

PT28- 07/3

# Tipping point: The price of a cubic metre of sand

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The race to the top to be the biggest, best, most efficient, high tech world port is on. From Rotterdam to Los Angeles/Long Beach to the Far East, world class ports are adding container terminals and berths, lengthening their quays, and deepening their access channels. This year, for instance, Shanghai will overtake Singapore as the largest port in the world, at least based on freight volume. In 2005 Shanghai's freight volume will most likely surpass 450 million tonnes – just another confirmation of the growing importance of China as a manufacturing and trading nation.

Shanghai, however, has a problem, not unlike the problem that threatened to limit the competitiveness of New York harbour: It has a shallow entrance. Currently the approach channel at the mouth of the Yangtze River is only 8.5 metres. The larger container ships need a channel of at least 12.5 metre deep. Presently these larger ships have to wait for high tide to enter and leave Shanghai port, and that, of course, lessens the accessibility and thus the competitiveness of the port. This is the reason that, as a container harbour, Shanghai is still only number three in the world, after Hong Kong and Singapore. What to do? Deepening the shallow entrance of the harbour to 12.5 metres does not seem to be a realistic option. And so the Chinese government is investing heavily to construct a deep water port – Yangshan Port – some 60 km to the north of the Yangtze River estuary.

Looking at these ports from the perspective of the International Association of Dredging Companies (IADC), it is clear what is needed: Maritime construction and dredging. Dredging and maritime construction, which support port expansion, are essential ingredients in port management.

Dredging companies and port authorities have an almost symbiotic relationship. Many ports could not exist without dredging, and without ports and harbours there would be less dredging going on in the world. What the IADC tries to accomplish is to encourage ports to get the dredging companies involved at an early stage, in the long-term planning for the development of the ports. Dredging companies have in-depth knowledge about matters like where sediments will be deposited by ocean flows, or how exactly discharging rocks in the water can prevent erosion. Their knowledge of water flows, erosion and sedimentation is all based on extensive scientific calculations. Dredgers often feel that port authorities, in order to take full advantage of their knowledge, and also of their problem-solving capabilities, should talk to them in the earliest stages of the planning.

## What do dredgers really do?

The dredging industry often wrestles with public perception problems. To many people, dredging means clearing away the sediments from rivers, canals, lakes, ports and harbours. Dredgers keep the arteries of the world of trade unclogged, to use a medical metaphor. This is called maintenance dredging, an important activity, but it constitutes less than a quarter of what keeps dredgers actually busy, worldwide. People often also know that dredgers are involved in coastal protection; they have seen beach replenishment in progress. However, coastal protection at this time represents less than 10 percent of the dredgers' activities. Because of the threat of tsunamis and hurricanes, and because of the rising



Airports in the water: Construction of the second phase of Kansai airport is well underway and is expected to be ready by 2007.

sea levels, as a result of global warming, this 10 percent may well become higher in the near future.

What then constitutes the other 65 percent of dredging activities? It consists of land reclamation and harbour extension, urban development of coastal cities, offshore constructions and LNG-harbours for supplying energy to the world. So dredging is often related to the expansion of a port, be it a seaport, a river port or even an airport. By now, there are quite a number of airports that have been built on artificial islands, or on other new land that used to be water. The best examples are those done in the Far East, in Singapore, Hong Kong and Japan. Compare an old map of Singapore with a recent one, and you can see: The eastern side of Singapore Island has grown. Where Changi Airport now stands, that used to be water. And also to the south the shape of the island has changed, there are land extensions to accommodate the expansion of the harbour.

Another example: When you fly to Japan and land in Osaka, you arrive at Kansai International, an airport built on an island in Osaka Bay. Kansai was the first artificial island airport in the world. It dates from 1993. A second runway is being built at this very moment. Of course, Schiphol Airport in the Netherlands is also located where there used to be a lake, but that is a rather ancient story. The Dutch have developed all kind of future plans to build a new large airport in the water to replace Schiphol, either on water lying to the east of the city of Amsterdam or in the North Sea, to the west of the city. Both JFK and La Guardia airports in New York City are, at least partially, built in the water. Australia is also fully participating in this trend: Sydney Kingsford-Smith Airport is partially built in the water, and so is Brisbane International.

