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CHALLENGE IN LOGISTICS: NEW SUEZ CANAL PROJECT

ABSTRACT

One of the biggest dredging projects of the current century, the New Suez Canal was, according to experts, a titanic effort in operations, planning and production to complete within the one year deadline.

Opened in 1869 after 10 years of construction, the Suez Canal was one of the greatest maritime projects of the time. It was only wide enough for one-way traffic, and transiting ships would stop in a passing bay to allow the passage of ships in the other direction.

Almost 150 years later, the need for increased capacity had become clear to the Government of Egypt. In 2014, the Suez Canal Authority unveiled a plan to expand the canal and build a new lane that would allow the transit of ships in two directions. When the tender was offered, one caveat was that the work would be completed in one year's time. Six major dredging contractors ultimately were able to achieve this by an intensive logistics effort. Although the dredging contract itself was traditional, the execution period of less than a year was exceptional. Several milestones were achieved and records were broken during execution. The most spectacular was that, the dredgers from all contractors moved a total of more than 245 million m³ of sand in in just nine months. Another milestone achieved during the project was that it involved the largest number of dredgers ever deployed on a single project – 28 units and over 40 pieces of auxiliary equipment.

INTRODUCTION

Opened in 1869 after 10 years of construction, the Suez Canal was one of the greatest maritime projects of the time. The artificial waterway allowed ships to travel more directly between Asia and Europe, instead of navigating around Africa, thereby reducing the sea voyage distance by about 7,000km (4,300 miles). This clearly expedited travel and trade between the East and West.

The original canal was too narrow for two-way traffic, and ships had to stop in a passing bay to allow the passage of ships in the other direction. On 5 August 2014, Egyptian President Abdel Fattah el-Sisi and the Suez Canal Authority (SCA) unveiled new plans for an additional lane to allow the transit of ships in both directions over a greater length of the canal (Figure 1).

Above: A bird's eye view of dredging operations at Lot 5 at the New Suez Canal Project site.

The 35km lane would be located a few kilometres from the existing canal, between enormous mountains of sand. It would go straight through the Sinai desert, parallel to the current canal from km 60 to km 95. The plan also included the construction of the expansion and deep digging of another 37km of the canal at the Great Bitter Lakes by-passes (27km long) and Ballah by-pass (10km long). Taken together this will allow navigation in both directions simultaneously in the longest central section of the canal.

Funding for the project was achieved quickly. Most of it came from the Egyptian public who were invited to participate in the purchase of interest-bearing investment certificates. The US$8.4 billion goal was achieved in 8 days.

Soon after financing was completed and tenders offered, contracts were signed by the

Amount of sand disposed of:
SCA/ Lot 1: 15 million m³
Challenge Consortium/Lot 2-5:
More than 200 million m³
Dredging International & Great Lakes/Lot 6: 45 million m³

SCA with two consortia. The Challenge Consortium (the Consortium) comprised of National Marine Dredging Company (NMDC) from Abu Dhabi; Dutch dredging companies, Royal Boskalis Westminster (Boskalis) and Van Oord; and Jan De Nul NV (subsidiary of Jan De Nul Group) from Belgium. The total contract value amounted to US$1.5 billion that was divided amongst the four partners. The second consortium, Dredging International NV (an operating company of DEME Group) from Belgium and Great Lakes Dredge & Dock Company (GLDD) from USA received the assignment to deepen and widen the western branch of the Suez Canal, worth US$540 million.

One essential prerequisite of the contracts, however, was that the project be completed in a year, an extremely short deadline for the amount of work. Therefore, due to the sheer size of the project, the work was divided into six lots to be carried out from 51.4 - 122.4km of the length of the canal. The SCA and the two consortia carried out the works in the various lots. The SCA did the work on Lot 1. The Consortium carried out the works on Lots 2 to 5 (from 58.2 - 92.6km). The final Lot 6 was completed by the consortium of Dredging International (DI) and GLDD.

Furthermore, before the dredging operations could begin, dry excavation works in the Sinai desert had to be carried out by the Armed Forces Engineering Corps of the Egyptian Army – the armed forces had to clear 250 million m^3 of dry earth.

