Military Sealift Command—Saving Time on Oil Analysis

The use of portable oil analysis instruments is helping the USNS Watson save up to 15 hours per week on oil analysis procedures, while also increasing the reliability and accuracy of the results.

By William Maus and Dan Walsh

Military Sealift Command (MSC) has responsibility for up to 120 active and reserve civilian-crewed ships that replenish U.S. Navy ships, provide service support, conduct special missions, strategically preposition combat cargo at sea around the world, and move military equipment and supplies to deployed U.S. forces.

In addition to the command's active ships, MSC gains operational responsibility once the Department of Transportation's Maritime Administration activates any of its approximately 50 ships that are maintained in Reduced Operating Status in the Ready Reserve Force. MSC also charters commercial vessels as required to meet government needs, and during a national emergency, can employ dozens of additional commercial vessels enrolled in the Voluntary Intermodal Sealift Agreement. These multiple sources enable MSC to provide a comprehensive, global capability to meet national maritime needs worldwide.

As the Department of Defense (DOD) is increasingly asked to do more with less, MSC's customers continue to turn to the command for innovative and cost-effective solutions for their transportation needs. Everything is on the table as DOD copes with rising manpower, operating, and ownership costs in the face of growing operational demands. While this is a challenge to MSC, it is also a tremendous opportunity to demonstrate the financial and operational benefits of employing civilian-manned ships and commercial maritime best-practices.

To meet the challenges of tomorrow, MSC continues to examine opportunities for cost reduction, thus freeing up the resources needed to sustain its force structure. It will continue to modernize and to create future logistics capabilities in a resource-constrained environment.

ONBOARD THE USNS *WATSON*

The USNS *Watson* is a large, medium-speed, roll-on, roll-off (LMSR) ships that have significantly expanded the nation's sealift capacity. The *Watson* is operated by commercial shipping companies under contract to Military Sealift Command. It 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 9/11 terrorist attacks.

The *Watson* is 950-ft long, has a beam of 106-ft, a fully loaded displacement of 62,644-T, and a service speed of 24-k. It has a cargo-carrying capacity of more than 380,000-ft², equivalent to almost eight football fields. There are two gas turbine engines, each with an output of 32,000-bhp, driving two shafts with 24-ft 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.

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 such as serious damage to or even destruction of a diesel engine or hydraulic pump. The ship's engineering department consists of 11 people which is not a lot for a 950-foot ship. These people 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 and by providing information that enables us to efficiently allocate our scarce resources by planning maintenance based on actual need as opposed to simple intervals of time.

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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 for the test equipment.

The chemicals used in the testing process are classified as HAZMAT, which poses problems for the shipping of chemicals and disposal of the used reagents. 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 tests required for generator oil for a total of approximately 35 minutes. Engineers were concerned about the accuracy and repeatability of the tests because they were dependent on using the right amount of both oil and chemicals and reliability of the test kit base equipment and about the need to work with hazardous chemicals.

HEAD-TO-HEAD COMPARISON

The USNS *Watson* was one of two naval ships asked in 2010 to perform a three-week 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. The other ship was a Bob Hope-class LMSR, similar to the *Watson*, but utilizing diesel engines for main propulsion instead of gas turbines. 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 instrument used in the test was the Spectro FluidScan Q1000 handheld lubricant condition monitor.

The first thing that was noticed was that portable instruments greatly simplify the process of measuring oil conditions. The instruments are light weight and do not require any chemicals or extra steps so you can carry them to the machinery and perform the analysis on-site. Another benefit is a major reduction of the quantity of oil required for testing and no generation of HAZMAT requiring disposal. The handheld lubricant condition monitor 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.

The result is that it takes 5 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, less than half the time required with test kits.

IMPROVED TESTING 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 total base number (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 engineers entered this value based on the specifications provided by the oil manufacturer; however, the accuracy of these specifications was in doubt. The handheld lubricant condition monitor, on the other hand, accurately measures TBN without being dependent on manufacturers' specs. The portable instruments also provide many additional measurements not available on the traditional test kits at no additional cost or time.

Another benefit of using portable instruments is that their higher accuracy increases the confidence in the results and leads to greater predictive maintenance efforts. The accuracy of the portable instruments gave crewmembers of the *Watson* confidence to base its predictive maintenance program on their results. The crew 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, the crew 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.

While at the end of the trial period, the *Watson* was supposed to give up the portable instruments and go back to the test kits, the Navy, despite very tight budgetary constraints, agreed that the Watson could continue to use them. When the ship is sitting in port and not operating a lot of equipment, the new oil analysis process saves about 10 hours per week. When underway at sea, the savings are approximately 15 hours per week.

The responsibility for oil analysis is assigned to a licensed engineer who also has many other responsibilities. So these time savings make his job much easier and allows more efforts to be focused on maintenance and repair throughout the ship.

BENEFITING FROM TECHNOLOGY

More recently, the Mobile Landing Platform ships, the first of a new class of auxiliary support ship, will be delivered the Q1000 handheld lubricant condition monitor as well as the SpectroVisc Q3000 portable viscometer. These ships are the centerpiece of the Navy's Sea Base concept and serve as a transfer point for Marine Corps amphibious landing forces between large ships and small landing craft.

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. Plans are in place to allow the crew of the USNS *Montford Point*, a Mobile Landing Platform ship, to download the test results from these instruments to the ship's computer-based maintenance program, which is replicated daily to shore side servers.

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