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Alternative heavy lifting

C&A

heavy lifting

Two issues ago our heavy lift feature concentrated on the large capacity All Terrain and crawler cranes as well as the latest ultra-heavy lift cranes including the 'Focus' a 24,000 tonne capacity mega crane concept from Mammoet and Stooft Engineering.

But how do you carry out a lift when a crane is not a practical option? This month C&A looks at alternative methods of lifting and moving loads using gantries, jacks, hoists, strand jacks and heavy duty fork trucks. We travel to Enerpac in the Netherlands and one of the world's leading manufacturers of high pressure

hydraulic systems for lifting and shifting heavy loads, and pay a visit to Pooler-LMT - the international distributor for Versa-Lift high capacity lift trucks - and chat with its managing director Bob Pooler. Finally, report on an application which combines several lifting methods to solve a tricky problem...

Working under pressure

Enerpac is one of the world's leading manufacturers of high pressure hydraulic products and solutions for lifting and positioning heavy loads. With facilities around the world, its range runs from the smallest hydraulic jack to complete, computer-controlled, jacking systems. Mark Darwin visited Enerpac's manufacturing facility in Hengelo, The Netherlands, to find out more about one of its two main divisions - Integrated Solutions.

Enerpac was founded in the USA in 1910, originally producing water pumps for the Ford Model T. It was not until the 1920's that it introduced its first hydraulic jacks and finally in the 1950s its Industrial Products division was formed using the brand name Enerpac. The company is still based in Milwaukee and is now the market leader for

hydraulic tools including cylinders and pumps, torque wrenches and presses. It has eight manufacturing facilities and produces more than 50,000 products distributed globally through 1,400 distributors.

Around 20 years ago demand for larger lifting applications caused many of its customers to seek help in combining its products, for example, cylinders and pumps into custom lifting solutions. This stimulated the company to invest in the area adding engineers to work with customers to create bespoke solutions.

In the early days, this service was centred around its office in Spain for applications worldwide. One of its largest and most high profile contracts at that time was the Millau Viaduct in France, with Enerpac supplying the bridge launching system for the iconic structure.



Enerpac SBL900



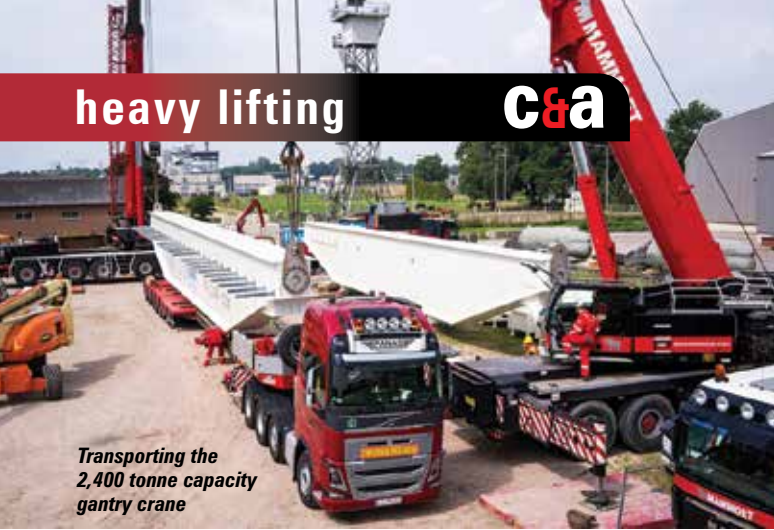
The Enerpac SHAS sync hoist

This was really the beginning of the Integrated Solutions business and in 2009 the company officially split into two specific divisions - Industrial Tools and Integrated Solutions. Although by far the smaller of the two, Integrated Solutions had huge potential and expansion through acquisition was the chosen route. Two companies were added in 2010, jacking specialist Hydrosplex based in Hengelo, and engineering company

Team Hydrotec from Singapore. Hydrosplex was a family owned business transformed by Tjerko Jurgens from a hydraulic cylinder manufacturer into heavy lift jacking specialist with products that included strand jacks, hydraulic gantries and skidding systems sold to leading heavy lift companies including Mammoet, Sarens, Burkhalter and Bigge for major projects such as the London Eye and the salvaging of the sunken



Enerpac has recently launched a range of SPMTs



Transporting the 2,400 tonne capacity gantry crane



Enerpac MBL Series



Testing the jack-up system for the Reunion project at Hengelo

drive system for the Las Vegas High Roller - the world's largest observation wheel - and providing a 4,800 tonnes capacity heavy lift bridge, the largest in the world, to help erect a ring road around Reunion Island, off the coast of Madagascar.

