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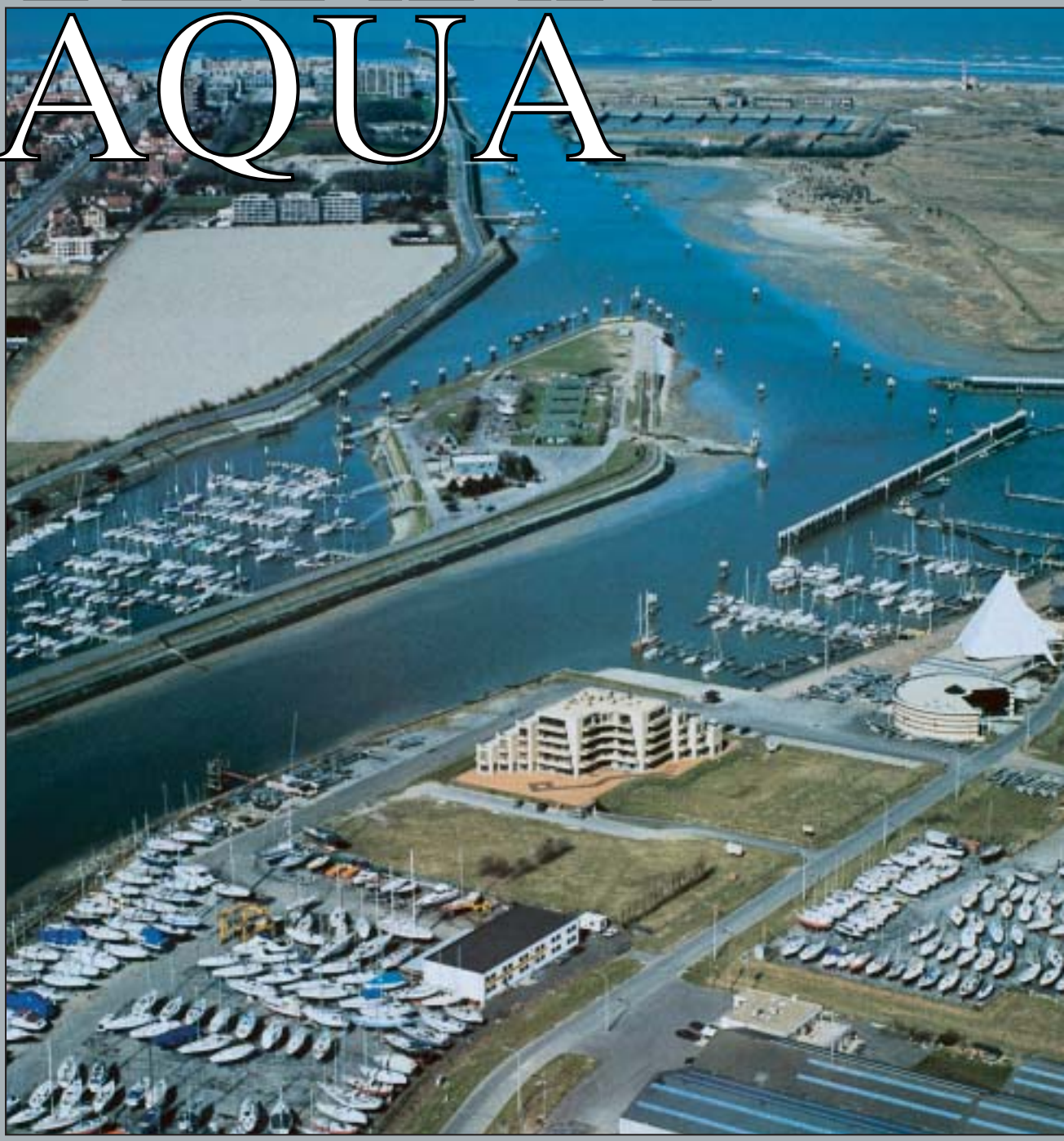
TERRA ET AQUA



INTERNATIONAL ASSOCIATION OF DREDGING COMPANIES

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Front cover:
As part of an extensive research project, Nieuwpoort Harbour, pictured here, was chosen by the Belgian Government as a test site for environmental evaluation and monitoring of dredging and relocation operations (see page 19).

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International Association of Dredging Companies

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TERRA ET AQUA

EDITORIAL

As you can see, there is something new under the sun. In an effort to become even more accessible to our worldwide audience than previously, the International Association of Dredging Companies has joined the WorldWideWeb with its own homepage (http://www.gasandoil.com/iadc). *Terra et Aqua* can be found there, as can descriptions of IADC's many fine publications. Updates on seminars and other activities are also available. Now you can also correspond with us directly at iadc@compuserve.com if you need to order back issues of *Terra*, have any comments on articles, or even have an article you might like us to consider.

Speaking of articles, this issue starts with the keynote address given at the CEDA Dredging Days, an overview of the past and a projection of the future areas of dredging. This was just one of many interesting papers presented at the conference. Space limits what we can print here, but some of the other outstanding papers are described in short in the Book Review on page 27. In addition, the fourth book in the IADC/CEDA Environmental Aspects of Dredging series, *Guide 4, Machines, Methods and Mitigation*, is also reviewed.

Going from one conference to another, it is never too early to mention the WODCON. It is time to sign up for the Fifteenth World Dredging Congress and Exhibition being held from June 28-July 2 1998 in Las Vegas, Nevada, USA. Everyone will be there, including the IADC, which will be presenting its Annual Award to a young author. The IADC booth will also be opened to all, so do stop by. In the meantime, visit our homepage, or drop us an email.

Marsha Cohen
Editor

R. Nick Bray

A Review of the Past and a Look to the Future

Abstract

The paper reviews the changes that have taken place in dredgers, dredging fleets and dredging technology over the past two decades in the light of the changing market for dredging works.The influence of global development in trade and constraints imposed by environmental legislation are also considered.
An attempt is made to determine whether the market leads development or whether development leads the market.
The potential future market for dredging work is also reviewed and the possible developments which might be seen in technology. It is concluded that dredger evolution is generally Darwinian, but that some innovative technological advances may create new markets.The way forward is for the major players to take the environmental aspects of development proactively and integrateengineering and environmental solutions.

This paper was the keynote address at the CEDA Dredging Days, held during Europort in November 1997 in Amsterdam, The Netherlands, and was first printed in the Proceedings of the conference.
This revised version is reprinted with permission.

Nick Bray graduated from Cambridge University, UK in 1983. After working for Posford Pavry & Partners as a graduate engineer, he joined Demarok International in 1968. Returning to consultancy in 1973, he practised with Livesey & Henderson, which later merged with Binnie & Partners. In 1989 he formed Dredging Research Ltd and acts as an independent consultant. He is the principal author of *Dredging, A Handbook for Engineers*, and sits on the Environmental Steering Committee of CEDA.
He was the keynote speaker at the CEDA Dredging Days, November 1997.

R. Nick Bray

Introduction

The international dredging industry operates in a continually evolving global market-place. This is a market where the stalls change in size and type from year to year, and from decade to decade, where at one moment you may find a flurry of activity in one corner and a short time later the activity has shifted somewhere else. Meanwhile, the day-to-day trading steadily continues.

For a dredging company to be successful, it must keep a keen eye on the market-place. It must adapt its dredging fleet and technology to keep pace with the trends in the market, or even to precede them, and it must avoid the pitfalls of fleet over-capacity, over-specialisation and over-generalisation. To achieve this fine balancing act is no easy task when you are dealing with such a large and diverse market. It takes good management and a fair degree of luck. Detecting trends and reacting to them is somewhat akin to designing for the effects of global warming. All things are predictable in a deterministic way if we understand the rules that govern the changes. Unfortunately, there are usually too many rules and we only understand a few of them!

However, it may be possible to gain some insight into the future by reviewing the past; perhaps to discover some pointers to the art of survival; a few broad principles which could be used in decision-making. Maybe to answer some basic questions, such as "Does the market lead the technology or does technology lead the market?", and "Can Darwinian theory be used in the study of dredger development?"

In this paper, the changes which have occurred in dredging technology over the last 20 years or so are

reviewed. The background against which these changes have occurred is investigated and some thoughts about the future are postulated.

One area which has not been covered is the North American market. Here, owing to certain legislative measures and a monopolistic regime, for much of the period under study, competition and development were stifled. However, in an effort to break free from the environmental stranglehold, the US dredging industry has shown some signs of freeing itself up for development.

General Changes Over the Past 20 Years

That fundamental changes have taken place in dredger size and type over the last two decades there is little doubt. For example, Figure 1 shows the size distribution of trailing suction hopper dredgers in 1977 compared to that in 1997. Although the sources from which the numbers in this figure are derived are generally inaccurate and incomplete, it is clear that there has been a massive increase in hopper capacity of individual vessels. However, the true effect of this on the marketplace is not easy to see until one examines the fleet capacity. Incidentally, the number of smaller trailers has probably not fallen. The 1977 figures contain some dredgers which worked exclusively in one port and have not been included in the 1997 figures.

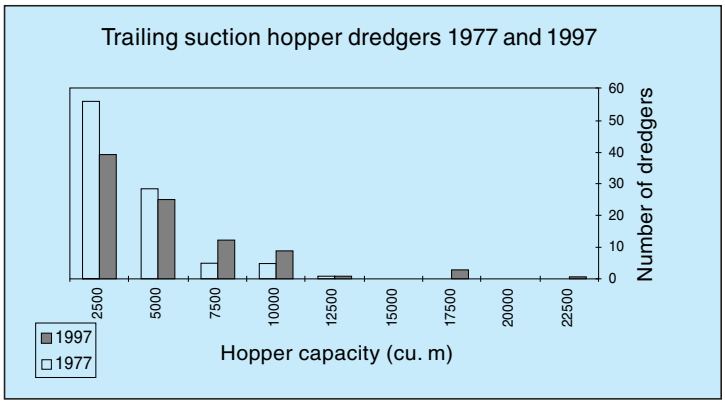


Figure 1. Numbers of trailing suction hopper dredgers in 1977 and 1997.