The expansion of the canal was completed as planned by 6 August, 2015 in time for the inauguration. The current extra lane is between 147m and 177m wide across the bottom and 24m deep.

THE CHALLENGE CONSORTIUM WORKS ON LOTS 2-5

An ongoing effort in mobilisation

Mobilisation was a herculean effort according to the experts of the Challenge Consortium. Ensuring that all the equipment and people were in place and operations carried out within the tight project deadline was the greatest of logistical challenges.

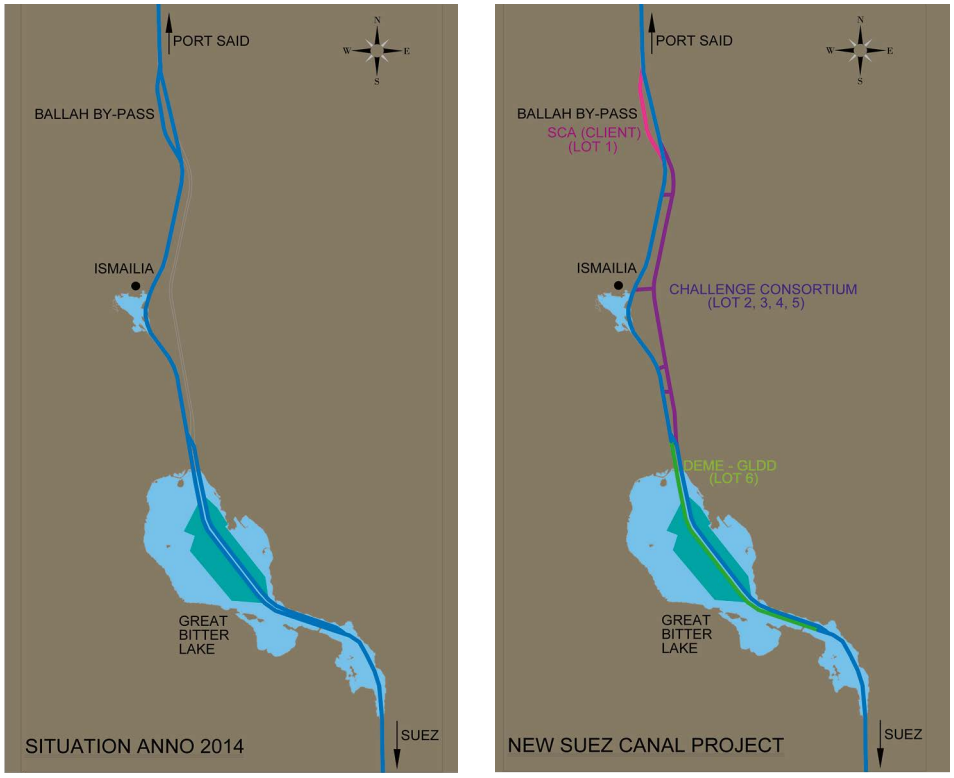


Figure 1. Left: The illustration shows the original Suez Canal waterway; Right: Illustration of the New Suez Canal work carried out by SCA, the Challenge Consortium (Lots 2-5) and DI-GLDD consortium (Lot 6)

BAS VAN BEMMELEN

holds a M.Sc. in Mining and Petroleum Engineering from Delft Technical University, the Netherlands. After graduation in 2000, he joined Boskalis as a geotechnical engineer, later becoming superintendent on dredging projects all over the world. In 2004 he became project manager in Asia, the Middle East and Africa. From 2007-2012, he was a proposal and regional manager; from 2012- mid-2014, director of the offshore contracting business unit, responsible for dredging and subsea rock installations. He is presently in charge of Boskalis' contracting and execution of dredging projects in Africa. On behalf of Boskalis, Bas was the managing director for the New Suez Canal Project and in this respect was a member of the Board of Directors in the JV.

