

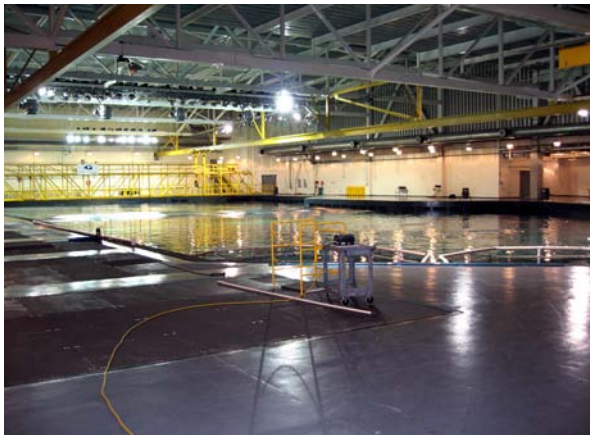
Case Study: Georgia Aquarium

At the Georgia Aquarium, a Multitude of Hardware Vendors Provide the Control Equipment, and System Integrator RCK Controls Puts It All Together

The 550,000 square foot Georgia Aquarium (www.georgiaaquarium.org) is, by many standards, the world's largest. With its 6.2 million gallon Ocean Voyager exhibit (the largest under one roof) and over 100,000 fish, the aquarium is hugely popular and has had well over a million visitors in its first three months of operation. Indeed, because the aquarium limits the number of visitors it allows at one time, it's not unusual for it to sell out by noon.

RCK Controls (www.rckcontrols.com) and Opto 22 (www.opto22.com) hardware are the key components of the integrated control systems within the Georgia Aquarium. Ten RCK processors and more than 3100 Opto 22 *mistic* and SNAP I/O points (583 analog, 2,523 digital) control all of the aquarium's fish-related water processes. Or as John Hale, RCK Controls Project Manager puts it, "Anything affecting any of the fish habitats is run by RCK controllers communicating to Opto I/O."

A few stories below the aquarium are the corridors, control rooms, service and storage areas, offices, and open areas that house the critical systems and equipment that keep the aquarium operating and the fish thriving. These life support systems (LSS) include huge mixing tanks—each with a capacity of more than 65,000 gallons—that create the salt water for the aquarium's exhibits, as well as the reclamation tanks that store and recirculate the water every ninety minutes.



The 6.2 million gallon Ocean Voyager exhibit.

As specialists in the development of process control and data management systems, RCK Controls has completed a number of water flow and control projects for an impressive list of clients that includes Sea World of California, NASA's Neutral Buoyancy Laboratory, and the Mirage Hotel in Las Vegas.

Along the way, the company has also carved a unique niche for itself as a developer of life support systems for zoos, fish hatcheries, aquariums and specialty parks.

RCK Controls designed and installed most of the Georgia Aquarium's LSS systems including the Open Ocean Recovery System, which collects, filters, cleans and returns the reclaimed water. To accomplish this, a total of 10 RCK custom controllers work with the Opto 22 I/O to monitor and regulate all processes. For example, sand filter flow rates are monitored to maintain a constant design flow rate. As filter vessel's sand media becomes more and more clogged, variable frequency drives (VFDs) speed



LSS Manager Joe Poniatowski heads to the aquarium's control room.

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is controlled. "The recovery system we designed required us to connect and monitor a number of I/O points," says Hale. "Valve positioning, analog reclamation water levels and flowmeter readings all help determine when a sand filter can be automatically backwashed. When a VFD's speed is 'maxed out' and filter performance has declined, it means the filter is ready for backwashing and the process is initiated."

"There are 56 filters just for the main tank," adds Joe Poniatowski, the Georgia Aquarium's Life Support Systems (LSS) Manager. "Monitoring and maintaining those alone would be a full-time job. Automating this process frees LSS from this responsibility."

"All fish water backwashes to a common reclamation system," says Poniatowski. "We process and reuse almost all of this water, resulting in a close to zero percent salt water discharge. That's something that's pretty much unmatched by most other aquariums."