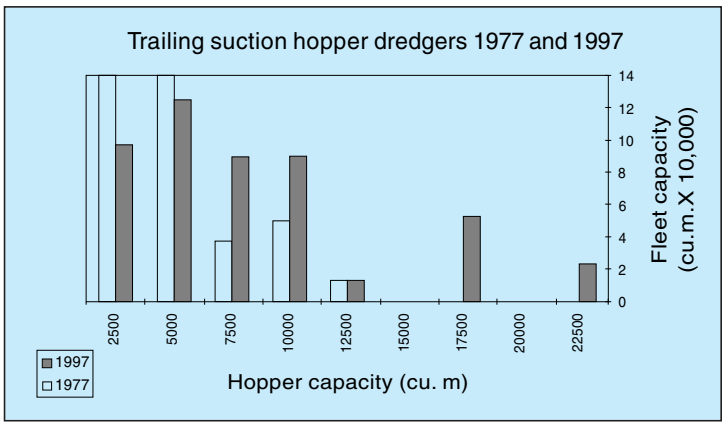


Figure 2. Capacity of the trailing suction hopper dredger fleet in 1977 and 1997.

Fleet capacity is defined here as "number of dredgers x hopper capacity" for any particular size category of dredger. The results of this are shown in Figure 2. As can be seen from this figure, the two largest categories (around 17,500 m^3 and 22,500 m^3) represent nearly 20% of the total available fleet capacity. The large vessels under construction and still to be launched will increase this percentage even further (Figures 3, 4, 5, 6).

It can also be seen from Figure 2 that the total fleet capacity has increased overall since 1977. This increase is not quite as large as appears from the graph, because in 1977 most hoppers were designed for a load density of around 1.8 Mg/m^3, whereas now many of the hoppers are designed on a load density of 1.4 to 1.6 Mg/m^3. For any additional capacity to be usefully employed, either the total amount of work has to increase or the trailers have to obtain a larger share of the market at the expense of other types of dredger.

One way in which the trailers can increase the total amount of work is for them to be capable of carrying out dredging in conditions hitherto not possible for this type of vessel. This aspect is examined later.

Other dredger types also exhibit a marked change in their distributions over the same period. Figure 7 shows the comparison of the numbers of backhoe dredgers available in 1977 and 1997. Here, there has been a marked increase in numbers overall, particularly in the smaller sizes. In terms of the total fleet, the backhoe dredger has probably trebled its capacity.

The bucket chain dredger numbers are shown in Figure 8. The smaller sizes of dredger have fallen in numbers to about a third of their original fleet. However, as the dredgers become larger so the numbers have been maintained, until one reaches the 800 to 900 litre bucket size where the capacity has changed little over the intervening years. This is probably owing to the fact that the larger bucket dredgers are used for dredging appreciable volumes of strong soils, which they are capable of doing at economic rates compared with backhoes.

Grab or clamshell dredgers have suffered the same fate as the bucket dredger (see Figure 9). Here the numbers of the smaller sizes have reduced considerably, whilst the larger grabs have increased in numbers. There is even a 200 m^3 capacity grab dredger in Japan, which has not been shown. Clearly, use has been found for the larger sizes of grabs whilst the smaller

Figure 3. The Pearl River (17,000 m³), built in 1994, is one of the largest TSHDs in the world.

grabs have been largely superseded by another type of dredging method.

It is difficult to draw firm conclusions from the numbers shown above, because of the numerous factors involved and the unreliability of the reporting of numbers. However, it is probable that, in some respects, they may be explained by the following:

a) Dredging of weak soils
   The trailer dredger has become much more efficient at dredging weak soils and has extended its capability into soils of greater strength. When working in harbours in a maintenance capacity, and particularly when used in conjunction with a bed leveller, it has replaced the grab dredger and the bucket dredger.
b) Dredging of strong soils
   The bucket dredger still dredges strong soils, when volumes are large. When volumes are small the backhoe is more likely to be economic. Very large grabs may also be used for firm soils, particularly when sea conditions prevent bucket dredgers and backhoes from working.

It will be noticed that cutter suction dredgers have not been mentioned in the above analysis. This is because the number of cutter suction dredgers has not changed significantly over the last 20 years. However, their characteristics have changed and are described below.

Trailing Suction Hopper Dredgers

The main changes in trailer dredgers over the last two decades, apart from the considerable increase in hopper capacity, are as follows:

a) On the suction side, degassing systems have become more reliable and have enabled higher density mixtures to be dredged during maintenance dredging. Pumps in the dragarm have also contribu-

Figure 4. The 18,000 m³ TSHD Amsterdam, launched in May 1996, is shown here at work in Hamburg Harbour, Germany.

Figure 5. The jumbo trailer Gerardus Meractor (also 18,000 m³) was launched in September 1996.

Figure 6. In June 1997 the WD Fairway became the world's largest trailer with a hopper capacity of 23,425 m³.

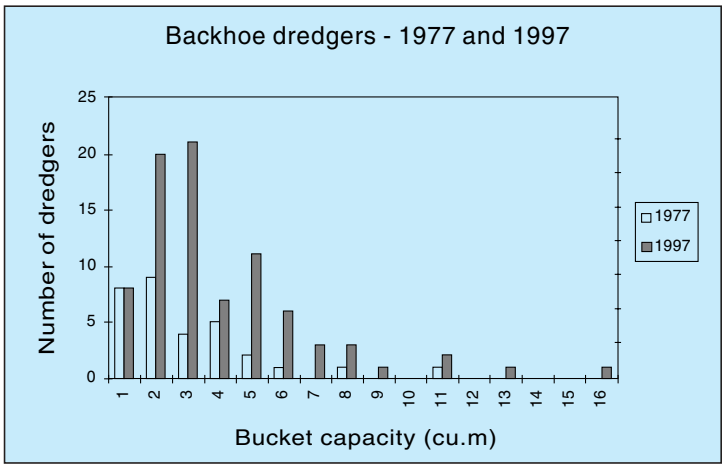
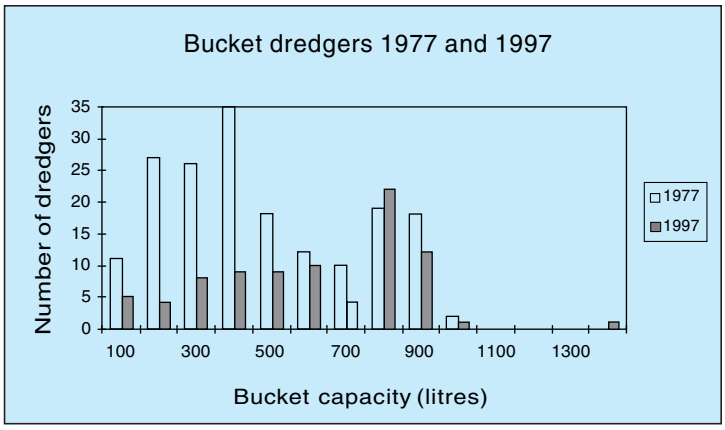


Figure 7. Numbers of backhoe dredgers in 1977 and 1997.

Figure 8. Numbers of bucket dredgers in 1977 and 1997.



ted to higher density mixtures and dredging at much greater depth.

b) In the hopper, overflow weirs have become adjustable, allowing vessels to change their characteristics to suit either sand or silt/mud dredging, and to adopt more sophisticated loading techniques. There has been a marked decrease in the ratio of hopper carrying capacity to hopper volume.
c) Discharge systems have become more adaptable. Many trailers now have a pump ashore or rainbowing capability as well as the conventional bottom discharge. Some are able to discharge through the suction pipe for such operations as covering pipelines. More environmentally acceptable methods of overflowing have been developed.
d) On the bridge, considerable improvements in monitoring and control have been introduced. Positioning, tracking and draghead control are now sophisticated operations. Dynamic positioning systems have improved efficiency in temporary positioning situations.
e) Overall, costs have been reduced by reducing manning levels and making machinery more efficient.

Figure 10 shows the current normal characteristics of trailer dredgers. It is interesting to note that, in spite of the large increases in hopper capacity, the laden draughts of the larger vessels are not appreciably greater than the smaller trailers. This is partly explained by the lower load carrying capacity of the hopper.

Cutter Suction Dredgers

Cutter suction dredgers went through some evolutionary changes in the later 1970's and early 1980's, mainly as a result of the boom in the Middle East, where many projects involved the dredging of sands, silts and rocks, to be used in reclamation. The effect of this market is illustrated in Figure 11. In this graph, the massive increase which occurred in cutterhead drive and pump power may be seen. These powers are necessary for the dredging and pumping of rock.
Also noticeable in the graph is the increase in dredging depth achieved by the use of ladder pumps in the larger dredgers. Unfortunately, as the Middle East activities slowed down, very little cutter suction work emerged elsewhere. This resulted in an overcapacity of the heavy duty rock cutters.

The main changes in cutter suction dredgers over the last 20 years may be summarised as follows:

a) the introduction of self-propelled cutter suction dredgers for the larger sizes, which considerably reduced mobilisation costs;
b) the introduction of ladder pumps to improve concentration in the deeper dredging depths;
c) the introduction of anti-abrasion materials in pump and pipeline systems to reduce wear and tear;
d) the development of faster cutter tooth changing, cutterhead changing and spud movement owing to improved systems;
e) automation of the dredging controls to improve accuracy and productivity (some dredging systems can now anticipate the soil conditions by remembering the conditions on the previous cutting swing); and
f) reducing costs by reducing crew numbers and making the mechanical and electrical systems both fuel- and maintenance-efficient.

