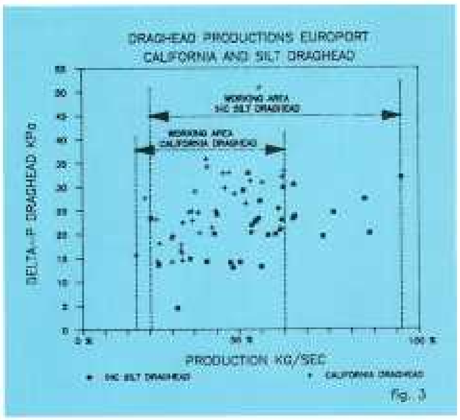


Fig. 3

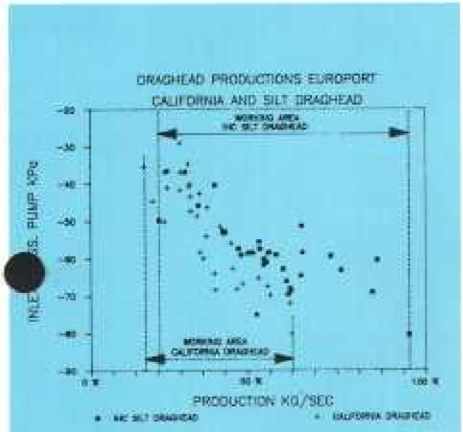


Fig. 4

Delta-p; and secondly, choking of the inlet of the silt head is virtually impossible by reason of the shape of the head. The latter phenomenon is quite common with heads of the California and standard IHC types when working in deep layers of silt, and it is often necessary to admit water through the top of the head in order to prevent water hammer.

An alternative presentation of the values obtained in the test is given in Figs. 3 and 4, in which the average measured values of Delta-p of the head and the inlet pressure of the pump are shown as a function of the production. The operating range within which the values were measured is also shown in both figures.

The higher production values for the silt head on the whole coincided with runs at higher speeds. It is not, however, necessary to exceed 2 knots in order to achieve such levels of production.

The difference in production between the California head and the IHC Silt head, measured during a large number of runs, averaged just under 50%. The values include those measured during numerous "optimization runs" in which extreme setting parameters were used for the silt head; these were necessary in order to determine the optimum settings for the head, and had an adverse effect on production.

A surprising fact which emerged after the processing of the data was that despite an increase of nearly 50% in production, the pressure over the silt head was on average 15% lower than that over the California head.

TESTING THE IHC SILT HEAD IN AMERICAN WATERS

Early in 1987, in response to a contract received from the U.S. Army Corps of Engineers, IHC participated in a series of tests, the purpose of which was to measure and analyse the performance in silt of dragheads of various types. The tests were conducted on board the trailing dredger *Essayons* in the Inner Harbour at Oakland, California.

The *Essayons*, the flagship of the USACE fleet, was commissioned in 1983. IHC supplied the complete dredging installation and an extensive automation system for the vessel, whose principal particulars are:

Length b.p.	106.68 m
Beam	20.73 m
Mean laden draught	8.23 m
Normal dredging depth	24.38 m
Dredging depth with extended pipe	28.65 m
Hopper capacity	4,588 m³
Suction pipe diameter	711 mm
Output of main engines (2)	2,687 KW
Output of motors driving underwater pumps (2)	1,082 KW
Laden speed	13.5 knots

The Inner Harbour of Oakland lies on San Francisco Bay. Rainwater from the Rocky Mountains contributes to the deposits of silt in various parts of the bay and in the harbours which are situated around it. The port of Oakland is used by naval and commercial vessels and pleasure craft.
In the trials carried out in this silt, a California-type head was mounted on the port side and used for reference, while on the starboard side an IHC Silt head was used, followed by a Portland Mud head. The measuring instruments for the port and starboard dredging installations were regularly calibrated, which meant that the results were mutually comparable. Unfortunately, local circumstances made it impossible to complete the trial; however, the results which were obtained fully confirm the conclusions drawn from the earlier tests with the prototype silt head in Dutch waters.

The shortage of measured data makes it more difficult to draw the same conclusions in respect of the Portland Mud head, and for this reason it has not been included in our considerations.

Analysis of the samples taken during the trials showed that there were no significant differences between the silt which is deposited in the Inner Harbour at Oakland and that found in the pit in the Europoort region of Rotterdam. The differences in specific mass in situ, viscosity, grain size distribution and gas content were negligible. The mean dredging depth in the four areas designated for the American trials varied between 12 and 15 metres according to location and tide. But because submerged pumps were used, the ultimate results differed significantly. The difference between the production of the California head and that of the IHC Silt head was only 28% (in favour of the latter).
The most important mean values measured during a large number of test runs were as follows:

	IHC Silt head	California head	Unit
Delta-P of draghead	39	75	kPa
Inlet pressure of pump	47	79	kPa
Mean production	0.621	0.485	t/s
Mean pump speed	268	272	rev/min.

The pump speed of about 270 rev/min. was the speed which would normally be selected in that area and under the prevailing circumstances. It can be deduced from the above figures that the California head was operating at the limits of the decisive vacuum of the pump, but that this was clearly not the case with the IHC Silt head. As the values given for the inlet pressure of the pump are mean values, which implies that higher or lower values were also measured, water hammer will certainly have occurred when the California head was used. As the vessel used for the trials was equipped with submerged pumps, and the vacuum gauge installed was of a damped type, this phenomenon will have been difficult to recognize from the console. To avoid damage in the longer term, and in the given circumstances, the pump speed should

"Essayons" Performs Agitation Dredging In Alaska

Dredging Anchorage harbor will take three weeks this year instead of the usual four months because the most powerful automated hopper dredge to work in Alaskan waters is doing the job.

The Army Corps of Engineers' Alaska District is paying $42,000 a day or $1.1 million to test the Corps' two-year-old hopper dredge, "Essayons", on Cook Inlet's glacial silt and high tides. Last year the Corps paid a private contractor $1.35 million to do the same work.