MENNO NAGEL

received his B.Sc. in Civil Engineering in 1991 from the University of Arnhem, the Netherlands. He joint Van Oord in 2006. He is the tender manager at Van Oord Dredging and Marine Contractors. During the execution period of the Second Suez Canal project, Menno was responsible for the coordination of NMDC, Boskalis, Van Oord and Jan De Nul JV Board activities and secretary of the Board. Furthermore, he headed Van Oord's Coordination Desk for the Suez Canal project and was on behalf of Van Oord, a member of the Technical Committee in the JV.

KENNETH WILLEMS

is head of Risk Management department at DEME. He received a M.Sc. in Civil Engineering from University of Ghent (Belgium) in 2005 and a MBA from Manchester Business School (UK) in 2013. His work at DEME focuses on design, tendering, project management and risk management. His experience includes projects such as Panama Canal Expansion, New Suez Canal, Durban Port Extension and Ras Laffan LNG Port. For the New Suez Canal Project, he acted as the proposal manager for DEME during the tender phase and as chairman of the DI-GLDD consortium's Technical Committee during the execution phase.

OSAMA FAROUK EID

is the head of Marine & Logistics Department in NMDC. He graduated from Arab Academy for Science, Technology and Maritime Transport. He has over 25 years of sea going experience, including 15 years in the offshore oil & gas industry. He is a specialist of marine, offshore and logistics operations, and an offshore oil and gas industry specialist. For the New Suez Canal project, he planned, coordinated and executed all mobilization and demobilisation for NMDC equipment in coordination with the project team and others. He also liaised with Suez Canal movements departments regarding the arrival, departure, loading and offloading procedures of marine units, and was a member of the Demobilisation Committee for the Consortium.

WIM DHONT

has a M.Sc. degree in Civil Engineering (Electromechanics). Wim has been working with the Jan De Nul Group since 1999. He worked as a plant manager and moved to being the deputy area manager of Middle-East and Northern Far East for the Dredging and Marine Department and eventually the area manager for the Middle-East area for the same department. For the New Suez Canal Project, Wim supported the operations team by analysing daily reports, production summaries of the dredging vessels and progress planning. He was also a member of the Technical Committee.

Figure 2. Cutter suction dredger Hercules was re-routed from Brazil to the New Suez Canal Project

The partners had to ensure that they could mobilise immediately after the contract was signed and already during the tender phase, they had started to look into the availability of various equipment and people. During the preparation of the works, a detailed planning was drafted for swift mobilisation. In fact, the first dredger – Al Mirfa from NMDC – was on site two weeks after the contract was signed. All four partners mobilised their dredgers from all over the world. This was organised from each of their head offices. Since the vessels and other equipment could only be utilised when they were available from their other projects, mobilisation was an ongoing process during the project. Once the Suez project headquarters was established in Ismailia, a city in northern Egypt, on the west bank of the Canal, the logistics experts were sent to the site in Egypt and mobilisation continued from there.
The contract was signed on 18 October, 2014. On that date, Van Oord's cutter suction dredger (CSD) Hercules was on her way back to Rotterdam from Brazil and was immediately re-routed to Suez on a semi-submersible transport vessel (Figure 2). The ship arrived on site 10 days later on 28 October 2014, a few hours after CSD Al Mirfa arrived. The other dredgers were mobilised as soon as they were available. Seven months into the job, some of the small dredgers were already demobilised and in the last month, a large self-propelled CSD was mobilised to finish the project on time. Besides equipment, Van Oord sent about 250 employees (staff and crew) for work on site.

Boskalis started making preparations for the mobilisation in mid-September, weeks before

Figure 3. Boskalis' trailer suction hopper dredgers, Coastway and Barent Zanen at work site

Figure 4. Jan De Nul's largest cutter, J.F.J De Nul was mobilised for the project

Figure 5. CSD Al Mirfa from NMDC was the first cutter suction dredger to arrive on the project site for the Challenge Consortium

Figure 6. Ocean Majesty, strategically positioned near the work site, could accommodate up to 325 people; the cruise ship's amenities included a swimming pool

the contract was signed. That included such efforts as mapping of its equipment, talking to transporters including its wholly-owned subsidiary Dockwise, provider of heavy marine transport services, to block space for transport vessels, if the contract were to be awarded.