Backhoe Dredgers

Twenty years ago the custom-built backhoe was relatively rare. It is now treated as one of the main classes of dredger and has emerged as a suitable workhorse for strong soils, such as glacial tills, and for dredging fragmented or friable rocks.
There has not been much development in the basic excavator and its support platform. Power has increased and controls have become centralised. Positioning and control of the bucket have improved

because of electronic positioning and bucket location systems. Land-based backhoes, used for dredging inland waterways, have been developed to improve reach and a number of low-ground pressure and amphibious versions are now available.

Other Developments

The above sections have described the changes which have taken place in the numbers and designs of the traditional items of dredging equipment. However, as one would expect in an innovative and competitive industry, there have been a number of new developments and designs which have been introduced in the last two decades. It would be impossible to describe all of these. A few of particular note are illustrated here.

Water injection dredging

The water injection dredger, a proprietary design, is fundamentally different from other items of dredging plant. This dredger, illustrated in Figure 12, fluidises material on the sea or river bed, thereby encouraging the material to form low level density currents which move into deeper water. The system has found many applications and is one of the few really novel designs to have proved of wide practical use for the dredging of "clean" materials.

There may well be environmental problems to be overcome in the use of the water injection system for the maintenance dredging of large volumes of material. However, it is possible that its low cost may encourage the development of more frequent and environmentally

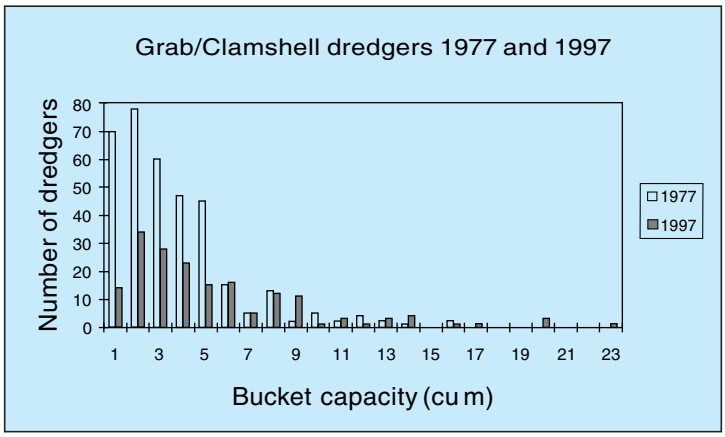


Figure 9. Numbers of grab/clamshell dredgers in 1977 and 1997.

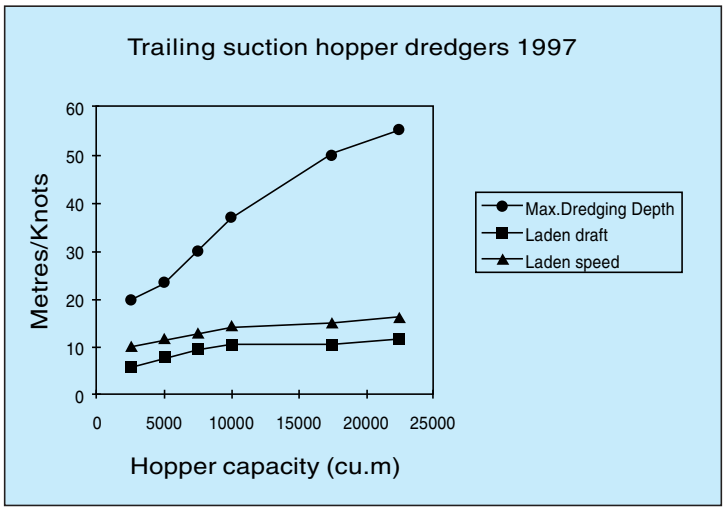


Figure 10. Characteristics of trailing suction hopper dredgers in 1997.

Figure 11. Characteristics of cutter suction dredgers in 1977 and 1985.

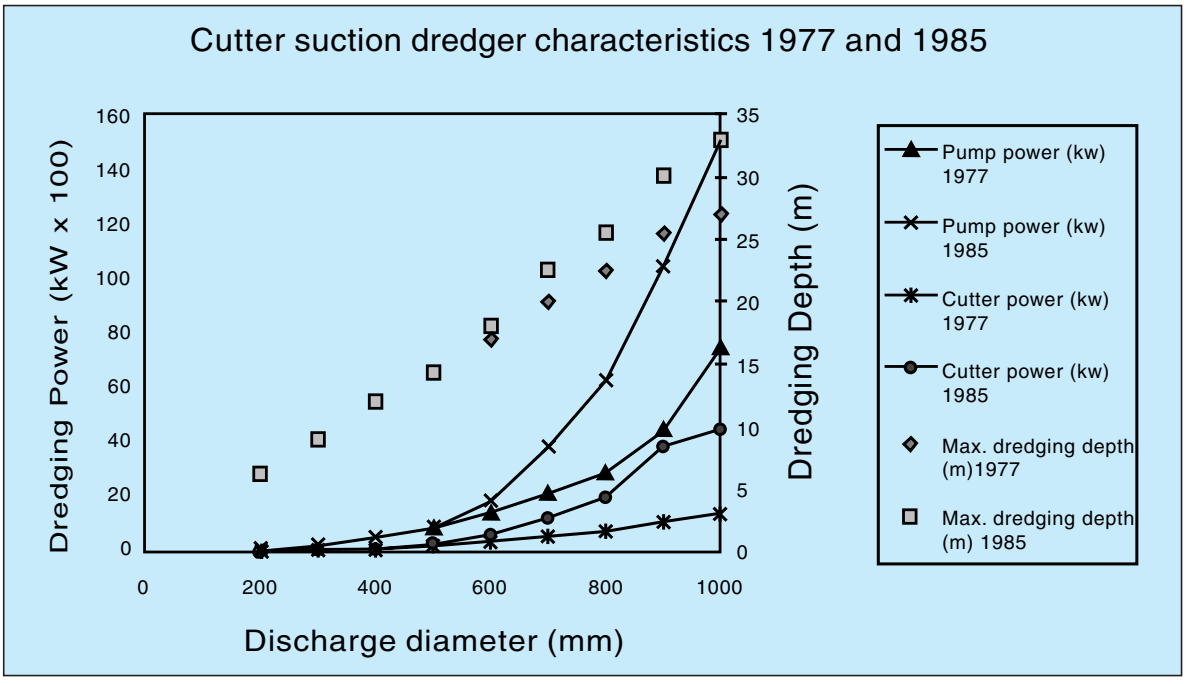


Figure 12. Through this artist's rendering underwater, the unique design of the water injection dredger Jetsed can be seen.

friendly maintenance dredging campaigns which involve the fluidisation of small and more acceptable volumes of sediment for dispersal into the local environment.

Much of the success of this system will depend on the ability of engineers to establish the baseline environmental characteristics of their dredging sites in a comprehensive manner and to predict and monitor the effects of the water injection works.

Environmental/restoration dredgers

The other area which has seen a proliferation of innovative ideas, driven by necessity, is in the field of environmental/restoration (or remedial) dredging. In this field it was soon recognised that benefits accrued to the company which could produce a dredger that was accurate (thereby reducing overdredging) and minimised the suspension of bed materials. A great variety of developments has emerged, many as attachments to standard items of plant. A number of these are mentioned below:

a) Backhoe dredgers: Closed buckets such as the Visor Grab, which closes the bucket, thereby preventing loss and compression of the material. Also the screening bucket which coarse screens the dredged material as it empties.
b) Grab dredgers: The Cable-Arm closure clamshell bucket, which minimises overdredging and prevents overflowing of the bucket.
c) Bucket chain dredgers: Sound-proofing, enclosing the ladder, valved buckets to prevent air escaping at bed level, bucket cleaning.
d) Suction dredgers: Environment-friendly cutterheads, the Matchbox suction head, the Scoop- and Sweep-heads (Figures 13 and 14), the disc cutterhead (Figure 15), the closed auger (Figure 16), all designed to minimise turbidity generation.
e) Positive displacement pumps: All designed to pump dredged material at its in situ density, thereby reducing volumes for transport and disposal.
f) Trailing suction hopper dredgers: The re-circulation of overflow water by feeding to jets at the draghead, thereby reducing the quantity of overflow being discharged to the site. This is a proprietary system developed by Royal BosKalis Westminster.

The Dredging Market

The world dredging market is huge and diverse and it is not possible to analyse it in detail in a paper such as this. However, a few broad points can be made.

Over the last five years the dredging market has been

Figure 13. The scoophead reduces turbidity during dredging.

Figure 14. The cutter dredger Vlaanderen XV has been rebuilt with a sweephead, an environmentally friendly dredging system.

dominated by activities in South East Asia, particularly in Hong Kong, where reclamation works associated with the Port and Airport Development Strategy and Metroplan have involved the movement of around one billion cubic metres of dredged material. Developments such as these show no sign of tailing off in Hong Kong or in the region as a whole. Already, there are plans for further massive land reclamation works in Singapore, Malaysia and Taiwan, with one such project requiring around 200 million m^3 of fill. With figures like this in mind it is not difficult to see why dredging contractors are confidently building large trailers.

To demonstrate the reason for this confidence, it is merely necessary to examine the costs of dredging sand, transporting to a site and dumping. Figure 17 shows the results obtained for a mythical project for various sizes of trailer. It also shows the costs associated with dredging by stationary dredger and transporting by barges. There are two key points shown by this figure; the larger trailers are cheaper than barge transport and the larger trailers are making the supply of sand cheaper in absolute terms. Hence, to compete with conventional equipment (dustpan/grabs and barges) it is essential to have trailers of over 14,000 m^3 capacity.
It is also possible that the reduction in absolute sandfill cost will increase the market volume, as the marine dredged sand becomes more acceptable than that from an equivalent land-based source. The graph in Figure 17 might be very different under different circumstances, where for instance total sand volume, water depths, environmental constraints and other factors varied, but it serves to illustrate the points.

