SPS TECHNOLOGY

Structural Composites Engineered for the 21st Century

Maritime

SPS is a structural composite material used in a wide variety of repair and strengthening projects in the maritime and offshore sectors.

SPS comprises two metal plates bonded with an elastomer core, delivering high strength. SPS may be used for new construction, repair or reinforcement of existing structures where the plating is wasted or where the function of the structure needs to be enhanced.

The use of SPS is a safe, fast, low risk, simple, proven, economic and Class approved permanent method of repair and strengthening that can be completed in drydock, afloat or in-service. SPS removes the need to crop out original steel as the existing structure forms one element of the new composite.

SPS has been used in the maritime and offshore industries since 1999 for a diverse and innovative range of repair projects. No hot work and low heat SPS solutions have been available since 2003.

Repair and strengthening applications

Tank tops

SPS delivers an improved, impact resistant and permanently flat surface. Dishing is eliminated leading to easier, more efficient cargo handling, reduced turnaround times and improved long term operational economics. Maintenance costs are reduced as a result of enhanced resistance to wear and corrosion.

Side shells

Protection to side shells from impact loads from cargo handling cranes, off-loading and supply vessel berthing is provided through the installation of SPS. The SPS strengthens the existing structure and improves its load sharing capability to provide enhanced impact protection.

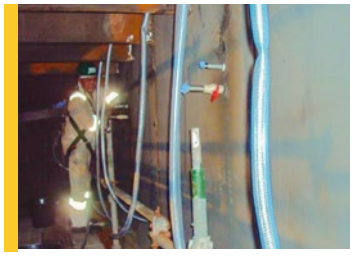
Passenger and vehicle decks

SPS offers a fast and economical repair close to operational routes. Steelwork and SPS installation can be undertaken whilst vessels are in-service or in transit to a yard to eliminate or minimise time out of service. Adjacent and under deck services are not disturbed, reducing project risk.

Ice class upgrade

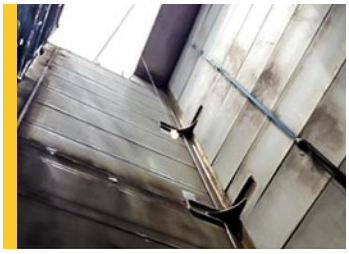
Through the application of SPS to the ice belt region, vessels can be upgraded to ice class rating. It is a simple, cost-effective method that improves the lifetime performance of a vessel.

Bulkheads



The installation of SPS onto vertical surfaces enables bulkheads to be reinstated and strengthened. Structural integrity is maintained throughout the process, facilitating in-voyage repairs or shortened docking maintenance.

Thermal insulation



SPS can be used to create thermal boundaries enabling operators to, for instance, maintain different but very stable temperatures in individual tanks and optimise tank storage.

Vibration damping

Through the application of SPS to affected areas, sound and vibration issues can be rectified. The SPS elastomer core greatly reduces the propagation of vibration and noise through the steel structure.

Pipe repair

A permanent Class approved pipework repair solution used where structural integrity, containment or protection against corrosion is needed. Can be installed whilst the pipe is in-service and is a no hot work bolted design.

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Dropped object protection

SPS has been used on the decks of heavy lift vessels, barges and pontoons to provide protection from heavy dropped objects. SPS spreads the load and prevents puncturing of the steel deck.

Fire protection

SPS has exceptional resistance to fire. It is an extremely effective barrier to heat, flames, smoke and toxic gases. It will help to contain a fire and prevent it spreading to adjacent compartments, greatly limiting the growth of a fire through a structure. A 25mm SPS core provides an A60 barrier. SPS also has H120, H60 and J60 certification.

Helidecks

Strengthening helidecks can be achieved through the installation of SPS with limited under-deck structural strengthening. With minimum added weight, the resulting deck has greater stiffness and improved load carrying capacity.

Grooving corrosion

SPS is able to offer a repair solution for corner areas and joints between bulkheads and decks where sitting water propagates corrosion. Repairs can run along joints, eliminating fatigue and strengthening the structure.

Tubular repairs and strengthening

It is possible to repair these chambers from the outside whilst a vessel remains in-situ and in-service. Curved panels are adhered to the exterior and the void injected with the SPS elastomer core to reinstate or increase structural strength and integrity.

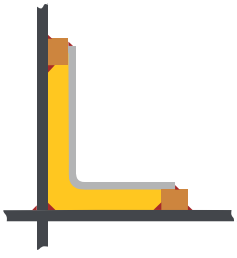
Link-span bridges

SPS can be used to reinstate and strengthen port infrastructure, including link-span bridges. Careful project planning and execution can ensure that vessel dockings and sailing schedules are unaffected.

