

Queen Anne's Revenge
Shipwreck Project



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Live from Morehead City,
it's *Queen Anne's Revenge*

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Abstract

Since the announcement of its discovery by Governor James B. Hunt on March 3, 1997, the public response to *Queen Anne's Revenge* is nearly overwhelming. The shipwreck has already been the subject of documentaries filmed by University of North Carolina/Public Broadcasting System (UNC-TV), British Broadcasting Corporation (BBC), National Geographic and the Discovery Channel as well as live feature segments on Cable News Network (CNN), the History Channel and National Broadcasting Company's (NBC) *Good Morning America*. In short, the discovery of Blackbeard's flagship has created a unique educational opportunity for public and classroom programming relating to a broad range of subjects relating to this famous eighteenth century ship. The most innovative initiative involves a distance education program, based on live streaming Internet transmissions and entitled *QAR DiveLive*.

Introduction

Wreck site 31CR314, the alleged *Queen Anne's Revenge* (*QAR*) site, since its discovery in the fall of 1996 has excited the public's imagination. The ability of staff to disseminate information about the site has been assisted by their ability to video archive the archaeological expeditions. At the same time, interest generated by Blackbeard's flagship made the project the focus of several documentaries including those seen on UNC-TV, BBC, and National Geographic among others. It has also been featured on several live segments with CNN, the History Channel and NBC's *Good Morning America*. The lacking thread was the project's ability to contact students, educators and public directly. The exhibition of *QAR* artifacts in the North Carolina Maritime Museum, while notable, did not reach a large enough audience to fulfill the educational needs of the project.



Figure 1: *Good Morning America* camera crew filming at the *QAR* site

Early in 2000 Bill Lovin of Marine Graphics and Rick Allen, Nautilus Productions, proposed a week long educational event based on daily live broadcasts at the *QAR* site. The partnership between Lovin, Allen and *QAR* melded television technology, Internet streaming, and underwater archaeology. At the time of the proposal, Allen had served as project videographer for the previous two years, and Lovin not only had produced numerous shows on North Carolina shipwrecks, but also currently directed the live webcast twice a year for the Rachel Carson site of the North Carolina National Estuarine Research Reserve in Beaufort, North Carolina.

The challenge was to obtain a signal from twenty-five feet below the Atlantic Ocean's surface, send it two and three-quarter miles to the shore station, and then digitize it for relay to the Internet where school groups and the general public could watch and participate. Allen and Lovin's proposed method involved placing a mini-video studio aboard a research vessel anchored over the shipwreck site. There were multiple technological challenges to overcome for this to work. The first was to transmit video and audio in real time from the ocean floor to a boat. The second challenge was to transmit that signal from the boat to the shore station. Third was to receive the microwave signal at the shore station and digitize it for Internet webcast, and lastly to provide a real time link from the web, back to the boat and site allowing archaeologists to answer questions. This effectively linked



Figure 2: Map indicating the transmitting sites for DiveLive

television technology, archaeology, information technology, and public education. Allen's crew would document activities on the bottom while feeding a live video signal to the surface via a cable and audio via an Ocean Technology System (OTS) communication system. Once on the surface,

audio and video technicians selected different cameras, including underwater or surface feeds, and sent the signal via microwave to shore for digitization and finally web streaming. The shore studio was equipped for live digitizing, and television equipment for providing videotaped inserts and recordings for delayed transmission and archiving.

As with the Estuary Internet event, schools pre-registered for the event and during designated times could email questions to technicians at the shore station. From there, questions and information on the student and school were transmitted to a shipboard operator, who transferred the inquiries to divers through the underwater communication system. These latter audio transmissions paired with the responses from divers were sent back to the shore station, out on the Internet and back to the schools.