In the Middle East, where activity has been relatively steady over recent years, there still seems to be a modest base load of dredging and reclamation works, generally associated with industrial ports and waterside leisure developments. This work has traditionally been executed by heavy-duty cutter suction dredgers and there is no reason to doubt that these machines will continue to carry out the bulk of the future work of this type.

In western Europe the market is likely to be dominated by coastal engineering works and port developments. So-called "soft engineering" solutions to coastal problems, involving the re-charge of beaches with sand or

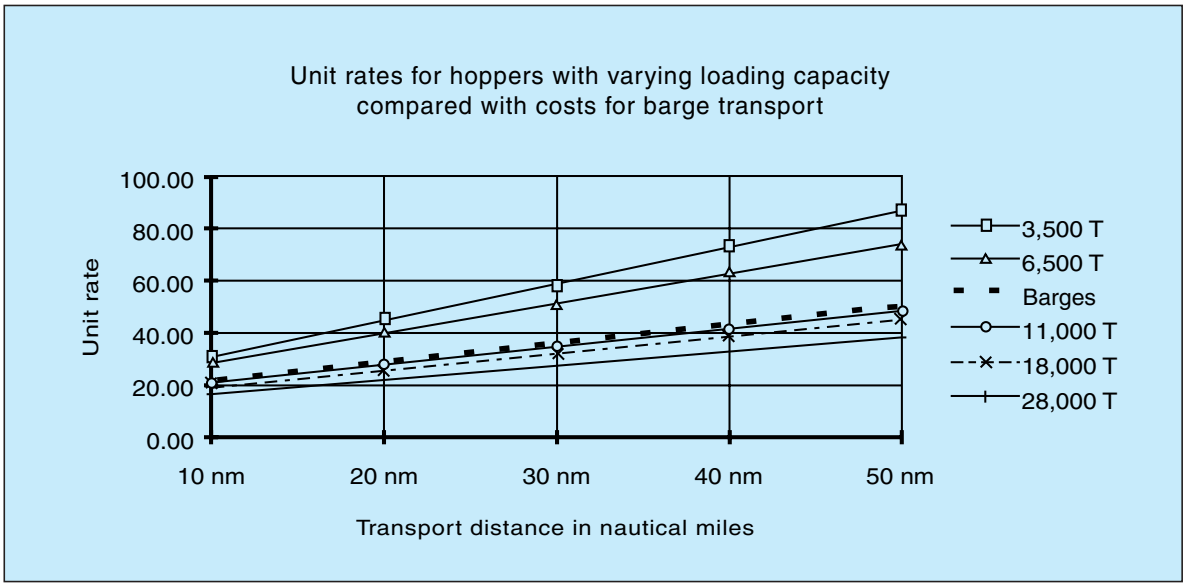
Figure 15. Close up of the environmental disc cutter installed on the Vecht.

Figure 16. The closed auger, Willem Bever, has been used to dredge in highly contaminated waters.

gravels, have been the fashion for a few years now and are likely to continue for the foreseeable future. Although not massive, the volumes of dredging involved add an appreciable workload for trailer dredgers. European ports are beginning to deepen their access channels and berths again to maintain competitiveness, particularly in the container trade. Adding another 2 metres to an existing navigable depth frequently represents a sizeable dredging project; work which may be carried out by trailer, backhoe and bucket dredger. The deepened ports may also require additional maintenance. More work for trailers! If European container terminals are getting deeper, it is probable that container ports in the rest of the world will be developing in a similar fashion and that more capital dredging will occur.

Some of the South American economies have seen formidable growth rates in the past five years. Although the west coast of South America is not likely to generate massive dredging works, there being few substantial rivers on that side of the continent and deep water relatively close inshore, the situation on the east coast is very different. Large rivers and estuaries exist and a

Figure 17. Cost of dredging, transporting and dumping : trailer dredgers 1997



considerable amount of trade depends on river transport, estuarine ports and dredged channels. It is likely that trailer dredgers could be gainfully employed in these areas for some time to come.

In summary, therefore, it would appear that, in the short to medium term there is sufficient work for trailing suction hopper dredgers and backhoe dredgers. Cutter suction dredgers will not be in huge demand, but a base load of work will probably continue. Innovative dredgers for special projects and remedial dredging will continue to be in demand.

Future Trends

The evidence from the above discussion of dredger types and changes over a 20 year period is that, in general, dredger development has followed the market. The one development which might be seen to have not been market-led is the introduction of water injection dredging. This dredger may, to some extent, be making its own market.

The dredging market itself is affected by two major, but often opposed, factors; trade and the environment. Almost all dredging projects relate to one or both of these factors. Trade encourages people to move goods around the world and leads to the need for new ports, deeper ports, industrial ports, infrastructure, new land and leisure facilities. Environmental legislation affects the way projects are carried out. It controls use and disposal of dredged material. It affects the methods of dredging. It affects the way engineering is carried out and this, in turn, may determine whether dredging is required or not, and how it may be executed.

For example, the whole question of development in estuaries. How is it best to modify an estuary?
By dredging large volumes over short time periods and taking the dredged material to sea, or dredging small volumes over very long periods and trickle feeding the material back into the estuary?
In coastal engineering, should we build "hard" or "soft" defences? Should we build ports out to sea or dredge basins inland?

If we want to predict the future volume of dredging we need to look at world trade. If we want to predict the form of dredging projects, we need to look at trends in the way that the engineering world is adapting to the requirements set by our environmental legislators. These will give us pointers towards the types of dredgers we need in the future.

Historically, there have always been two main driving forces behind innovation in dredging; reducing dredged volume and reducing unit costs. These two forces remain. Speculating about what might happen to dredgers in the next few years might lead to the following suggestions:

For trailers:
- the development of on-board mixture handling processes designed to increase the density of the dredged material in the hopper
- the introduction of more devices to reduce overflow plumes
- greater control over draghead position.

For cutter suction:
- systems for reducing the amount of low density water passing down the pipeline.

Generally:
- further increases in pump and engine efficiencies
- more automation
- possible return to simpler "agitation" type dredging methods, if baseline measurement of site and environs is improved.

Conclusion

In general, it may be said that the evolutionary process of dredger development is Darwinian, i.e. companies which adapt their fleets to have the most suitable plant and the right mix of plant will survive. However, it is possible to create a new market and the water injection dredger may be just beginning to show us this.

Further innovative dredger designs may yet appear to enable other new markets to be developed. But the question which arises is "how do you identify the potential markets?" This may be answered by studying the two driving forces; trade and environment. In particular, the environmental solutions to developments necessitated by trade may give some useful pointers to where we should be looking in the future.

If one accepts this, then it might not be too strange in the future to find environmental scientists in the research and development departments of major dredging companies. This would then enable teams to put forward comprehensive solutions to development needs, by introducing new techniques which have been evolved against an environmentally sound background. It has already happened in the field of dredging for inland waters.

Environmental Aspects of Dredging
Guide 4: Machines, Methods and Mitigation

"Dredging is an important activity for creating and safeguarding our ports and industrial areas. It is not a goal in itself but should be considered a tool to improve and adapt our surroundings to meet the requirements of modern industrial and living standards. It...can be either negative or positive or in some cases, both".

So writes by Mr Jos Smits of International Marine & Dredging Consultants of Antwerp, Belgium, author of Guide 4 of the "environmental aspects of dredging" series. The series is a joint effort of the International Association of Dredging Companies (IADC) and the Central Dredging Association (CEDA), and an Editorial Board comprising members from both associations have been actively involved in the development of the concept.

Using this basic premise, that dredging is a tool, Guide 4 proceeds to define what this "tool" is, in terms of dredging plant, methods which mitigate the impact of dredging, and methods for monitoring environmental impacts.

To begin with, as explained in Chapter 1, three types of dredging projects are recognised: capital, maintenance and remedial dredging. Each has its own characteristics, which are defined, and each has its own positive and negative effects.
To evaluate these impacts, criteria to judge the environmental effects of a dredging activity and of the dredging equipment are established. In Chapter 2 the phases of the dredging process are explained: disintegration of the in-situ material; raising of the dredged material to the surface; horizontal transport; and placement or further treatment.

The methods to accomplish these phases are explained in Chapters 3 and 4. First, standard dredging equipment is described, and then new types of dredges especially developed for low impact projects are discussed. Both types of equipment are evaluated based on the criteria as stipulated in Chapter 1.
Chapter 5 spends attention to the possible methods for transport and placement of dredged sediments, with emphasis on the techniques and equipment that mitigate environmental impacts.

The discussion of mitigating measures, to be implemented on board the dredges, at the dredging sites as well as at the relocation site, continues in Chapter 6. And finally, in Chapter 7, the monitoring and control of the dredging process is considered in terms of compliance, verification of the assessments, and the acquisition of know-how in order to better assess future projects.

Other Books in the Series

Though Guide 4 is written as a stand-alone document, it is best used in conjunction with the other Guides in the series. Other books in the series already available are:

Guide 1: Players, Processes and Perspectives, written by Jan Bouwman and Hans Noppen of AVECO bv, is an analysis of the players involved in reaching a decision to dredge and creates a system for assisting these decision-makers.

Guide 2: Conventions, Codes and Conditions; Marine Disposal and Land Disposal, written by Neville Burt, Carolyn Fletcher and Elena Paipai of HR Wallingford, presents the international conventions governing disposal of dredged materials and examines how various national legislation complies with this.

Guide 3, Investigation, Interpretation, and Impact, written by Richard K. Peddicord and Thomas M. Dillon, independent consultants, describes pre-dredging investigations for material chracterisation. This includes field surveys, sampling and laboratory testing for physical, chemical and biological characteristics of dredged materials.

Guide 5, which will give a review of placement of dredged materials and beneficial use options, is scheduled to be published in autumn 1998.