Flat deck

Curved shell

L-shaped



- existing steel members
- elastomer core
- new steel plate
- perimeter bars
- weldings

For more information contact: **maritime@spstechnology.com**

Benefits

- Faster repair schedules, minimal labour and reduced downtime
- Non-disruptive, safe, permanent repairs
- Reduced repair costs, lower operating costs and increased revenue potential
- Class approved permanent solutions

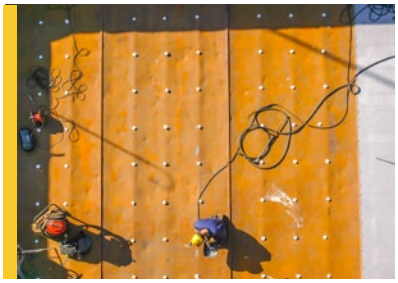
SPS has a strong track record in the maritime industry with hundreds of projects completed around the globe. Vessels and structures include:

- RoRos, car carriers, freight and passenger ferries
- Cruise ships
- Bulk carriers and tankers including capesize and panamax vessels
- Offshore vessels and structures including FPSOs and FSOs, drilling rigs, semi-submersibles and OSVs
- A wide range of other vessels and structures from barges, dredgers and floating pontoons to helidecks

Better economics

Shorter repair schedules lead to lower repair costs.

Considerably faster than crop and replace, the use of SPS saves significant downtime for operators. Work in adjacent areas is able to continue in parallel and, as the existing structure remains intact, shortened project schedules are predictable and maintained. Risk is reduced as attached services and pipe runs are not removed. An SPS repair requires up to 90% less labour and 56% less steel than conventional crop and replace repairs.



Faster installation

Repair projects can take place whilst a vessel is in-situ and in-service. It is possible to undertake repairs in tight, restricted areas, with limited access. A range of elastomer injection machines have been developed to facilitate such projects. Equipment ranges from self propelled machines for large areas, such as tank tops and vehicle decks, to small machines which can be air-freighted and easily moved into tight areas. Projects can be completed in sections to minimise disruption and can be undertaken from above or below deck.

Improved solution

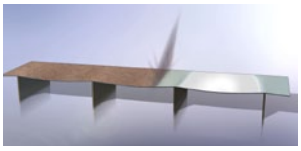
Improved in-service performance leads to lower operating costs.

The high impact resistance of SPS limits operational damage to the vessel's structure and coatings. An SPS surface will remain flatter for longer, improving cargo loading and unloading efficiency.

SPS repairs lead to enhanced fatigue resistance, extended service life, can improve load capacity and achieve a weight neutral deck.

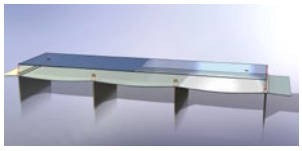
Typical SPS repair

1 **Prepare** existing surface



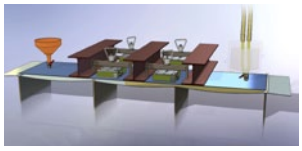
Grit blast and clean

2 **Create** cavities



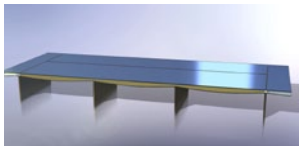
Fit perimeter bars and new top plate to form an airtight cavity

3 **Inject** elastomer core



Temporary restraint beams positioned and cavities filled

4 **Repair** complete



New, flat, impact and vibration resistant surface

Performance

Repair & strengthening

SPS can be used to reinstate and strengthen vessels and structures without needing to crop out existing worn and corroded plating. The inherent efficiency of the composite means that plating that is corroded beyond Class Society allowances can be utilised.

Approvals

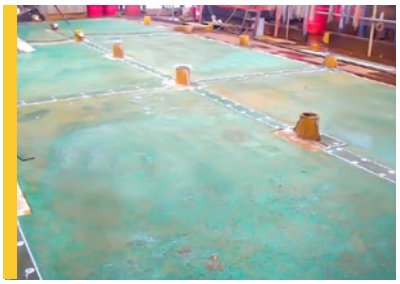
SPS is approved by all major Classification Societies as a permanent solution. We will work with you to design and specify an SPS solution and secure Class approval.

Maintenance

SPS eliminates local buckling, is less susceptible to fatigue, corrosion and the formation and propagation of cracks.

Blast and ballistics

Tested by major defence institutes, SPS is proven to absorb more blast energy through membrane action than equivalent all-steel structures, resisting rupture and maintaining structural integrity. SPS resists projectiles at shorter strike ranges and higher angles of attack. It has been proven to be 70%+ more efficient than stiffened steel. It can also withstand extreme loads and absorb impact energy efficiently.



Vibration damping

The damping coefficient of SPS is up to 5 times greater than steel, which helps to reduce the amplitudes of vibration and improve comfort and safety for crew.

Health & Safety

SPS repairs reduce a project's complexity as steel is not cropped out. The integrity of attached pipes and service runs remain intact as there is no risk to them through steel removal. Fewer trades are required at yards or on-board, simplifying logistics and optimising the health and safety of workers.