The vessels for Boskalis (Figure 3) came from across the globe and its first vessel was on site by early December. In fact, the first vessel was loaded a week before the signing of the contract and started sailing a day after the signing of the contract. Its last vessel was at the site in the beginning of July 2015, three weeks before completion. The Suez job required so much equipment that when any equipment, crew and staff from other jobs became available, they were sent to the Suez project. The organisation also sent about 400 people for the project – around 80 staff and 320 crew members.

Jan De Nul also started working on their mobilisation plans around September 2014 until the contract was signed. During the course of the tender and negotiation process, the organisation started looking into their available equipment. A total of 7 CSDs were sent for the project – two vessels came from Dubai, two from Vietnam, one from Singapore. The last two, one from Panama and one from Belgium, were mobilised during the course of the project (Figure 4). In addition, 20km of land pipeline and 3km of floating pipeline were sent. The first vessel arrived during the second half of November, one month after signing. The organisation also sent about 600 people for work on site.

NMDC mobilised its equipment immediately after the contract was signed and its units were mobilised from two locations in Abu Dhabi – Port Khalifa and Mina Zayeed (Port Zayed anchorage area). Since the sailing time is around two weeks, the first dredger at the site was NMDC's cutter suction dredger Al Mirfa (Figure 5). CSD Al Mirfa with a barge, multicat and two tugboats was on the first load and it arrived on the project on the 28 October 2014. Other units and auxiliary equipment were sent on another six loads throughout the project. The dredging company sent a total of 20 units that included 5 CSDs for the project. NMDC also sent a total of 577 people – of this group, 22 were

key personnel for the project for work such as planning, operations and logistics.

The Consortium also subcontracted for local labour force from Egypt for work such as operators for sand bulldozers and pipefitters for fixing landlines.

At final count, a total number of 21 cutter suction dredgers, 5 trailer suction hopper dredgers, 2 water injection dredgers, over 40 pieces of auxiliary equipment and 80km of pipelines were utilised for the project. However, not all of the equipment could be used at once as the site could not allow for it. The Consortium had eight working fronts, two ends that connected to the existing channel and four side access channels that were utilised as logistical channels.

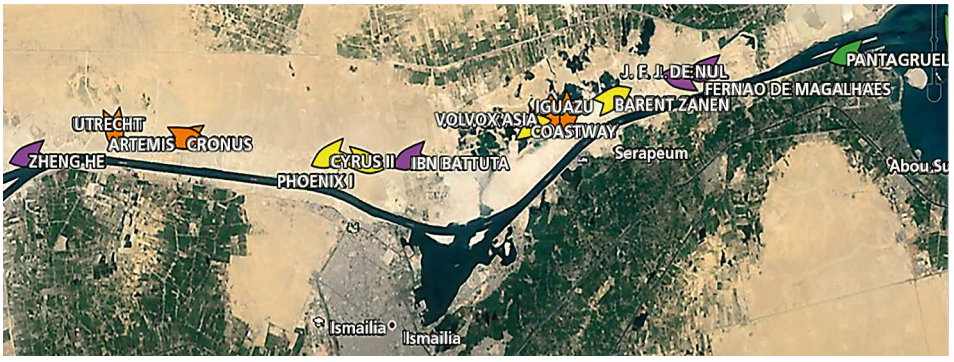


Figure 7. A satellite image of different cutters for Challenge Consortium at the work site. (Courtesy: Google Earth)

Tackling accommodation and daily logistics

With a huge ongoing project and works being carried out 24/7, it was essential for the Challenge Consortium to ensure that hundreds of employees had good accommodation. However, given the work location and insufficient facilities for employees on land, the Consortium came up with the solution of living quarters on water.

During the peak period of the project, 1,100 people had to be accommodated every day. Four accommodation barges, Puccini, Vivaldi, Bellini, Verdi, and a cruise ship, Ocean Majesty were hired. Also, four hotels were used to accommodate crew and staff. The accommodation barges for the project included big mess rooms, gym area, prayer rooms and recreational areas. As Ocean Majesty was a cruise ship it had more amenities including a swimming pool (Figure 6).

