



The Marine Design Center

Created in 1908 as the Marine Division and headquartered with the Philadelphia District since 1938, the Marine Design Center (MDC) has had a distinguished history within the Corps of Engineers. From the outset, the mission of the Marine Division (renamed the Marine Design Division in 1938 and the Marine Design Center in 1979) was to provide the Corps with “a group of naval architects and marine, mechanical, and electrical engineers who could design, build, and maintain the complex craft needed to improve and maintain our inland and coastal waterways.”¹ The center has upheld and expanded this mission throughout its history, as it has provided services not just for the Corps but for other government

agencies as well. Physically collocated with the Philadelphia District but operating as a separate entity, the MDC uses innovative technologies and rehabilitative maintenance to keep the Corps’ fleet afloat.

At its inception, the MDC was the only division in the Corps with nationwide responsibility.² Its initial assignment centered on the development and maintenance of the Corps’ dredge fleet, the critical element in ensuring the navigability of the nation’s waterways. During the Second World War, the division’s responsibilities increased significantly, as it engaged in various projects and expanded its portfolio. The division designed and constructed “tugboats, towboats, barges of wood and steel, floating cranes, floating machine shops, port



The USACE Marine Design Center logo

Facing page: Survey Boat Moritz during sea trials, prior to delivery by the Marine Design Center to the New York District



The Towboat Creve Coeur

repair ships, and floating power plants.” It outfitted dredges with guns, armor, and ordnance.³ These changes supported the war effort; with the cessation of hostilities, the division turned away from gunnery and armaments and resumed its work of refining, rehabilitating, and applying state-of-the-art technologies to Corps vessels.

From the 1950s to the 1970s, the MDC worked on a variety of innovative projects. It designed controllable pitch propellers for dredge use and implemented

the first enclosed duct-type bow thruster on an American dredge. Staying on the cutting edge of technology, the MDC designed the first floating nuclear power plant, the *Sturgis*, which was capable of generating 10,000 kilowatts. The Corps deployed the vessel for use in the Panama Canal Zone. At the same time the MDC was developing new technologies, it upgraded older ships with modern equipment so they could continue in service, repowering dredges and converting them to use

contemporary techniques, such as topside discharge via a “snorkel” (1960s). The division continued its work on other watercraft for the Corps, designing and managing the construction of barges, towboats, and survey boats.⁴

The 1970s was a time of change for the MDC. Throughout most of the decade, the center operated under the aegis of the Philadelphia District, so the division chief reported to the district engineer. In 1979, that arrangement changed as a result

of a Corps-wide reorganization in which a number of separate organizations dealing with water resources were gathered under the umbrella of the Water Resources Support Center, headquartered at Fort Belvoir, Va. The MDC was transferred to the new organization and placed within its Dredging Division. But although the center reported to a new chief, its offices remained in Philadelphia. As former MDC Director Keith Lawrence recalled, “We stayed right there. Nothing changed,

Construction of a survey boat





The Marine Design Center teams with workers at the Corps' Ensley Engineer Shipyard in Memphis, Tenn. to set the kingpost on the St. Paul District's Crane Barge Leonard prior to load testing

nobody moved, nothing happened, but organizationally we were no longer part of the Philadelphia District. We were now part of the Water Resources Support Center.”⁵

The organizational transfer of the MDC was followed by other changes focused on keeping up with rapid innovations in technology, such as upgrading personnel qualifications to incorporate computer-aided drafting and design. Certain positions were realigned, with such jobs as inspectors and draftsmen reclassified to professional engineering posts. Having an increasingly professional staff generated new responsibilities, and expanded responsibility led to increased staff interest in the projects. In addition, the creation of project teams allowed a greater delegation of accountability within the center. Each team, with its own project manager and project engineers, became “the face of the organization” to the project sponsor.⁶ The use of a single project manager “from the initial studies to sea trials” was an effective maneuver and foreshadowed the Corps’ implementation

of life cycle project management in the 1990s.⁷

Although the MDC was under the auspices of the Water Resources Support Center, it was a self-sustaining unit. As Lawrence explained, “Nobody in the Corps of Engineers has Marine Design Center in their budget....the organization exists only on the work that comes in.” The MDC had to promote itself as an organization to ensure that other entities within the Corps knew “who could help them, who could get them the right kind of equipment that they needed to help them repair what they needed, improve what they had.”⁸ The MDC’s continued existence testified to its usefulness, expertise, and excellence.