Standard product types

Hydraulic gantries

Hydraulic gantries are a safe, efficient and cost effective way to lift and position heavy loads such as generators and transformers in applications where there is insufficient space/headroom for traditional cranes. Easy to set up, gantries used with rail systems can also move and place the load. As mentioned above Enerpac offers three series of hydraulic gantry - the cost effective Super Lift, the heavy-duty Super Boom Lift which can lift up to 1,000 tonnes and the Mega Boom Lift series which uses a two-leg configuration to achieve lifting heights of more than 12 metres. Features include self-contained hydraulics and electrics, self-propelled wheels or tank rollers and Enerpac's Intellilift wireless control system which provides the operator with information about the stroke, lift and load per unit as well as automatically correcting any unsynchronised motion of the individual units. Accessories include header beams, skid tracks, side shift systems and lifting lugs.

Strand jacks

The strand jack lifting technique originates from the concrete post tensioning principle - think of it as a linear winch. In a strand jack the steel cable or strands are guided through a hydraulic cylinder which pulls it, while wedges grip and hold the cable as the cylinder retracts for another pull, by stroking the cylinder in and out a heavy load can be lifted or lowered. The cylinder is driven by hydraulic power packs - either electric or diesel powered - and

Enerpac uses its SCC software programme to synchronise and control the movements. Two strand diameters are used - 15.7 and 18mm - with maximum capacities of 500 tonnes and 1,250 tonnes respectively. Enerpac strand jacks are used by many of the leading heavy lift companies, for example, Mammoet and ALE to lift bridges, roofs and other structures.

Skidding systems

Although skidding techniques have been used for centuries, Enerpac has applied high-pressure hydraulics for its HSK systems. Three systems are available - HSKB-Series (Skid Shoe Beam) which uses a tall skid shoe with built-in push/pull cylinders. Skidding direction can be easily switched by flipping a lever on the attached gripper box. The HSKJ-Series (Skid Shoe Jack) which is similar to the HSKB but with a built-in cylinder for lifting or levelling the load and the HSKLH-Series (Low Height Skid Shoe) with low height skid shoes that can be linked together with the push/pull cylinder connected to the first shoe.

SPMT's

Enerpac has also entered the self-propelled modular trailer (SPMT) market, developing an 'easier to use' trailer. The SPMT600 Series

is a three axle per trailer modular system - with each trailer having a capacity of 60 tonnes - low height, slim design and remote wireless control make it highly suitable for confined spaces. It also means that two trailers and a power pack can be shipped inside one 20ft container.

Self-Erecting Facility Hall (SEFH)

The latest product just released is a mobile maintenance facility - a fully contained, easy to erect covered building which includes a 70 tonne overhead crane with strand jack which can travel the full length of the hall. Transported in 10 standard containers, the SEFH to be erected in remote areas. It includes a tightly closing overall cover to keep the climate inside bearable.

Synchronous lifting systems

Enerpac's family of EVO synchronous lifting systems provide precision controls for most lifting/lowering applications. Its PLC-control uses feedback from multiple sensors to control to automatically adjust the oil flow to each cylinder, to lift or lower any large, heavy or complex structure, regardless of weight distribution. The system maintains very accurate positional control and eliminates manual intervention, helping increase the productivity and safety of the

Russian submarine, the Kursk. (See interview Cranes & Access Jan/Feb 2005)

The addition of these companies allowed Enerpac to expand rapidly, partly due to new gantry products, increased engineering specialisation and expanded distribution in USA, Australia and China.

The expansion of the standard product range has allowed it to move away from 'one-off' specials. Over the past five years a more modular design and greater component commonality was applied. For example, base-frames on the Super Boom Lift SBL900 and SBL1100 are the same. There are now eight gantry models in the SL (Super Lift), SBL and MBL (Mega Boom Lift) range with capacities from 60 to more than 1,000 tonnes. This covers between 80 and 90 percent of customers' needs, but also allows faster production, shorter delivery times and cost savings. Over the past few years, the division has invested in strand jacks and skidding systems and has recently launched a new modular trailer. They have also provided solutions for several signature projects including the erection and



Enerpac vertical cask transporter

lift. PLC-controlled synchronous lifting systems reduce the risk of bending, twisting or tilting, that can be caused by uneven weight distribution or load-shifts between the lift points. The system can control up to 48 lifting points and has an accuracy of up to one millimetre with built-in warnings and stop alarms.