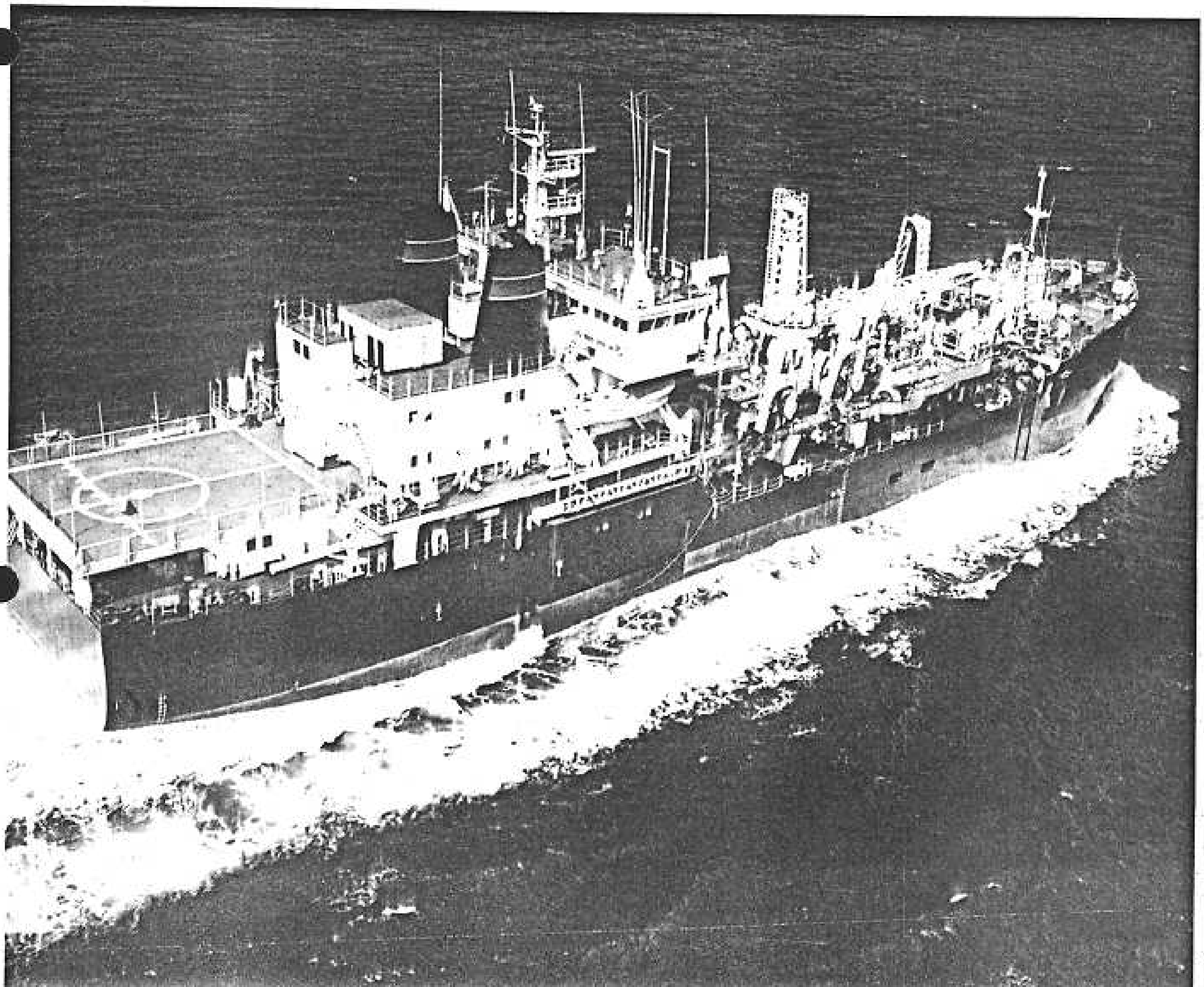
The "Essayons" arrived in Anchorage July 20 and returned to its home-base in Portland about August 8.

Each year approximately 550,000 cubic yards of glacial silt accumulates at the Anchorage dock: enough to fill 150 dump trucks every day for a year. Usually the Corps pays a contractor to remove material from a 3,000-foot lane along the front of the dock. Contractors usually use a clamshell dredge and transport spoil to the deep water dumping site by barge.

The "Essayons" carried out agitation dredging at Anchorage. The dredge lowers its dragarms which sweep along the bottom sucking up material. The silty water is spewed out of the hopper and is carried away in the harbor's 30-foot tides.

"Cook Inlet Silt is finely ground up rock," said Steve Boardman, Corps chief of Navigation and Flood Control. "It's finer than normal silt. It packs hard as a rock but when agitated, it stays suspended in the water for a long time."

The Corps discovered in 1981 that, unlike most dredged material, Cook Inlet silt did not settle into a dredge's hopper. Because of heavy shoaling that year the



The U.S. Army Corps of Engineers 6,000 cubic yard hopper dredge "Essayons". The "Essayons" performed a dredging program at Anchorage, Alaska this year to verify that agitation dredging is an effective way to remove Cook Inlet glacial silt.

"Essayons" Incorrectly Identified

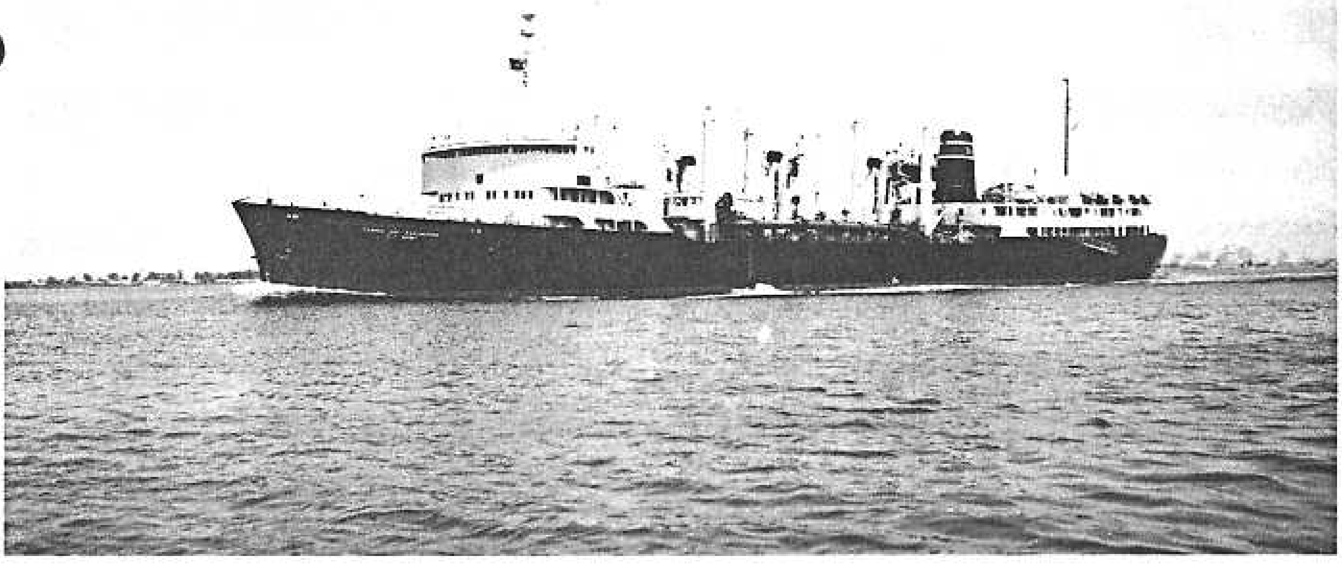
The Corps of Engineers 6,000 cubic yard hopper dredge "Essayons" commissioned September 22, 1983.

