



FLNGs could be the answer to powering emerging economies, says Constantinis. Right: Inspections put workers in hazardous environments – EM&I is developing robotic solutions



Man of integrity

For decades, pioneering engineer Danny Constantinis has designed, developed and introduced a series of new technologies that have helped the offshore sector cut costs and improve the safety of its workers

INTERVIEW / DENNIS O'NEILL

In the offshore oil and gas industry, Danny Constantinis has an unrivalled reputation for engineering innovation. Over more than 30 years, his inspired designs have helped reduce asset downtime, improve operator safety and save major players enormous amounts of money. His approach is inventive and creative, but also pragmatic. Having worked in several sectors and disciplines, he's a keen student of technology used in other industries, particularly nuclear energy, aerospace and civil engineering – and even forestry and medicine.

"There's no point trying to reinvent the wheel," he explains.

"Adapting and using proven technologies from other sectors is the key to achieving rapid development of new innovations in the offshore sector."

It was while working in offshore diving operations that Constantinis first began thinking of better ways to carry out structural inspections, using techniques that would be safer and more efficient than relying on rope access or sending down divers. To promote his ideas commercially, he set up the integrity management company EM&I Group – a move that proved successful very quickly. Today, EM&I Group has bases in Australia, Brazil, Canada, China, Europe, South-east Asia, the US and West Africa.

"When we started the business, in 1986, we set out to be the world's leading asset integrity service provider – and that meant doing things differently," Constantinis explains. "We began by working on fixed installations, but eventually shifted our focus towards marine, floating production and drilling assets. We realised that fundamental changes were needed in the way FOIs [floating offshore installations] and MODUs [mobile offshore drilling units] were designed, operated, maintained and inspected to avoid the expensive penalties associated with unplanned dry-docking and unnecessary shutdowns. That's when we decided to develop robotic alternatives to diving and confined-space inspections and maintenance."

Floating assets

There are estimated to be more than 300 FOIs currently in operation around the world – a figure predicted to increase significantly over the next few years as more oil and gas reserves are discovered in ever deeper waters. Most FOIs operate on long-life projects, often with no dry-docking scheduled for 25 years or more. Coatings and protective anodes therefore have to last for the entire time the vessel is on station, necessitating expensive, and potentially dangerous, intervention by divers or remotely operated vehicles (ROVs) to complete integrity inspections and maintenance.

To tackle these tasks as safely and cost-effectively as possible, Constantinis and his team have designed an impressive catalogue of robotic technologies that are now in constant demand with major international oil and gas clients.

"Our ODIN diverless inspection system is used for hull and valve inspections and repairs, while our NoMan robotic camera systems are used to remotely inspect tanks and pressure vessels on FOIs and MODUs. Both systems have been

adapted from the nuclear industry, where the use of robotic methods is very advanced. We've adapted them to minimise the need to use marine personnel in hazardous areas, at height or in confined spaces.

"We've developed ODIN technology to inspect mooring systems and measure mooring chain and tension leg loads on FOIs and CALM [catenary anchor leg mooring] buoys – methods we believe will be applied to deepwater wind farms in the near future.

"We also have ExPert, a system that enables detailed internal inspection of electrical equipment without having to shut the system down, and LORIS, a subsea robot designed for cleaning, inspecting and, in the future, repairing deepwater mooring chains."

Battling to break through

Constantinis has learned that introducing new technologies into the offshore sector requires the provision of convincing evidence of the benefits to be gained. This is neither quick nor easy.

"The oil industry has traditionally been careful when accepting new

CV: DANNY CONSTANTINIS

With more than 40 years' experience in integrity management in the oil and gas, marine, aerospace and energy sectors, Danny Constantinis is executive chairman of the EM&I Group and project director of the Hull Inspection Techniques and Strategy (HITS) joint industry project, which he created in association with major offshore organisations.

After gaining a BSc in metallurgy, his career began at Hawker Siddeley, where he worked as an inspection engineer on civil and military aircraft, before leaving to become an engineering manager on the construction of offshore platforms, drilling units, aircraft and power infrastructure in Singapore. He then trained as a commercial diver and worked on the Maui gas field in New Zealand, before returning to the UK to work in the development of robotic systems for the nuclear industry.

