Scanner

ASRT Scanner (ISSN 0161-3863) is the official member newsmagazine of the American Society of Radiologic Technologists.

Founded in 1920. ASRT is the world's largest radiologic science organization with 125,000 members.

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Images were combined to create our October cover. The skull image is by Chris Harvey, London. The photo of the ship is by Jack Larmour, also of London. Images from BigStockPhoto.com.

THIS MONTH Shipwreck Treasures

Clumps of material retrieved from shipwrecks sat in warehouses for decades awaiting the day that digital radiography would reveal their secrets. Portable medical imaging equipment

divulged the buried booty and nautical history.

Ready To Celebrate NRTW[®]?

Mammography of the Future

Digital breast tomosynthesis is on the horizon for

mammographers. Now in clinical testing, the 3-D

breast screening technology promises better and

National Radiologic Technology Week® is almost here. Educate the public - and others in your facility - about the important role you play in providing quality health care services. R.T.s at Brigham and Women's Hospital in Boston share what they did last year.

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Serving His Country

earlier detection of breast cancer.

Radiography has taken Sgt. First Class Jeffery Vaughn, M.S., R.T.(R), to different parts of the world and given him a new appreciation for the quality of life in the United States. A career Army man, he's adapted to assignments and challenges from a NATO command center in 28 Belgium to the killing fields of Cambodia.

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Medical Imaging Equipment Uncovers Sunken Treasures

By Wendy Lewis, Contributing Writer

n centuries past, real-life pirates of the Caribbean and naval forces pioneered the seas in search of treasure, profit and military victory. Sometimes their dangerous missions ended on the ocean floor where their sunken seafaring vessels came to rest. Today, medical imaging equipment and radiologic technologists are helping to uncover those treasures.

Imaging specialists have assisted in the recovery and archiving of artifacts from at least three marine crafts that played pivotal roles in American history: the *H.L. Hunley*,

the first submarine in history to sink an enemy ship; the USS *Monitor*, the first ironclad warship commissioned by the United States Navy; and the *Whydah*, North America's only known pirate shipwreck.

Maritime archeologists are especially fond of sunken vessels, often likening them to time capsules because they contain artifacts pertinent to a particular historical event or



Portable digital radiography in action: Greg Dice positions the Canon CXDI-50G panel while Rita MacLean positions the RadPro 40kW mobile unit.

time period. However, the investigation of sunken artifacts presents unique challenges.

When a sunken craft rests on the ocean floor, layers of sediment and organic material cover the vessel and its contents. These layers thicken over time, forming dense, concrete-like shells called "concretions." Concretions are a mixed blessing for maritime archeologists: Although they can help preserve the artifacts they encase, they also conceal their contents.

In the past, archeologists' only option was to chip away carefully at concretions, a painstaking process that risked damaging the artifacts inside. Often the risk to the items was deemed too great, and they were stored away in the hopes that technology eventually would provide a better way to examine them. Twenty-five years have passed since

Pirate's Booty Becomes Historical Treasure

For its documentary "Real Pirates: The Untold Story of the *Whydah* From Slave Ship to Pirate Ship," National Geographic asked a team of imaging specialists at Canon U.S.A. Inc. to assist in the recovery of artifacts. The *Whydah* sank off the coast of Cape Cod in 1717.

"Some of these pieces were taken from the wreck site 25 years ago. They didn't know what to do with them until now, with the technology we now have," said Gregory Dice, senior sales engineer of Canon's Digital Radiography Systems, referring to the advantages of digital radiography over film. Mr. Dice has imaged statues and paintings for the Museum of Modern Art in New York, but never a shipwreck. He said

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Results of the images are displayed within seconds. A part of the image is magnified, revealing the shape of a cross on what appears to be a dagger handle or a hand tool.

some artifacts left their murky gravesite only to be cataloged and stored in a warehouse. But thanks to digital radiography, the time has come to examine these concretions without harming their contents.