Because the MDC remained housed with the Philadelphia District, it continued to rely on the district for administrative support. The district provided contracting and human resources services, as well as finance, accounting, and legal support on a reimbursable basis—and occasionally assisted with technical support unique to district missions. As Lawrence

recalled, although it was separate, the MDC “still worked hand-in-glove with all the elements of the Philadelphia District.” Because the district provided contract support, the district engineer had to sign off on contracted work for the MDC, although the work was subsequently managed by the MDC with minimal district involvement.⁹

Changes in the MDC’s administrative affiliation continued into the 1980s. Just as the MDC had to perpetuate itself through its project load, its umbrella organization, the Water Resources Support Center, was also somewhat precariously positioned. According to Lawrence, when the head of the Dredging Division retired, that branch of the Support Center simply “ceased to exist.”¹⁰ With no clear direction as to the revised chain of command, the MDC director took the initiative to report to the director of civil works at Corps Headquarters. Perhaps because of this, the MDC was established as an unaffiliated field operating activity in 1989, reporting directly and officially to the Directorate of Civil Works.¹¹



Cover design for MDC information brochure

The Dredge Chester Harding



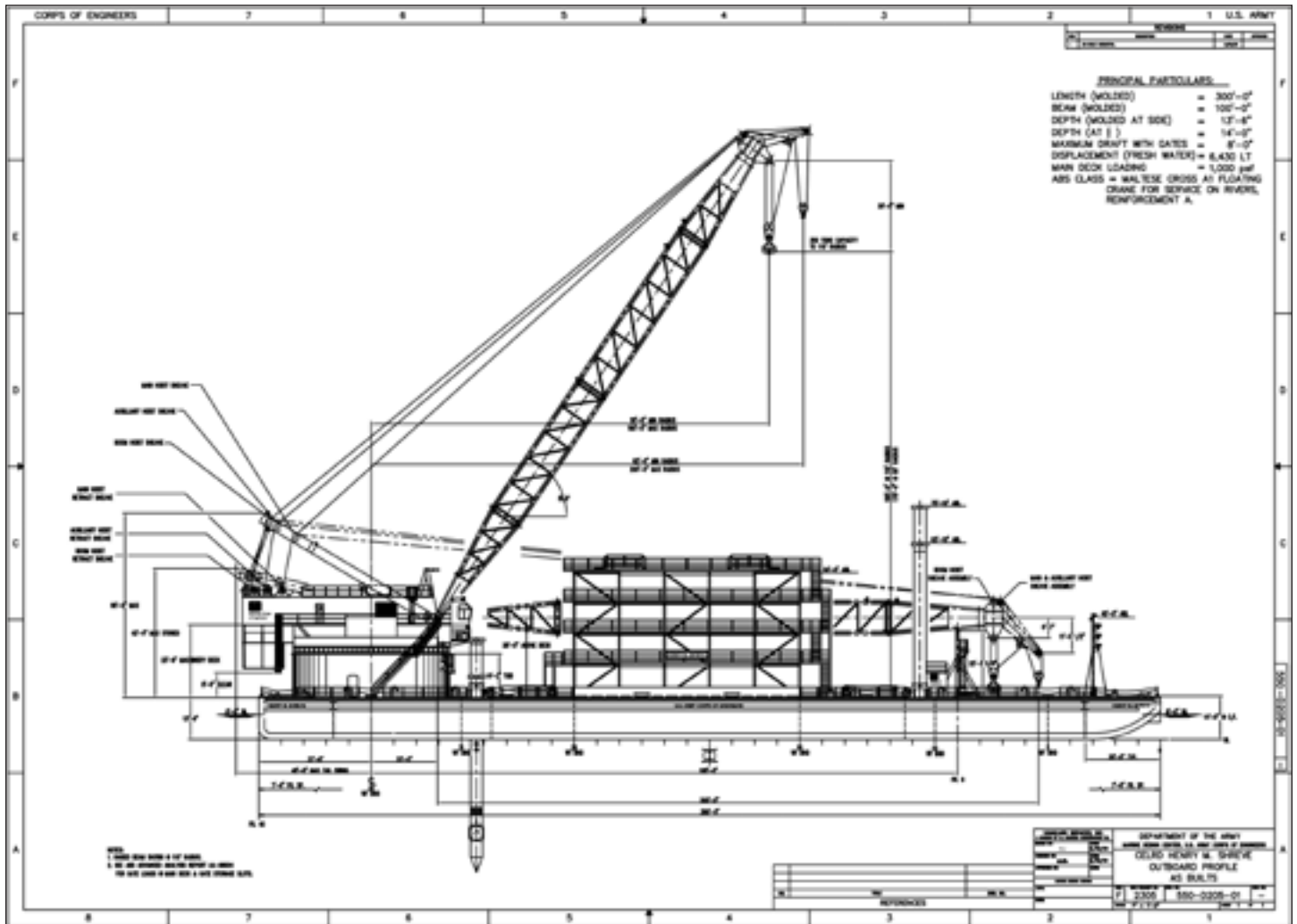


Three of the Corps' four "Minimum Fleet" oceangoing Hopper Dredges (from front): McFarland, Wheeler, and Essayons

The MDC was significantly affected by operational changes as well. In 1976, the Office of the Chief of Engineers "directed the Marine Design Division to begin preliminary design work on three new state-of-the-art hopper dredges," to be constructed under the most "modern marine construction techniques."¹² However, in 1978, Congress passed legislation requiring the secretary of the army to "retain only the minimum federally owned fleet capable of performing such work."¹³ In effect, the MDC was tasked with designing new dredges while the Corps sought ways to reduce the fleet.

