

Naval Sealift Ship Puts Accuracy to the Test

BY DAN WALSH



*USNS
Watson
under
way*



The United States Naval Ship (USNS) Watson is one of the large, medium-speed, roll-on, roll-off ships that have significantly expanded the nation's sealift capacity. The Watson has a considerable amount of machinery, including main engines, generators and cranes, that need oil tested on a regular basis to detect potential problems and eliminate the possibility of a catastrophic failure. Operated by Ocean Shipholdings Inc. under contract to the Military Sealift Command, the Watson previously used oil test kits but found them time-con-



U.S. Army tracked vehicles are loaded aboard the roll-on, roll-off ship USNS Watson. (USAF photo by Staff Sgt. Ricky A. Bloom)

suming. Its engineers questioned the kits' accuracy, too.

Three years ago, the ship switched to handheld lubricant condition monitors, and one year ago added a portable viscometer to its oil testing arsenal.

"The portable instruments help us get more done in less time while providing results that are more accurate and reliable than single-test kits," said Ocean Shipholdings' William Maus, chief engineer of the USNS Watson. "When I show them to engineers from other ships they ask, 'when can we get ours?'"

Major military mover

Military Sealift Command operates approximately 110 non-combatant, civil-

ian-crewed ships that replenish U.S. Navy ships, strategically pre-position combat cargo at sea around the world and move military cargo and supplies used by deployed U.S. forces and coalition partners.

The Watson can carry a variety of military equipment in support of Army and Marine Corps operations. The Watson and other ships of its class were the major transporters of military equipment during Operations Enduring Freedom and Iraqi Freedom and during the military operations in Afghanistan and Iraq that began after the September 2001 terrorist attacks.

The Watson is 950 feet long, has a beam of 106 feet, a fully loaded dis-

placement of 62,644 tons, and a service speed of 24 knots. It has a cargo-carrying capacity of more than 380,000 square feet — equivalent to almost eight football fields. There are two gas turbine engines, each with an output of 32,000 brake horsepower (bhp),



Oil viscosity results are visible in the Q3000 display.

driving two shafts with 24-foot controllable pitch propellers at 95 rpm at full power. The ship's diesel generators are capable of producing 12,500 KW of electrical power. The ship has many hydraulically powered cranes, cargo doors and ramps.

Oil: Critical to mission

“Our engineering department consists of 11 people, which is not a lot for a 950-foot ship,” Maus said. “We are responsible for millions of dollars of machinery which could at any moment become critical to our national defense. As in all major Navy ships, oil analysis plays a critical role on the Watson by alerting us to problems that have the potential to damage a vital system.” The information provided by oil analysis enables Maus and his team to efficiently allocate scarce resources and to plan maintenance based on actual need as opposed to simple intervals of time.

In the past, Watson engineers used

test kits for oil analysis. Engineers collected oil samples, brought them back to the control room, and mixed them with the chemicals in the test kit. It was necessary to perform tests in the control room in order to maintain a stable environment for the test chemicals and



Testing air compressor oil aboard the USNS Watson, using the Q3000

for the test equipment. The chemicals used in the testing process are classified as hazardous, which poses problems for shipping the chemicals and disposal of the used reagents.

Normally, it takes about five minutes to collect a sample, five minutes to bring it back to the control room, and five minutes to perform each of the five tests required for generator oil, for a total of 35 minutes. Maus was concerned about accuracy and repeatability because the tests were dependent on using the right amount of both oil and chemicals, and on the reliability of the kit's base equipment. He was also concerned about the need to work with hazardous chemicals.

Alternatives were found with the Spectro FluidScan Q1000 handheld lubricant condition monitor, and the SpectroVisc Q3000 portable viscometer. The Q1000 performs 87 tests and provides 174 results in about two-thirds the time it took to conduct 138 tests yield-

ing 138 results with the chemical test kit. But Watson's operators wanted to be sure these test results were accurate and reliable, not just fast.

Head-to-head comparison

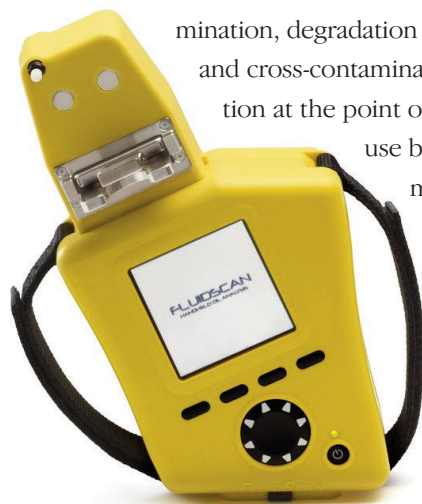
The USNS Watson was one of two Military Sealift Command ships asked to perform a head-to-head comparison of the traditional one-test-at-a-time kits versus portable instruments that operate on the same principles as laboratory instruments. To evaluate the performance of the kits versus portable instruments, Watson personnel were asked to perform a specified number of tests in triplicate — once on a test kit, one on a portable instrument, and also by sending a sample to a lab on shore.