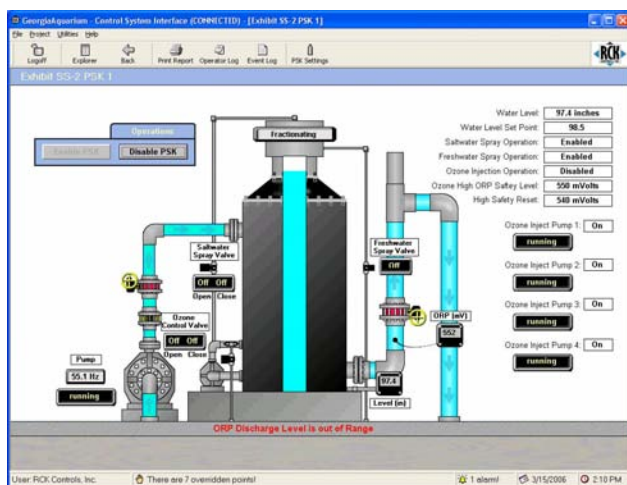
For the Georgia Aquarium to transport, process and reuse its water requires a host of water treatment equipment, hundreds of pumps, and over 61 miles of piping. Water is carried from the salt water mixing tanks to the exhibits and then back to the reclamation tanks. Along the way, the water is treated through the use of carbon filters (which strip out chlorine and fluoride) and protein skimmers, large tanks used to collect the water and remove any dissolved organic compounds (DOC) through a process called fractionation. Fractionation occurs when massive amounts of tiny air bubbles are injected into the water by a high pressure water pump and air valve. The rising air bubbles act as a lift, allowing DOC particles to attach to the bubbles and hitch a ride to the top of the protein skimmer, where they are captured in a collection cup and rinsed away via a jet spray.



Water reclamation tanks



Protein skimmers



Dissolved organic compounds are collected at the tip of the protein skimmers and disposed of.

The Georgia Aquarium has 59 of these protein skimmers and each is equipped with its own on-board I/O. A mix of analog and digital connections to injector pumps, spray down valves, and pH and ORP (oxygen reduction potential) sensors and other components on this equipment, effectively enable each of the individual protein skimming processes plus a lot more.

“Some of the species here are very sensitive to water temperature, salinity, pH balance, turbidity, etc.,” says Poniatowski. “So we need to have very precise control over all of our protein skimmers and other water treatment systems. The RCK control engine provides just that.” The aquarium’s LSS control room serves as a center of operations where Poniatowski and his staff can view all of the aquarium’s 62 I/O panels (and thus any and all of the aquarium’s critical life support systems) from their computers.



At the Georgia Aquarium, hardware from RCK Controls and Opto 22 controls and monitors all of the exhibits’ critical life support system equipment and components including:

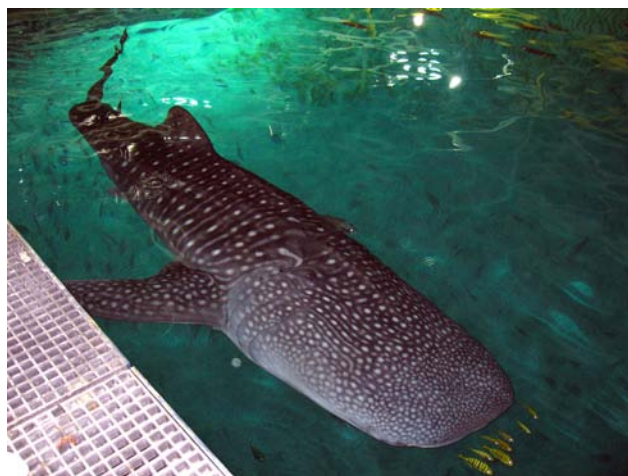
- Flow monitors ([GF Signet](#))
- Heat exchangers
- Ozone equipment ([WEDECO](#))
- Injector pumps
- Sand Filters ([Neptune Benson](#))
- Filter pumps ([USFilter, a Siemens company](#))
- Draindown pumps
- Protein skimmers ([RK2 Systems](#))
- Salt water mixing tanks ([Neptune Benson](#))
- Salt water reclamation tanks
- Discharge, inlet & backwash valves ([ASAHI & Bray](#))

“What makes this possible is our use of standard Ethernet-enabled components in the design of the control system,” says Hale. “The RCK controllers communicate over the aquarium’s dedicated and secure Ethernet network, allowing full monitoring capabilities from any connected PC or laptop.”

In such cases, a graphical user interface, designed by RCK Controls, gives a straightforward presentation of all of the processes taking place with the protein skimmers, mixing tanks, pumps and other equipment. Wireless connectivity enables mobile LSS staff carrying handheld units to receive alarm data instantly should any of these aquarium systems need servicing.