His many, and varied, maritime engineering innovations include the Donut escape system and TOES self-launching lifeboat system.

He is currently working on the formation of a second joint industry project (FloGas) to address integrity challenges in the floating gas sector.



OFFSHORE ENGINEERING

technologies, even when they have been proven in other industries. This conservative approach is understandable in an industry where mistakes can be catastrophic and cost lives. However, times are changing and new technologies can offer significant cost and work-hour savings over traditional techniques. And, above all, they are much safer.

“My experience is that ‘seeing is believing’, so we regularly host demonstrations at our various technology centres, where clients and regulators can see first-hand how our systems work, and where we can freely discuss ideas, applications and potential improvements with colleagues, regulators and class societies. Often the outcome of these demonstrations is to move to a trial or pilot scheme on an offshore operating asset to validate the idea technically and commercially.”

Underwater periscope

EM&I’s latest innovation, HullGuard, is perhaps its most creative.

“We were approached by a major client to come up with a solution for replacing ICCP [impressed current cathodic protection] anodes on an FPSO [floating production storage and offloading unit] without the use of divers,” Constantinis explains. “So, after considering a number of alternatives, we came up with the solution of an anode that could be inserted through a class-approved access port in the hull shell plating, usually in the engine room, which has sufficient headroom for the ‘periscope type’ anode and its launching tube.

“First, we had to prove that we could drill holes underwater safely, so we conducted tests at the National Hyperbaric Centre in Aberdeen. The tests and special cold-water welding procedures were observed by the

“The ‘wetted area’ of an FPSO hull is around the size of two football pitches, so there is a significant area requiring protection”



The HullGuard system can be easily retrofitted in a fraction of the time required to carry out operations with divers

client and class society, who were both satisfied that it was safe.

“The next step was to design an anode that could be inserted easily through the access port and incorporate a dielectric shield to protect the hull in the immediate area of the anode. A number of ideas were considered, but eventually a tubular style anode with a non-conductive high-strength plastic nearest the hull was adopted. The anode itself is titanium with a mixed metal oxide coating.

“The launching mechanism comes from the hydraulic industry, but is operated by compressed air for ease of use on-site. For an average new FPSO, two to four HullGuard anodes are required. They will be able to cope with a hull coating breakdown of around 7.5%. If more coating breakdown is present, or occurs over time, it can be covered by varying the ICCP current or introducing additional anodes. The ‘wetted area’ of an FPSO hull is around the size of two football pitches, so there is a significant area requiring protection.

“HullGuard anodes can be installed in a fraction of the time required to carry out the operation with divers. Although HullGuard can be easily retrofitted, it makes sense where possible to install the access ports in the yard during the conversion or new-build stage.”

HullGuard can be used as an upgrade to existing ICCP or combined with sacrificial anode systems for life-extension projects or to replace existing anode systems.

“It’s a solution that can also be used on drillships, MODUs and FLNG [floating liquefied natural gas] assets.”



Future opportunities

Constantinis believes that the FLNG and floating storage and regasification unit (FSRU) sectors present the greatest future opportunities for his company – and for young people thinking of taking up a career in the offshore industry.

“FLNGs and FSRUs are developing fast, because liquefied natural gas is a relatively ‘clean’ and well-proven technology for producing power, particularly for emerging economies with little or no infrastructure. There are hundreds of existing gas carriers that can be readily converted to FSRUs, so the market has great potential to grow rapidly.

“A 1,000MW gas-fired power station can be built in just 18 months and supplied from an FSRU that can receive gas from anywhere in the world. It’s probably the simplest, quickest and most economical solution for providing reliable energy.

“This is one of the most exciting and progressive periods I can remember in this industry. Robotics are enabling us to reduce the risks of putting people into hazardous situations, and digital methods are helping us to use the vast archives of data we’ve accumulated over the years to reduce inspection work scopes, predict trends more accurately, improve maintenance efficiency and – above all – enhance safety.

“There’s never a shortage of challenges to keep us occupied.” ■