

STRIKING A

Danny Constantinis,
Executive Chairman and CEO,
EM&I Group, Malta, considers
LNG safety culture in the era of
artificial intelligence.

At the company's Malta head office, EM&I recently received two calls in quick succession. The first was from the Global SHEQ Manager with news of a safety award that had been bestowed upon the company. The second was from the Director of Operations, providing an update on an ongoing incident offshore Brazil. One of the company's highly valued inspection ROVs had become entangled underwater in the hazardous 'spaghetti junction' of a floating production vessel, surrounded by risers, cables, piping, and associated production plumbing.

This scope of work was being managed from the new Onshore Command Centre in Macaé, Brazil, where remote operations of multiple remotely operated vehicles (ROVs), in this case from about 200 km away, had become a necessary reality – true robotics at work.

Despite safety award certificates from global safety institutions on the walls, the question always lingered: "Robotic technology is advancing rapidly, but what might be missing, and could the advent of machine learning (ML) and artificial intelligence (AI) help reduce safety and other risks?"

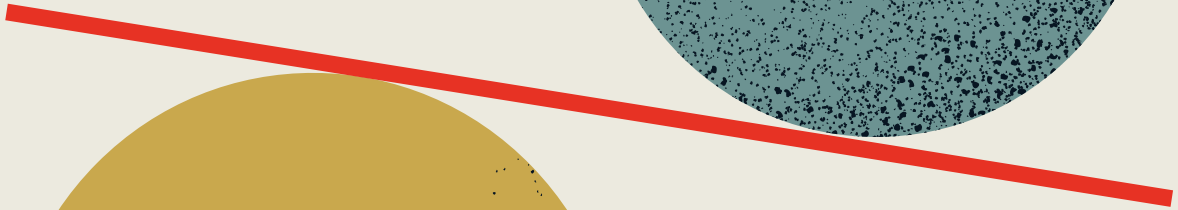
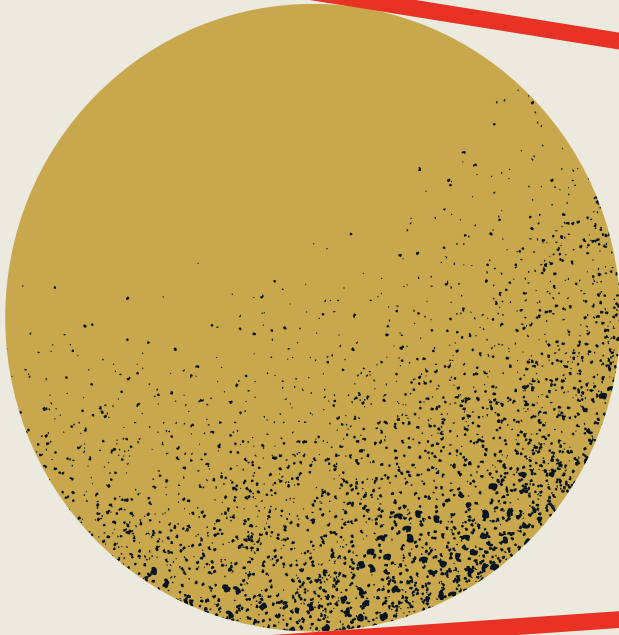
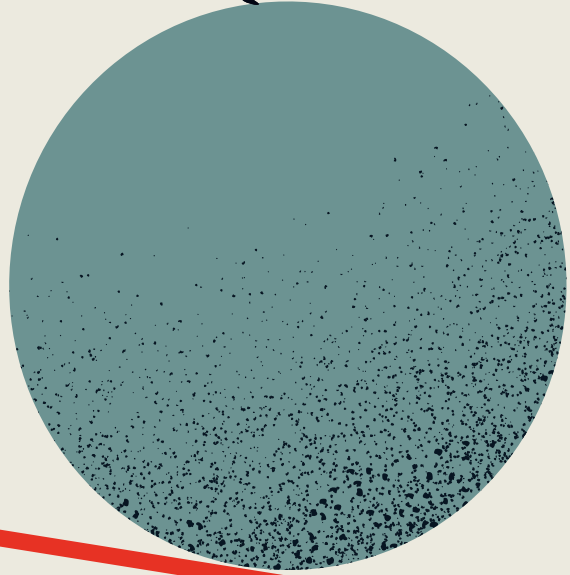
The safety challenge of AI and ML-enabled technologies in asset integrity

EM&I has led the industry in the use of robotic methods to reduce safety risk to humans in the area of asset integrity of high value assets, including in the world of LNG, and believes the power of AI and ML to be transformative for the company.