The same principles of synchronised lifting have been applied to Enerpac's JS-Series jack-up systems (see the Fore River bridge project below) and the Sync Hoist System (SHS) to provide high precision high load manoeuvring, vertically and horizontally using one crane. Features of the SHS series include the reduced risk of damage from oscillations of the wire rope due to sudden

crane starts and stops, weather conditions play a less critical role, intelligent hydraulics turn lifting into high accuracy hoisting and load positioning system and there is also a cost reduction when compared to conventional load positioning methods.

Using a single crane reduces risk, cost and improves operating speed and worker safety. The synchronous hoist system can be used for pre-programmed positioning, tilting, aligning and high precision horizontal and vertical load positioning.

Standard products

Standard products now account for about 60 percent of the business - the remainder being the one-off special contracts,

such as the Fore River Bridge (see application). The advantage says Enerpac is that it designs, develops, manufactures, assembles and tests in-house, which is much smoother and quicker than if parts of the process were sub-contracted around the world. Enerpac sells its products and systems to both rental companies and end users, and will supply engineers for short periods to help train users on the project, only leaving when the local staff are competent. It can devise custom solutions based on standard products or products it has used in the past, to develop a system that provides the needed solution. If standard products are not able to



The pier positioning system on the Vinci Reunion Island project

the job it will consider designing and manufacturing a special one-off for the contract.

New bridge over the Fore River

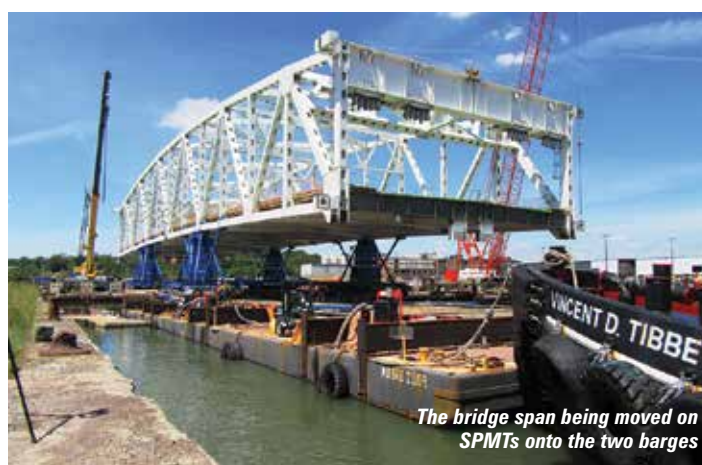
The temporary lift bridge over the Fore River between the Boston suburbs of Quincy and Weymouth, Massachusetts constructed in 2002 was recently replaced, through the state's Accelerated Bridge Program, as it could no longer safely carry the 32,000 cars that cross the river every day. The replacement steel vertical lift bridge was installed almost alongside the old structure and has an expected life span of 75 years.

Costing \$272 million, the new bridge has a much better clearance height when raised - 76 metres compared to 53 metres - allowing larger ships to pass into the Fore River's port area. With an improved 18.2 metre vertical clearance in its lowered position, most sailboats can also pass beneath the new bridge without the need to raise the lift span.

Challenges included building a bridge that would function well in cold and/or windy conditions with minimal long-term maintenance and minimal disruption to vehicle and water traffic during construction. Safety, as always, was a primary concern, particularly while lifting heavy loads into place from barges. Work began in 2013 constructing the pile foundations to support both the new road and the two lift towers which raise and lower the central bridge section. At the same time about half a mile down river, the 1,360 tonne steel lift span was constructed near the quayside.

Once ready Columbus, Mississippi-based Burkhalter Rigging attached four jack-up towers to the bridge section and then jacked all four towers up to load them on four, eight axle line SPMTs - one under each jack-up tower. They were then driven onto two side by side barges and once on board, the span was raised to 20 metres - the height needed for installation.

