CONSIDER TRANSPORTATION BEFORE IT'S TOO LATE

WRITTEN BY LINDSAY MCDOUGALL
TECHNICAL DIRECTOR, MALIN ABRAM

Fabrication facilities, producing large structures or items of equipment, are almost always positioned close to a river or coastline where there is a suitable quayside for loading to a ship or barge. The reason for this, of course, is that transporting any large item a considerable distance usually requires some element of sea transportation and the closer a facility is to the open sea and facilities for loading and discharging equipment, the more competitive and effective it can be. It is therefore surprising that in many cases the consideration of transportation is of prime importance when selecting a build site and then typically left as a secondary consideration during design and manufacture.

It's then not until close to the completion of the equipment that transportation considerations return to the fore. While budget tendering for the relocation of the final item will likely have been done during any bid stage, it is often not until during build, and often close to the end, that a heavy lift partner is selected to do the final move. At this point, engineering will be undertaken and, unfortunately, by this point in the project life cycle options become limited leaving solutions that are costly and complicated to implement. For this reason, I would always advocate looking at how you are going to support, move, lift, turn and ship an item at the earliest stage possible to maximise the benefits and time to develop an optimal solution.

Considering transportation at the early design stages offer greater opportunities to ensure the equipment can be shipped with minimal difficulty. Some key areas that should be considered are:

- Design of a bespoke transportation frame
- The shipping route and associated constraints
- Factoring transportation into the equipment design
- Heavy lift equipment selection to ensure maximum competitiveness when tendering for your final contractor

A bespoke transportation frame, tailored to suit the size, shape and characteristics of the equipment can result in a much simpler transport and leave a solution open to a wider variety of land and sea based equipment, maximising the supply chain you can approach for prices. Ideally, this frame would be considered at an early stage of the equipment's fabrication allowing sufficient time for design and manufacture. The frame can incorporate features to aid in sea fastening, provide suitable load spreading and accommodate the preferred load-out method for the equipment.
Some large times of equipment do not lend themselves to a transport frame as the item already has a large flat base offering ample load spreading and large lever-arm for stability other considerations such as local point load capacity and bearing points for concentrated loads must still be considered and modification to suit lifting and moving are best done at the design stage.

The main advantage of a bespoke transportation frame is the very fact that it is bespoke. This allows the frame to be designed to meet the specific needs of the equipment such as spanning and supporting it at any inherent strong points the structure may already have as well as avoiding any weak points with little inherent structural strength, and then allowing a variety of options for static and dynamic load transfer from heavy lift equipment through the frame and into the native primary structure behind. It also allows for the incorporation of external securing points on the equipment and allows for integration into any existing temporary interfaces such as bolted connections or lifting points.

Another key consideration when transporting any large and/or heavy item of equipment by sea is the transfer of the item from the shore to the vessel or barge. When loading to most conventional ships the item will be lifted by shore or vessel crane. For these operations, it is normal to simply incorporate the lifting eyes into the equipment itself however even when this is possible, it is worth considering how lifting aids or frame might make the lift safer, easier or reducing any internal stiffening needed for just the lifting case. This can be as simple as a frame that ensures any lifting lugs are loaded in one plane only to reduce the secondary stiffening behind a lifting point or it can be much more involved such as the creation of a frame that is used for supporting the equipment from its base while the crane lifts from dedicated points around the perimeter of the frame. This protects the integrity of the cargo as support forces are applied at the strongest locations and lifting locations can be positioned to allow for an even lift and it can double as load spreading under the equipment and serve as a flexible interface between the equipment and a wide range of transportation vessels. If the equipment is being transported on a barge or vessel with RORO (Roll-on/Roll-off) capabilities, then a skidding or SPMT arrangement may be utilised. Where the equipment does not have a framed base or suitable points for trailer/ skidding support then, again, a transportation frame will be required. The frame will act as an interface between the equipment and loading method, offering suitable support points

fig. 03/ large subsea towhead navigating narrow streets

points for the transport equipment and any deck grillage and sea fastening after being loaded out to the vessel.

It is often the case that large, out of gauge items of equipment have small footprints and/or high centre of gravity compared with their height. This can cause large vertical, dynamic loads into the deck and in some cases when the lever-arm of stability is small, tipping can occur at maximum roll angles. In both instances this can cause issues with deck strength limiting the number of suitable vessels for transporting the equipment. When a suitable transportation frame is introduced the frame can be designed to spread the loads over a greater area, increasing the number of available vessels and open up greater options for transportation.