A Corps of Engineers study completed in response to the 1978 legislation recommended "that the hopper dredge portion of the minimum fleet consist of 8 dredges: 1 large class, 4 medium class and 3 small class dredges."¹⁴ This would occur as a phased reduction in the fleet, dropping from fifteen dredges in fiscal year 1978 to the recommended eight by fiscal year 1983.¹⁵ The upshot of phasing in the fleet reduction was that the MDC continued with its design and construction of three new dredges that would replace older, still active models.

The MDC successfully carried out its orders. In 1981, it completed construction of the small-class Dredge *Yaquina*, and in spring 1982, it finished the medium-class *Essayons*, both of which were assigned to the Portland District to serve the entire west coast and Hawaii. (*Essayons* was originally destined for the Philadelphia District but was replaced by the *McFarland*.) In 1981, the MDC also completed construction of the large-class *Wheeler*, assigned to the New



Orleans District “for work along the Gulf Coast and in the lower Mississippi River.” The latter two dredges replaced two Corps vessels that had been in service since the first half of the twentieth century: the *Goethals*, built in 1938, and the *Langfitt*, completed in 1947. The new ships incorporated automated technology, which reduced the number of crew required to operate the vessels and effectively

cut costs. Additionally, the modernized dredges had such luxuries as air-conditioning and recreational facilities for the crews, including gyms and saunas.¹⁶

Even with the reduction in the number of dredges, the MDC continued its mission to maintain and improve the Corps’ fleet into the twenty-first century, remaining at the forefront of technology and implementing

Design drawings for the Crane Barge
 Henry M. Shreve

the latest innovations in marine design. With a fleet comprising debris collectors, survey and patrol vessels, towboats, floating cranes, dredges, and barges, this was no small task.¹⁷ According to Richard Pearsall of the Philadelphia District's Public Affairs Office, "At any given time the U.S. Army Corps of Engineers keeps 2,500 vessels afloat," and the MDC "gives a decentralized fleet a central organization to turn to for advice on everything from repairing old

craft to designing and purchasing new ones."¹⁸

In addition to designing new craft for the Corps, the MDC rehabilitated aging vessels to extend their operational life. In 1985, the MDC repowered the Dredge *Jadwin* from steam powered to diesel-electric powered for the Vicksburg District. The refurbished dredge returned to Vicksburg with new generators, propellers, propulsion motors, and dredge pump gears and motors,