Burkhalter used Enerpac's JS-500 jack-up system with a capacity of 500 tonnes per tower - to lift the 1,360 tonne bridge span. Each leg of the jack-up tower contains four cylinders which lifted the load in one metre increments, with the one metre deep by two metres square tower boxes inserted using an automated system on each cycle. Once at the full 20 metre height, the barges were moved up river by tugs, passing under the old bridge before being manoeuvred into position between the newly constructed bridge towers. Once in position the jack-up system lowered the new



The bridge span being moved on SPMTs onto the two barges



The bridge span was floated into position



The new lift bridge span almost in position

span onto the lift mechanism. The connecting road was then completed and the old bridge removed. Despite challenges including potential storms, general bad weather and

working on moving water affected by two high tides and two low tides every 24 hours, the lift went off without a hitch.

High flyer

There can't be many people that specialise in heavy lifting and also have a business flying and selling aircraft. Mark Darwin visited managing director Bob Pooler of Shropshire based Pooler-LMT (Load Moving Technology) to find out more...

Bob Pooler has been in the heavy lifting sector for four decades and for the past 30 years or more with Pooler-LMT which specialises in the sales of Versa-Lift and Lowry heavy duty fork trucks together with other specialised lifting products such as gantries, Steerman Skates, hoists and jacks. The company has also recently been appointed Enerpac Integrated Solutions dealer for the UK for the sale of hydraulic gantries, jacking systems and modular trailers.

Pooler also has a passion for aviation and runs Aviat Aircraft UK which sells American built Aviat Husky two seat bush planes and Pitts high performance aerobatic aircraft. He is a CAA authorised aerobatic display pilot and during the summer months performs at local airshows, weddings and other public events. He is also chief flying instructor at the nearby Sleep Airfield near Wem just north of Shrewsbury.

His long history in cranes and heavy lifting started as a sales rep and technical manager for Sparrows Crane Hire in the UK in the 1970s. Before moving into the heavy lifting industry he worked for Villiers Engineering Company in Wolverhampton as a development engineer primarily working on the Starmaker, a 250cc two-stroke single cylinder engine that powered



Bob Pooler

Peter Inchley and his Villiers Special motorbike into third place in the 1966 Isle of Man TT race.

During his nine years at Sparrows, Pooler loved the heavy lifting business, particularly solving lifting problems. By the time he left the company he was manager of the heavy crane division.

"It was the heyday of UK crane hire when I was at Sparrows and I loved it. The company had the foresight to make large investments into the new large cranes and during that time purchased a £2.5 million, 1,000 tonne capacity Gottwald - the biggest in the world at the time - bought on spec without a particular contract in mind. However as soon as it was delivered it went straight out to work on building an oil refinery in Kalimantan, Indonesia and then on to New Zealand to undertake similar work."

After several years gaining



Pooler has a passion for aviation and also sells Pitts high performance aerobatic aircraft such as the one above

experience Sparrows shipped him off to the USA for five years where he became heavily involved with all the major US contractors such as Bechtel and Brown and Root.

"I was selling the company's lifting services to the US contractors building refineries in the Middle and Far East. Not wishing to return to the UK when my five years was up in the mid-1980s, I set up own company and was approached by 4-Point Lift Systems - the leading manufacturer of hydraulic gantries and lifting technology - whose equipment transformed certain sectors of the industry."

"Prior to using the gantries, the accepted method of lifting a 100 tonne press crown was in stages using a six inch stroke hydraulic jack and railway sleepers. The whole process had to be repeated so many times and two weeks later you ended up with a bird cage of timbers and the 100 tonne press about six metres in the air. It was time consuming and dangerous work and was totally transformed by using hydraulic gantries. Half a day was required to rig the gantry with beam and slings to lift the press in one go and then be moved into position and lowered. Two weeks work now took just half a day, transforming the safety and efficiency of lifting

and moving presses. Even if you could have managed to get a crane into position, it would be enormous and the cost astronomical. If you were a contractor erecting presses and machines and didn't have this equipment you were simply not competitive. You had to own a gantry."

Product developments

"Products have developed since then with improvements in the hydraulics along with the operating and control systems. The levelling and safety features in particular are much better as well as the cylinder designs. The long stroke cylinders need more overlap and tighter tolerances to prevent the banana effect from side loading when extended. Originally they used lift cylinders from large dump trucks which were not designed for high capacity vertical lifting. Later the cylinders were surrounded by a sliding box structure designed to handle the side loadings. Now we have a blend of the two - the smaller capacity gantries use simple cylinders, while the larger ones are boxed. Originally capacity was 400 tonnes rising to 800 tonnes."