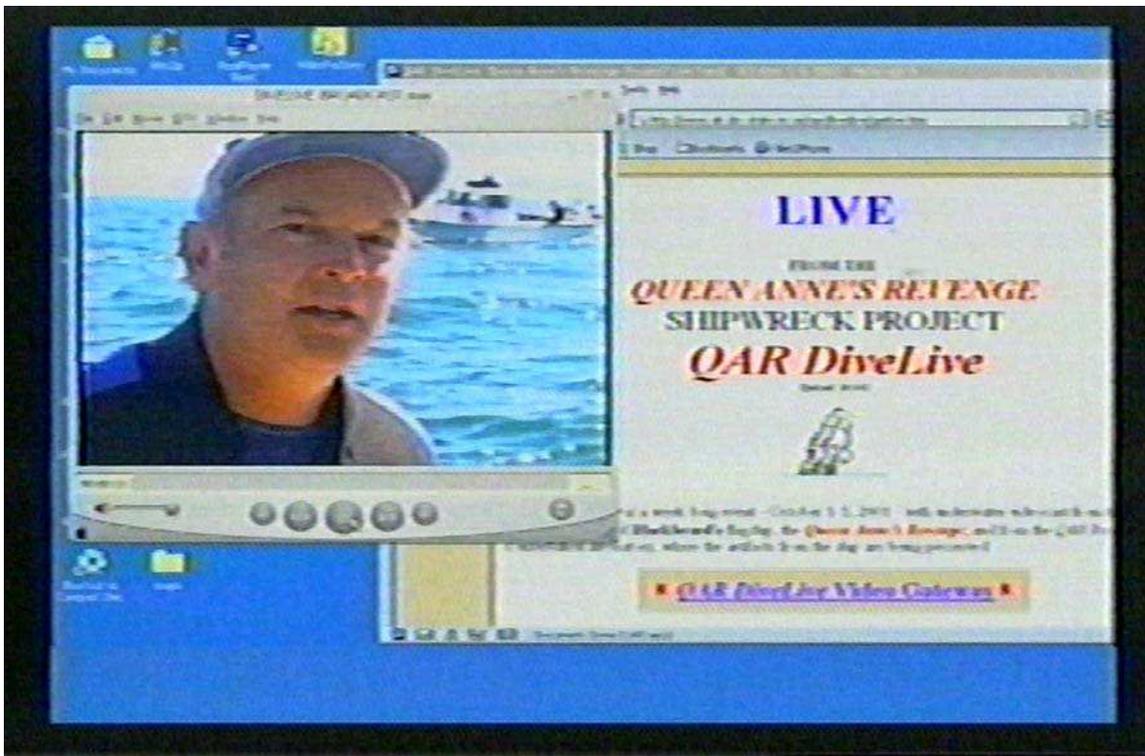


Figure 3: Richard Lawrence, UAB Head Archaeologist, Live from the *QAR* dive site

While in theory the system would work, the distance from the site to the shore station created uncertainty. Most problematic was the quality of the microwave signal from a rocking boat, especially when the sea state deteriorated. Funding was secured for the inaugural event, *QAR LiveDive 2000*, and conducted in conjunction with archaeological recovery work in October 2000.

QAR LiveDive 2000

The initial goal of *LiveDive 2000* was to broadcast live from *QAR* to the Internet while allowing students to log on and question archaeologists as they worked on the ocean floor. To make this

work, Bill Lovin and Rick Allen used two microwave transmitters and five antenna arrays. The high-powered transmitter was placed on the boat and pushed the signal back to our shore facility at Duke Marine Lab, and to the North Carolina Maritime Museum in Beaufort. On the rooftop of one of Duke's buildings, five antennas received the transmission and sent the signal down a cable to the digitization studio where Bill Lovin compressed the signal for the web.