The barges Verdi, Puccini and Bellini were equal in size and could accommodate a maximum of 190 persons each, while Vivaldi and Ocean Majesty could accommodate up to 295 and 325 people, respectively. Moreover, the barges and the cruise ship were positioned at a central point for each working zone to cut down the transfer time of personnel. Tenders, that is transfer vessels, were used to ferry crew back and forth from the work sites within 10 to 30 minutes. Besides accommodation, water, food, waste and fuel were issues that needed to be addressed. A Consortium expert states that it was akin to running a floating town for close to a year. During the peak of the project, a team of about 150 to 200 site supervisors and operations people were handling these issues. Several local suppliers (ship chandlers) were contracted for various services such as catering and cleaning. With intensive work being carried out, the vessels kicked up a lot of sand sediment and it was difficult for vessels to make their own water as when in open seas. Water and different types of food, suited to the workers' various cultures, had to be provided on a daily basis. Water was supplied by water trucks and supply vessels. Also, barges came to collect garbage to be sent to proper disposal areas.

Fuel was efficiently delivered by the client and not a single vessel ran out of fuel during the entire duration of the project. During peak production, the vessels were consuming about 1,200 tonnes of fuel per day.

Maximising production during project phase

Before the project could begin, the client had to prepare the site for the works. Some areas of the land were at +24m, so the Egyptian army removed 250 million m^3 of dry earth to prepare the area for the dredging work to commence.

All equipment had to be placed at different locations at the site to maximise their production capabilities in order to finish the work on time. To achieve this, a Planning and Production department comprising experts from the different partners was put together as soon as the project was awarded. During the project, an average of 15 experts were on the team, based in the headquarters.

Various cutters were assigned to work simultaneously in the different lots (see satellite image, Figure 7). For operational efficiency, each partner was responsible for one lot. The day-to-day operations such as deploying the vessels and efficient disposal of dredged material were allocated by the Planning and Production department to a particular lot.

Jan De Nul was in charge of Lot 2, Boskalis worked on Lot 3, Van Oord managed Lot 4, while NMDC was on Lot 5 (see Figure 8, collage on next page).

In fact, the work was so efficient that the Consortium reached a record-breaking production of more than 1.4 million m^3 a day.

Disposal areas for dredged sediments were also located along the new canal on both sides and workshops were located close to different lots for wear and tear and maintenance. A central workshop was located on shore in the middle of the project between Lots 3 and 4 comprising a welding workshop, a mechanical workshop, a dry plant workshop and a large general storage area. There was also a floating (mainly welding) workshop located in front of the central workshop and smaller workshops were located in each lot.

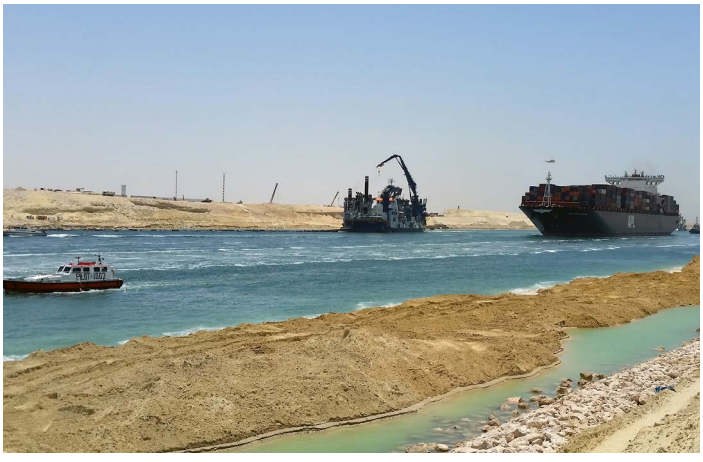
Maintaining a safe environment

Safety is an essential priority for any dredging project and the New Suez Canal Project was no exception. However, the Consortium had the extra task of taking into account the strategic nature of the Suez Canal area.

