Innovative dredging/fluidization for protection of fiberglass tubes

by James E. Clausner and Thomas J. Wright

The U.S. Navy's Trident Submarine Base in Kings Bay, Georgia, has a new magnetic silencing facility. An integral part of this facility is a row of fiberglass tubes designed to house devices that measure and eliminate a submarine's magnetic signature. The fiberglass tubes are placed approximately 30 feet apart along a distance of 700 feet (Figure 1). During construction of the facility in 1991, the pipes were jetted deep into the bottom, with the top of the pipes at -44 feet mean low water.
GEORGIA mlw, leaving 2 to 3 feet of mate-
rial over the center tubes. Con-
KINGS
control of the draghead elevation
KINGSBAY was critical to prevent damage to
the fiberglass tubes and cable
array located on the bottom of
the slip. The 5- to 6-foot tide
range at the site required the con-
tractor to continually monitor
and correct for elevation changes.

The initial dredging left a 20-foot-
wide, 2- to 3-foot-deep layer of
silt covering the fiberglass tubes
(Figure 2). To remove the re-
mainming silt without damaging
the tubes, the contractor con-
structed a fluidizing pipe that
consisted of a 20-inch-diameter
horizontal pipe, 24 feet long,
with 0.5-inch jets spaced 1 foot
apart (Figure 3). This horizontal
pipe was lowered from a small A-
frame barge. Two high-pressure
water pumps (one with a 5-inch-
diameter discharge line and the
other, a 6-inch-diameter line) sup-
plied water through flexible
hoses at 125 psi.

During fluidizing operations (con-
ducted in late August and early
September 1993), the horizontal
pipe was maneuvered over the
row of tubes while the water
from the horizontal pipe fluidized
the silt surrounding the tubes.
Once again, vertical control was

While the barge was fluidizing
the material around the fiber-
glass tubes, the dredge moved
alongside the barge, removing

(MLW). Plugs were placed in the
top of the tubes to keep out shoal
material.

Between completion of the in-
water portion of the facility in
1991 and August 1993, approxi-
mately 8 feet of silt deposited in
the slip. This meant that, before
the Navy could install the de-

ices within the fiberglass tubes,
the slip had to be dredged and
the tubes uncovered without
damage.

Under contract with the Corps'
Savannah District, Wright Dredg-
ing Company of Chesapeake, Vir-

ginia, developed an innovative
technique for dredging the slip
without damaging the fiberglass
tubes. The 10-inch cutterhead
dredge Long Bay, owned by
Marcol Dredging of Charleston,
South Carolina, was specially
modified for this project. The lad-
der was extended to 53 feet, and

a custom-design: a auger head
(though similar to other commer-
cial units) was attached as a
draghead. The auger allowed
the dredge to move in a straight
line rather than in the normal
side-to-side fashion.

During initial dredging, in mid-
August 1993, the slip was

The slip on either
side of the central tube array
was then dredged to -44 feet

ug head.

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-46 FT

Figure 2. Dredge-cut cross sections prior to fluidizing

-41 FT

Fiberglass Pipe
the fluidized material. The dredge then moved to the other side of the slip to dredge the remaining material. The operation generated no silt plumes visible from the surface, and divers working within 100 feet of the operation reported little reduction in visibility. Dredged materials were pumped 11,000 feet to an upland disposal area with the dredge Enterprise assisting as a booster.

This innovative concept resulted in a successful operation. A flat bottom at -46 feet was produced with the row of undamaged fiberglass tubes extending 3 to 4 feet above the bottom.

For additional information, contact Tom Wright, Wright Dredging Company, at (804) 482-5775, or Alan Garrett, Savannah District, (912) 652-5058.

James E. Claussner is a hydraulic engineer with the Coastal Engineering Research Center (CERC), Waterways Experiment Station. Jim joined CERC in 1981 after several years at the Naval Civil Engineering Laboratory where he was involved in design and testing of propellant embedment anchors and measuring submerged sediment properties. Jim is responsible for research on sand bypassing projects and equipment. He received his Bachelor of Science and Master of Science degrees in Ocean Engineering from Florida Institute of Technology. Jim is a registered Professional Engineer in the state of Mississippi.

Thomas J. Wright has over 30 years of experience in the dredging industry, having been employed as a field engineer, dredge superintendent, and general superintendent and advancing to the position of executive vice president in 1986. In 1993, Wright Dredging Company of Chesapeake, Virginia, began operations with the purchase of equipment and assets of Atkinson Dredging Company.

Figure 3. Fluidizing dredge head
Water injection dredging at Bayou Teche, East and West Calumet floodgates

by Gregory L. Williams

In late December 1993, Gulf Coast Trailing (GCT) conducted the first contract water injection dredging (WID) project for the U.S. Army Engineer District, New Orleans, at the East and West Calumet floodgates in Bayou Teche near Morgan City, Louisiana (Figure 1).