Pooler was still working in the USA when strand jacks up to 600 tonnes became popular and he began



Pooler-LMT is the international dealer for Versa-Lift fork trucks



It also specialises in other lifting products such as gantries



Steerman LX skate kit.

working for PSC Freyssinet which adapted concrete pre-stressing technology to create a range of strand jacks. After he returned to the UK, 4-Point Lift Systems asked him to be its UK distributor and he sold the first system, a 400 tonne unit, to Lifting Gear Hire in Manchester. Having built a successful business though the late 1980s and the 1990s he established Steerman Engineering - alongside his distribution business - to manufacture machinery skates with nylon wheels. These had a number of novel features and were ideal for moving heavy loads up to 100 tonnes in industrial environments.

Steerman skates

While there were other manufacturers producing this type of equipment they were using welded parts which affected overall quality and performance. Pooler decided the best way to maximise the strength of the skate was to make the frame out of SG or malleable iron which has the benefits of cast iron but is not brittle and can take large loads. Another critical feature was the size of the wheels he used, which unlike the competition were narrow



One of 11 Versa-Lift's owned by Charles Russell Transport

enough to minimise scrubbing when turning a corner. The company and the products enjoyed considerable success to the point that he sold it to Yale Industrial products - now Columbus Mckinnon. Pooler is now the distributor. "It is weird selling products that we used to design and manufacture," he says.

Versa-Lift trucks

However the company's main product now is the Versa-Lift range of fork trucks. Pooler met Gary Dick - the designer and manufacturer - at an SC&RA meeting in Texas in 1999. Dick had just started building the first Versa-Lift truck, a blend of heavy fork lift and mobile crane. Features include a hydraulic vertical lift crane at the front, balanced by an extendable counterweight at the rear which increases lifting capacity by 40 percent when extended to its 1.2 metre maximum. Pooler brought the technology back from the USA selling the first unit to Alan Morris of Doncaster-based rental company AEM Lifting. Morris was initially interested in another fork truck Pooler was selling - the Lowry, a seven tonne Hyster, modified and beefed up to handle 10 tonnes - but changed his mind and ordered the Versa-Lift after looking at the specification sheet. Although Pooler had planned to rent machines as well as selling them, this initial sale to AEM, along with 20 more over the years - meant Pooler remained as a distributor and left the rental side of the business to others.

At the start there was only one Versa-Lift model available - the 40/60 with a 27 tonne capacity - but this has now grown to four models, ranging from the 25/35 to the 100/140.

"The Versa-Lift model numbering is quite easy to understand,"



Enerpac hydraulic gantries

says Pooler, "the first figure is the lift capacity in thousands of pounds with the counterweight retracted, and the second the capacity with it fully extended. So the smallest Versa-Lift 25/35 lifts 25,000lb (11,330kg) with the counterweight retracted and 35,000lbs (15,875kg) when extended.

Pooler-LMT is the international distributor for Versa-Lift covering most of the world apart from North and South America. There are currently around 120 units operating in the UK with AEM Lifting running a fleet of 20 rental machines while others such as Charles Russell Transport has 11 operated for their own contracting work. Only three of the largest 100/140s have been sold by Pooler - one in the UK, one in Germany and one to South Korea.

"We expected companies in China and the Far East to start copying the trucks but, so far there has been nothing," says Pooler. "The factory in the States is still family run and produces nine units a month.

We had a record year last year selling 35 machines, mostly in Europe, with the UK being the largest market. These machines last indefinitely when looked after - every machine we have sold since 1999 is still working. They also hold their value amazingly well - last year three 10 year old machines



Lowry forklift

were traded against new machines and the trade in value was exactly the same as the owner had paid for them new! They are still very popular and there is normally a waiting list."

Pooler still sells Lowry fork trucks however the company is owned by Manitex Lifting and Lowry's are a totally new design. The range fits in well beneath the Versa-Lifts - the largest Lowry is about 18 tonnes, while the smallest Versa-Lift is 16 tonnes.