R.T. Rita MacLean Travels the Globe Life as an Applications Training Specialist

By Wendy Lewis, Contributing Writer

When Rita MacLean, R.T.(R)(M)(CV), was searching for career direction as a teen in Kentucky, her father urged her to pursue a career in the medical field. "There will always be sick people, and you will always have a job," he said. His wisdom came from his personal experience in hospitals — not as a health care professional, but as a patient. He had his first heart attack at age 32, before Rita was born, and had several major vascular surgeries when she was a youngster.

Ms. MacLean, who had always been very interested in science, investigated several medical career paths. Ultimately, she decided on radiography. Unlike her dad, Ms. MacLean had visited a hospital only once — to have her tonsils removed. She had never broken any bones or had any accidents requiring medical imaging. "It is interesting that I had virtually no exposure to the field of radiology, and yet I wanted to be an x-ray technologist," she said.

Soon after graduating from Wingo High School in Graves County Ky, in 1978

Graves County, Ky., in 1978, she began her radiography training at Madisonville Vocational-Technical School of Health Occupations. "Back then, there were fewer programs available than there are now, and most were hospital-based," she said. Her training was an eye-opening experience. "At the time, I thought x-rays were only used on bones. I had no concept of how many types of exams x-rays were used for, or what other modalities were being developed. I almost fainted when I saw my first knee arthrogram performed with an 18-gauge, 1-1/2-inch needle!"

After completing her radiography training and being certified by the American Registry of Radiologic Technologists in 1980, Ms. MacLean began her radiography career as a fluoro/mammo/angio/operating room technologist at Terrebonne General Medical Center, a trauma center in Houma, La. She was promoted to radiology coordinator in 1988. Ms. MacLean also gained teaching experience. She was always one of the first to learn to use new equipment and would then train the rest of the department in its applications. She also was a clinical instructor for radiography students. Ms. MacLean transitioned to the vendor side of the profession at the suggestion of a friend who sold radiology equipment for Toshiba America Medical Systems. Ms. MacLean's teaching experience and her love of travel drew her to an applications training position with the company, which she accepted in 1995. "I performed x-ray, R and F (radiography and fluoroscopy) and angiography applications for Toshiba for 10 years before coming to Canon Medical Systems in

2005, so I have been on the road now for 12 years."

In that time, Ms. Mac-Lean has trained customers at a variety of locations in the United States and abroad. "I miss the day-to-day interaction with patients, performing exams and the adrenaline rush of getting called in for an angiography or trauma case," she said. "But I enjoy meeting new people, going to a different place every week and keeping up-to-date with new technology."

The majority of Canon's medical imaging sales team

is made up of R.T.s, but Ms. MacLean is the only dedicated applications specialist. "I am also probably the only applications specialist who ever stated I wanted to travel more instead of less," she said with a laugh.

Flexibility with traveling is important for any applications specialist. Ms. MacLean usually is at any given site two to three days, but she may have to schedule follow-up visits, depending on what equipment was purchased. "I try to schedule myself about a month in advance, but sometimes things change, especially on new installs where there is construction or inspections to be done."

Ms. MacLean enjoys observing how

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The Whydah imaging team members are, from left, Barry Clifford, Rita MacLean, John Allen, Gregory Dice and Whit Fowler, all of Canon U.S.A. Inc.

Ms. Macl ean said it was after about 15 years that she began to feel the need for a career shift. "I enjoyed being a chief tech in charge of the day-to-day operations of our department, but I was disappointed with some of the changes we were seeing due to managed care. For example, we had to shorten our time windows for scheduled appointments in order to perform more exams, and I didn't want to see our standard of patient care deteriorate. I was attending classes two to three nights a week to further my education, with the thought of a radiology administrative director position in the future. I was also on call for angiography and the operating room, and I began to experience burnout."

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www.hunley.org

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that the imaging involved a lot of trial and error at first. "We took exposures with less penetrating x-rays at first, and then started gradually going up. There are no technique charts for rocks," he said. The team spent three days imaging the artifacts at a warehouse in Massachusetts, then turned over the images to National Geographic.