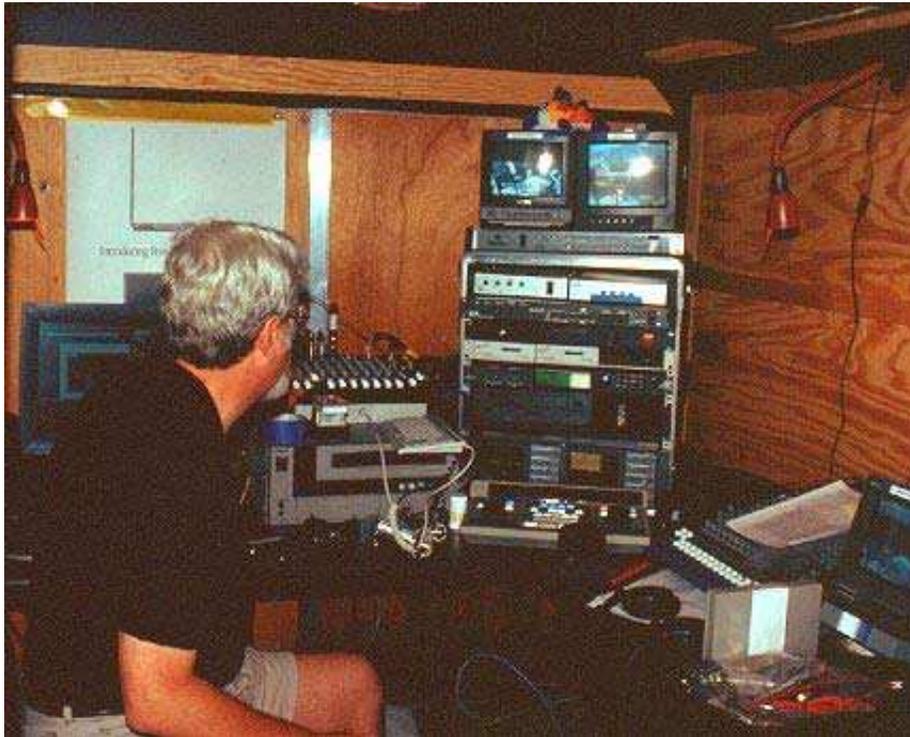


Figure 4: Bill Lovin of Marine Graphics in production studio

LiveDive 2000 began with little publicity and fanfare, but by the end of the week of webcasts from the wreck site in October 2000, an estimated 1600 school children from across North America had tuned in. Forty-nine school groups participated, including schools from North Carolina, Washington State, New York, and Canada. These students logged on to the website every day to watch the twice daily live broadcasts and ask the archaeologists questions in real-time as they worked on the ocean floor. Included in the live question and answer periods was the North Carolina Maritime Museum in Beaufort, the home of the project, and the North Carolina Museum of History in Raleigh. In both locations the live segments were broadcast and used for public education over the course of the five days.

The conclusion of LiveDive2000 demonstrated that the *QAR* Project had the necessary components to make a webcast such as this happen technologically. The success was evident when at the end of the event the large number of users logged onto the two servers caused both streaming

sites to crash rather unexpectedly. This only raised the bar for the following year. In August of 2001 planning began for DiveLive 2001. This time the coordination of Bill Lovin, Rick Allen, and the *QAR* Project resulted in better-planned sessions, better technological troubleshooting, richer content and a far better webcast.

DiveLive 2001

October 1-5, 2001 the *Queen Anne's Revenge* Shipwreck Project again went live from the wreck site to the web. For two and a half days students and the public could log-on to watch and talk to archaeologists as they worked on the site. For the last two and a half days the project staff took students into the conservation laboratories to witness conservation and documentation processes.



Figure 5: Broadcasting from the *QAR* Conservation Lab

After running LiveDive 2000, the *QAR* project staff and DiveLive staff felt they knew how to improve on the previous year's webcast. To accomplish this they set specific goals for 2001: first, to broadcast live from the wreck site; second, to involve an even larger group of children and public thus taking archaeology into a larger arena; and third, to broadcast from the conservation labs and demonstrate the importance of slowly and thoroughly documenting every artifact and concretion. With minimal publicity again this year the event drew an even larger audience, reaching sixteen states,

two countries, eighty-seven schools, two museums, over thirty-six hundred school children and more than twenty-seven hundred of the general public.