All books in the series may be ordered from the IADC Secretariat in The Hague. ***Guide 4: Machines, Methods, and Mitigation*** *(72 pp. Illus. NLG 30.00) will be available this spring.*

J. De Groote, G. Dumon, M. Vangheluwe and C. Jansen

Environmental Monitoring of Dredging Operations in the Belgian Nearshore Zone

Abstract

The Waterways and Marine Affairs Administration of Flanders, Belgium initiated a research project, which aims at the environmental evaluation and monitoring of the dredging and relocation operations in the Belgian Coastal Harbours. The operations were required to meet the BATNEEC principle, that is, "Best Available Technique Not Entailing Excessive Costs".
In order to test the monitoring methods, a small dredging site at Nieuwpoort Harbour was selected. Three types of studies were conducted: physical, chemical and ecotoxicological.

The authors acknowledge the Flemish Department of Infrastructure and the Environment and the Waterway and Marine Affairs Administration for their support and for the opportunities offered by the ambitious project Mobag 2000.

Introduction

Since 1995, the Waterways and Marine Affairs Administration of Flanders, Belgium has initiated the Mobag 2000-research project, which aims at the environmental evaluation and monitoring of the dredging and relocation operations in the Belgian Coastal Harbours. Since the relocation operations are subject to the directives of the London, Oslo and Paris Conventions on the pollution of the seas, these operations should meet the BATNEEC principle, meaning that for the execution of the works, the "Best Available Techniques Not Entailing Excessive Costs" should be selected.

The research project consists of two phases. During the first phase, a system for the continuous monitoring of the environmental impact of the dredging and relocation operations would be developed. The second phase includes the implementation of new technologies to reduce adverse environmental impacts identified during phase 1.

To be able to test methods for the monitoring, a rather small dredging site was selected: Nieuwpoort Harbour, where annually about 250 000 m3 of material is removed by means of a cutter dredger. To be able to compare the effect of different dredging techniques on the behaviour of the material after relocation, during the test period some parts of the sediments were removed by means of the sweephead dredging technique.
The sediment relocation was observed from three points of view: physical (turbidity), chemical, and ecotoxicological.

The Dredging Site

Nieuwpoort is a small harbour at the Belgian coast, situated between the Port of Dunkerque and the Port of Zeebrugge. The main port activities include yachting and fishing (Figure 1).
Dredging operations are annually carried out in the entrance channel (the river Ijzer) and the marinas.

Table I summarises the main physical characteristics of the dredged material: muddy sand to sandy mud, depending on the location. Table II displays the main concentrations of chemical parameters present in the dredged sediment. Only relatively small amounts of contaminants – heavy metals, mineral oil, PCBs and

Table I. Overview of the physical characteristics of the dredged sediments. (Percentages by weight).

The Dredged Sediment Physical Characteristics				
Sample	> 63 µm	2 - 63 µm	< 2 µm	Dry solids
1	57	2	41	26
2	77	10	13	55
3	70	10	20	52
4	26	30	44	30

Johan de Groote

Johan De Groote graduated in 1982 as an engineer specialised in hydrographic and land survey work. Since then, he has been responsible for several survey projects in Belgium and abroad. Currently, he heads the off-line survey department of the J.V. Northsea and Coast, where he is responsible for the processing and interpretation of hydrographic and environmental data collected by the survey teams.

Guido Dumon

Guido Dumon holds degrees in chemical engineering and in environmental sanitation engineering. He is a senior engineer at the Coastal Waterways Division of the Ministry of the Flemish Community, where he heads the department of hydrometry and the environment.

Marnix Vangheluwe

Marnix Vangheluwe is an engineer and research associate at the Laboratory for Biological Research in Aquatic Pollution, University of Ghent. He is the team leader of the Sediment Toxicology Group whose research aims are fundamental understanding of factors affecting contaminant bioavailability and effects in sediments; and the development and validation of risk assessment approaches for freshwater and marine sediments.

Colin Janssen

Dr. Janssen is a research co-ordinator and senior scientist at the Laboratory for Biological Research in Aquatic Pollution, University of Ghent (Belgium). For the past 15 years, he has been an active researcher in various fundamental and applied aspects of sediment and effluent toxicology; biochemical aspects of pollution-related environmental effects; terrestrial toxicology; and environmental risk assessment.

PAHs – could be detected; the concentration of pesticides was below the detection limit.

For the comparative tests of dredging and relocation techniques, a location with comparable physical and chemical sediment composition was selected. The works were executed with the cutter suction dredger *Vlaanderen XV*, equipped with a traditional cutter crown (Figure 2). This was later replaced by the sweephead (Figure 3). The dredged material is discharged in the intertidal zone on the beach, where the sediment plume clearly can be observed (see Figures 1 and 4).

Physical Monitoring

The physical monitoring of the relocation operations was done by monitoring-frames placed on the beach, which measured current, turbidity, temperature and salinity. Because of the marine environment, temperature and salinity did not change too much during the measurements (April 1996); turbidity increased close to the outlet, but rapidly diluted up to background levels (see below).

Additional measurements were executed from the survey vessel *Oostende XI*, equipped with the continuous measurement system Navitracker, on which an OBS turbidity probe was mounted (Figure 5).
This configuration enabled the continuous profiling of the water column by undulating the probes during a "turbidity" survey, which resulted in the production of "suspended solids concentration maps", as shown in Figures 6 and 7.

The surveys resulting in these maps were done at high tide. The suspended solids concentrations were mapped every metre, starting 1 m above the bottom. The size of the maps does not allow displaying them all in these columns, but the maps shown here are representative for all levels.

These maps indicate that close to the discharge outlet the supended solids concentrations are very high (>12.500 mg/litre), but the concentration returns quite rapidly to background values (400 mg/l, at 400 m from the outlet). These maps also display a fundamental difference between the applied dredging technology:

– A cutter crown requires the addition of water to the sediment for the hydraulic transport of the removed material. This results in a rapid "dilution" – horizontally as well as vertically – of the relocated material. About 3 m above the outlet, hardly any increase of suspended solids could be observed. It was concluded that the use of a traditional cutter crown to remove the sediments results in a rapid return of the suspended solids concentrations to background values.

Figure 1. Aerial view of Nieuwpoort Harbour. At the left of the picture, a cloud of "black water"– generated by the relocation of harbour sediments on the beach – can be observed.

– The sweephead on the other hand, does not add any water to the sediment, which results in a larger "high density spot" of relocated dredged material close to the seabed. This "spot" is believed to move for a while along the bottom with the tidal currents, but there is no evidence of this yet.

Figure 2. View of a traditional cutter crown.

Chemical Monitoring

The chemical monitoring of the relocation operations aimed at the comparison of the quality of the seawater during the dredging and relocation operations and in periods without any dredging activities.

Table II. Summary of the chemical analysis of the dredged material.

The Dredged Sediment: Chemical Characteristics					
Parameter	Unit	Sample 1	Sample 2	Sample 3	Sample 4
As	mg/kg	16	7.3	7.4	16
Cd	mg/kg	0.48	0.2	0.21	0.48
Cr	mg/kg	70	25	25	63
Cu	mg/kg	21	7.2	7.7	22
Hg	mg/kg	0.33	0.1	0.1	0.33
Pb	mg/kg	62	25	25	58
Ni	mg/kg	56	22	22	52
Zn	mg/kg	180	50	62	130
Mineral oil	mg/kg	570	340	240	580
SUM PCB	mg/kg	0.36	0.27	0.32	0.51
Sum PAH's Borneff	mg/kg	6	1.5	1.4	2

Table III. Comparison of the seawater quality near the relocation area in periods without any dredging activities and during the works with cutter crown and sweephead.

Chemical Monitoring: Results Seawater Near Discharge					
		Background	Cutter	Sweephead	
As	µg/litre	100	100	110	100
Cd	µg/litre	< 1	< 1	< 1	< 1
Cr (total)	µg/litre	< 5	< 5	< 5	< 5
Cu	µg/litre	20	10	10	10
Hg	µg/litre	< 0.5	< 0.5	< 0.5	< 0.5
Pb	µg/litre	< 10	< 10	< 10	< 10
Ni	µg/litre	< 10	< 10	< 10	< 10
Zn	µg/litre	< 50	< 50	< 50	< 50
TOC	mg/litre	2.5	3.4	5.2	4.1
Mineral oil	mg/litre	0.3	< 0.2	< 0.2	< 0.2
EOX	µg/litre	< 10	< 10	< 10	< 10
Organo chlorine pesticides	mg/litre/component	< 0.2	< 0.2	< 0.2	< 0.2
SUM PCB	µg/litre	< 0.2	< 0.2	< 0.2	< 0.2

Figure 3. The dredger Vlaanderen XV equipped with the sweephead.

Figure 4. The discharge of the dredged material in the intertidal zone on the beach. The generated plume can clearly be observed.

Therefore, several seawater samples were taken in the discharge area and analysed on relevant parameters. The average values of the collected samples are displayed in Table III. This table shows that there is no change in the quality of the seawater owing to the relocation of dredged sediments in the nearshore zone near Nieuwpoort Harbour.

Toxicity Tests

To evaluate the ecotoxicological consequences of the dredging works, the following types of toxicity tests were executed by the University of Ghent, laboratory for the biological research of aquatic pollution.

- Porewater and elutriate tests:
  - 72 hr growth inhibition test with micro-algae
  - 24 hr lethality test with copepod

Figure 5. OBS turbidity monitors mounted on the towfish of the Navitracker system for the continuous monitoring of the suspended solids throughout the sediment column.

Figure 6. Map indicating the suspended solids in the relocation area 1 metre above the bottom, measured during the works executed with a traditional cutter crown.