The value of radiographic imaging in the artifact recovery process became apparent almost immediately. "Some of the

concretions turned out to be nothing more than big rocks," Mr. Dice said. "The archeologists could have spent a lot of time carefully breaking them apart only to find there was nothing in them.

"I could only hope to work on another project like this. It was lots of fun, very interesting and I learned a lot," he said. The team was able to contribute to history noninvasively.

Rita D. MacLean, R.T.(R) (M)(CV), training and development specialist for Canon Medical Systems, also was on the *Whydah* imaging team. In her 27 years as an R.T., Ms. MacLean has worked at hospi-



Rita MacLean and Barry Clifford review the x-ray images of the concretions taken from the pirate ship Whydah, which sank in 1717.

tals, clinics, imaging centers, a medical examiner's office and military and government facilities, but said, "Working on the *Whydah* project has been one of the most interesting experiences I have ever had."

Ms. MacLean was chosen for the project because of her expertise in portable imaging. The large, heavy concretions — some weighing thousands of pounds — could not be transported easily or lifted onto x-ray tables for imaging. Instead, the team brought portable imaging machines to the warehouse where the concretions were stored and worked around the irregularly shaped objects. Images were obtained by positioning the x-ray tube and panel on opposite sides of the concretion. "The flexibility of the equipment [Canon CXDI-50G portable DR panel] made a huge difference in x-raying the concretions," Ms. MacLean said.

Digital images were available within seconds on a view screen, where the images were enhanced and artifacts identified. "I remember seeing the looks of amazement and delight on the other team members' faces while viewing our images," Ms. MacLean said. "Artifacts such as a handcrafted pistol and engraved gold coins had not been seen since the early 1700s. It was a very fulfilling experience for me as an R.T. to be able to show them these 'prizes' inside the concretions. I would compare it with the feeling of satisfaction on obtaining the perfect positioning of an oblique sternum or mastoids, or something equally difficult to position for."

Same Principles, Different "Patients"

Doug Hackradt, national sales manager of FUJIFILM Non-Destructive Testing Systems, has worked with industrial applications for 35 years and has been involved in several maritime recovery projects, including those of the USS *Monitor* and *H.L. Hunley*.

The *Monitor* is most famous for holding its own against the Confederacy's Virginia in the Civil War battle

of Hampton Roads on March 9, 1862. The *Monitor* was discovered on the ocean floor in 1973. More than 1,200 objects have been recovered from the vessel.

The Hunley, the Confederacy's "secret weapon," was the first submarine in history to sink an enemy ship, the USS Housatonic. The Hunley was lost off South Carolina's Charleston Harbor in 1864 and remained underwater until it was raised in 2000. Artifacts from both crafts and parts of the crafts themselves — have since been imaged.

Mr. Hackradt is an expert

in nondestructive testing, commonly referred to as NDT, which is industrial testing that does not destroy the test object. Imaging is regarded as one of the most important tools in the NDT world. "In principle, the medical and NDT markets are very similar; we x-ray patients and determine the results," Mr. Hackradt said. "But our 'patient' could be anything from a jet engine to a pipeline. Also, these patients don't care about dose."

In nondestructive testing applications, much higher energy ranges are required than in diagnostic medical imaging. "It only takes so much radiation to penetrate a human body, but I've dealt with some exotic materials such as cobalt, nickel and steel that were as thick as 12 feet," Mr. Hackradt said. "It takes a lot more energy to penetrate those parts." While a typical "high" setting for medical imaging might be 150 kV, Mr. Hackradt and his imaging teams sometimes used settings as high as 12 MeVs, or 12,000 kV.