In August 1985, *World Dredging* ran an article titled "State-Of-The-Art Hopper Dredge: What Makes It Work," by Robert J. Hopman of North Pacific Division of the Portland District of the Corps of Engineers. The story dealt with the Corps' 6,000 cubic yard hopper dredge "Essayons" which is stationed on the West Coast of the United States.

Several of our readers have pointed out that the photographs we ran with the article were incorrect. The photographs which appeared with the paper were of the Corps 8,270 cubic yard hopper dredge "Essayons" which was retired in May of 1980. The original "Essayons" was commissioned January 16, 1950, saw duty off each coast of the U.S., and participated in clearing the Suez Canal of damage suffered in the 1956 war (see *World Dredging*, June 1980, page 22).

The new "Essayons", commissioned September 22, 1983, and dealt with in Mr. Hopman's article in August, is pictured above. The retired "Essayons" which incorrectly appeared in the August issue, is pictured below.

We apologize for this error and appreciate the input of our readers in pointing out our mistake. It is our intention that *World Dredging* be an accurate and reliable source of technical information and current news for the dredging industry. Reader feedback is essential in accomplishing this goal.■



The Corps' hopper dredge "Essayons" commissioned January 16, 1950, and retired in May of 1980.

"State-Of-The-Art" Hopper Dredge

What Makes It Work

By Robert J. Hopman
Chief, Navigation and Plant, North Pacific Division, Portland District, Corps of Engineers, Portland, Oregon.

This paper was originally presented at the 16th Dredging Seminar, organized by the Center for Dredging Studies at Texas A&M University and published in the proceedings of the 16th Dredging Seminar by the Sea Grant Program at Texas A&M University.

Introduction

This paper discusses what is needed to place a new, highly technical, extremely sophisticated hopper dredge such as the Corps of Engineers minimum fleet hopper dredge "Essayons" into operation.

Public Law 95-269 is the vehicle by which the minimum fleet concept was developed. The designated minimum fleet will ultimately consist of four hopper and six non-hopper dredges, including NPD's two hopper dredges, "Yaquina" and "Essayons", located on the West Coast. This paper, in part, will describe some of the principal features of the "Essayons". Following this will be a description of some of the normal difficulties associated with the startup of a spanking new state-of-the-art dredge. Then, for comparative purposes, I will briefly examine the misconception that a new dredge will cost less in terms of operating costs. Finally, I will describe several future items in store to make the "Essayons" an even more productive and efficient component of the minimum fleet.

Background

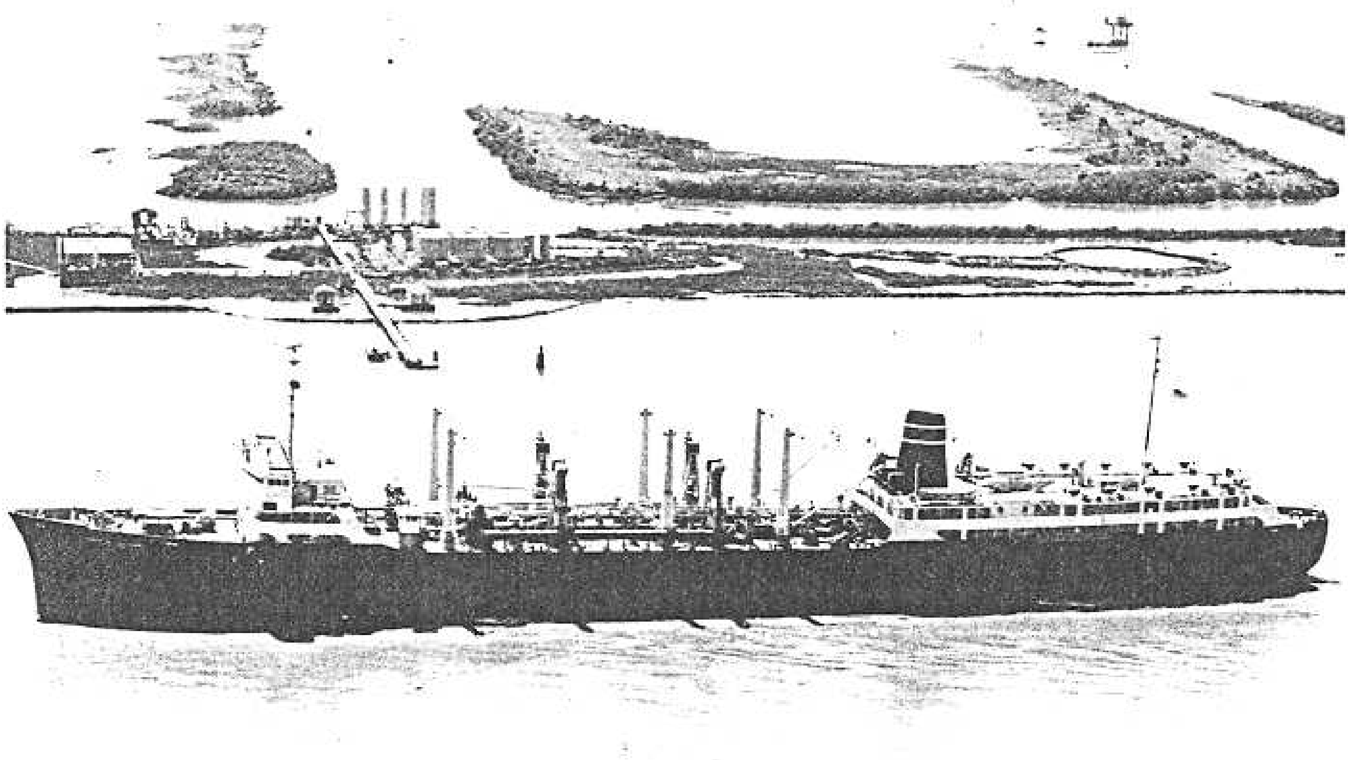
Public Law 95-269 enacted on 26 April 1978, is the legislation that directed the Corps of Engineers to undertake a study to be submitted to the United States Congress. The purpose of the study was to determine the size and makeup of the minimum federally-owned fleet of dredges capable of responding to the emergency and national defense needs of our country.

This law stated that as the industry demonstrated a capability to perform the dredging work currently performed by the existing federally owned fleet at reasonable prices and in a timely manner, the government-owned fleet of dredges would be reduced by the orderly retirement of plant until the minimum fleet level prescribed by Congress was reached. The legislation also stated that the minimum fleet of the Corps of Engineers would be maintained to technologically modern and efficient standards and be kept in a fully operational status.