The FluidScan Q1000 is a rugged, handheld infrared spectrometer that measures a range of key oil condition parameters in both synthetic and petroleum-based lubricants and fluids. It can

determine lubricant contamination, degradation and cross-contamination at the point of

use by

mea-



The Q1000 handheld

suring key oil condition parameters. FluidScan can readily determine total acid number (TAN), total base number (TBN), oxidation, nitration, sulfation, additive depletion, incorrect lubricant, water, glycol, soot, glycerine and FAME (fatty acid methyl esters) in biodiesels.

The SpectroVisc Q3000 was designed

to determine kinematic viscosity in the field, for applications when immediate results are required to determine the health of critical equipment. This portable, battery-operated instrument has a touch-screen interface and is designed to be easy to use. Requiring no solvents, no density checks and no thermometer, the SpectroVisc Q3000 measures each sample at a constant temperature, for consistent accuracy without pre-test measurements.

Hours saved

“The first thing we noticed was that Spectro’s instruments greatly simplify the process of measuring oil conditions,” Maus said. “The instruments are light and don’t require any chemicals or extra steps, so you can carry them to the machinery and perform the analysis on site.” Additional benefits he noted were a major reduction of the quantity of oil required for testing, and no generation of hazmat that requires disposal.

“The FluidScan Q1000 measures the full range of oil condition parameters in about five minutes, the same time that is required to measure a single parameter with a test kit,” Maus said. He calculated that it takes five minutes to take a sample of oil from a diesel generator, five minutes to measure critical parameters on the oil condition analyzer at the generator, and five minutes to measure the viscosity, for a total of 15 minutes. That’s less than half the time required with test kits.

“When we are sitting in port and not operating a lot of equipment, we save about 10 hours per week,” Maus said. “When we are under way the savings are approximately 15 hours per week. The responsibility for oil analysis is assigned to a licensed engineer with many other responsibilities, so these

time savings make his job much easier and allow more efforts to be focused on maintenance and repair throughout the ship.”

Proving accuracy

A key part of the head-to-head assessment was comparing the accuracy of the portable instruments to the test kits. Testing by an independent laboratory showed that the portable instruments were consistently accurate over the full range of measurement parameters. The accuracy of the test kits, on the other hand, varied from good to poor depending on the specific test and the care taken by the person running the test.

For example, problems were identified in the measurement of TBN with the test kits. This measurement is used on diesel engine oil to measure additives used to neutralize acids produced as a byproduct of combustion. The test kit measurement is based on and requires entry of the original TBN in the oil. Ship’s engineers entered this value based on the specifications provided by the oil manufacturer; however, the accuracy of these specifications was in doubt. The FluidScan Q1000, on the other hand, accurately measures TBN without being dependent on manufacturers’ specs. The portable instruments also provide many additional measurements at no additional cost or time.

Maus added that another benefit of using portable instruments is that their higher accuracy increases the confidence in their results and leads to greater predictive maintenance efforts. “The accuracy of the portable instruments gives us confidence to base our predictive maintenance program on their results. We can track

exactly what’s going on and identify problems in plenty of time to take corrective action. At the same time, if the results look good we can extend the service life of the oils to save time and money.” In addition to the advantages this equipment offers, the portable instruments are actually less expensive than the test kits previously used, which required replenishment of chemicals and periodic recalibration of the base unit.

“At the end of the trial period, our guys did not want to give up the Spectro instruments and go back to the test kits,” Maus said. “The Navy agreed that the Watson could continue to use the Spectro kits while they continued their evaluations. We are hopeful they will decide to switch the entire fleet over to the new portable instruments. The end result will be increased accuracy and more measurements, which in turn will provide higher mission readiness, lower maintenance expenses, and time savings that can be applied to other shipboard projects. Our future goal is to integrate the results from the new instruments into the ship’s computer based maintenance program so measurement results will automatically be available to shore-side personnel within 24 hours after samples are tested.” ■

Daniel Walsh is director of product management for Spectro Inc. Spectro, based in Chelmsford, Mass., specializes in analytical instrumentation and software for machine condition monitoring, and is one of the largest suppliers of oil and fuel analysis instruments to industry and the military worldwide. For more information, visit www.spectroinc.com or phone (978) 431-1120.