Latest products

Pooler has also recently taken on Enerpac Integrated Solutions as sole dealer in the UK for its range of gantries, modular trailers and strand jacks. It has just delivered its first new Enerpac system - a 125 tonne, four leg SL125 system - to a specialist heavy lift and transport company in Nottingham. The system was earning money for the company the day after it was delivered.



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Skidding solution at mill

Installing two new boilers at Evergreen Packaging Canton paper mill located at the foot of the Smoky Mountains of North Carolina, USA presented huge logistical challenges which lifting specialist AME was called on to solve.

The boilers - each weighing 72.5 tonnes and measuring 14.6 metres long, by 3.65 metres wide and 4.8 metres high - were delivered by train to the mill's rail head. They then had to be unloaded and moved 60 metres to their final position, passing under a low overhead restriction, lifted into place and installed, all while the mill remained fully operational.

AME unloaded the boilers from the railcars with a gantry system, and when the plant was ready a 500 tonne Grove GMK 7550 All Terrain crane lifted the boilers with the help of a large spreader beam, slewing through 90 degrees to set them onto a 270 tonne capacity HT300 heavy track Hydra-Slide skidding system for the 61 metre ride to their final resting place. Clearance under the plants' overhead services was just 100mm but once through the restrictions there was more room and a second gantry system was used to lift the boilers into place.

Many complications

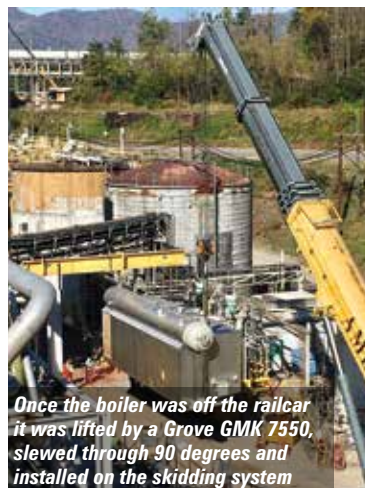
"The project had a number of complications to be overcome," said Jason Walker, senior project engineer at AME. "The rail head had

to be left free to allow uninterrupted use for production, the boilers had to pass through a low, narrow opening, and the weather could not be allowed to affect the already tight installation schedule. Also, the proximity of hazardous materials in chemical storage meant that every crew member had to carry emergency evacuation respirators throughout the process."

The HT300 was onsite for a month, including a week for delivery and assembly, two weeks in use and a final week for disassembly and load out. It took around three days to move each boiler from the rail lines to the foundations including delays caused by the ongoing operation of the mill, such as trains coming through the work area as well as steel and piping deliveries for other trades. However even with the delays, each boiler completed the 61 metres in around six hours.

Complete package

Hydra-Slide operations director Robert Young - on-site for the installation of the first boiler - said: "This was an exciting project and AME engineered an impressive, detailed multi-lift plan involving



Once the boiler was off the railcar it was lifted by a Grove GMK 7550, slewed through 90 degrees and installed on the skidding system



Transferring the boiler from the Hydra-Slide to the second gantry for installation on the foundations



The boilers had to be skidded into the mill under a pipe gallery and between two structures, with just inches to spare on all sides



Close up view of the boiler on the HT300 skidding system, travelling into the mill



The boiler was skidded using a 10-1G power unit and HT300 skidding system from Hydra-Slide. The equipment was chosen for its low profile and simple mobilisation

gantries, mobile crane, numerous material handlers and the HT300 skidding system - all working within an operating paper mill."

"The HT300 - suited to moving, loading or unloading all types of heavy loads where a rigid, load carrying track is required - presented an alternative to several other solutions considered by the AME team, including beams and dollies, plates and dollies, and multi-line transporters."

"The system has a total height of 180mm, saving jacking time and making it suitable for applications with reduced heights. The ratchet track design allows continuous movement and automatic resetting of push cylinders with no need for anyone to be close to the track during the move. The track and

skid shoes are fully bi-directional so loads can be moved in either direction by simply repositioning the push cylinders."

Walker added: "It was the only complete solution considering the dimensional constraints, safety and engineering concerns and speed and control issues, while offering ease of use and functionality. We needed a solution that was pre-engineered, simple in design and effective regardless of weather conditions. I wouldn't say the HT300 was purchased exclusively for this project, as we have been considering a system for some time, but it was the obvious choice in this instance. We intend to have the system for a very long time and it will replace the old practice of using beams and dollies."