Minimum Fleet

The study required by PL 95-269 to determine a minimum number of federally-owned dredging vessels was submitted to the Office of the Secretary of the Army in April 1982. The study as prepared by the Corps, recommended a minimum fleet of eight hopper and nine non-hopper dredges, was reviewed and fully considered in developing the final position by the Secretary on the size and configuration of the minimum fleet of government dredges.

Since the submission of the final report, the Corps has developed a concept



The U.S. Army Corps of Engineers 6,000 cubic yard hopper dredge "Essayons". The $75 million dredge is assigned to the West Coast of the United States and is considered by many to be the state-of-the-art in dredging equipment.

which provides a civil reserve fleet which could augment the Corps' minimum dredge fleet. This concept would provide for the guaranteed response of private sector dredges to augment the minimum federally-owned dredge fleet during response to national defense or emergency situations.

In addition, the industry has developed a fleet of more than ten hopper dredges and for the most part they have been under-utilized. Consequently, it has become apparent that fewer government dredges would suffice without accepting inordinate risks for defense-related requirements and federal emergencies.

Accordingly, it was decided that a minimum dredge fleet sufficient to provide a dredge nucleus to meet national defense and emergency requirements would be four hopper dredges and six non-hopper dredges. The configuration of the minimum fleet would consist of two dredges being assigned to the West Coast. These dredges are the "Yaquina" and "Essayons". Briefly, some of the primary factors considered in locating these two dredges on the West Coast are:

- Geographical distribution of navigational projects in the United States and the overseas deployment areas related to national defense.
- Project dimensions and operational conditions as related to the size and type of hopper dredge needed.
- The frequency of the dredging cycle and level of maintenance required at each of the projects.
- Haul distance, dredging depths, type of materials, restrictions on overflow dredging, etc., all peculiar to the West Coast.

"Essayons"

The "Essayons", a medium class hopper dredge, is the newest hopper dredge in the Corps of Engineers fleet. It was built by **Bath Iron Works** of Maine under a subcontract from **Sun Ship, Inc.**, of Pennsylvania and was delivered to the West Coast "Essayons", French for the Corps motto "LET US TRY", will cost more than $75 million after all of the construction haggling, negotiations, and associated expenses have been settled.

Double Bottom Construction
Bridge Wing Propulsion Control Stations
Crusing Range of 7,500 Nautical Miles
Dry and Refrigerated Stores Capacity for 24 Hours per Day
Dredging Operations for 30 Days
A Shipboard Helicopter Facility
Recreation/Entertainment Facilities
Forty Ton Deck Crane
Swell Compensation Capability, 12 Foot Stroke
Variable Pump Speed Capability for Direct Pumpout Operations
Single Dragarm Dredging Capability
Computerized Variable Level Hopper Overflow System
Direct Pumpout Capability
Modern Electronic Positioning Equipment and Doppler Speed Log
Nuclear Density Meters
Production Meters
Automatic Light Mixture Overboard (ALMO) System
Yardage (Load) Meter
Dredging Data Logger
Automatic Dragtending
Centralized Dredging Control System
Long Range Navigation Equipment
Collision Avoidance Radar
Constant Tension Mooring Winches
Monohull Design
Unattended Engine Room Capability Through Automation
Maximum Computerization and Instrumentation to Permit Accomplishment of any Global Mission

Table 1. Special features found onboard the "Essayons".

You may be astounded by what appears to be an enormous price tag but the vessel came equipped with the latest technology available to the dredging industry and is well worth the $75 million in terms of national defense capabilities not found in private industry dredges.

The dredge has an overall length of 350 feet and a molded breadth of 68 feet with a maximum hopper volume of 6.000 cubic yards. Carrying materials with a specific gravity of 2.0 while loading to a 27-foot draft and with a burnout of 90 percent of consumables, the ship should have the capability of loading 5,440 cubic yards.

Other main features are:

Propulsion Power

Port and starboard engines drive controllable pitch (CP) propellers through reduction gears. Each General Motors, Model EMD 20-E5 engine develops 3,600 bhp @ 900 rpm.

Dredge Pump Power

Port and starboard engines drive A.C. generators which power (through transformers) A.C. motors that drive dragarm-mounted pumps, or power (through rectifiers) inboard D.C. dredge pump motors. Each generator is rated at 2,450 KW with each engine delivering 3.600 bhp.

Dredge Pumps

There are four dredge pumps. For normal dredging, port and starboard dragarm-mounted submerged pumps are provided. This allows deep dredging to be accomplished without danger of cavitation. Each pump is driven by a squirrel-cage induction motor specially designed for submersible operations. Motor rating is 1,450 hp for each pump.

Dredging Depth

The dragarms are of such a length to permit a normal maximum dredging depth of 80 feet with the ship at light service draft and with an arm angle of 45 degrees. Dragarm extensions will allow dredging to a depth of 94 feet.

Bow Thruster

The dredge is equipped with a 600 hp A.C. motor-driven CP propeller bow thruster. Power for the motor is obtained through a common bus so that the starting such a large motor will not create electrical disturbances on lighting and other loads.

Speed

Estimated speed through hull model testing was between 13.25 and 13.5 knots for loaded drafts. Actual measured speed is 13.7 knots under ideal conditions.

Dredging Performance

Actual performance is much better than originally estimated. It was calculated that it would take 69.5 minutes to accumulate 5,000 cubic yards of sand in the hoppers. Measured performance indicates it takes under one half the estimated time to accumulate a like quality of material.

Other Features

There are other features if the "Essayons" that certainly make it called, and accurately so, the most practicable and versatile and most sophisticated state-of-the-art craft afloat. Some of these principal features are shown in Table 1.

Shakedown Of "Essayons"