Legend for Figures 6 and 7:

blue	*= < 400 mg/litre*	*orange*	*= 1,000 - 5,000 mg/litre*
green	*= 400 - 700 mg/litre*	*red*	*= 5,000 - 12,500 mg/litre*
yellow	*= 700 - 1,000 mg/litre*	*dark red*	*= < 12,500 mg/litre*

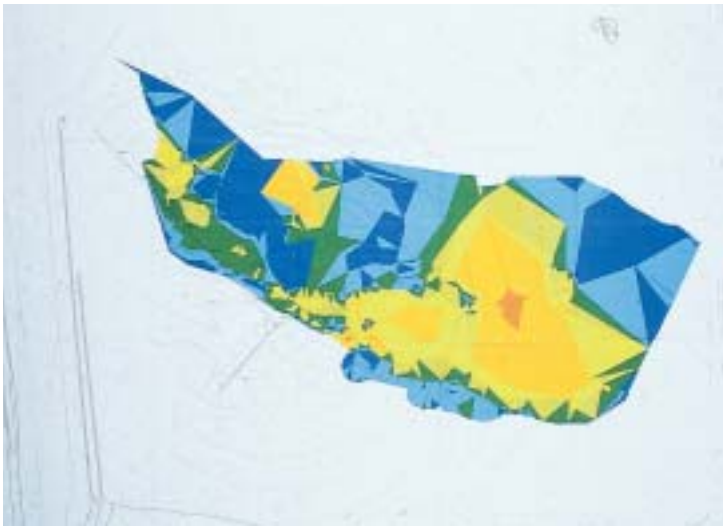


Figure 7. Map indicating the suspended solids in the relocation area 1 metre above the bottom, measured during the works executed with the sweephead dredge.

– 26 hr lethality test with mysid
– 24 hr embryo development test with bivalve
– 14 day growth test with copepod

The results of these tests are displayed in Table IV.

- Sediment-contact tests:
  – 10 day lethality test with amphipod
  – 10 day lethality test with mysid
  – 28 day growth test with amphipod

The results of these tests are summarised in Table V.

These tests clearly indicate that there is no acute nor chronic toxicity on the dissolved/suspended fraction of the dredged material. There is also no acute or chronic toxicity on the "bulk" fraction of the dredged materials.

Conclusion

The environmental monitoring of the dredging and relocation operations in Nieuwpoort Harbour provided the opportunity to develop and test methods within the framework of the Mobag 2000 project, initiated by the Flemish Government. This project aims at the environmental monitoring of all the dredging operations executed in the Belgian coastal harbours.
Mainly because of the quality of the removed sediment, it can be concluded that the maintenance dredging and relocation operations in Nieuwpoort Harbour only cause a visual effect near the relocation area, but have no adverse environmental effect and do not impact the local ecosystem as such.

Table IV. Results of the toxicity tests on the water phase.

Test	Harbour porewater	Harbour supernatans	Beach supernatans
algae	NO	NO	NO
bivalve	TOXICITY	TOXICITY	TOXICITY
copepod			
mysid			

No acute and chronic toxicity on the dissolved/suspended fraction of the dregded material

Table V. Results of the toxicity tests on the bulk sediments (harbour sediments and beach).

Test	Harbour bulk	Beach bulk
mysid - acute	NO	NO
amphipod - acute	TOXICITY	TOXICITY
amphipod - chronic		

No acute and chronic toxicity on the 'bulk' fraction of the dregded material

Charles W. Hummer, Jr.

Books/ Periodicals Reviewed

Proceedings of the Western Dredging Association Eighteenth Technical Conference and Thirtieth Annual Texas A&M Dredging Seminar. Charleston, South Carolina, USA. June 29- July 2, 1997.
Texas A&M University, College Station, Texas, USA. 319 pp, b/w illustrations. $50 plus postage and handling.
Center for Dredging Studies, Ocean Engineering Program, Civil Engineering Department

These proceedings include the technical papers presented at the Western Dredging Association Annual Meeting and the Texas A&M University Dredging Seminar that were held jointly in Charleston, South Carolina from June 29 to July 2, 1997. The proceedings are organised in two parts with the technical papers divided into the two different meetings.

The papers presented at the Thirtieth Annual Texas A&M University Dredging Seminar are eleven in number, with two appearing as abstracts only. The range of technical papers presented is impressive and covers experiences in the United States as well as Europe. Notably, the paper on the *Punaise*, a remotely operated submerged dredging system developed in The Netherlands, reflects the extension of interest in this European technology into the United States (see Terra, Nr. 69, p. 20).

The remaining papers contain a good mix of interesting subjects. Of special interest is the paper on deep ocean disposal of dredged material which reports on the modelling of the study of the option of isolating contaminated sediments on the abyssal seafloor, focussing on the containing, transporting and placing the material. The researchers simulated the use of free-falling geosynthetic fabric containers to place the material in deep waters. A complete list of the papers follows (* denotes papers where only abstracts are presented):
– Williams, G. and Visser, K., "The Punaise: A Remotely Operated Submerged Dredging System" (*Terra et Aqua*, December 1997, nr. 69, p.20).
– White, T., "Summary of Coastal Sediment Monitoring Techniques".
– Valent, P., Young, D., and Green, A., "Deep Ocean Relocation of Dredged Material: Containment, Transporting and Emplacement".
– Taylor, A., "Dredge Meridian".*
– Mohan, R. and Urso, D., "Design and Construction Elements for Creating Artificial Islands Using Dredged Material".
– Sellgren, A., Addie, G., and Carstens, M., "Determination of the Operating Velocity and Friction Losses for Dredge Slurry Pipelines".
– Pensland, S., Westphal, K., Mathies, L., Nord, B., Tao, Q. and Zganjar, C., "Beneficial Use of Dredged Material in the Mississippi River Delta Plain".
– Welp, T., Pilon, R. and Clausner, J., "Toussaint River Unexploded Ordnance Demonstration Project".
– Moritz, H., "Management of Ocean Dredged Material Disposal Sites at the Mouth of the Columbia River".
– McLelland, T. and Maurer, H., "Galveston District Dredging Conference 10 Years of Communication".
– Mathies, L, Nord, B, Penland, S. and Westphal, K., "Monitoring the Beneficial Use of Dredged Material in the US Army Corps of Engineers New Orleans District".*

Twenty-one papers were presented at the Eighteenth Annual Western Dredging Association Conference. Of these, four were titled as part of a panel presentation on decontamination of dredged materials and the papers were not included in the proceedings. Of the remaining papers, there were several of particular interest to the international dredging community.

The paper, "A Look at the Jones Act," by Judy Powers is particularly timely and of international interest. The paper gives the background to the legislation and

other related legislation related to protection of the US maritime interests. The paper highlights the activities of two organisations either in favour of maintaining current legislation or reforming the legislation to allow non-US dredges to operate in the US.

Likewise a summary of the latest information related to the London Convention of 1972 ("The London Convention of 1972: Revisions for the 21st Century") by Dr. Robert Engler is of particular interest. There are several excellent papers on beneficial uses of dredged material and several on sediment remediation and contaminated sediments.
A complete listing of the papers in the WEDA conference follows (* denotes papers where only abstracts are presented):

- Miller, C., Goodwin, J. and Chase, T., "Guidance Manual for Identifying, Planning and Financing Beneficial Use Projects Using Dredged Material".
- Vanselow, G., "A Columbia River Perspective on Dredging and the National Estuary Program".
- Mars, S., "In-Situ Measurements of Density and Viscosity in Liquid Sediment Layers Using Acoustic Reflection Intensity Techniques".
- Bosshard, M. and Randall, R., "A Real Time Data Acquisition System for Dredge Pump Testing".
- Bonsack, F. and Clarke, L., "Alternatives for the Dredging and Disposal of Sediment from the Miami Harbor (Miami River) Project, Florida".
- Clausner, J., McDowell, S. and May, B., "Software for Managing Open-Water Dredged Material Placement Sites".
- Garbaciak, S., and Averett, D., "Full-Scale Sediment Remediation in North America: A Survey of Recently Completed Projects".
- Bulchoz, M., "Contaminated Sediment Removal Redefining Dredging Projects in the Nineties".
- Spadaro, P., Hendley, M. and Verduin, J., "Interim Status Report: Thea Foss and Wheeler-Osgood Waterways Cleanup".
- Palermo, M., "Contained Aquatic Disposal of Contaminated Sediments in Subaqueous Borrow Pits".
- WEDA Environmental Commission Panel, "Decontamination of Dredged Materials from Navigation Projects: What, When, How Much, and Where".*
- Wakeman, T., "Dredging Requirements in the Port of New York & New Jersey for the 21st Century".
- Worthington, R. and Vogt, C., "The National Dredging Team's Role in Facilitating Dredged Material Management Planning and Formation of Local Planning Groups".
- Vogt, C. and Lin, S., "Implementation of the Administration's Dredging Plan: Issues and Actions".
- Powers, J., "A Look at the Jones Act".
- Engler, R., "The London Convention of 1972: Revisions for the 21st Century".
- Lecco, S., "A Monitoring Plan for the New London Disposal Site".

To order the publication please contact:
Executive Secretary, Western Dredging Association
Post Office Box 5797
Vancouver, WA 98668-5797 USA
tel./fax +1 360 750-1445

New Developments in Dredging Equipment and Technology.
Proceedings of the CEDA Dredging Days. Amsterdam, The Netherlands. 1997. Soft cover, 221 pages, illustrated.
Edited by the Central Dredging Association Secretariat

The Central Dredging Association (CEDA) sponsors the "Dredging Days" in collaboration with the Europort Exhibition in Amsterdam. The "Dredging Days" event is, in fact, a technical conference where new technology is presented in the form of technical papers and presentations. The technical papers are collected and published as proceedings by CEDA.