Further to this, the frame can be designed to work in conjunction with other available equipment such as existing grillages which may also be used for the transportation. A further consideration when transporting any item by sea is how the item will be secured. This can often cause problems when not considered during the item's design stages as there may not be suitable securing points on the piece (padeyes, lifting lugs). Further to this it is usually not possible to add these or weld to the item and this results in a complicated securing arrangement. A transportation frame allows for a securing method to be designed as part of the structure and allows for the equipment to be secured to the frame (either on shore or on the vessel) before the latter is then secured to the vessel deck. This offers good flexibility with the available securing methods which would not normally be available. The frame can also be designed to accommodate the most appropriate securing method for the equipment such as welded sea- fastening or lashings and does not limit the method to what is available at the time of transportation.

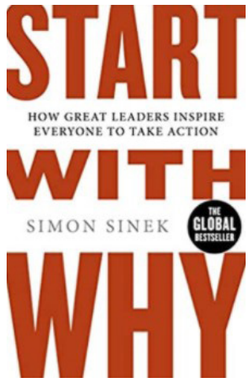
Even when a frame is employed it is often designed with only one item of equipment in mind and might not consider a wider project view. If a fabrication facility was regularly producing the same piece of equipment then reuse possibilities are obvious, however when a number of, at first glance, widely different items are being built as part of a wider programme, consideration for a slightly more complicated frame that can then be used multiple times is worth considering. Cargoes, that at first glance, appear very different may actually be hiding similar patterns of support points and primary structure. A level of flexibility may be designed into the frame so that it can accommodate variances in the equipment that are to be transported reducing overall project cost.

By doing this the cost of fabricating a transportation frame for every item is removed but consideration must be made of the costs for relocating the frame between moves. By enabling it to be road transportable, or dismantled (possibly by way of bolted connections) this could allow for a much reduced cost of transportation.

Essentially, designing and fabricating a transportation frame for any large and/or heavy item of equipment should always be considered and ideally at the early design stages. This could provide huge benefits in both cost and time both in late modifications to a structure near the end of build, after painting and outfit and in the selection of heavy lift equipment and partners to bid for the transport.

BOOK RECOMMENDATIONS...

438 DAYS
BY JONATHAN FRANKLIN



On the 17th November 2012, José Salvador Alvarenga and Ezequiel Cordoba set sail in a 7m open top fibreglass skiff from the coast of Mexico for 30 hours of fishing. With the exception of a terse radio message he was not heard from again until the 30th January 2014.

During that time he had drifted an estimated 6,000 miles over a period of 438 days and made landfall in the Marshall Islands.

The book tells his story, surviving, thanks in no small part to floating debris. Discarded water bottles were one of many things that helped save his life, rigged into sea anchors as well as allowing him to store water when it rained.

It is sobering to think that irrespective of the size of the pacific ocean, one man floating alone bears witness to an endless choice of detritus ranging from trainers to styrofoam blocks drifting by.

Despite some controversy surrounding the writing of the book, it tells a magnificent tale of survival and what we are capable of under extreme duress.

GALE FORCE 10 - THE LIFE AND LEGACY OF ADMIRAL BEAUFORT
BY NICHOLAS COURTNEY

I suspect everyone in the UK reading this magazine will have listened to the Shipping Forecast at some point. But Sir Francis Beaufort did so much more than contribute his surname to the famous wind speed chart for seafarers.

Not only did he have a distinguished Naval career, but at the age of 55 he was appointed British Admiralty Hydrographer of the Navy. For the next 25 years he oversaw the development of the collection of sea charts that seeded the british admiralty chart collection used by over 90 percent of ships trading internationally.

The book is a treasure trove of anecdotes and hidden surprises - from the revelation that he was Robert Fitzroy's mentor, to the fact the he was instrumental in securing Charles Darwin a place on the Beagle.
If you enjoy this book then it will set you on a path of Patrick O' Brian, C. S. Forester and the fantastic, little known gem by Harry Thomson "This Thing of Darkness". The latter book is a semi fictional account of HMS Beagle's trip exploring Tierra del Fuego and the complicated and tragic relationship between Charles Darwin and the Beagle's temporary Captain, Robert Fitzroy.

A Malin Group PUBLICATION