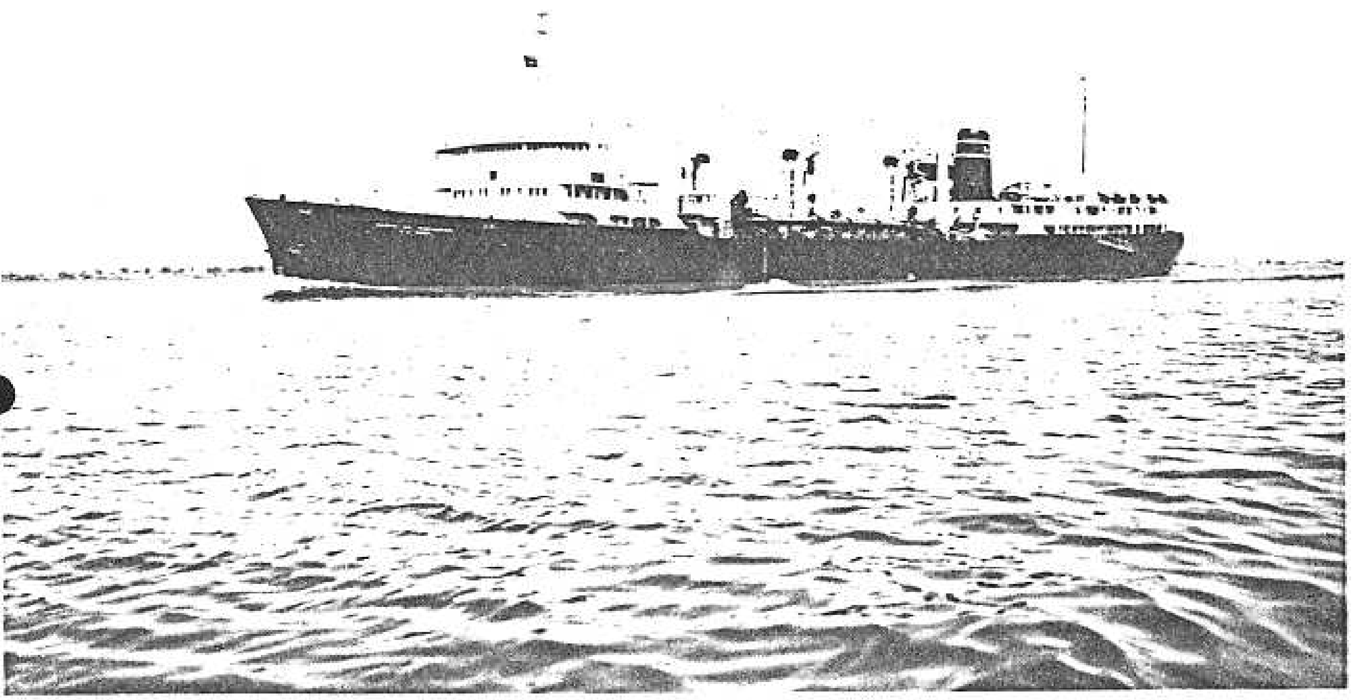
A successful transition from the "start up bugs" associated with a new state-of-the-art dredge to a fully responsive, productive, and efficient role has not occurred without some difficulty. The following description of a number of the operating and mechanical difficulties on the "Essayons" will verify this fact. However, it is not intended to cast a belittling portrayal on craftsmanship or any construction shortfalls stemming from real or imagined deficiencies on the vessel, but it is the framework for describing what it has taken to keep the dredge effectively functioning.

The "Essayons" is equipped with two sliding trunnion assemblies. Their justification is not questioned because of the many advantages over the fixed type. For example, several known advantages are that:

- They increase the efficiency of the pumps because they allow suction elbows to be lowered with reference to the water surface.
- They result in reduction of propulsion resistance thus allowing increased speed and/or fuel savings.
- They allow the dredge to be berthed without danger or damage to or from a projecting dragarm.
- They allow the crew to safely examine and repair parts of the dragarm while stowed on deck.

These are just some of the advantages which, without doubt, enforce the necessity of the sliding trunnion working properly in order maximize dredge production and efficiency.

Soon after starting its mission on the West Coast, the "Essayons" developed sliding trunnion problems. Galling as much as 1.4 inch deep developed on



Another view of the hopper dredge "Essayons". Soon after starting its mission on the West Coast, the dredge developed a number of mechanical problems, underscoring the need for an experienced shore repair team and appropriately outfitted boatyard during the initial working stages of such an automated dredge.

the trunnion carriage guide tracks. This was a serious condition because the tracks are an integral part of the ship's hull. It was first thought that the trunnion greasing systems had failed. It was subsequently discovered that the metering orifices were too small. They were enlarged and in addition, a heavier extreme pressure grease was used. These changes had little or no effect on the problem.

The solution to this major problem of galling was more than a simple engineering undertaking. Plans and specifications and technical manuals were not available, so a systematic technical solution could not be derived as one would want.

Because of not really knowing exactly what was causing the problem, we were unable to develop a repair concept that a shipyard facility could translate into a "FIX". Therefore it was left to our own forces. First task was to grind the tracks so that the scored metal was smoothed out. Next was to try to understand what was causing the problem, essentially through trial and error methods. The heavy weight of the carriage assembly exerted a horizontal force of some 40 tons against the hull castings.

This tremendous weight turned out to be the cause of the galling and had to be lessened to prevent further troubles. It was thought by some engineers that a textbook solution would be to lessen the pressure by changing the pickpoint from the sliding piece to a position more outboard and in line with the dragarm.

However, this challenge would require a great deal of time for design considerations and the services of a shipyard which were not available at the time because of an ongoing strike in the region. Therefore, we decided to modify the sliding carriage piece to accommodate larger bearing pads and experiment with different pad materials.

Essentially applying a basic understanding of frictional forces involving similar materials, we doubled the pad area and surfaced the new pads with a phenolic material which is an impregnated fabric with a bonding epoxy. This stopped the galling and burnished the guide tracks, but the pads wore out quickly. We then switched to replaceable bronze pads which have worked very well. Pads last on the order of six weeks. It was also determined that the guide rails are not parallel and therefore the ultimate solution to the trunnion problems cannot be finalized until the dredge is drydocked.

Other Problems

I do not intend to give a detailed account of each problem on the "Essayons", but will only briefly summarize a number of the major problems that we have been confronted with since receipt of the dredge. The purpose in describing them is the critical issue of this paper – to point out to both the knowledgeable and the unsuspecting, that it takes a lot of tender loving care to keep a new dredge on line, and fortunately the Portland District of the Corps of Engineers has that capability by having, in my opinion, the best highly dedicated repair group in the country.

The group of some 30 engineers, technicians, welders, laborers and the like in conjunction with ship personnel, have been able to keep the ship operating the majority of the shakedown time.

Dragarm Winch Motors

We experienced significant problems

with the dragarm winch motors. Each of the six motors, three for each dragarm assembly, had to be fully waterproofed. They developed leaks during the vessel's trip to the West Coast. In addition, reduction gears and motor couplings failed and had to be either repaired or replaced because we discovered alignment was off in some cases more than 3/4 inch. This took nearly one week to correct.

Hopper Door Rods

Next work order consisted of increasing clearances between hopper door rods and their respective guide bearings. The hopper door rod is the shaft connecting the operating gear activation cylinder above the hopper to the dump door in the bottom of each hopper. A guide bearing located in the recesses of the hopper is used to minimize horizontal movement of the rod. Sand and gravel were binding the rods which necessitated the crew to literally increase the bearing sleeve diameter by approximately one inch to ease the vertical sliding motion with no appreciable sacrifice to resistance to eccentric forces.