Fifteen papers are contained in the proceedings along with the keynote speech by Mr RN Bray (see this issue of *Terra*, page 3). The subject areas in which the papers are grouped are as follows:

- Cost cutting
- New techniques
- Investigations
- Environmental techniques
- Instrumentation

The keynote speech is an intriguing look at the past and possible future of dredging and dredgers in the world, with the exception of North America, where the author states, "owing to certain legislative measures and a monopolistic regime...competition and development were stifled". The conclusions of the paper are intriguing and certainly could be constructively debated by many in the field.

The other papers cover a broad spectrum of subject matter, even within the five major subject categories listed above. Of note are several papers on the technology employed or developed on the Øresund Link Tunnel Project linking Denmark and Sweden.

The paper on the use of trailing hopper dredgers for deep dredging by Noel Pille deals with an innovative subject but it leaves the reader asking for more information. Pethick's paper, "The beneficial use of dredging sediment in estuaries: a trickle charging experiment in the Medway Estuary Kent, UK", opens the door on some new directions for the disposal of dredged sediments beneficially and gives some encouraging results for commercial application. Oom's paper on the capping of contaminated sediments in the Hong Kong dredging project is likewise very useful in reporting on the use of this proven tool in a large and successful project.

Finally, the papers on instrumentation of dredgers and dredging processes, especially for remediation dredging, are also timely and offer new information in this technology that impacts on the costs and competitiveness of dredgers. In the case of instrumentation for the purposes of remediation, the increased use of dredgers for this purpose may constitute a major new market.

The use of the abstracts and key words in each of the papers merits mention. This initiative by CEDA to incorporate these elements in its proceedings advances the ability to search and retrieve relevant technical information from the literature is commendable.

As has been the case for many years, the CEDA Dredging Days proceedings add much useful and timely technical information to the literature on dredging. The purchase of the proceedings is an effective way to keep abreast of the technological developments by those who may not have been able to attend the sessions.

The publication may be obtained from:
CEDA Secretariat, PO Box 3168
2601 DD Delft, The Netherlands
Email: ceda@wbmt.tudelft.nl

Final Report, Development Programme for Treatment Processes for Contaminated Sediments. POSW Stage II (1992-1996).
Lelystad, The Netherlands. July 1997. Soft cover, 58 pages with photographs, tables, references. NLG25.

RIZA (The Netherlands Institute for Sweet Water Management and Waste Water Treatment)

This is a final report on Stage II of the Development Programme for Treatment Processes for Contaminated Sediments (POSW). Stage I was an exploratory stage in which a number of promising methods were researched, selected, developed and tested for the treatment of contaminated sediments. The objective of Stage II was "the delivery of a number of operational, environmentally friendly dredging and processing methods". The programme had to produce data to assess the technical feasibility, environmental and economic aspects of dredging and processing methods in the framework of remediation of sediments.

The report comprises of seven sections:
1. Introduction; 2. Studying and testing of methods; 3. From theory to practice; 4. Epilogue (summary and prospects); 5. References; 6. Abbreviations; and 7. Annexes

The report summarises the various approaches and results of the study. The first chapter includes: predredging surveys and dredging; separation of dredged materials; thermal and chemical treatment methods; biological treatment methods; and immobilisation of contaminants. Within these sections there are at least three "case study" type narratives.

The second major portion of the report deals with those methods that were determined to be practically feasible from the perspective of cost, environmental effects, marketing prospects of the processed materials and administrative implications. Subsequent subsections discuss assessing the environmental effects of the processes, selection methods for large-scale processing, scenarios and characteristics of large-scale processing and the marketing of products.

The report uses a parenthetical intermezzo or "text box" technique that summarises the particular subject matter in many of the more comprehensive narratives or paragraphs. The technique is especially useful for those who wish to scan the report for its major salient points. The report summarises a number of output results that it outlines in its final Epilogue. This final summary is also quite useful to those who wish to get a macro-view of the study and potential application of its results.

The study covers aspects of contaminated sediments that are crucial to the ultimate development of solutions to the problem. It also reflects the national priorities established by the Dutch government. One criticism of the report is that it is somewhat difficult to read perhaps because it is a translation from the Dutch. The English is essentially correct but the construction and word usage is not that of an English-speaking reader which makes the reading difficult. Since this report is probably the most likely introduction of the results of this valuable study programme, it would be beneficial if additional effort and attention were made to make it more readable.

The publication may be obtained from:
Koninklijke Vermande BV
PO Box 20, 8200 AA Lelystad, The Netherlands

Dredging Material Management Guide, Permanent Environmental Commission (PEC) Special Report.
Permanent International Association of Navigation Congresses. Brussels, Belgium. Special Supplement to Bulletin no. 96, 1997. Soft cover, 16 pages, with two figures. Price: BEF 350.

Tiedo Vellinga

This concise publication is extremely valuable: it presents and explains, amongst other things, the Dredged Material Assessment Framework, a major contemporary concept and process adopted by the United

continued on page 32

Seminars/ Conferences/ Events

SingaPort '98

World Trade Centre, Singapore
March 24-27 1998

Organised by the Port of Singapore Authority (PSA), SingaPort is Asia's largest maritime exhibition and conference. Exhibitions cover areas ranging from ship design to cargo handling to port planning. In addition to the extensive exhibition, SingaPort is well supported by two established international conferences, the SingaPort International Maritime Conference and the Singapore International Bunkering Conference (SIBCON '98). It will also feature satellite conferences on "Shipbuilding & Shiprepair" and "Logistics & Distriparks Asia '98", as well as technical visits.

For further information please contact:
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1 Maritime Square, #09-72 World Trade Centre
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tel. +65 321 2103, fax +65 274 0721
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Ms Christine Ng
Times Conferences and Exhibitions Pte Ltd
tel. +65 284 8844 ext 428, fax +65 286 5754
email: tcecn@corp.tpl.com.sg

ICPRESAM '98

Guangzhou, PR of China and Macao
May 11-15 1998

The Second International Conference on the Pearl River Estuary in the Surrounding Area of Macao is dedicated to the public presentation and discussion of the scientific and technical problems concerning this estuary. The purpose of the conference is to exchange information on estuary engineering, coastal engineering and marine geology, and to discuss the fluvial, coastal and marine interfaces of Macao.

The conference is organised by the Laboratory of Civil Engineering Macao; the Pearl River Water Resources Commission, the Laboratory of Civil Engineering Portugal and the Hydrographic Institute of the Portuguese Navy.
The technical sessions will take place at the White Swan Hotel, Guangzhou (May 11-12) and at the Hotel Hyatt Regency Macau, Macao (May 14-15) with a technical visit planned during the transfer from Guangzhou to Macao.

For further information contact:
Secretariat of ICPRESAM '98- Macao
Laborat¢rio de Engenharia Civil de Macau
Rua da SÇ, 22, Macau
tel. +853 343372, fax +853 578930, +853 343371
email: lecmdqn@macau.ctm.net
http://www-dh.lnec.pt/npp/icpresam98.html

ConSoil '98

Edinburgh International Conference Centre, Scotland
May 17-21 1998

The Sixth International FZK/TNO Conference on Contaminated Soil will be taking place in May 1998. The fifth conference in 1995 in Maastricht saw an attendance of 1000 delegates from 31 countries.

The series of International FZK/TNO Conferences focusses on policies, research, development, regulations, practical implementations and experiences related to contaminated sites. Legal, financial and insurance aspects of contaminated land will be included.
ConSoil '98 is organised by Forshungszentrum Karlsruhe (FZK) and The Netherlands Organisation for Applied Scientific Research (TNO) in cooperation with Scottish Enterprise.

For further information about the conference please contact:
Forshungszentrum Karlsruhe — PSA
PO Box 3640, D-76021 Karlsruhe, Germany
tel. +49 7247 82 3967, fax +49 7247 82 3949
email: mathes@psa.fzk.de
http://www.iai.fzk.de.soil98/

WODCON XV, "Dredging Into the 21st Century" and Exhibition

Las Vegas, Nevada, USA
June 28-July 2, 1998

The Fifteenth World Dredging Congress and Exhibition, hosted by the Western Dredging Association (WEDA), will include a three and a half day technical programme with the theme "Dredging Into the 21st Century". Suggested topics include but are not limited to: infrastructure; dredging equipment and innovations; dredge automation; disposal of dredged materials; beneficial uses of dredged material; environmental issues; dredging and the economy; education and training; and dredging case studies.
The IADC (International Association of Dredging Companies) will present a prize to the best paper by a young author (younger than the age of 35). DCA (Dredging Contractors of America) will also present an award for an outstanding paper.
The conference will be accompanied by an exhibition of dredging and marine construction-related equipment and displays which is also being organised by WEDA.

For further information about the conference or exhibition space please contact:
Lawrence Patella, Executive Director
Western Dredging Association
PO Box 5797, Vancouver, WA 98668-5797, USA
tel./fax +1 360 750 1445, or
tel. +1 503 285 5521, fax +1 503 240-2209

BaltExpo '98

Olivia Hall, Gdansk, Poland
September 1-4 1998

This ninth international maritime exhibition, organised by the Warsaw Exhibition Board of Biuro Reklamy SA and Agpol Promotion Ltd, attracts exhibitors and visitors from both Eastern and Western Europe.
The expo is sponsored by Poland's Ministry of Transport and Maritime Industry. The register of exhibits includes shipbuilding and repair; ship equipment; ports, terminals and port service; offshore; maritime management; salvage and pollution control and more.

For further information please contact:
Agpol Promotion Ltd
17, niadeckich Street, 00-654 Warsaw, Poland
tel. +48 22 628 7295, +48 22 628 7296,
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fax +48 22 49 35 84
email: BRSA@pol.pl

"Ecologically Sound Banks Along Fairways"

Technical University Delft,
The Netherlands
September 4-6 1998

This international postgraduate course is being offered by the Road and Hydraulic Engineering Division (RHED) of Rijkswaterstaat in conjunction with the PIANC conference taking place in The Hague. The course, which will precede the conference, will be held at the faculty of Civil Engineering of Technical University Delft, and is of particular interest to young professionals in the field of the ecology of the "wet infrastructure".