These are powerful tools that maybe can enhance safety in the high-risk industries in which it operates – AI could provide early warning of circumstances where safety risk is heading towards an unacceptable level. The company also believe that these tools have relevance, and will continue to develop and embed these in its integrity management systems, for example:

- Predictive analysis AI anticipates potential hazards by processing historical safety data, predicting incidents and failure points, and enabling preventative measures to reduce accidents. Continuous monitoring and real-time alerts address safety-related anomalies promptly.
- Wearables and employee health monitoring systems provide real-time health data, allowing early detection of fatigue, stress, or other health concerns. Location tracking ensures quick response times in emergencies, enhancing safety protocols and demonstrating a commitment to employee wellbeing.
- Computer vision systems analyse visual data in real time to identify potential hazards that might escape human detection. They monitor workers' movements, identify unsafe practices, and alert supervisors to prevent accidents.
- Virtual reality (VR) safety training offers dynamic and immersive education through realistic simulations. It enhances understanding of safety protocols, providing hands-on experience in recognising and mitigating hazards without real-world risks.

BALANCE



- ML systems that enable robotic devices to navigate pre-determined routes but avoid obstacles without human intervention.

However, the integration of these devices into the company's integrity management tools also introduces challenges. The complexity of AI systems can sometimes lead to unexpected behaviours or failures, and there is an increased risk of cyber-attacks. Cybersecurity warrants special attention due to its potential to compromise safety. The emergence of sophisticated ransomware poses a tangible threat to various offshore operations. Whether it is hijacking a drillship's thrusters or jamming communication systems, the need to develop an AI-powered system or application must be carefully considered against the driving need to strengthen safety and to ensure a robust safety culture.

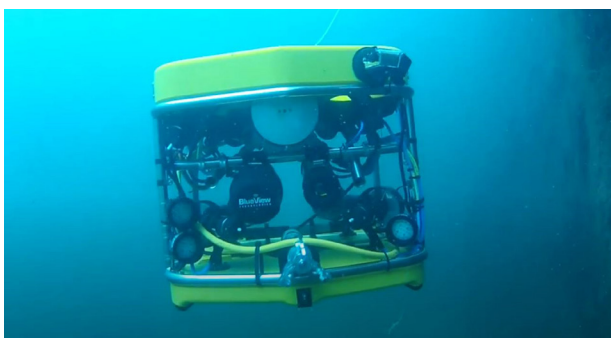


Figure 1. EM&I Inspection Class remotely operated vehicle.

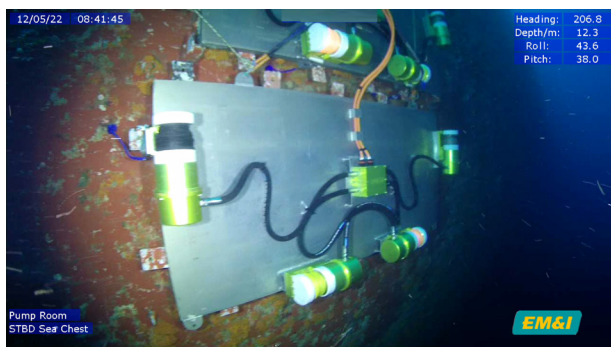


Figure 2. LIMPET Sea Chest Isolation to enable sea valve isolation.



Figure 3. ODIN camera insertion for sea chest inspection during normal operations.

What of ML?

As industries become more confident in the use of robots to carry out inspection, repair, and monitoring, they become more aware of the safety benefits of not using people, but also of the risks of highly expensive equipment loss or damage. This is of course much better than any risk to humans, but nevertheless it is important to 'teach' equipment to be aware of and alert operators to danger to itself and, where possible, to get out of trouble.

What of safety culture?

A robust safety culture in an asset integrity and inspection management company is vital for mitigating risks, ensuring compliance, safeguarding employee wellbeing, enhancing operational efficiency, and protecting financial performance. It is characterised by leadership commitment, open communication, continuous training, employee involvement, comprehensive safety policies, thorough incident reporting and analysis, proactive risk management, and recognition of safe behaviour. In practice, it includes regular safety drills, safety panels and committees, tracking safety metrics, and integrating advanced technologies to monitor and improve safety. This approach creates a safer, more productive, and positive work environment, ultimately protecting both the workforce and the organisation's assets.