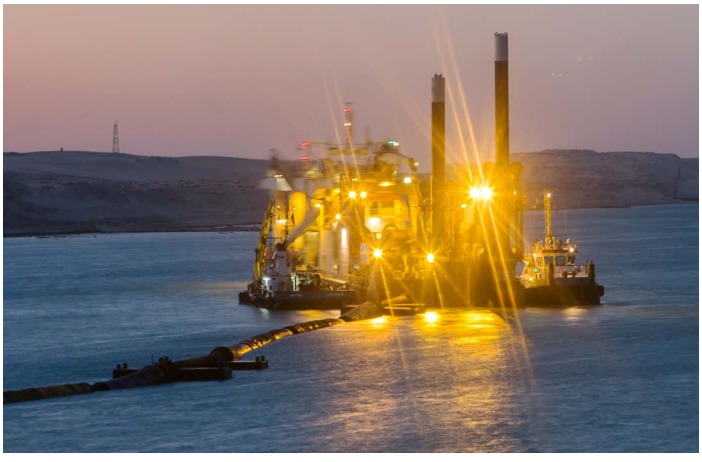
CSD Phoenix I and a backhoe dredger at work with accommodation vessel, Ocean Majesty in the foreground

Close up of NMDC's cutter suction dredger Al Sadr at work

Cutter suction dredger Leonardo Da Vinci carrying out dredging



First test passage of a vessel in the New Suez Canal with CSD Artemis to the left



Dredgers operating at night in the New Suez Canal Project site

Tunnelling works for the syphon construction of the irrigation channel under the New Suez Canal

Disposal area at the project site (Lot 3)

Cutter suction dredger Al Jarraf dredging amid normal container traffic at the Great Bitter Lake (Lot 6).

Figure 8. Above and on opposite page: Dredgers at work on the various lots. Work went on day and night, 24/7 for a year.

In addition, all crew and staff from the Consortium and local workers from Egypt needed approval for work for security reasons from the Egyptian Army. Also, the work site had tight security provided by the Army and the crew could only leave the premises in close contact with the Consortium's Security Officer.

Due to the historical nature of the Suez Canal area, unexploded ordinance (UXO) was an issue that the Consortium had to deal with as it encountered several UXO in the disposal areas. Consultants from Boskalis' wholly-owned subsidiary, Boskalis Hirdes, were flown in from Germany to support the Consortium in mapping the risk of UXO and the Egyptian Army was in charge of removal and disposal of any found objects.

Health and safety were another major priority for the Consortium, especially since the project site was not easily accessible. It engaged the services of the Travel Clinic of the Port Hospital (*Havenziekenhuis*) in Rotterdam. Consultants from the Clinic counselled the Consortium to make certain provisions such as having nurse stations on all accommodation vessels and offices. There was also a hospital on board Ocean Majesty. The Clinic also scouted the local hospitals in Ismailia to see the level of care and gave advice on the preparations that the Consortium should take and where to go in case of emergencies. Also, an emergency plan was put in place for clear pick up points on shore with travel instructions for the ambulances to the hospitals.

LOT 6: THE WORKS AT THE GREAT BITTER LAKE

Lot 6 works were carried out by the second consortium, Dredging International (DI) and Great Lakes Dredge & Dock Company (GLDD). DI completed 75% of the works and GLDD carried out 25% of the project. The contract for this Consortium was also awarded in October 2014.

The work on Lot 6 was to deepen and widen the western branch of the Suez Canal at Great Bitter Lake, Deversoir Reach and Kabreet Reach – an additional 250m wide, 24m deep, and 29.5km fairway through the Great Bitter Lake and the access channels to the lake would be widened to 140m.

This consortium also mobilised a large amount of equipment for the project to be completed by the stipulated deadline – 4 cutter suction dredgers, 6 trailer suction hopper dredgers, 42 auxiliary vessels from DI and 2 Middle-East based cutter suction dredgers (Ohio and Carolina), 1 trailer suction hopper dredger (Sugar Island) and other auxiliary equipment from Great Lakes.