Turning to South America, there is a plan to build an artificial island in the Rio de la Plata, to accommodate a new airport for Buenos Aires. The working title for that island is Aeroisola, and a number of private dredging companies are involved in the feasibility study for this project. There also seems to be advanced plans to build an international airport a half kilometre offshore



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from north Tel Aviv but it will demand significant environmental studies. The latest news about airports built on new land comes again from Japan. In February of this year Centrair International Airport, 35 km south of Nagoya, in the Ise Bay, was opened. It is, no surprise here, built on an artificial island. And next year Kobe Airport is scheduled to open, built on an artificial island just off Kobe's coast.

For people not familiar with maritime construction, it may look like building an airport on an artificial island has become a fad. None the less, the real reason has to do, as is so often the case, with efficiency and finances: it has become an affordable necessity. Why a necessity? All the airports on artificial islands mentioned before, are located along the coast, often as part of a port and harbour hub. Port and harbour conglomerations are quite space consuming. Additionally, where there is a port, there is often the estuary of a river, and river deltas happen to be the most densely populated areas on earth. So, existing land for building an airport in such a situation comes at a high premium. Moreover, departing and arriving airplanes are not ear-friendly phenomena for the local residents. Putting an airport out to sea has therefore many advantages, including limiting noise pollution.

## The tipping point

Now consider affordability, that is, simply the cost of a cubic metre of sand. A tipping point was reached somewhere in the 1990s, in terms of technological innovation within the maritime construction and dredging industry. To bring sand from point A somewhere on the seabed to point B, a point where new land is being created, dredging companies mostly use trailing suction hopper dredgers. These "TSHDs" suck the sand from the seabed with a drag-arm, fill the hoppers with sand, bring the sand to its destination and pump it on land, through a pipeline or by rainbowing. The production cost of one cubic metre of sand depends on the following factors. On the one hand: where is the sand coming from? from how faraway? from how deep? On the other hand: how much sand can the hopper hold? how deep can the drag-arm reach? and how easily can the sand be located?

By looking at the changes that have taken place in dredging

technology you can see just what the tipping point means. Before 1990 the largest hopper could hold 8,000 cubic metres. In the mid-1990s larger hoppers were built, that could hold first 12,000 and later up to 18,000 cubic metres. Today the largest hoppers hold something like 30,000 cubic metres. That means that in 1989 in order to transport 30,000 cubic metres of sand, you would have needed five trips, up and down. Nowadays you need one trip. And because the dragarms today can reach sand so much deeper than in the past – some dragarms can go down to 120 metres – the trip to borrow pits is now often shorter than trips a decade ago. And the fact that sand deposits can now be located with the help of computers and the Global Positioning System (GPS), further speeds up the process. In addition, the engines that move the ships are also stronger, as are the suction pumps and the rainbowing pumps. All these technological advances added up to faster, better, more efficient sand-winning. But the decisive factor, the tipping point in the cost of a cubic metre of sand, came with the increased size of the hoppers. With this increased capacity, the creation of new land for ports, airports, residential and recreational use became economically feasible.

## Showing the world what the future looks like

The scales probably tipped in Hong Kong in the early 1990s, when all the technological advances added up one by one, and the private dredging companies showed the world what can be done with these new dredging technologies. They showed the world what the future could look like. A new airport on new land, plus the highway infrastructure and the bridges necessary to link the different islands, and more or less at the same time, the creation of an enormous container harbour that is still number one in the world. It was done with ships that were smaller than the jumbo, 35,000 cubic metres capacity TSHDs, which are still afloat today. Looking at Hong Kong you could say, "thanks to dredging, the future is now".