Slightly more than 20,000 cubic yards of material was dredged from the floodgate areas and diverted to the neighboring, deeper Wax Lake Outlet (Figure 2). Dredging specifications required a navigable depth of 9.0 feet mean low gulf (mlg) for both floodgate cuts. Material was placed on the side slopes of the Wax Lake Outlet or below the -30-foot contour) and no closer than 110 and 150 feet from the bottom of the West and East floodgate cuts, respectively.

GCT used their dredge BT-208 (Figure 3), which is a non-self-propelled barge designed similarly to HAM Holland’s (WID

Figure 1. Vicinity map, Calumet floodgates

Figure 2. Plan view of floodgates and dredge cut
The Calumet floodgate cuts are typically dredged with a bucket dredge, requiring 2 to 3 weeks of operating time as well as an increased crew size. For this project, less than 1 month of time elapsed from GCT's bid submission in early December 1993 to project completion on 30 December. Between December 28 and 30, the dredge operation time was 21.5 hours, of which 16.25 hours of actual pumping occurred, resulting in an average production rate of over 1,400 cubic yards/hour.

**Background**

WID is a relatively new technique of dredging sediment in which shoal material is fluidized, causing it to flow to deeper areas where it will not affect navigation. The WID concept is based on vessel-mounted pumps that inject large volumes of water at low pressures via a horizontal pipe to the substrate. This water causes the sediment to become fluidized, creating a gravity-driven density current that can flow down slopes.

Originally developed and patented in Holland in the mid-1980s, WID potential in the United States has recently begun being developed. In July and August 1992, Gulf Coast Trailing (the U.S. license holder for WID technology) and the U.S. Army Engineer Waterways Experiment Station conducted two WID demonstrations on the Upper Mississippi River (UMR) with the BT-208 dredge. Prior to the UMR demonstrations, GCT also performed dredging at two locations on the Lower Mississippi River at dock and wharf locations.

The UMR demonstrations were intended to verify the accuracy of contractor predictions of production rate, transport distance and direction, and suspended sediment distribution and also to test the application of the WID technology in conditions found on the UMR (moderate currents, medium-sized substrates, and two types of shoals—crossing and point bars). These demonstrations confirmed that WID is better suited for fine-grained sands and silts, but some success was realized on the UMR at point bars with nearby deeper water.

**WID at Calumet floodgates**

The Calumet floodgates were ideal locations for application of WID because of the proximity and access of the deeper Wax Lake Outlet and the small grain-sized material. Both floodgate cuts had design depths of 9.0 feet mlg compared to depths of 80 feet mlg in the adjacent Wax Lake Outlet. Sediment grain size, from four predredging sediment samples (two from each cut), found the material to be a silt ranging between 0.004 and 0.05 mm in diameter.

Predredging surveys were conducted on December 27, 1993, and dredging began at the West floodgate area on the afternoon of December 28, 1993. The dredging procedure consisted of starting from the Wax Lake Outlet and working toward each respective floodgate. Because the WID technique requires an adjacent downward slope for flow of the fluidized sediment, work progressed from the disposal area toward the floodgates. On December 29, dredging moved to the East floodgate area while the West floodgate area was surveyed. Surveying and dredging continued to switch between the
West and East floodgate areas as additional cleanup passes and volume surveys were conducted. Final dredging and surveys were completed on December 30.

GCT reported a total of 23,234 cubic yards of material (14,632 cubic yards from the West floodgate cut and 8,602 cubic yards from the East floodgate cut) with Corps-paid yardage of 21,995 cubic yards. Total cost of the project was $49,098 ($15,000 for mobilization/demobilization and $34,098 for dredging).

Summary

The advantages of WID compared with other traditional types of dredging include lower cost for mobilization/demobilization, quicker response time for project start-up, potentially lower operating cost, potentially higher production rates (with comparable horsepower), and therefore potentially quicker project completion time.

For additional information on WID experience at the Calumet project, call John Flanagan at (504) 862-1682. For general information on WID, call Jim Clausner at (601) 634-2009 or Clark McNair, Manager, Dredging Research Program, at (601) 634-2070.

Calendar of dredging-related events

June 23-24, 1994  ASTM Symposium on Dredging, Remediation, and Containment of Contaminated Sediments, Montreal, Canada, (215) 299-5400


September 7-9, 1994  Challenges and Opportunities in the Marine Environment—1994 Marine Technology Annual Conference and Exposition, Washington, DC, POC: Beth Cain, (703) 631-6200; (703) 818-9177 FAX

Sigsbee Sounding Machine rigged for reeling in, with the strain pulley brought into use (Source: *Deep Sea Sounding and Dredging* by Charles D. Sigsbee, U.S. Coast and Geodetic Survey). Submitted by Norm Scheffner, Coastal Engineering Research Center

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