Crane Barge Henry M. Shreve



among other substantial improvements that incorporated “power management”—the enhanced application of power, fuel savings, and the resultant emission reductions. The renovation was an outstanding achievement considering that the *Jadwin* was originally commissioned in 1932 and its contemporaries had long been retired from active service. In 2001, the MDC completed a similar rehabilitation (also from steam to diesel-electric) with the Dredge *Potter* for the St. Louis District.¹⁹

In its rehabilitation projects, the MDC operated within the confines of increasingly stringent environmental standards. As William F. Gretzmacher III, who became director of the MDC in 1999, reported, “A lot of what we do deals with being more ‘green.’”²⁰ Even relatively recently built Corps craft, such as the *Yaquina* and the *Essayons*, constructed in the early 1980s for the Portland District, underwent substantial repowering in the first decade of the twenty-first century. The *Essayons*, in particular, benefited from changes

in technology—a major renovation completed in 2009 would boost its propulsion by 2000 horsepower. The MDC was also providing the dredge with new propellers to increase its efficiency and eight new engines that would “greatly reduce” emissions, keeping the vessel in line with environmental emission standards.²¹

Beyond increasing the efficiency and effectiveness of the Corps’ fleet, the MDC was an innovator in the field of floating cranes. According to Lawrence, “One of the most dangerous pieces of marine equipment ever is a floating crane.”²² Engineers at the MDC developed a set of standards to make the cranes safer, while at the same time optimizing crane load charts in relation to vessel stability.²³ The result, according to Lawrence, was that “any floating crane that comes out of the Marine Design Center today is the safest floating crane anybody is ever going to see and it will do the job that it’s designed to do.”²⁴ A notable example was the heavy-lift Floating Crane *Shreve*, which allowed a new lock and dam



New launch boat for the Hopper Dredge Essayons, delivered to the Portland District in 2003

maintenance concept—replacing existing gate leaves with spares, thus reducing lock closure periods and the resultant delaying effects on the transportation industry.

The Floating Crane Monallo



In 1993, the Corps' Waterways Experiment Station (WES) enlisted the assistance of the MDC in its efforts to minimize the impact of dredging on sea turtles in Florida's waterways. A study conducted by the Jacksonville District and the WES investigated the potential for a device "installed on hopper dredges to deflect turtles before they got sucked into the dredge pumping system." The MDC created a prototype deflector to be installed on the draghead intake, "the 'working ends' of dredging equipment which suck up material from a navigation channel." The study involved two other experimental deflectors constructed by outside sources, along with three hundred artificial turtles built from concrete and foam to approximate the "actual size, shape, and weight of sea turtles." After initial tests, project manager Mark Wolff reported that the MDC's design was "far and away the most successful."²⁵

In addition to its work for the Corps, the MDC worked for other federal entities. In the early 1990s, the MDC completed a project for

the Navy, working alongside a Navy research and development group operating out of the Naval Surface Warfare Center, Carderock Division. The approximately \$2 million project (funded by the Navy) involved the repowering of a surface effect ship, transforming it “from a traditional propeller configuration to a water jet configuration.”²⁶ When the MDC began the project, the use of water jet propulsion was an experimental practice. The collaborative effort was a singular success—designed, contracted, and completed in just over two years, an impressive accomplishment for the Navy.²⁷ William Gretzmacher recalled that the “two organizations blended very well together and we had an excellent combined Government team.”²⁸

Another federal agency for which the MDC worked was the U.S. Geological Survey (USGS). In the twenty-first century, the MDC assisted the USGS with the construction of two fisheries research vessels: the *Kiyi*, commissioned in 2000, and the *Sturgeon*, commissioned in 2004. The MDC worked