That enthusiasm, capability and, most important, feasibility has now spread to the Middle East, to Dubai, Qatar, and some other island nations that need space for expanding populations and for tourism. In Europe as well, in France, Holland and Germany,



Aerial view of the work at the Port 2000 at Le Havre: Expansion of the port will guarantee that the French harbour will be able to accommodate increasingly larger container ships as well as an increase in shipping traffic.

port expansion is thriving. The arrival of jumbo trailers, GPS, and extra-long drag-arms has created the tipping point where almost any port can consider harbour extension on new land or the creation of an airport in the water or offshore islands for residences and recreation. It has made building on a cube of sand from the seabed more affordable than buying up old land in crowded waterfront areas.

Of course no overview about maritime construction and dredging is complete without the most frequently asked question: What about the environment? Isn't there resistance from environmental groups against building artificial islands and creating new land in the sea, including resistance to port expansion?

The pressure from environmental groups has in the long run been beneficial to the dredging industry. Environmental pressures helped the industry to intensify research into new technologies, for instance, for precision dredging. Nowadays dredging engineers and environmentalists work closely together to define and solve problems. A more holistic, comprehensive approach has evolved where maritime construction looks at social and cultural aspects, after economic and ecological aspects have been studied.

Take for instance harbour extension. What impact does harbour extension have on employment, living conditions and recreation? What is also very intriguing is the conversion of old dock areas into residential and entertainment areas in many cities around the world. In Hamburg, Antwerp, Dublin and New York, the old harbour as part of the inner city, has now become an exciting living and business space. Waterfront development is an art in itself, generating economic activity and jobs and acting as a magnet for tourism. It can stimulate a cultural revival in old, worn-out industrial areas.

Talking about culture, another frequently asked question is what is it like on board a dredging ship, after all these technological changes? It is true, dredging crews are in some ways different now. They are better educated, they get extensive training from the private dredging companies, and they are often as familiar with computer software as with the tools you find in a hardware store. The crews that work for the IADC companies have traveled all over the world and worked on many different continents. They are still tough independent people, but now it is a highly educated toughness.

In fact, the work terrain of the dredging and maritime construction industry is broad, and broad-minded. Recently, the IADC celebrated the 40th anniversary of its founding and also the 100th issue of *Terra et Aqua*, its quarterly journal dedicated to publishing up-to-date information about dredging activities. To mark both these events, this Jubilee issue of *Terra* is called "Forty Years of Maritime Solutions that Changed the World". For that is what dredging does: it changes the world. It increases world trade by improving world ports. It protects the 3 billion people living along coasts and rivers. It makes new land for overcrowded coastal areas. It restores beaches for tourism and recreation. It cleans industrial pollution and creates wildlife habitats; and it even helps the offshore industry bring gas and oil onshore. Over the last forty years, the private dredging companies have emerged as trend-setters, and as instruments for progress in our modern world, broad-minded in their approach to thinking about how the world could and should look.

Dredging supports port expansion and port expansion encourages world trade. Trade brings prosperity. Wherever there is a dynamic port, there is a flourishing economy. The bottom line is that with a flourishing economy there is money to improve nature and people's quality of life.

*Terra et Aqua* 100 can be ordered via the IADC website: [www.iadc-dredging.com](http://www.iadc-dredging.com)

#### ABOUT THE AUTHOR



Constantijn Dolmans joined IADC in 1997 and has taken on the position of Secretary General in October 2003. He holds a degree in law and public administration (Leiden University, The Netherlands, 1995) and is actively involved in a number of international legal and environmental task groups.

#### ABOUT THE ORGANISATION

The International Association of Dredging Companies (IADC), is a trade organisation with more than 50 main and associated members in the private dredging sector, all of which operate sizeable fleets and are active on the world market. IADC companies have been involved with every major international dredging project of the last century. Their objectives are to advance fair trade practices and standard contracts to establish sound environmental practices, and to publish and encourage the publication of information about technological advances in the dredging industry. IADC works to attract worldwide recognition for the dredging industry in general and to increase the public's awareness of the significant contributions of dredging towards economic growth and prosperity.

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