

## Offshore



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

SPS comprises two metal plates bonded with an elastomer core, delivering a 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.

It is a safe, fast, low risk, simple, proven and Class approved 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 is used as one side of the new composite.

SPS has been used in the offshore sector since 2003 for a diverse and innovative range of repair projects. No hot work and low heat SPS solutions are also available.

# Repair and strengthening applications

## Deck strengthening

Pipe rack and accommodation decks both benefit from SPS being used to address their corrosion, strength and impact requirements. With accommodation decks, pipes and service runs remain intact, limiting disruption to day-to-day activity.



## Ice class upgrade

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



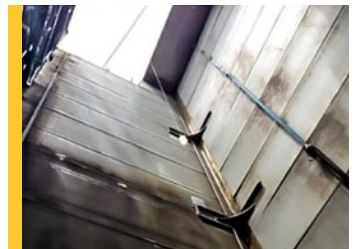
## Dropped object protection

SPS has been used on the decks of heavy lift vessels, barges, pontoons and offshore platforms to provide protection from dropped objects such as drill pipes. The areas reinforced with SPS spread the load and prevent puncturing the steel deck.



## Thermal insulation

SPS can be used to create thermal boundaries enabling operations to, for instance, maintain different, but very stable, temperatures in individual tanks.



## Bulkheads reinstatement

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 reduced maintenance dockings.



## Spud-can reinforcement

Increased structural protection from highly concentrated loads can be provided by SPS. Operational risk is reduced and the vessel's service capability is increased.



## Side shells impact protection

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



## Helidecks upgrade

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.





## Vibration and noise 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.



## Fire protection

SPS has exceptional resistance to fire: it is an extremely effective barrier to heat, flame, 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 throughout a structure. A 25mm elastomer core provides an A60 barrier. SPS also has H120, H60 and J60 certification.



## Grooving corrosion

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



## TSG/SPS pipe repair

A permanent Class approved pipework repair solution used where structural integrity, containment or protection against corrosion is needed. This in-service, no hot work, bolted design is a permanent, class approved solution.



## Caisson repairs and strengthening

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



## Escape tunnel

On FPSOs, an SPS escape tunnel offers protection from explosions and subsequent fires. They offer a safe refuge and a protected means of escape.



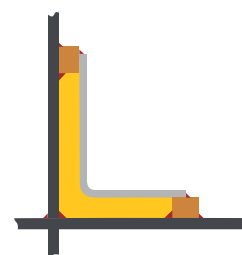
### Flat deck



### Curved shell



### L-shaped



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

# 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

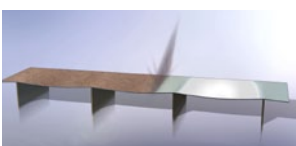
Improved in-service performance leads to lower operating costs.

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.

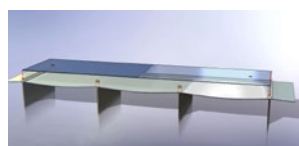
## Typical SPS repair

### 1 Prepare existing surface



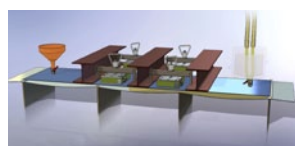
Grit blast and clean

### 2 Create cavities



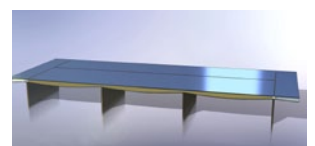
Fit perimeter bars and new top plate to form an airtight cavity

### 3 Inject elastomer core



Temporary restraint beams positioned and cavities filled

### 4 Repair complete



New, flat, impact and vibration resistant surface



## 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.



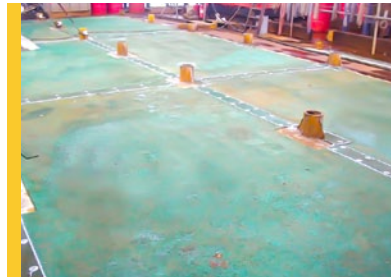
## Maintenance

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 and 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.