Jetting Pipes

The crew spent several days installing additional bracing onto the jetting pipes that are used to facilitate the dumping process. Pipes extending both horizontally and vertically in the hoppers yielded or sagged as much 24 inches due to the loading action of heavy West Coast sands.

Sliding Valves

The sliding valves that automatically regulate flow direction during ALMO operation continuously plugged with dredged material. This is due to the fact that because of space restriction, the valves have been installed horizontally rather than vertically as designed. Internal open/close sensors within the slide valves were tilted approximately 45 degrees in an upward direction to help reduce sand plugging. Also, flushing piping was added and rerouted to further reduce the sand plugging. This operation resulted in five days of down time for the dredge.

Hydraulic Lines

Leaks continuously developed in the many miles of hydraulic lines throughout the ship. We found it necessary to be always on the alert for such leaks because they not only hindered normal operations but the unrestrained hydraulic fluids can become a safety hazard. Correction consisted of eliminating the strain on the tubings by realignment wherever possible. Bracings were installed in other cases. Tightening of couplings and adding new "O" rings at number of leak locations occurred as often as four times per connection. Other times, the stainless steel tubing was replaced by high pressure rubber hose. Several weeks delay in dredge operations resulted from this continuous and widespread situation.

There were many other corrections made by our repair group such as repairing the constant tension winches which required about one week. Describing them would further amplify my point but, again, as already mentioned, the intention is to make the reader aware that it does take an extremely conscientious and experienced shore repair team and an appropriately outfitted boatyard to keep an automatic dredge effectively functioning during its initial working stages. That's what makes it work. All in all, our repair group has spent nearly 10,000 hours of actual work on the "Essayons" to keep it operative since its delivery to the West Coast.

A Misconception

As I mentioned before, the Corps of Engineers minimum fleet dredge, the "Essayons", is a state-of-the-art dredge especially with respect to the automated dredging system. This has not only significantly reduced the number of people working aboard the dredge but has changed the mix of licensed versus non-licensed personnel, altering the way we maintain the dredge.

The important thing for the dredging manager to realize is that his operating cost (including payroll, vessel maintenance, etc.) may not go down in proportion to reduced number of people on board and in fact may increase slightly, although this, on the surface may seem alarming. When one compares the productivity of a new state-of-the-art dredge to an older dredge, however, the increased productivity more than makes up for increased operating costs. The most significant factor to the dredging manager, cost per unit volume of material dredged, goes down.

We need only to compare the "Biddle" to the "Essayons" to see clearly what is meant. Before she was retired the "Biddle" was manned by a crew of 82. The "Essayons" is presently crewed with only 56 personnel and we expect that number to go down slightly. Therefore, we have reduced the total crew by more than 30 percent. It is very clear that in reducing the crew we have eliminated for the most part the lower paid positions such as the number of deck hands and non-licensed engine room personnel.

While total cost for number of people on the payroll has gone down, the average cost per person has gone up. However, where we have found our most significant change has been in the area of vessel maintenance. On the "Biddle" the day to day routine maintenance and minor repairs were the responsibility of the crew. The crew was able to care for such important items as pump changes, welding, painting, general housekeeping, etc.

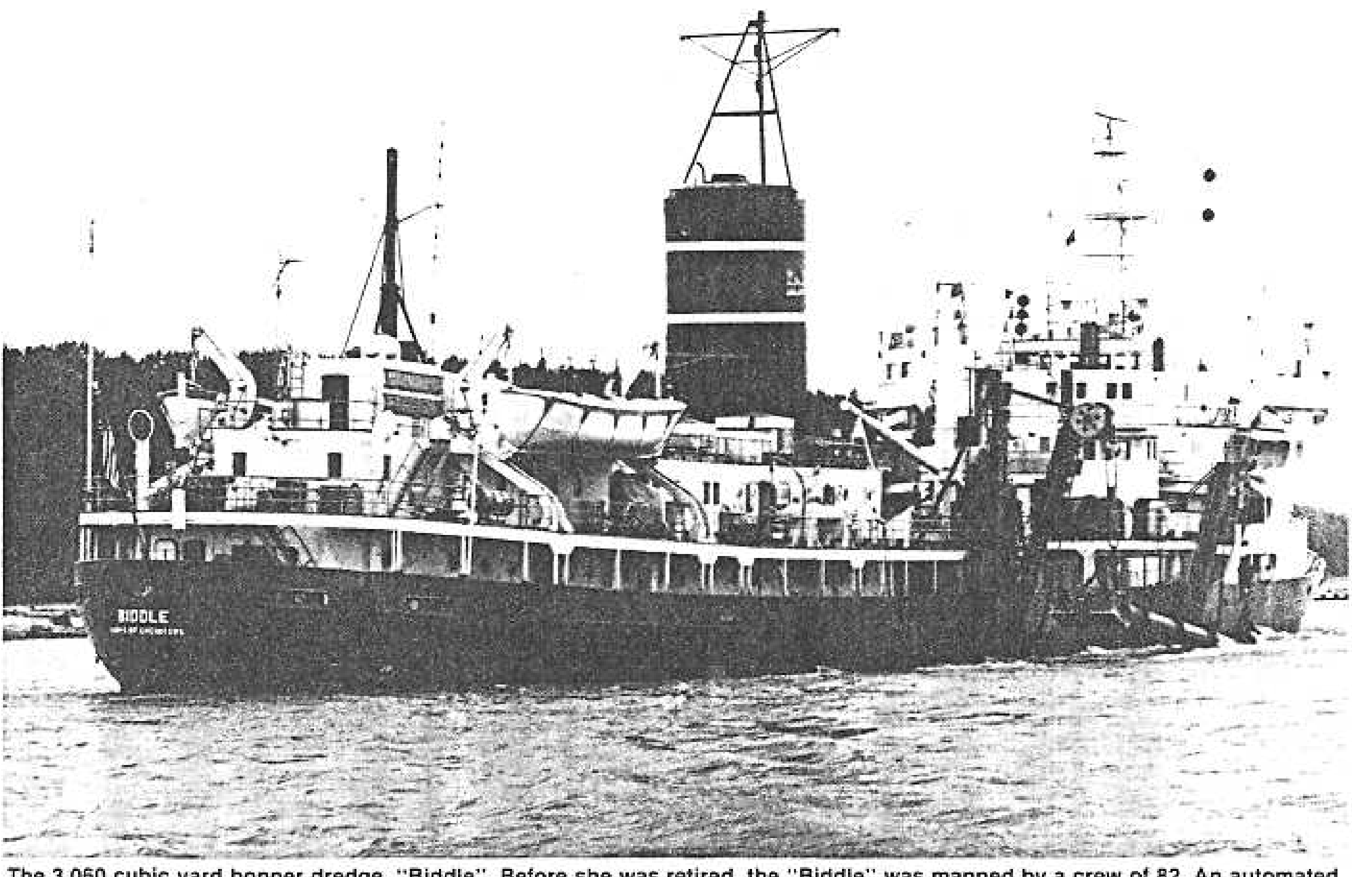
This type of work was cared for primarily by those same people that have been eliminated on the "Essayons". For this reason, when these minor repairs or routine maintenance items require attention, either the vessel must come to the dock or we must send a shore-based repair crew to the vessel. This, of course, has significantly increased their cost.

