USCGC HEALY: THE UNITED STATES' NEW POLAR RESEARCH ICEBREAKING VESSEL

By Jonathan Berkson and George DuPree, originally published circa 1998.

USCGC HEALY, the first polar icebreaker to be commissioned by the United States Coast Guard since 1978, was launched in November 1997 and is scheduled for delivery at the end of 1999. The ship is named in commemoration of Captain Michael A. Healy, a legendary figure of Alaskan Arctic history and Commanding Officer of the U.S. Revenue Cutters CORWIN and BEAR from 1884 to 1895. HEALY was designed from the keel up for the primary mission as a high-latitude research platform for conducting a wide variety of research tasks in diverse fields of science and engineering. The ship is equipped with a highly automated engineering plant, a state-of-the-art array of navigational equipment, extensive communication and computer systems, a voyage management system, and a modern suite of science systems. Although HEALY will be capable of supporting a wide range of missions in support of U. S. national interests in both polar regions, the Coast Guard intends to operate the ship primarily as an Arctic research vessel scheduled for up to 200 operational days per year. The ship was designed and constructed for extended polar operations including the ability to winter over for planned science missions.

With a length of 420 feet, beam of 82 feet and displacement over 16,000 tons, HEALY will become the world's largest non-nuclear polar icebreaker. The ship has diesel electric propulsion with 30,000 shaft horsepower and is being built by Avondale Industries, Inc., New Orleans, Louisiana. The ship control systems include anti-roll stabilization tank, a bow thruster, two rudders, fixed pitch propellers, and a bow wash - bow thruster system which can lubricate the hull during icebreaking operations. The minimum icebreaking design requirements are 4.5 ft at 3 knots going ahead and 8 feet backing and ramming. The computerized, integrated navigation system will use electronic charts, an autopilot and electronic positioning information to automate many ship control functions. A dynamic positioning system allows precise station-keeping and movement. In addition to a variety of ship communication systems, a separate system will provide dedicated satellite communications for scientific work. HEALY is also equipped with a ship-wide computerized data logging system to record and store data from the navigation, oceanographic, engineering, and communications systems. HEALY was specifically designed to accommodate scientific operations. For example, sonar hydrophones are flush-mounted in the hull, the ship's engines are located on the main deck to reduce noise for the sonar systems, and the ship has the ability to hold overboard discharges up to 24 hours to allow uncontaminated water sampling.

With a crew of 75 and maximum scientific party of 50, HEALY accommodates more scientists than the Coast Guard's POLAR Class icebreaker with half the crew. The ship normally will carry 35 scientists living two to a stateroom, with the senior scientist in a single stateroom next to the ship's captain. Each science stateroom can accommodate a third person in a fold-down rack, which allows the surge capacity of 50 people.

Even before the U.S. Congress authorized funds to build the HEALY in 1990, vessel requirements for a research icebreaker were developed with input from governmental, academic, and industrial groups. The detailed design and construction contract, managed by the Naval Sea Systems Command, was awarded to Avondale Industries, Inc., in July 1993. The program office consists of Naval Sea Systems Command officers, civilian employees, and Coast Guard officers, with Coast Guard Captain Greg Johnson as the Program Manager. The Navy Supervisor of Shipbuilding in New Orleans, through a Coast Guard office of technical personnel, manages the contract and provides on-site inspection at the shipyard. To increase involvement of the scientific community during construction and testing, the University-National Oceanographic Laboratory System (UNOLS) Arctic Icebreaker Coordinating Committee (AICC) was formed in September 1996, with Dr. James H. Swift as Chairman. The initial design of the scientific spaces was modified after input was received from scientists. The AICC, which is supported jointly by the U.S. Coast Guard and the National Science Foundation, continues to provide valuable input to the design of the science suite. It also provides advice for the planning and operation of Arctic science support for the two Polar Class icebreakers POLAR STAR and POLAR SEA. The USCGC HEALY pre-commissioning unit, with Captain Jeffrey Garrett as the Commanding Officer, is engaged in training HEALY's crew and is developing procedures and protocols for operating the ship.

HEALY is well equipped for towing and for handling the wide variety of sensor arrays and oceanographic gear needed for ocean research. Deck equipment and five cranes are strategically located for loading supplies and equipment, setting up experiments, positioning vans, and deploying/recovering scientific gear and boats. Two separate ocean winches and a double-drum trawl/core winch are available for scientific operations. A-frames located on the stern and starboard quarter provide versatility for over-the-side operations. Two helicopters and five boats are available for aiding science operations and logistics. HEALY has a helicopter deck, a hanger, and will normally carry two HH-65 helicopters. The ship can also carry one 39-foot Arctic Survey (ABS) boat, two 36-foot LCVP cargo boats, and two 23-foot Rigid Hull Inflatable Boats (RHIB).