Experts in hydraulic engineering and ecology from the RHED, joined by experts from other countries, will acquaint participants with the concept of ecologically sound banks and with a practical, systematic approach to the management of multi-functional banks.

The costs of the course are NLG 550 (US$300) and include lunches, transportantion, excursions and the course proceedings. There is a reduced fee for participants from developing countries (NLG 350, US$200).

For further information or a registration form contact:
Rijkswaterstaat, Hydraulic Engineering Division
att: R. Boeters (course Leader)
PO Box 5044, 2600 GA Delft, The Netherlands
tel. +31 15 269 9111, fax +31 15 261 1361
Email: R.E.A.M.Boeters@dww.rws.minvenw.nl, or
M.A.Graafland@dww.rws.minvenw.nl

29th PIANC International Navigation Congress

Netherlands Congress Centre, The Hague,
The Netherlands
September 6-11 1998

The 29th International Navigation Congress of the Permanent International Association of Navigation Congresses (PIANC) will be held next autumn in The Hague, The Netherlands. There will be two sections which will be running in parallel sessions: (I) inland navigation, and (II) maritime naviagation.

Two technical excursions, to the ports of Rotterdam and of Amsterdam, are also planned. In addition, the congress will be preceded by two short postgraduate courses organised by the Road and Hydraulic Engineering division of The Netherlands government agency, Rijkswaterstaat (Ministry of Transport, Public Works and Water Management) in cooperation with Technical University Delft.

The International Exhibiton on Ports and Navigation, which is being held concurrently in the Statenhal of the Netherlands Congress Centre, is directly accessible to the conference.

For further information about the congress or related events please contact:
Lidy Groot Congress Events
PO Box 83005, 1080 AA Amsterdam, The Netherlands
tel. +31 20 679 3218, fax +31 20 675 8326
email: Lidy.Groot@inter.nl.net

Odessa 98

Passenger Terminal Building, Port of Odessa, Ukraine
October 20-23 1998

The Third International Exhibition for Shipping, Shipbuilding, Ports and the Offshore Industries of Ukraine and the Black Sea region will be held in October in Odessa. The exhibit will offer opportunities to view the latest shipbuilding technologies and port equipment, to increase sales to Ukraine and the CIS. It will also focus on short-sea and ferry operations in and around the Black Sea, developing inland waterways and upgrading port handling.

For further information contact:
Odessa 98, Dolphin Exhibitions
112 High Street, Bildeston, Suffolk IP7 7EB, UK
tel. +44 1372 278 411
fax +44 1372 278 412, +44 1449 741 628
telex: 987882 MRM INT G

Marine Port China 1998

Shanghai Exhibition Centre, PR of China
October 27-30 1998

The Sixth International Exhibition for Port and Waterway Construction, Shipbuilding Industry and Transport is being organised by the Hamburg Messe (Germany), the RAI group (The Netherlands) and the Shanghai International Exhibition Corporation (SIECO), with the cooperation of the Chinese Ministry for Transport. Shanghai is the largest seaport in PR China and is in competition with other ports in the Far East.
To increase efficiency, plans are being made for the expansion and modernisation of the Chinese trading fleet, for the development and construction of container and other ships, and for extensive projects to improve the infrastructures of the ports and of the hinterlands. The exhibition will provide an important venue for those interested in the growing sea trade with China.

For further information contact:
Hamburg Messe
St. Petersburger Strasse 1
D-20355 Hamburg, Germany
tel. +49 40 3569 2192, fax +49 40 3569 2187
email: hamburgfair@hhmesse.de
http://www.hhmesse.de

Marine Port Vietnam

Ho Chi Minh City International Exhibition and Convention Centre, Ho Chi Minh City, Vietnam
November 3-5 1998

Vietnam is strategically located to become an important transshipment centre for the Indochina region and Southeast Asia. With over 3200 km of coastline and more than 11,000 km of inland rivers and canals, the potential for waterborne transportation and shipment is enormous. The government is committed to investing in port development and shipping infrastructure as well as the upgrading and modernisation of its current merchant vessel fleet. Such ports as Hai Phong, Da Nang, Vung Tau, Saigon (the country's largest port), Thi Vai, and Phu My (the first private port), are already being expanded. This exhibition provides an opportunity to take part early on in the rapidly developing Vietnamese maritime industry.

For further information contact:
Singapore RAI, 1 Maritime Square #09-01
World Trade Centre, Singapore 099253
tel. +65 272 2250, fax +65 272 6744

Amsterdam RAI, PO Box 77777
1070 MS Amsterdam, The Netherlands
tel. +31 20 549 1212, fax +31 20 646 4469

Hamburg Messe, PO Box 302480
20308 Hamburg, Germany
tel. +49 40 3569 2187, fax +49 40 3569 2187

Expo Marítima Mercosur

Centro Costa Salguero, Buenos Aires, Argentina
November 11-13 1998

The newly developed Expo Marítima Mercosur is being organised by Diversified Expositions, a leading publisher of marine journals including *Workboat Magazine*, and producer of the International Workboat Show. This new event follows on the heels of the recent creation of Mercosur — a free trade zone developed by Argentina, Brazil, Paraguay, Uruguay and associate members Chile and Bolivia. It spotlights the construction of the Hidrovía, the inland waterway system linking the Mercosur countries, and reflects the accelerated investment and interest in this area.

The exhibition will provide an important venue for those involved in port construction, inland waterway development, oil exploration, cargo handling, vessel overhaul and other marine-related industries.

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Seminars/ Conferences/ Events

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For further information contact:
Diversified Expositions Latin America
121 Free Street, PO Box 7437,
Portland, ME USA 04112-7437
tel. +1 207 842-5500/ fax +1 207 842 5503, or

Diversified Expositions Latin America
Uruguay 1134, 7o, "B"
1016 Buenos Aires, Argentina
tel. +54 1 813 1814/ fax +54 1 813 6143

Call for Papers

Hydro '99

University of Plymouth, UK
January 5-7 1999

Papers are now invited for The Hydrographic Society's eleventh international symposium. Supported by an exhibiton of equipment and services, the symposium's main theme will be "Information Management" and will deal with a wide range of global issues affecting acquisition, management and presentation of hydrographic data. Topics include: transfer of data sets from vessels via satellite to shore-based processing centres; production of online DTMs; visualisation of land and marine data in four dimensions; data manipulation and presentation for ECDIS and GIS.
In addition to conventional spoken presentations, there will be opportunities for electronic reviews of issues utilising a university computer suite or media such as Internet. For further information concerning proposed papers on designated topics and related subjects contact:

Hydro '99, Institute of Marine Studies,
University of Plymouth,
Drake Circus, Plymouth PL4 8AA, UK
tel. +44 1752 232410, fax +44 1752 232406
email: hydro99@plymouth.ac.uk

Books/ Periodicals Reviewed

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Nations London Convention for the disposal of wastes at sea. The guidelines give a brief description of PIANC, the London Convention, some of the regional conventions related to dredging, and take the reader through a generalised flow chart.

Since the publication is reasonably brief and written in easily readable form and terms, it can be a very effective mechanism to disseminate the concepts related to dredging and the disposal of dredging material. Not the least of the explanation concerns the very need for dredging. The effects on the environment of not dredging and the logical processes that should be followed from the outset of a navigation or other project that may require dredging are explained.
The paper covers the pertinent steps in the processes with clear explanations of each of them. It describes the three components of the characterisation of material to be dredged. The description and explanation of the concept of "action list" is presented in a few effective paragraphs. Other concepts such as "sustainable relocation", "beneficial use", disposal options, treatment, impact assessment, permitting, monitoring and the critical issue of controlling contaminant sources are also covered in a brief but understandable way.
The publication meets and exceeds its stated objective of providing a framework for good management practise when dealing with contaminated dredged material. Those in the field could and should use this publication as an educational tool for the various segments in the public and private sectors whose view impact on the maintenance of viable navigation systems. The widest possible distribution of this publication would serve a critical need.

The publication may be obtained from:
PIANC General Secretariat
Graaf de Ferraris-gebouw - 11th Floor
Boulevard Emile Jacqmain 156, B.3
B-1000 Brussels, Belgium
email: navigation-aipcn-pianc@tornado.be

WODCON XV: "Dredging into the 21st Century"

June 28 – July 2 1998, Las Vegas, Nevada, USA

Contact: WEDA Executive Offices, PO Box 5797,
Vancouver, WA 98668-5797 USA
tel +1 360 750 0209, fax +1 360 750 1445
email: weda@juno.com

The International Association of Dredging Companies will present its annual award for the best paper written by a young author. You are cordially invited to visit the IADC Booth.

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Gulf Coast Trailing Company, New Orleans, LA, USA
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Dredging International N.V., Tehran Branch, Tehran, Iran
Gulf Cobla (Limited Liability Company), Dubai, UAE
HAM Dredging Company, Abu Dhabi, UAE
HAM Saudi Arabia Ltd., Damman, Saudi Arabia
Jan De Nul Dredging, Abu Dhabi, UAE
Van Oord ACZ Overseas BV., Abu Dhabi, UAE

Australia

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Dredeco Pty. Ltd., Bulimba, QUE., Australia
New Zealand Dredging & General Works Ltd., Wellington
Van Oord ACZ B.V., Victoria, Australia
WestHam Dredging Co. Pty. Ltd., Sydney, NSW, Australia

Europe

ACZ Ingeniører & Entreprenører A/S, Copenhagen, Denmark
Anglo-Dutch Dredging Company Ltd., Beaconsfield, United Kingdom
A/S Jebsens ACZ, Bergen, Norway
Atlantique Dragage S.A., Nanterre, France
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Heinrich Hirdes G.m.b.H., Hamburg, Germany
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Sociedad Española de Dragados SA., Madrid, Spain
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