Although cameras and underwater housings have been around for decades, the transfer of a live audio and video signal from a wreck site to a shore based station to the Internet is still a new concept. In 2000 the project paired archaeological processes with the LiveDive event only to discover that the webcasts interfered with the underwater work, as both archaeologists excavating



Figure 6: Diver Kim Eslinger with *QAR* anchor

and archaeologists on camera required the communication units. To accommodate this problem in 2001, an archaeological plan, generated by Field Supervisor Michael Plakos was the foundation for both broadcast times and the processes that could be shown on camera. In this way the archaeology continued as the webcasts happened. As a result students watched and listened to the new gradiometer survey, participated as a new baseline was laid, learned about artifact tagging, and site examination. This year's broadcast combined the excitement of underwater archaeology on the *QAR* site with the scientific processes in the *QAR* labs. Students learned about archaeology, history, chemistry, and geology while being able to ask questions and receive answers in real time. The questions received during the five-day webcasts from students and teachers clearly demonstrated both previous participation and the success of both this year and last year's events.

To handle the expected students for this year's broadcast it was necessary to change some aspects of the DiveLive production. This process began with meetings between Rick Allen, Bill Lovin and DiveLive Coordinator Kim Eslinger. Together they planned out contingency broadcast schedules, set tasks, determined technological parameters and laid out the event. To accomplish DiveLive this year several constraints needed solving; the SGI needed to be eliminated, and more streams were needed on the servers. This year rather than relying on the SGI workstation that wreaked so much havoc the previous year; work was transferred to Power Mac G4's even while streaming to the Real Player server on NC DPI. Apple Computers donated streaming server space for the project to allow us a continuous stream without concern over crashing servers. It was quite clear in 2000 that there simply wasn't enough server space to handle the amount of traffic that even minimal publicity generated. NC DPI came through again with access to their server, but they could only handle a small number of streams. In response to requests for greater server space David Kaye at NC DPI approached Apple Computers to look into hosting the event on their ALI site. While streaming live audio and video is difficult enough and bandwidth intensive, it was more difficult to get Apple and DPI's servers to talk to one another. To send the signal to Apple the signal was obtained from the wreck site, sent back to the shore station, then sent via either T1 or T3 lines to NCDPI, Apple Computer's server then "split" the signal and broke through DPI's firewall to pull a stream to their server where it was made available to anyone that wanted to watch. With virtually unlimited bandwidth at Apple's server anyone could log on without our worries regarding server crashes.

Unfortunately while the computer technology mostly worked there were some glitches primarily associated with email communication between participating school groups and project engineers. A virus in North Carolina took out most of the school servers resulting in major problems for all of their Public Schools in accessing our site. Adding to the difficulties was the fact that the address set up to handle the incoming questions failed and refused to recognize the emails. On the very first day of the webcasts we received questions from students on the west coast three hours after the broadcasts had ended, apparently yet another server issue. Several participants also complained about the delay in the audio signals or that the signal was jumpy on their screens. These issues appear to have solved themselves in every case, and there is still no answer as to why they happened as they did.

Participation grew again this year at the end of the week as word circulated. One of the keys to making an event such as this possible is the inclusion of proper publicity. Without advance public relations and proper planning the event with either fail technologically or from lack of participation. Because the point of an event such as this is to reach as large an audience as possible it is important to notify schools and the public well in advance so that they can be computer savvy enough to

participate. As school budgets across the country are continually cut, this too is a new and exciting way to introduce school children to a world that they would be unable to see on traditional field trips. In conclusion, this live Internet event was a resounding success for the *QAR* Project Staff, the students and public involved.



Figure 7: Students participating with Dive Live at the North Carolina Maritime Museum

While technological problems are expected, they can generally be resolved, and as technicians continue to gain experience many can be anticipated and avoided. As confidence in the technology grows and the ability to reach larger audiences becomes possible, organizers will seek to engage a larger audience. Greater publicity and advanced notice can be accompanied with pre-project lesson plans and activities, which in turn, will better prepare students for the DiveLive event and enrich that experience. *QAR DiveLive* has proven that through technological advances, innovative and dedicated personnel, and a relatively low budget an exciting, interactive experience in underwater archaeology can be brought to tens of thousands of students and the interested public.