Another aspect of the "Essayons" which we find is changing our maintenance attitude, is the sophistication of the automated feature of the dredge. Maintenance, upkeep, and repair of this equipment, requires much more formal training than did maintenance of former dredges. Electronic engineers, technicians and computer experts are replacing mechanics and electricians and naturally at a greater cost in salaries.

Because of the sophistication of the equipment on board, we have found it necessary to define maintenance items appropriate for the crew and maintenance items which should only be handled by the shore-based personnel, and assigned the work accordingly. By so doing, we have accomplished two very important goals. We have defined the level of training required by the crew and ship personnel and have set definite areas of responsibilities for each group.

The Future

Recently I was on a Delta Airlines flight to Atlanta from Jacksonville, Florida. After touchdown in Atlanta, the pilot informed passengers that the landing of



The 3,060 cubic yard hopper dredge, "Biddle". Before she was retired, the "Biddle" was manned by a crew of 82. An automated dredge such as the "Essayons" can be manned by a crew of 56: a reduction of more than 30 percent in crew.

the L-1011 Tristar Aircraft had been completely handled by an onboard Advanced Automatic Navigation System because of foggy conditions in the local area. The pilot went on to inform us that in this instance his chief duty was to sit back and make sure the guidance system functioned properly.

Shouldn't this be a goal to reach on the "Essayons"? I definitely think so. We are not there yet but certainly are approaching it. We currently have a fully automated dredging system that only requires pushing three buttons during a dredging cycle. We have electronic positioning equipment that allows the vessel to pinpoint designated areas needing dredging. Automation has also provided unattended engine room capability. What else is there?

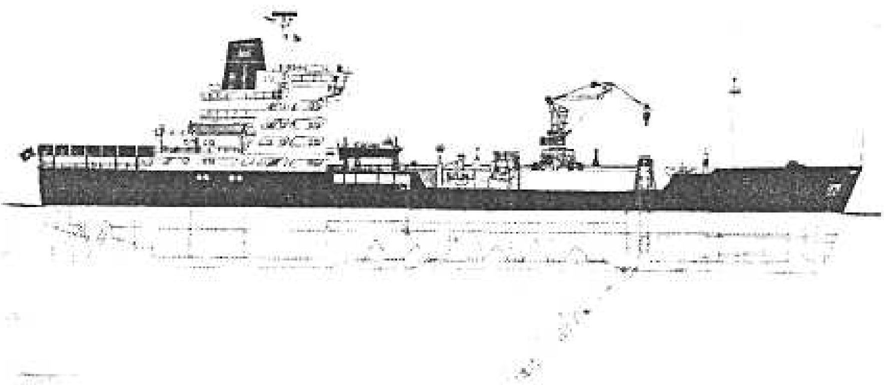
In my opinion, automation, in light of what I have just described above, has advanced to such a degree that further automation most probably will proceed only grudgingly in shorter leaps. This is not to say that more sophisticated automation will not occur, because it will, if for no other reason than because of the inherent nature and life span of current technology. Still, there are a number of ways to improve overall operations of the "Essayons".

For example, components of rapid wear – and there are many on a dredge due to abrasion, vibration, and climatic conditions – could be constructed of inexpensive, non-repairable material. Throwaway elements would be modularized and standardized for rapid replacement. Ultimately less downtime on the dredge for scheduled and non-scheduled repairs would result, equaling money savings.

Another item would be a computerized production indicator to insure maximum production of the dredge at all times. This would entail such instantaneous additional inputs as exact density of bottom materials, water temperature and its conductivity value, knowledge of pump wear and efficiency and its relationship to motor efficiency, and knowledge of anticipative machinery output most likely from statistical measures. The list of inputs could go on and on.

These, at best, may offer only slight improvements in dredge production but when we consider that the dredge costs over $40,000 a day to operate, any impending improvement most likely is worth the effort of study.

Finally, testing and evaluating various dredge components must continue in order to assess relative performance. In one example, this is exactly what Portland District is doing in its evaluation of several dragheads for the purpose of improving production while working in



Artist's rendering of the 825 cubic meter trailing suction hopper dredge "Yaquina" which, along with the "Essayons", is assigned on the West Coast.

light, silty bottom materials. Performance evaluation of at least three draghead configurations developed by the district personnel and the purchase of a new draghead developed by a Dutch company for dealing with silt, is currently being conducted. We expect to improve performance in fine materials by more than 20 percent.

As can be clearly seen from these several examples, the dedicated engineer with only the slightest amount of imagination can devise means to improve dredge production and efficiency at a relatively minor expense.

Summary

This paper began by pinpointing out that P.L. 95-296 was the critical piece of legislation that enabled the Corps of Engineers to determine what it needed as a minimum fleet capable of responding to emergency and national defense needs of our country. Four hopper dredges and six non-hopper dredges is the configuration. Two of the four hopper dredges, "Yaquina" and "Essayons" are stationed on the West Coast.

Further on, I discussed the fact that making the "Essayons" an effective and productive tool required a top notch, experience repair group and a suitable repair facility. This often leads many to believe the new dredge is one of the finest testaments to modern day technology. New dredges may often cost comparatively more to operate than the older hopper dredges because payroll and some maintenance costs may be higher. The extra costs are however, offset by increased productivity.

Finally, I described several particulars, that, in my opinion, are in store for the future that will make today's sophisticated hopper dredge even more productive.■

References

Murden, William R., Overview of the Dredging Program of the Corps of Engineer, September 1982, Fort Belvoir, Virginia.

Wooley, C.W. and Johnson, L.W., Personnel from Portland District, Corps of Engineer, Personal Interviews Concerning the Hopper Dredge "Essayons", Portland, Oregon, October 1983.

Eddystone To Represent Kleber

Dennis Blanc, export manager of **Kleber Industrie,** and Ron George, general partner of **Eddystone Engineering** and Marine announced jointly that the two companies have entered into an agreement whereby Eddystone Engineering will represent Kleber in the North American dredging market.

Kleber Industrie is a leading worldwide supplier of industrial hoses to the construction, mining, and dredging industries.

Kleber operates five plants employing 4,600 people and is held at 90 percent by the Michelin group. Michelin supplies its state-of-the-art steel cable and rubber matrix to Kleber for use in their Metaldrag suction, discharge, and floating dredging hose.

