



Designing  
and  
Integrating  
Next  
Generation  
Real-Time  
Information  
Technologies

**Focus:** The acquisition and manipulation of data to produce accurate information and knowledge.

**Sponsors:** Department of Energy, multiple branches within the Department of Defense, the Federal Bureau of Investigation, the International Atomic Energy Agency, and private industry and corporations.

**Group Members:**

- Randall Wetherington (Acting Leader)
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- Barry K. Daniel
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## Overview of the Real-Time Systems Group

The Real-Time Systems (RTS) Group develops and integrates high-performance systems for the generation, acquisition, analysis, and management of real-time information. The group uses leading edge technological advances to develop high-speed, multichannel systems that can support many concurrent users. These systems are designed to be highly available, secure, and accurate. The systems often use advanced signal processing, control, and database methodologies in uniquely parallel architectures to generate, obtain, analyze, and store highly precise data. With a wealth of advanced systems engineering and project management expertise, RTS has the capabilities to implement systems development from concept to operation. The systems developed by the group are usually production grade designs that clients use at their own facilities.

Staff members possess clearances that are sufficient for the most stringent national security needs.

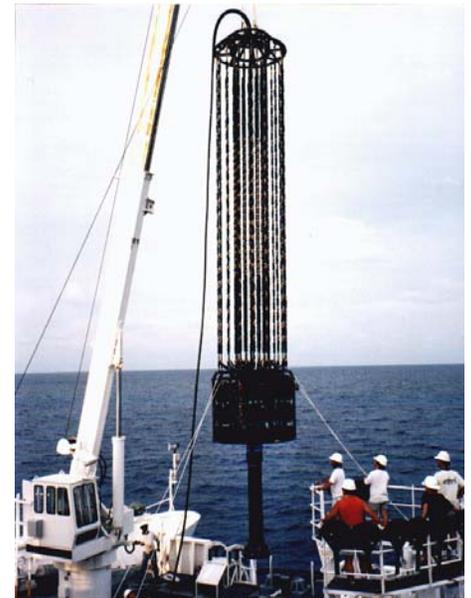
### Computer Systems Design

RTS has the capability to design computer systems to meet the most demanding needs of its customers. The group can integrate leading edge and laboratory developed technologies into functioning systems. Approaches used in the designs are independent of specific vendors and include the best technologies for a given customer need.

### Digital Signal Processing

RTS specializes in the adaption of digital signal processing techniques in real-time systems. These methods are used to accomplish real-time measurements and simulations that

would not otherwise be possible in applications such as sonar measurements and radar simulation.



The group developed a frequency-domain beam former to process the data from this large volumetric sonar array.

### Open-Source Technologies

The group has deployment experience in many computer operating systems and technologies. Of particular note are those based on open-source standards and tools such as Octave and SciLab. RTS can take open-source technologies and integrate them with our knowledge base to develop solutions that meet demanding requirements. The use of open-source technologies offers significant flexibility in customization and can lower the final cost of a system.

### Multicore Processors

The RTS Group has developed systems that feature advanced multiprocessor architectures. This experience dates back to deployment of array processors, I/O computers,

and vector processors. The focus continues today in the adaption of technologies such as the IBM Cell. These technologies allow the group to deliver unprecedented performance in platforms that occupy relatively small amounts of space.

### High Availability and Secure Approaches for National Security

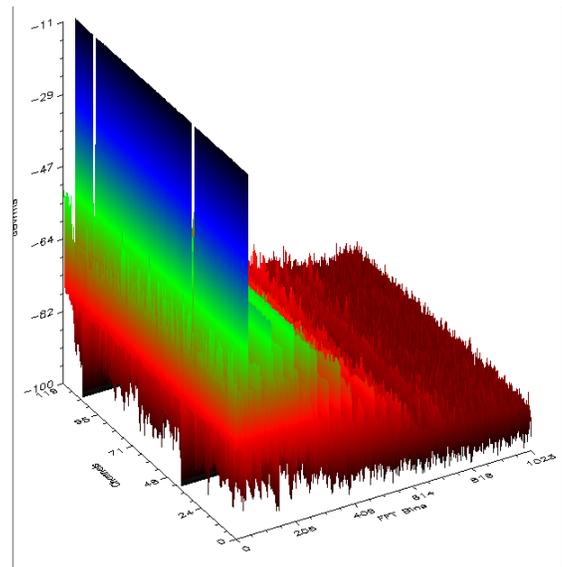
RTS has designed, developed, and deployed system architectures designed for high availability, including systems supporting communities of more than 50,000 users with secure network connection and authentication methods and role-based access.

### The Art of Making Measurements

The group has significant experience in analog-to-digital conversion technologies and signal conditioning approaches. These technologies are crucial in the process of gathering accurate data for measurements. We have designed systems that feature more than 2,000 channels of input sensors coupled with real-time signal processing techniques to produce measurements with significantly reduced noise and a reduction in overall data volume. RTS also understands how to design systems where extremely large volumes of data must move and be processed and/or stored in a sustained manner. Advanced hardware and database architectures are used in these designs.

### Advanced Data Analysis

Our expertise also extends to advanced data analysis techniques that can be used for mining information that would otherwise not be easily observed. These methods are particularly useful for sponsors who have extremely large data sets and low signal-to-noise ratio. The group has extensive working knowledge of state-of-the-art analysis tools such as MatLab and Simulink.



Graphical analysis of 120 channels of sensor data quickly allows identification of dead sensors.

### Contact Information

If you have a problem, we have a solution. To find out more about our capabilities, partnering with RTS scientists and engineers, and/or accessing our user facilities, please contact Randall Wetherington ([wetheringtgr@ornl.gov](mailto:wetheringtgr@ornl.gov)) at 865-574-5717.