Mobilising for a different terrain

DI started its tender in the first weeks of September 2014 and submitted the tender around 20 September. The client took about

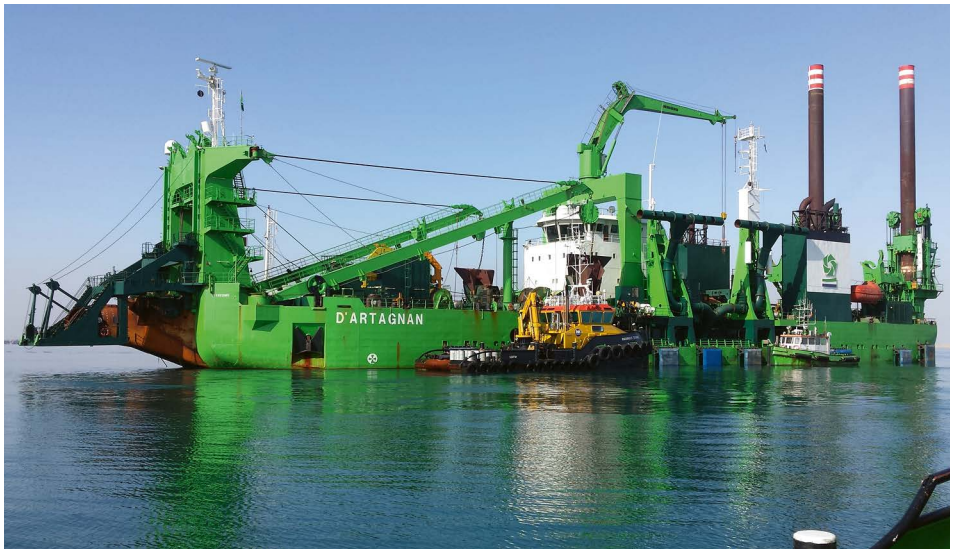


Figure 9. Dredging International's biggest cutter, D'Artagnan, was mobilised for work at Lot 6

four weeks to look into the tender documents and negotiate. During this time, DI started looking into site investigation and possible mobilisation on where to place pipelines, what vessels to use, and which equipment to buy.

Lot 6 was quite different in scope from the other lots, as the project site was not located in the Sinai desert, but at the Great Bitter Lake area (and the adjacent reaches). This meant a different methodology had to be applied as there would be more interactions with the ongoing Suez Canal traffic. As the DI tender team was made up of people who were experienced in the Panama Canal Expansion Program, where this was also the situation, the team anticipated SCA's issues and proposed solutions in the tender proposal. For example, in its technical solution proposal, DI elaborated a full traffic management plan for ongoing transport traversing the Canal.

As with the other contractors, DI's equipment was mobilised from across the globe. Their biggest cutter, D'Artagnan, was immediately mobilised at the time of the signing as she was at another project in Siberia (Figure 9). The D'Artagnan was re-routed to Belgium for a quick stop for a few days to take spare equipment for Suez and then set sail to the project site. The CSD was on site on 26 November, five weeks after the contract signing. Other equipment and pipelines from the United Arab Emirates (UAE) also arrived around November. Another 80% of equipment and vessels arrived between December and the beginning of February, with vessels coming from countries from both the East and the West such as Belgium, the Netherlands, the UAE, Singapore and Australia (Figures 10 and 11).

About 950 people (crew and staff) from DI were sent for the project. The commercial department staff were there before the contract was awarded but after the first week, a few other staff were sent to the site. By December, most of the staff had arrived and local labourers were on site between March and April. The number of staff fluctuated depending upon the phase of the project – between 10%-25% of the total work force were staff, while the rest were crew.

Remodelling equipment for the project

DI had to remodel a couple of pontoons for the project work. The contractor had to make an investment to transform two pontoons – one into a spider pontoon and a floating workshop (Naseem) and another into a floating workshop (Thornton 1); DI started making preparations for the technical modification (spider pontoon) during the negotiation period in October. On the day the contract was awarded, the management gave the green light to the technical department to transform the pontoon and the modifications were done in UAE.