Turtle deflector visor designed by the Marine Design Center for the McFarland

in partnership with the USGS Great Lakes Science Center, based in Ann Arbor, Mich., for the construction of both craft, completed at a total project cost of approximately \$6 million. The vessels were placed in active service in the waters of the Great Lakes.²⁹

The MDC also worked on projects in other countries, most notably one completed in the 1980s for Sudan. In the early 1980s, Khartoum, the capital, and 87 percent of the rest of the nation received their power from a hydroelectric plant on the Blue Nile River. However, the dam providing the power had been subject



The U.S. Geological Survey Research Vessel Kiyi

The USGS vessel Sturgeon on the waters of the Great Lakes



to repeated spring runoffs that deposited silt in and around the hydroelectric generating turbines. The issue came to a head when runoff collapsed a stream bank, clogging a turbine with silt and compromising power generation for the country. To assist the government of Sudan, the U.S. State Department solicited the aid of the Corps, which, in turn, looked to the MDC.³⁰

The MDC faced the task of designing a dredge that would be assembled in the United States, disassembled, transferred to the job site half a world away, reassembled using less-than-modern tools, and put to work removing the excess silt from the river. Keith Lawrence explained the assignment to his staff this way: “This is a new challenge. . . . You guys are constantly working on state-of-the-art stuff . . . [but] this has to be low tech.”³¹ Working under this directive, the center designed a dredge that would meet the need.

Vint Bossert was the MDC technical representative who oversaw the reassembly of the craft in Sudan in 1984. He recalled

that the delegation that delivered the project “built it, launched it, operated it, showed them how to operate it, made sure it could be maintained, and then we took off.” Although in Sudan for just four months, the MDC crew, augmented by Sudanese laborers, successfully completed the mission of clearing the silt from the turbine. The MDC team trained the Sudanese in the operation of the equipment to maintain their waterway in the future.³²

As the 2000s drew to a close, the MDC continued to function as a streamlined technical organization, although it had grown to comprise three branches with a staff of thirty. Eighteen people worked in the Design Branch, including “all the engineers engaged in technical work.” The MDC also included a Program Management Branch, composed of the program manager, project managers, and a contract administrator. Finally, the center had a Support Services Branch that provided administrative support, although the MDC continued to rely on the Philadelphia District



Installing an engine on a hopper dredge

for contracting services to assist with the MDC’s use of best value procurements—maximizing the use of industry and vendor knowledge and participation to obtain better overall results, rather than going with the lowest bidder.³³

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Throughout its history, the MDC has been the Corps’ go-to source for state-of-the-art marine design. Its record has made it “the Corps of Engineers center of expertise and experience for



Above: Crane Barge Binkley, Memphis District



Left: Survey Boat Moritz, New York District

*Below: Towboat Gordon M. Stevens,
Louisville District*





Above: Dredge Goetz, St. Paul District



Right: Deck Cargo Barge, Omaha District

Below: Dredge Hurley, Memphis District



the development and application of innovative strategies and technologies for naval architecture and marine engineering.”³⁴ The MDC has extended its expertise to other federal agencies and even to other nations. Although the center

underwent numerous administrative and operational changes after 1972, it continued to fulfill its mission and earn its reputation for cutting-edge marine design and engineering in the twenty-first century. 🏰