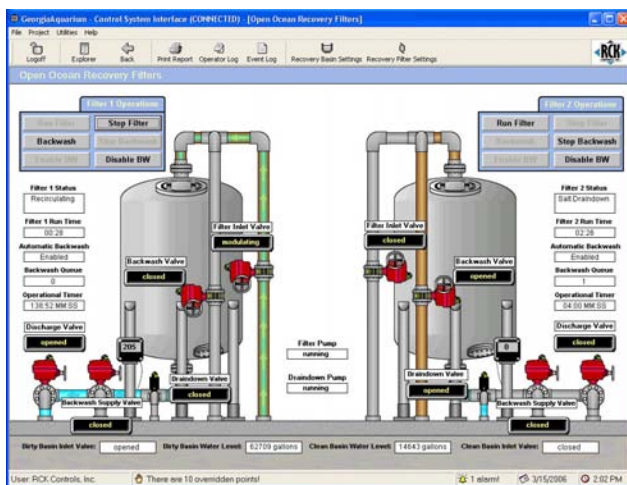
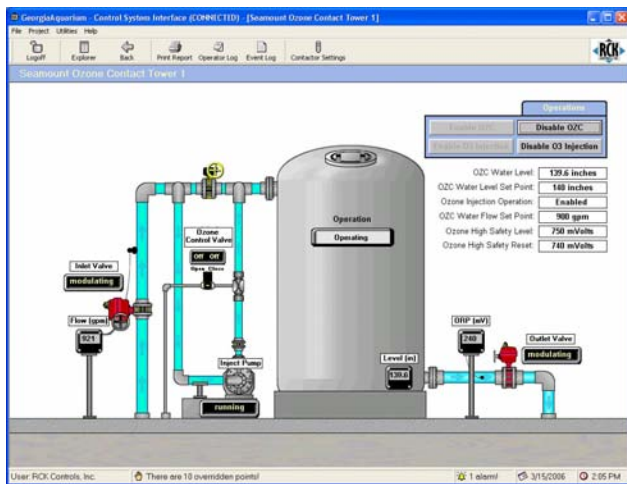
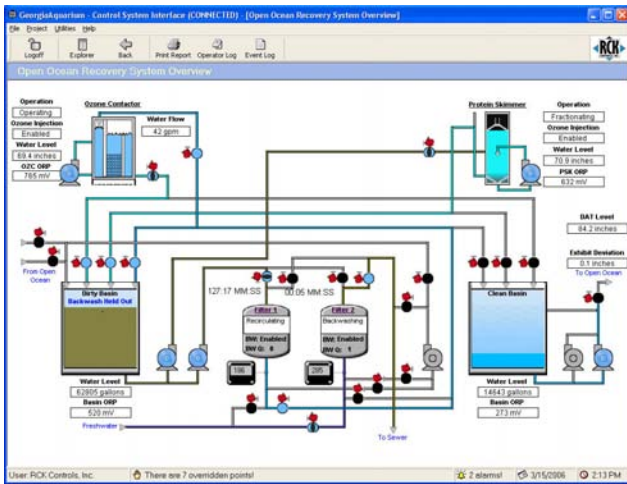


*Opto 22 I/O in a Georgia Aquarium control panel.
A Linksys router provides wireless connectivity.*



Whale shark

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RCK Controls designed these custom HMI screens to provide an easy-to-understand control interface for LSS personnel.

Georgia Aquarium Fast Facts:

- The aquarium has its own animal hospital where doctors and surgeons anesthetize, treat, and operate on sick or injured fish.
- More than 90% of the aquarium's fish come from agriculture, that is, they were originally caught or raised for food.
- It took thirty-six hours to fill the aquarium's 6.2 million gallon Ocean Voyager exhibit.
- Ralph and Norton, two whale sharks, are the aquarium's largest animals and a visitor favorite.
- To obtain the correct mix of major, minor, and trace elements for the Ocean Voyager exhibit, 741 tons of Instant Ocean® sea salt were added to the water.
- The facility is equipped with a 9000 lb. freight elevator that opens onto a loading dock so trucks can make easy deliveries. Many of the aquarium's larger species arrived this way.

RCK Controls, Inc. (www.rckcontrols.com) specializes in the development of process control and management systems. This includes the design, development, construction, operation, and management of cogeneration projects and energy and environmental resource management solutions for zoos, fish hatcheries, aquariums and specialty parks. RCK Controls also develops major life support systems for marine animals. The company integrates Opto 22 hardware with process control and data management software for applications related to water flow and water quality control. Completed projects include Sea World of California's Journey to Atlantis, Sea World of Florida's Discovery Cove, NASA's Neutral Buoyancy Laboratory and the Mirage Hotel's Dolphin Habitat.