Eddystone provides both design of hopper dredging equipment and supply of steel fabrications in addition to Kleber hose.■

Irrigation order in Guyana

Ballast-Nedam has received an order for carrying out irrigation projects in Guyana. The value of the contract is Dfl. 95 million. The order has been contracted in cooperation with Lareco B.V. from Arnhem, which participates in the contract with 20 per cent. The contract has been received from the Mahaica-Mahaicony-Abary Agricultural Development Authority in Georgetown and comprises digging canals with infrastructures.

Consultants are Sir William Halcrow & Partners in England.

Demountable cutter suction dredger HAM 250

The diesel-electric cutter suction HAM 250 was handed over to her owners, HAM Holland, in the spring of 1980. The vessel is of the demountable type and is equipped with a single dredgepump and a spud carriage installation, and of IHC Holland design and construction.

It would be more accurate to describe the HAM 250 as a "superdemountable" dredger, for the hull consists of no less than eight separate pontoons, added to which the cutter ladder can be broken down into sections.

The vessel can be dimantled and reassembled on land or afloat.

The largest section, which determines the method of transport, is the forward central pontoon, which measures 15 x 3.50 x 2.80 m.

The principal particulars of the "HAM 250" are:

Type	demountable cutter suction dredger
Year of construction	1980
Owners	HAM Holland
Length overall	60.00 m
Length of pontoon hull	36.50 m
Breadth	9.00 m
Depth	2.75 m
Dredging depth	14.00 m
Cutter drive power	250 kW (335 hp)
Pump drive power	840 kW (1140) hp)
Total machinery output	1320 kW (1800) hp
Suction pipe diameter	550 mm
Delivery pipe diameter	500 mm

The vessel was built under the supervision of Bureau Veritas for Coastal Service and carries the certificate of the Netherlands Shipping Inspectorate for operation up to 15 miles from the work harbour.

The cutter and winches are electrically driven, while the spuds are hydraulically operated.

The sub-division of the hull into a number of small pontoons necessitated distributing the machinery over three enginerooms.

The foremost central pontoon houses a wear-resistant, single-walled dredgepump of the type RE 130 x 50 powered by an 840 kW (1,140 hp) Caterpillar diesel engine. The pump and engine rooms are separated by a watertight bulkhead. The greater part of the auxiliary machinery is situated in this engineroom.

The after central pontoon contains a generator driven by a 400 kW (530 hp) Caterpillar engine. This generator supplies current for the cutter motor, winch motors and general circuits.

The third engine, which is of DAF manufacture and develops 100 kW (140 hp) is installed in the after starboard pontoon. It powers the harbour generator, a welding generator and an emergency pump for the hydraulic system.

The remaining pontoons incorporate storage spaces and tanks for fuel, fresh water and ballast water. There are also three compartments housing box coolers for the diesel engines.

Royal Volker Stevin in 1979

In 1979 Royal Volker Stevin achieved an annual turnover of Dfl. 2.6 milliard "a slight reduction" when compared with Dfl. 2.8 milliard in 1978. The net profit amounted to Dfl. 80.5 million, which is also slightly lower than the Dfl. 85 million of 1978.

However the value of the orderbook rose from 2.6 milliard at the end of 1978 to Df. 3.3 milliard at the end of 1979.

Ultimo 1979, the company employed 20,884 persons (ultimo 1978: 24,086 persons). In the course of 1979 the fleet of Netherlands Offshore Company in which Volker Stevin had a 40 per cent interest, was sold.

The year sal also the launching of the dredging platform "Simon Stevin" however with considerable delay.

The organisation of the head office became fully operational in 1979.

The prospects for the company wil be influenced by heavy competition experienced on the international market and the lack of available cash in various many countries. Apart from traditional customers, the group is also active in the field of project financing and development aid. Principal countries of interest remain Saudi Arabia and the Emeritas. Growing interest has the company in Nigeria where an expansion scheme is in progress in Port of Onne, while activities are also directed at North and South America.

Five dredger contract of Dredge Technology Corporation

In 1977 an angreement was signed between IHC Holland and John J. McMullen (JJMA) of New York concerning the establishment of Dredge Technology Corporation. The latter company is active in the field of the design of dredging installations for the American market.

During the first two and a half years this company has won a number of contracts clearly demonstrating its capability in constructing large dredgers.

The projects involved:

Shallow-draught trailing-suction hopper dredger

A 690 m³ (900 cu yd) trailing dredger being constructed for the US Army Corps of Engineer by the Norfolk Shipbuilding & Dry Dock Corp.

Under a contract from the Corps of Engineers, DTC designed and supplied the dredging installation, complete with suction pipes, gantries and associated automatic control equipment. The dredging instruments and the main control panels were supplied direct to the shipyard.

Large trailing-suction dredger

A 6,000 m³ (8,800 cu yd) trailing dredger being built for the US Army Corps of Engineers by Avondale Shipyard Inc.

DTC is carrying out the engineering for this vessel and preparing the complete design and working drawings on behalf of the builders. DTC is also responsible for designing the dredging installation. Virtually all the components are being supplied by IHC Holland via DTC.

Earlier, JJMA designed the machinery installation for this vessel.

Medium-sized trailing dredger

A 4,600 m³ (6,000 cu yd) trailing-suction hopper dredger under construction by the Sun Shipbuilding & Dry Dock Co. for the US Army Corps of Engineers.

DTC is carrying out the engineering, draughting and purchasing for this vessel on behalf of the builders.

JJMA had earlier undertaken part of this work under a contract from the Corps of Engineers.

Split-hopper trailing-suction dredger

A 3,700 m³ (4,800 cu yd) traling dredger of the split-hopper type now being built by Avondale Shipyards Inc. for the Eagle Dredging Corporation.

DTC carried out both preliminary and final designs for this vessel and will also design and supply the principal components of the dredging installation, the hull hinges and the associated control equipment. The contract for these services was placed by the owners.

Split-hopper trailing-suction dredger

A 2,500 m³ (3,250 cu yd) split-hopper trailing dredger which is to be constructed for the Gulf Coast Trailing Company.

DTC is responsible for the preliminary and final designs. Tenders for its construction and the award of a contract to an American yard are expected before the end of the year.

Volker Stevin merges project activities

The Netherlands activities of Volker Stevin's Project Development Division are being merged in a new venture Volker Stevin Development Company B.V.

Merged into the new company are: Stevin Development Company B.V. and the Netherlands activities of Geoproject B.V.

Manager of the new company is Mr. T. Goudswaard and the activities of the Company will be directed from Zoetermeer.

Management appointments at Volker Stevin

Mr. J. W. Dorresteijn has been appointed to deputy-manager of Stevin Bouw B.V. On the same date Mr. B. C. Troost be-