On the *Monitor* recovery project, imaging specialists used computed radiography not only to search inside concretions, but also to examine larger structures of the ship that had been raised, such as its gun turret, steam engine and parts of its hull. The images have detailed rivets and other fastenings that provide clues as to how the ships were built. "The *Monitor*'s turret is about 10 to 12 inches thick and made of iron, so this is a perfect application for the technology," said Mr. Hackradt. www.monitorcenter.org

<u>USS</u> Monitor

"CR is such a fast imaging medium compared with film," he said. "Not only does it expose very quickly, because it requires such a lower dose, it allows you to go through thicker and more dense materials." Film could take several minutes to process, whereas CR images are available within seconds.

Coroners took care of the human remains that were found and performed DNA studies. The military handled the burials, since the *Monitor* was a Navy ship.

We Took the X-rays. Now What?

The National Oceanic and Atmospheric Administration owns the *Moni*tor site and all its artifacts, while the Mariners' Museum in Newport News, Va., is the official repository of the 200 tons of artifacts. FUJIFILM Medical Systems donated digital imaging technology to the muse-



This artifact found aboard the wreck of the USS Monitor was unidentifiable before imaging because of the concretions that had collected on it for more than a century.

um to assist in its conservation and restoration efforts.

Marcie Renner, chief conservator of the Mariners' Museum, and a team of archeologists and technologists reference x-ray images often in the *Monitor* Conservation Project.

In some cases, the original object decayed completely while the concretion that formed around it remained. Digital images exposed such voids inside the concretions. Archeologists produce a mold of the original object by drilling a small hole into the void, injecting epoxy and then removing the concretion. Though the original object is lost, the facsimile can be studied.

Composite artifacts, objects comprising dissimilar materials, present unique challenges. The ship's condenser, for example, was made with copper pipes, iron washers and



Using FUJIFILM's NDT computed radiography imaging system, conservators at the Mariners' Museum in Newport News, Va., easily identified the object as a clock.

rubber gaskets. Such materials decay at different rates and require special restoration treatments. X-ray images reveal each component's level of decay.

"With composite pieces, we have to disassemble them, restore each part according to its material, and then put them back together," Ms. Renner explained. "You can see where the x-rays are essential for our disassembly and reassembly efforts." Large items such as the condenser require thousands of images, which are then assembled like a mosaic for reference.

Monitor artifacts spend much of their

time in large tanks of water in the museum's conservation lab, where they undergo a long and complex dechlorination process. It may take years to completely restore larger items, but many artifacts already are on view for the public to enjoy.

By the time the last artifact from the *Monitor* is fully restored, R.T.s will have developed even more ways to contribute their expertise to maritime archeology. As Ms. MacLean explained, "When I started my career in the early '80s, I never would have dreamed that one day I would be asked to help x-ray sunken treasure! This experience definitely served to remind me, as a radiologic technologist, that as our technology continues to advance, there still is a world of opportunity waiting."

R.T. Travels the Globe

medicine is practiced in different hospitals and different countries. "I did a training mission in South Africa at a private hospital and was horrified when the doctor never put on gloves to perform two sterile procedures," she said. "On the upside, every day the administrator or assistant administrator visited every patient."

Ms. MacLean boasted that she has earned thousands of hotel and frequent flier points and a diamond-level Hilton membership. Another perk of the traveling life is shopping. Though work usually keeps her

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too busy to visit many tourist attractions, she said she enjoys hitting the malls in the cities she visits. "I do my Christmas shopping on the road all year long. By the time Christmas gets here, my shopping is done," she said.

Ms. MacLean's husband, Andrew, who also travels for business, understands her schedule. She boasted that their lifestyle is actually good for their marriage. "Every weekend that we're at home together is like a honeymoon," she said. Yet, she regrets that she and her husband cannot have any pets. "I always had dogs, and I miss that terribly. The only way we could have pets is for one of us to stay home, and neither one of us wants to do that yet."

In the event that Ms. MacLean eventually does tire of traveling, she said she will return to being a full-time R.T. in a medical setting, either in Southern California where she and her husband reside or perhaps in Europe where there is a need for English-speaking technologists. "I can't imagine doing anything else other than x-ray," she said.