COL/NW/01

A Portable, Multi-project, Real-time Shipboard Data Display System

FY 2004 Proposal to the NOAA HPCC Program

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Proposal Theme: Technologies for Collaboration, Visualization, or Analysis

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A Portable, Multi-project, Real-time Shipboard Data Display System

Prepared by: Timothy S. Bates and Donald W. Denbo

Executive Summary:

We propose to create a portable shipboard system to integrate data from multiple projects participating in large field experiments, such as New England Air Quality Study (NEAQS) and Intercontinental Transport and Chemical Transformation (ITCT) Study. Experiments such as these will use shipboard measurements to characterize pollutant sources (local vs. distant), pollutant mix, and transport (vertical and horizontal mixing) and transformation processes along the New England seacoast. Individual projects bring their own sensors and data acquisition systems aboard ship. We are proposing to develop software, using the new SGT Java Bean toolkit and client-server technology from the Climate Data Portal, to integrate the multi sensor inputs from these different acquisition systems into a single real-time shipboard data display. This system will aid researchers in quickly responding to changes in observed data thus allowing them to adjust the cruise track and sampling strategy if necessary.

Problem Statement:

This project addresses the FY2004 HPCC goal to tackle "innovative and technically challenging solutions" which "improve technology for access to critical data, information and unique resources in a manner that increases mission effectiveness". Atmospheric chemistry data are collected aboard ship by several separate systems. These systems have proved reliable and provide the necessary functionality to record the measurements, location, particle size distribution, etc, that are needed to accomplish the science. However, these systems do not presently provide an easy mechanism to access the data as it is being collected in real-time.

Data collected during past NOAA Atmospheric Chemistry cruises have been logged by several individual data collection systems and stored as individual ascii files. These files, while at sea, have been used to provide snapshots of the collected data to ensure proper operation of the system. Previous cruises have had fixed data sampling strategies and access to the data in real-time has not been required for the successful completion of the research. However, field experiments such as the upcoming NEAQS/ITCT project off the coast of New England (to assess/improve NOAA's forecasting of air quality and climate change) will not have fixed sampling strategies and will need real-time access to the collected data in order to adjust the cruise track to sample urban and point source plumes.

This project meets the HPCC objectives as a technically challenging and innovative approach to an enabling technology that directly supports NOAA's mission.

Proposed Solution:

The solution proposed here is summarized in Figure 1. The system will be developed using Java, a cross-platform language, and standard communications protocols (jdbc and odbc) to tie together acquisition systems running on several platforms (Linux, Windows, etc) written in several languages (Visual Basic, C++, etc) into a single data acquisition system. Data collected by these independent acquisition systems will be stored in a relational database. The database will include a single table for each data source and a column for each variable. Each data stream will be identified uniquely by a "table/column" combination. Database tables will also be used to store metadata about instrumentation, description, comments etc for each variable and the date/time of the last update for each data table.

The Data Logger and Size Distribution acquisition systems can be modified (code was developed locally) to directly update the database. The PILS chemistry system (a commercial application) and other outside systems will use a separate program (DataStream Ingest) to read their data files from a local or network mounted disk volume and ingest these files into the database. Thus a single database will exist that is continually updated by all the data sources.

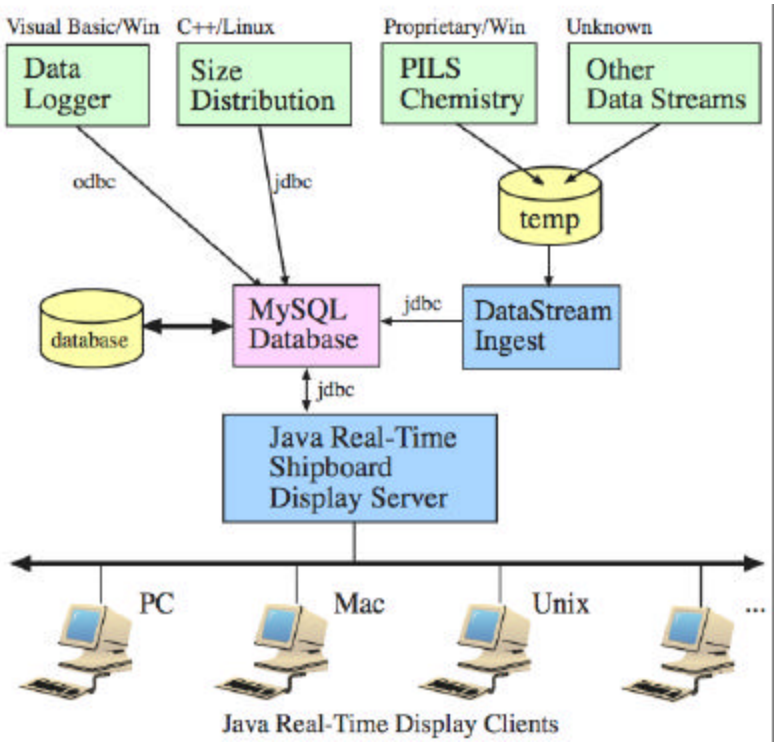

Figure 1. Block diagram of real-time shipboard data display system.

Relationship to NOAA HPCC objectives:

This proposal addresses the **primary HPCC goal** of "… providing greater access to its vast holdings of real-time … information to users in a more complete, more usable form, and much more timely manner through increased use of advanced technologies" This proposal also

addresses the **secondary HPCC goal** to "improve technology for access to critical data, information and unique resources". As part of the "**Technologies for Collaboration, Visualization, or Analysis**" theme, the proposal will "develop tools that are extensible, scalable, and available for easy deployment throughout NOAA."

Analysis:

The Real-Time Shipboard Display Server (RTSDS) will access the database to extract data subsets and determine when each database table was last updated. The RTSDS will be responsible for coordinating requests from the Real-Time Display Clients. Each Real-Time Display Client (RTDC) will be able to independently subscribe to data streams from the RTSDS and be available to the RTDC within a few seconds after collection. The client will have the capability of display several time-series at once and a latitude-longitude map display of the cruise track with a data channel displayed along the track. The graphics for the client will be implemented using the Scientific Graphics Toolkit, providing platform independent Java graphics with a minimum of additional effort. The software also will be made freely available to other groups requiring real-time data integration and display.

This proposal is highly appropriate, since it supports the primary and secondary HPCC objective, and directly addresses the Theme objective to take develop tools that are extensible, scalable, and available for easy deployment throughout NOAA.. **This proposal leverages HPCC investments** in the Scientific Graphics Toolkit (SGT) and the client-server components of the Climate Data Portal. The **scope** of this proposal is wide, since it will provide portable and flexible software for use aboard NOAA ships as well as chartered and UNOLS vessels. **The cost/benefit is favorable** since there is already a user community to direct the development, and the PMEL EPIC team developer capabilities are well known and respected.

Performance Measures:

This project will be successful if a prototype portable shipboard system is developed to integrate multi sensor inputs from different acquisition systems into a single real-time data display.

Milestones/Deliverables:

Month 06 – Complete design and initiate prototype development
Month 12 – Prototype development complete