To date, EM&I has found that its safety culture has been impacted by three specific ML and AI factors.

Over-reliance on technology

Dependence on AI and ML can sometimes lead to complacency, where employees might neglect their vigilance and adherence to safety protocols due to over-reliance on automated systems. Where inspectors trust an AI system implicitly, they may skip manual inspection reviews, assuming the AI will catch all potential issues. This could be dangerous if the AI fails to detect an anomaly that a human would have noticed, leading to a significant safety incident. Where AI systems might be used to assess structural integrity and rely solely on AI assessments without cross-verifying with manual checks, they might miss critical flaws that the AI did not account for, potentially leading to structural failures.

Employee resistance and fear

The introduction of AI and ML can trigger resistance among employees if not handled effectively. Any subsequent lack of trust in the technology can adversely affect morale and overall safety culture. Additionally, mistrust in AI systems can stem from concerns about transparency and error disclosure. If employees believe that errors or failures in AI systems are not being disclosed or addressed properly, it can erode trust in the technology. As an example, if an AI enabled system used for inspection or quality control in a production plant missed defects, and these errors were not communicated transparently, employees may feel that their safety and professional integrity are being compromised. This lack of transparency can foster a culture of fear and suspicion, further detracting from a positive safety culture.

Cost and complexity

Implementing AI and ML solutions in hazardous hydrocarbon production assets or offshore plants can be both costly and complex. These advanced technologies require significant investment in hardware, software, and skilled personnel to develop, implement, and maintain them. Offshore operators today are investing heavily in AI to enhance their exploration and production processes. However, improper management of these technologies

can strain resources and lead to inadequate implementation, potentially compromising safety. As an example, an offshore oil platform might deploy AI-enabled systems for predictive maintenance to monitor equipment and predict failures before they occur. While this can reduce downtime and maintenance costs, the initial setup and ongoing management of such systems can be expensive. If the company fails to allocate sufficient resources or train staff adequately, the AI system might not function as intended, leading to undetected equipment issues and increased safety and production risks.

Moreover, the complexity of integrating AI and ML into existing systems can pose challenges. For example, retrofitting an older offshore platform with AI-driven monitoring systems might require extensive modifications and upgrades. If not managed properly, these changes could introduce new vulnerabilities or disrupt existing safety protocols.

Mitigating the risks and challenges

How might these challenges to a company's safety culture be mitigated?

First, consider the importance of human oversight and vigilance, even with the most advanced AI systems in place. Regular training and reminders about the potential limitations and risks of AI can help ensure that employees remain engaged and attentive to safety protocols.

Next, it is, in EM&I's view, crucial for companies to foster a transparent and inclusive environment where employees are actively involved in the integration of AI and ML. Regular communication about the purpose, benefits, and limitations of the technology can alleviate fears. Training programmes that equip employees with the skills to work alongside AI can also boost

confidence and trust. Furthermore, openly addressing and disclosing any errors or failures in AI systems is vital to maintaining transparency and building a culture of trust and collaboration.

To mitigate cost and complexity, companies must carefully plan and manage the implementation of AI and ML solutions, ensuring that they have the necessary resources and expertise to support these technologies effectively. Regular training, robust cybersecurity measures, and transparent communication about the capabilities and limitations of AI systems are essential to maintaining a safe and efficient operation.

It is also the company's view that overarching all of this, there is one attribute that stands above all in mitigating the challenges and in fostering a robust safety culture: ownership of the problem.

It is the ability, intellectual capacity, and willingness for a leader – at whatever level – to step up and 'own' the problem. To step in when the situation is uncertain and possibly 'chaotic'; to see through the 'fog' that accompanies a safety incident and to formulate a plan – then articulate it quickly and effectively irrespective of barriers of distance and language. Having such leaders is a 'game changer' and does much to strengthen a safety culture that is adapting to emerging technologies that bring complexity and – to a degree – acute uncertainty.

Conclusion

AI and ML are clearly the future of many technologies that are being used by the LNG industry and the world of asset integrity in particular.

Their use has to be introduced carefully and with full knowledge of the benefits and potential pitfalls, but the benefits will bring major advantages in safety and efficiency. **LNG**



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