The newly repowered Dredge Potter headed back to work



- ¹ “Marine Design Center,” document provided by William F. Gretzmacher III, U.S. Army Corps of Engineers, Marine Design Center, Philadelphia, Pennsylvania (hereafter referred to as MDC); Snyder and Guss, *The District*, 187.
- ² Keith Lawrence telephone interview by Paul Sadin, 9 March 2009, transcript, 8.
- ³ Snyder and Guss, *The District*, 188.
- ⁴ Quotations in Snyder and Guss, *The District*, 189–192; see also Unpublished Morgan Draft District History, 114.
- ⁵ Quotations in Lawrence interview, 8–9; see also Unpublished Morgan Draft District History, 114.
- ⁶ Lawrence interview, 8–10.
- ⁷ “Marine Design Center.”
- ⁸ Lawrence interview, 10–11, 17.
- ⁹ Lawrence interview, 12–13; Edward Voigt, Chief, Public & Legislative Affairs, NAP, personal communication with Joshua Pollarine, 4 April 2011.
- ¹⁰ Lawrence interview, 19.
- ¹¹ “Marine Design Center.”
- ¹² Unpublished Morgan Draft District History, 115–116.
- ¹³ Act of 26 April 1978 (92 Stat. 218).
- ¹⁴ “Minutes, Corps of Engineers Marine Engineering Board, 24–26 April 1979, Philadelphia, PA,” 3, Minutes of the Marine Design Engineering Board, Sept 77 thru Apr 79, Marine Design Center Library, U.S. Army Corps of Engineers, Philadelphia, Pennsylvania [hereafter referred to as MDC-Library].
- ¹⁵ Unpublished Morgan Draft District History, 115.
- ¹⁶ Unpublished Morgan Draft District History, 116–117; Voigt personal communication.
- ¹⁷ U.S. Army Corps of Engineers, Marine Design Center, “USACE Vessel Factsheets” <<http://www.nap.usace.army.mil/mdc/factsheets.htm>> (7 April 2010). Regarding survey vessels, the MDC designed high-speed craft, with specific attention to the incorporation of multibeam survey transducers. Voigt personal communication.
- ¹⁸ U.S. Army Corps of Engineers, Philadelphia District, “District Spotlight: Marine Design Center Keeps the Fleet Fit” <<http://www.nap.usace.army.mil/cenap-pa/spotlight/index.htm>> (7 April 2010).
- ¹⁹ U.S. Army Corps of Engineers, Marine Design Center, “USACE DREDGE POTTER” <<http://www.nap.usace.army.mil/mdc/fs13.htm>> (7 April 2010); Voigt personal communication.
- ²⁰ U.S. Army Corps of Engineers, Philadelphia District, “District Spotlight: Marine Design Center Keeps the Fleet Fit” <<http://www.nap.usace.army.mil/cenap-pa/spotlight/index.htm>> (7 April 2010).
- ²¹ “MDC Repowers Portland’s Essayons,” *The Observer* (Spring 2008): 8–9.
- ²² Lawrence interview, 21.
- ²³ William F. Gretzmacher III email to Joshua Pollarine, 2 April 2010, copy in possession of the authors.
- ²⁴ Lawrence interview, 21.
- ²⁵ “McFARLAND and Marine Design Center Assist with Study to Save Sea Turtles,” *The Observer* (July 1993): 9.
- ²⁶ Gretzmacher email to Pollarine, 2 Apr 2010; William F. Gretzmacher III email to Joshua Pollarine, 5 April 2010, copies in possession of the authors.
- ²⁷ Lawrence interview, 15.
- ²⁸ Gretzmacher email to Pollarine, 5 April 2010.
- ²⁹ U.S. Army Corps of Engineers, Marine Design Center, “USACE Fisheries Research Vessel KIYI” <<http://www.nap.usace.army.mil/mdc/fs12.htm>> (7 April 2010); U.S. Army Corps of Engineers, Marine Design Center, “USACE Fisheries Research Vessel STURGEON” <<http://www.nap.usace.army.mil/mdc/fs17.htm>> (7 April 2010).
- ³⁰ Vint Bossert, conversation with Joshua Pollarine, 6 April 2010.
- ³¹ “Low tech” may have been an understatement. Lawrence recalled that the craft was reassembled in Sudan and “put to work with nothing but screwdrivers and pliers and hammers.” Lawrence interview, 14.
- ³² Bossert conversation, 6 April 2010.
- ³³ Gretzmacher email to Pollarine, 5 April 2010; see also U.S. Army Corps of Engineers, Philadelphia District, “District Spotlight: Marine Design Center Keeps the Fleet Fit” <<http://www.nap.usace.army.mil/cenap-pa/spotlight/index.htm>> (7 April 2010); Voigt personal communication.
- ³⁴ U.S. Army Corps of Engineers, Marine Design Center, “Our Mission” <<http://www.nap.usace.army.mil/mdc/index.htm>> (7 April 2010).