Science systems and equipment on HEALY include the Acoustic Doppler Current Profiler (ADCP), Bathy2000 depth sounding and subbottom profiling system, SeaBeam 2112 multibeam sonar system, Oceanographic Data Acquisition System (ODAS) for expendable oceanographic probes (e.g. Expendable Bathythermographs), TeraScan weather satellite system, meteorological

measurement system, Conductivity-Depth-Temperature (CDT) acquisition and analysis system, rosette water sampling system, a bow tower for clean air experiments, a dedicated area for daylight incubation experiments, and a continuous flow, sea water sampling system, and a jumbo coring system. Data will be stored and analyzed with the aid of a dedicated fiber optic Science Data Network (SDN) with computer jacks throughout the ship, including two in each stateroom. The SDN will date and time-stamp all data collected from the twenty-four installed scientific, navigational, and engineering systems and will have the capability of handling twelve additional systems, such as other sensors that scientists may install. To minimize the effect of disk crashes, files will be simultaneously stored on two separate hard disks. For convenience of the scientists, the system will allow the use Microsoft, OS-2, Apple, and UNIX operating systems. Data can be transferred by e-mail via INMARSAT through the dedicated science communications system.

There are over 5000 square feet of interior science laboratories and science support rooms in addition to covered science staging areas and exterior space (see Table I). The main science lab is the scientific operations center and has immediate access to the wet lab, the dry assembly area, science vestibule, hazardous material locker, two of the science vans, the two science staging areas, and the after working deck. The layout allows scientists to move from the stateroom or mess area to the after working deck without going through the main science lab or the weather. The biological/chemical analysis lab and the climate-controlled chambers are also accessible from the interior of the ship with out going through the main science lab. The three science cargo holds provide for up to 20,000 cubic feet of storage space with hoist. Each of the two staging areas for science operations has roller door access with a freezer curtain to the weather deck.

In addition there are spaces for eight 20-foot science vans (two on the 01 level bow, two on the 02 level port and starboard, and four on the fantail (two opening into the ship and two opening onto the fantail)) and two 40-foot science vans (02 level port and starboard in the location of the science work boat and the LCVPs). The Science Van spaces are provided with most ship services (telephone, SDN, various water systems, electrical power, etc.)

After the delivery of HEALY to the Coast Guard in late 1999, there will be a 45-day period for fitting out and loading the ship. The ship will then start a series of warm water shake down tests in the Gulf of Mexico and Caribbean Sea in early 2000. During these post-delivery tests, all scientific equipment will be tested and the bottom mapping sonar will be calibrated. Following the warm water tests, HEALY will begin a northward transit to the Arctic to conduct six weeks of icebreaking performance trials followed by four weeks of science suite testing and evaluation. In conjunction with the AICC and the UNOLS Research Vessel Technical Enhancement Committee (RVTEC), chaired by John S. Freitag, the HEALY project office has contracted with a group of engineers, scientists and

technicians to conduct rigorous integrated testing of all science systems throughout the shakedown period. HEALY will transit to her homeport of Seattle at the conclusion of the testing and trials program.

HEALY will be operated by the Coast Guard as a dedicated research vessel for the diverse needs of the U.S. science community and with the level of services to be equivalent to those provided on UNOLS large research vessels. During the shakedown cruises, the Coast Guard will be refining administrative and operational procedures to optimize services. The complex array of science equipment will be operated by Coast Guard Marine Science Technicians with support from contracted specialists as required.

HEALY's first unrestricted science cruise is anticipated for 2001, after completion of maintenance and warranty work required by shakedown operations. Efficient and full utilization of HEALY in the Arctic will require expeditionary planning to identify and coordinate schedules, logistics, and to arrange for companion vessels when high Arctic missions are made. The AICC has scheduled the first annual Arctic planning meeting to be held one day before the annual fall American Geophysical Union meeting to prepare a 5-year rolling community-drafted plan for Arctic marine science use of Coast Guard icebreakers. The advent of HEALY, with its extensive capabilities and dedicated scientific mission, signals an unprecedented era of research opportunity in the Arctic.

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TABLE I:

Laboratory and Science Support Spaces:

Main Science Lab 1233

Science Wet Lab 390

Biological/Chemical Analysis Lab 310

Two Climate-Controlled Chambers 200

The Aloft Conning Station (Wildlife Observation Platform) 256

Meteorological Laboratory 64

Science Lounge/Library/Conference Room 300

Dive Locker facilities 225

Photography Laboratory 105

Science Communications Center 62

Electronics/Computer Laboratory 528

Future Science Laboratory 475

Science Conning Station 439

Hazardous Materials Locker 100

Science Freezer 130

Science Refrigerator 130

Science Dry Assembly Area 152

Science Vestibule/Arctic Gear Locker 240

Science Staging Areas

Starboard Science Staging Area 315

After Science Staging Area 315

Exterior Support Spaces:

Daylight Incubation Area 108

Forward Working Deck 820

Starboard Overside Handling Area 600

After Working Deck 3000