# Case studies



## Transocean Legend, helideck strengthening

The helideck on the Transocean Legend was originally designed to support the Sikorsky S-61 and needed to be strengthened to accommodate the increased landing and takeoff weights of a Russian Mi-17. A conventional upgrade would have required the replacement of the existing aluminium helideck, which was an expensive and lengthy solution. This project was completed in seventeen days and used the existing aluminium deck, a 20mm elastomer core and a new aluminium top plate to significantly strengthen the deck.

*"We are delighted with the end result and the speed with which the strengthening took place."*

Guy Cantwell, Transocean



## 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



## Petrobras, side shell strengthening

SPS was used for side impact protection on three Petrobras FPSOs. The vessels, classed by DNV, had SPS installed on boat landing areas adjacent to the cargo oil tank. This work was required to meet the low energy impact resistance requirements of IMO MARPOL Annex I Requirements for FPSOs and FSUs. The SPS created a compact double side shell which exceeds these regulatory requirements. The work was carried out at Enseada do Paraguaçu S.A. Shipyards (EEP) in Brazil and COSCO (Dalian) Shipyard, China.



## BP, EOR tank lining

SPS was selected by BP as a high performance lining for the EOR tanks onboard the Glen Lyon FPSO. A stainless steel lining was required to protect the specialised EOR heat sensitive fluid from contamination and to provide a thermal insulation from adjacent fuel oil tanks. SPS delivered a solution which minimised structural weight yet maximised the tanks' storage capacity.



## Global SantaFe Development Driller, pontoon protection

The 2005 hurricanes highlighted the need to protect critical areas of lower hull pontoons from large environmental loads encountered during severe storms. Global SantaFe identified a particular risk to the thruster rooms located inside their Development Driller 1's pontoons. The pontoons needed to be reinforced to be able to withstand the impact of a 2 tonne drill collar dropped from 30m. After detailed analysis 19-50-existing SPS was specified and installed on the pontoons top.

*"We are very pleased with the increased level of lower hull watertight integrity. The team did a good job of integrating with the GSF and Kiewit site teams to ensure that the work went smoothly. The low risk associated with the application procedure made it a perfect solution."*

Mick Kucharski, Director, Semi Submersible Building Program, GlobalSantaFe

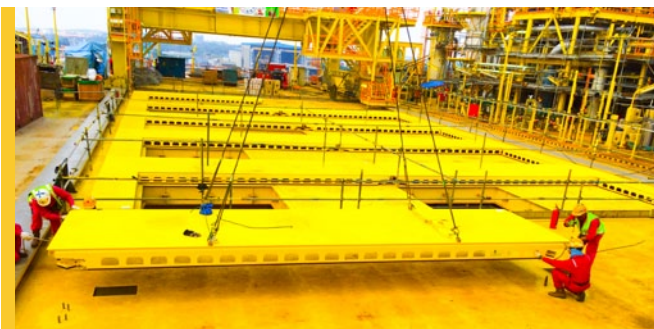


## Petrofac FPSO FPF-003, below waterline repair

Work to repair five separate areas on board FPSO FPF-003, operated by Petrofac South East Asia Pte Ltd, was completed using SPS whilst the vessel was on-station. The areas were: engine room side shell, pump room bottom shell, forward cofferdam bottom shell, bulkhead and a portion of the main deck. Repair locations were in confined spaces and below the waterline.

*"The SPS repair went well. An additional area was identified mid-project for which an innovative solution was proposed by IE and successfully executed. The team on board were all very experienced which enabled the project to progress rapidly and be executed to a high standard. SPS simplifies steel reinstatement on board working vessels. It was the right solution for this project."*

Stephen Blair, EM&I Program



## Tension leg platform, dropped object protection

A 1,014m<sup>2</sup> SPS prefabricated, impact protection deck, consisting of three types of interchangeable modular panels, was installed over the existing deck on a tension leg platform. Depth and weight design constraints were adhered to whilst ensuring that it provides an impact resistant system that prevents rupture of the main deck and minimises the deformation of the main deck plating and members under impact.



## Quad204, escape tunnel

The blast and fire-resistant escape tunnel for the new FPSO Quad204 runs the length of the processing modules and is designed to withstand the harsh environmental conditions of the North Sea and resist extreme emergency loads. Arranged in an innovative double-layer, the SPS panels provide a primary barrier to survive accidental loads from both an initial blast and subsequent hydrocarbon and jet fires so that shipboard staff can escape safely to their muster points.



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