Figure 10. Multiple dredgers working simultaneously at Lot 6

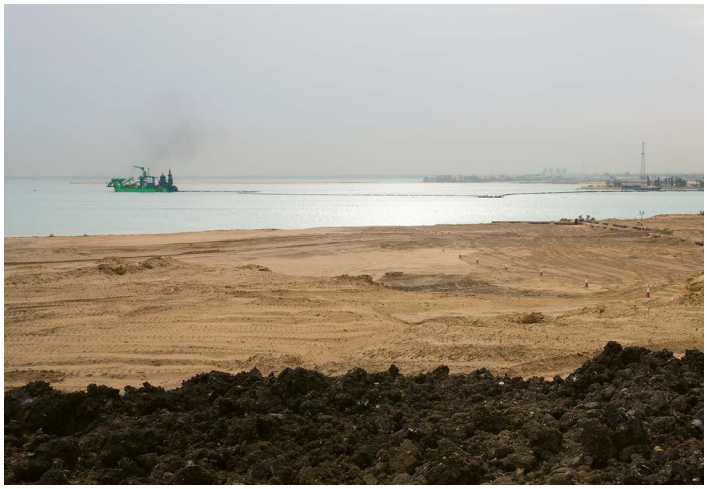


Figure 11. A panoramic view at the work at the Great Bitter Lake (Lot 6)

The transformed spider pontoon had two loading systems on top of it. They were akin to wings where pipelines are connected to the barge and can move down. Not only were barge loading pontoons transformed, other equipment was also needed to be assembled such as a workshop for cutter heads and extras on that pontoon. The full modification was completed in UAE and at the end of December, DI mobilised the whole spread to Suez.

GLDD rapidly mobilised its Middle East-based heavy duty, high production cutter suction dredgers, the Carolina and the Ohio, as well as their auxiliary support equipment and TSHD Sugar Island, to execute its portion of the work.

Steering cooperation

Both partners, DI and GLDD, worked together to ensure there was synergy in work when possible. Various committees such as a Technical Committee that included planning and production work, a Financial Committee and a Board, each with six members steered cooperation between the partners. These teams were established when the contract was awarded.

Also, during the production phase, each partner had its own disposal area and tried to keep dredging operations as separate as possible whilst still trying to work together when it came to logistics such as using a dockship for mobilisation and coordinating on using sinker lines in the existing Suez Canal.

Accommodating staff and crew

Most of the vessels had their own accommodation but DI also rented a houseboat, Rossini, with a capacity of 110 cabins. Also, the organisation had booked a few hotels and rented villas for staff. The villas were situated on the left side of the Great Bitter Lake and they were easy to protect as there only one road on the peninsula. Some of these villas also served as offices for the DI-GLDD consortium – one office for general management, one for operational management and one for Great Lakes.

The organisation also had contracts with local suppliers with regards to food (they also had several supply ships). They had over 40 auxiliary vessels and these vessels were used for purposes such as fresh water, fuel, garbage, sewage and sludge. The vessels that had accommodation on board had their own laundry as did the houseboat.

Safety and security were also major issues for the DI-GLDD consortium and so they had safety and security experts and guards to create a safe working environment. Doctors were on standby in case of emergencies. The Egyptian army had tight security around the premises. Also, DI came across several UXO after having done several investigations such as with a magnetometer survey but did not have any incidents.

CONCLUSIONS

The successful completion of the New Suez Canal Project within a year by the two consortia was a testament to their logistical and operational achievements in terms of coordinating the sheer number of equipment, staff and crew as well as handling various logistical and operational challenges. As the original Suez Canal became a historical achievement, so too will the New Suez Canal – it will serve as an iconic project for the dredging industry for decades to come.

It is also essential to note that the project was ultimately undertaken to realise the Egyptian government's aims to improve the national economy. The second lane reduces waiting times for transiting ships, facilitates traffic in two directions and increases the numerical capacity of the waterway. The drop in waiting times reduces fuel expenditures and costs for ship owners, which is meant to attract more ships including mega-cargo vessels to the waterway. The SCA expects the revenues to increase from US$5.3 billion at present to US$13.2 billion by 2023.

The New Suez Canal Project is also meant to support the Suez Canal Area Development project – a special economic zone in the heart of the Suez Gulf of Egypt to attract both Egyptian and foreign investors – that will boost the national economy. This in turn will help create job opportunities for people living in the Canal Zone, Sinai and neighbouring areas and create new urban communities.

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