoi.edu>. Initially, the data will be organized into two separate, hierarchical file structures.

RESULTS

Partnership building: 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.

Outreach: We have tapped a genuine interest and need in the fishing community for better ocean and meteorological 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. We continue to provide an arena for open discussions between the stakeholders in the Northeast fisheries crisis - who sometimes appear to be at war.

FleetLink sensor system development, production, and deployment: We have assembled one prototype system for deployment in November, 1999. Bench-testing is nearly complete at this time, and the system is fully functional and user-friendly. We are now purchasing three additional systems and will begin shortly an extended field demonstration involving all aspects of the project.

IMPACT

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. The environmental and fisheries data that will be collected will be available to all stakeholders for their individual missions: management, marketing, assessment, prediction, modeling, regulation, enforcement, and research.

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 catch records to local cooperatives. There is a pressing need for better environmental data from coastal and offshore marine waters in order to effectively monitor the health of the ecosystem, and to more effectively manage marine resources. We expect that the acquisition of biological and physical information - available in real time - regarding the immediate status and dynamics of the ocean environment will create new opportunities and useful new products for the oceanographic and fisheries communities.

TRANSITIONS

Mike Curran, of the Naval Oceanographic Office, has offered to help coordinate the proposed NOPP effort and the operational Navy programs and entities who require and use real-time environmental data from the coastal ocean. Curran reported that NAVOCEAN is currently running a similar program in the Gulf of Mexico. We have also spoken with Elizabeth Horton of NAVOCEAN, who is interested in possible transitions to NAVOCEAN's drifting buoy operations. We expect that NAVOCEAN and other Navy programs will be interested in high-quality near-realtime information from coastal waters off the Northeastern US.

RELATED PROJECTS

A few of the most closely related projects are:

- 1 - The Atlantic Coastal Cooperative Statistics Program (ACCSP), which is a cooperative effort among federal and state fisheries managers, scientists, and commercial and recreational fishermen to coordinate and improve data collection and data management activities on Atlantic coast.
- 2 - The Massachusetts Fish Auction Project, which is directed toward setting standards to be used by fish auction houses to standardize prices.
- 3 - The North Atlantic Marine Alliance (NAMA), which is conducting surveys of the attitudes and goals of Northeast commercial fishermen.
- 4 - The International Society for Ocean Monitoring and Research (ISOMAR), which seeks to place ocean sensors on ocean-going yachts.
- 5 - The Electronic Logbook Project of the NMFS Northwest Fish Science Center in Seattle, WA, which is developing an electronic log book to record and report commercial fish landings.