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Case studies

P&O, vehicle decks

A total of 916m² of deck was reinstated on board the Pride of Canterbury, Pride of York, Pride of Burgundy and Pride of Bruges at Remontowa Shiprepair Yard, Gdansk in Poland between January and March 2017. These repairs brought the total number of SPS projects for P&O to 28 since 1999. All four vessels had multiple areas that required reinstatement.

"The use of SPS for these repairs was perfect as, on a couple of the vessels, the repair areas were between the bulkheads and deck with pipes and drains littering the area making access difficult. The SPS team had to carefully plan injections and process control as the temperature was colder than we would have liked."

Hans Pronk, Technical Operations, P&O Ferries

FPSO Conkouati, side and bottom shell reinstatement

Operating in the Yombo field, 60 miles off the Congo coast, steel diminution meant that the vessel's side and bottom shell required reinstatement. The vessel remained on-station and continued full production throughout the repair. Areas of the side shell were strengthened externally whilst the bottom shell was reinstated intercostally below the waterline without the need for dry docking.

"SPS was an obvious choice for us. The repairs were not intrusive and were carried out on-station whilst normal operations continued on board. The equipment used for the job was small and portable and meant that its movement did not cause major inconvenience or involve many people. The work was finished with excellent results."

Miss Klervi Keryhuel, Marine Engineer, Perenco

Korea Line Corporation, tank tops

Over 10,000m² of tank top was reinstated on five Capesize bulk carriers for the Korea Line Corporation. The initial 3,532m² on-board the Silver Bell was completed in just 10 days at Shanhaiguan shipyard in Northern China despite temperatures ranging from -6°C to 3°C. The vessels were all classed with Korean Register.

"We chose to use SPS on five of our bulk carriers because it is a fast repair that delivers flatter, longer lasting tank tops and the results improve our operational costs"

Mr Y S Jeong, Vice President, Korea Line

Volvox Iberia, side shell

110m² of side shell was strengthened in two areas of her port side shell where extra fendering and impact protection was required. The SPS helped to spread the load between side shell frame members, therefore distributing the effects of any side shell impacts.

"We have used SPS on various projects previously and are familiar with its benefits. In this case, we were able to strengthen two areas of the dredger's side shell. We are very pleased with the outcome."

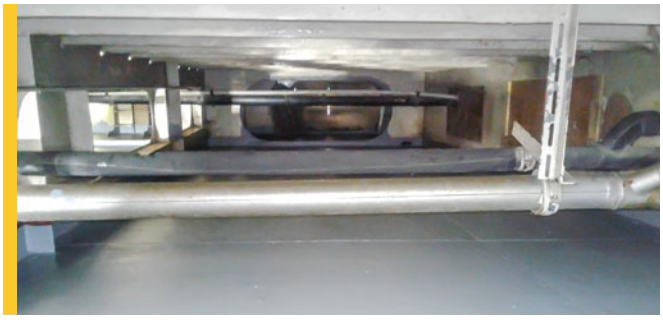
Sipke de Vries, Technical Superintendent, Van Oord

Red Funnel, link-span bridge repair

SPS was used to refurbish Red Funnel's East Cowes link-span. The 220m² bridge deck was reinstated and strengthened using SPS between 10-27 December 2016 with no disruption to scheduled ferry services. SPS and its licensee, SRC, undertook the repair which was completed a day and a half ahead of schedule.

"To maintain an outstanding service to our regular customers was our key priority. SPS was the only way to keep the bridge open and achieve a first class permanent repair. SPS had gone to extreme lengths to ensure that all logistical challenges had been considered and resolved before the start. Red Funnel would thoroughly recommend SPS for link-span repair to any operator."

Commodore Mark Slawson OBE
Fleet and Technical Director, Red Funnel



Queen Mary 2, tween deck reinstatement

During a return voyage between New York and Southampton, an 88m² permanent repair was undertaken onboard Carnival UK's flagship, the Queen Mary 2. The SPS steel reinstatement repair technique facilitated this in-service repair on the tween deck (deck 8) and took just 11 days to complete, 2 days ahead of schedule.

"The team was able to complete the repair under challenging circumstances whilst the vessel was in-service. In order to not impact on our guests' cruise experience, restrictions were placed on when works could be undertaken which the team worked around, delivering the project on time with minimal disruption."

Andrew Menzies, Deck & Safety SME, Carnival UK

Tankers, fuel tank conversion

3 LNG tankers required thermal barriers installed between two heavy fuel oil (HFO) tanks to create a marine gas oil (MGO) tank as part of the shipowner's strategy to meet new exhaust gas emission requirements (IMO MARPOL 73/78 Annex VI). The outcome is that upto 90°C HFO can be kept next to MGO stored at temperatures <40°C.

Allseas Solitaire, tank top

The 127,500dwt Solitaire, one of the world's largest pipe-layers, had 545m² of tank top in hold number 6 repaired using SPS. Undertaken with LR Class approval at United Stevedores in Amsterdam, SPS licensees, SRC, completed all steelwork and SPS injection engineers the elastomer injections.

A second project to reinstate 99m² was undertaken a year later in June 2017.

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