A NEW CHAPTER FOR OIL AND GAS

Al Rivero, Rajant Corp., USA, explains how next-generation technologies can allow organisations to closely manage and optimise unmanned remote operations, improve worker safety, and limit their impact on the environment.

Following the worldwide pandemic, the oil and gas industry has had to transition from a more 'hands on' approach to remote operations. The shift in the sector posed serious concerns and difficulties, with smaller crews on site requiring significant operational changes such as new technologies and more data to be shared to augment operations and make them more efficient. These increasing demands can easily outpace a network's capacity in a robust environment.

A significant change to operations comes with a cost, and companies must be sure of a return on investment (ROI), which is of particular importance in an industry characterised by substantial and constant price swings. In April 2020 for example, the oil price plummeted to US$40/boe, and two years later, with the war in Ukraine, the price skyrocketed to more than US$105/boe.

Not only this, but the industry must also evolve operations to conform with global expectations of greener processes and help to lower carbon and other harmful emissions. Directly and indirectly, the oil and gas industry accounts for 42% of global emissions, and companies in the sector must reduce these emissions by 90% by 2050 to achieve net neutrality. With sustainability at the forefront of regulation discussions, companies must invest in new equipment that instils confidence.

A key component to achieving these operational gains is the ability to access real-time data and analytics as part of a fully integrated picture of the oilfield. This will provide oil and gas operators with a clear view of the assets and personnel operating within it. However, this places a considerable amount of pressure on the communications network.

Investing in new technologies

Complex technologies, also known as the Industrial Internet of Things (IIoT), and capabilities such as mobile machine-to-machine (M2M) communication, real-time field intelligence, and predictive analytics, have all been introduced into the oil and gas industry. Ultimately, this has increased productivity and ensured that sites are safer for personnel operating in potentially dangerous oil rig and gas production environments. As more complex IIoT applications are introduced, operators must ensure that processes can operate seamlessly with new technologies.

Innovative technology, such as hands-free voice communication and wearable cameras, can provide a full-spectrum perspective that increases visibility and real-time insights into identifying disturbances and site monitoring of equipment, vehicles, and staff constantly on the move. This technology also ensures complete security of the production site, preventing unauthorised access.

Operators have also opted to utilise robotics in these challenging environments to combat the potential efficiency issues that human error can cause, such as downtime. Most importantly, deploying robotics to monitor and inspect hazardous industrial equipment removes worker safety risks by completely removing them from the operation. Robots have discrete sensing capabilities to identify and target maintenance needs more accurately.

The greatest challenge in supporting robotic and autonomous solutions is keeping them connected. Safety is a significant challenge in such an environment, requiring real-time optimisation and complete visibility. For example, oil rigs can be prone to heating up underground if the rig gets too dry, leading to potential burn up, and this poses a danger to remote site personnel and presents substantial repair costs.

Figure 1. *With the ever-changing volatility in oil prices, oil and gas operators are realising the need for a network solution that is flexible and not rigid to optimise production efficiency while minimising expenses.*

Figure 2. *A typical remote and rugged oil and gas terrain needs constant observation. A reliable network is key to this, allowing operators to access real-time data and analytics to understand all aspects of the assets.*

While these additional assets add value, expanding interconnectivity puts pressure on the network that must ensure the security and authenticity of the communications traffic moving in, out, and across it. To achieve and maintain peak productivity and efficiency, mission-critical applications must run on a communications network that offers reliable, agile, and adaptable connectivity that can thrive in diverse, evolving, mobility-driven environments. Critical networks cannot afford downtime.

Rugged environments block smooth wireless paths

Companies face daunting challenges when planning and implementing a communications network that provides site-wide mobile access to vital data, voice, and video. In the face of intense economic pressure, organisations are striving to maintain continuous operations, increase productivity, and cut operating costs while maintaining safety standards.

A typical remote and rugged terrain needs constant observation. This can cause issues in achieving a consistent network connection, as the core environment of an oil or gas production site can be unpredictable and often isolated. As a result of implementing more technology on-site, an enormous volume of data is produced by devices that enhance oil recovery and improve production. Effectively managing this data will become even more critical as the industry moves towards unmanned facilities.

Operators often experience difficulties securing a reliable connection by conventional means, such as when deploying long-term evolution (LTE) or 5G technology. Public cellular networks often need to offer the levels of reliability, availability, latency, and security that mission-critical services in oil and gas require. As some mobile devices lack infrastructure capabilities, they can only connect to one access point at a time. This means that if an access point fails, all nodes connected to that access point are disconnected from the network. Access points therefore are potential areas of failure. In the case of root controller nodes, one device manages the routing for the entire wireless network. If the root node fails, the whole network subsequently goes offline.

After a reliable network is ensured, the subsequent action is to capitalise on the advantages of remote collaboration, which can bring significant societal, economic, environmental, and climate benefits. Real-time support provided by remote collaboration enhances operator efficiency and safety, offering specialised knowledge and skills to remote or underserved workers while reducing workplace accidents and fatalities without compromising performance.

Furthermore, remote collaboration generates considerable economic benefits by decreasing travel costs and time, improving productivity, and streamlining operations. Additionally, it minimises the need for travel and commuting, resulting in fewer carbon emissions and air pollution, benefitting industries that require frequent travel and on-site inspections while lowering their carbon footprint.

According to estimates provided by the UK government, avoiding a single travel event through alternative solutions like automation and remote support significantly reduces CO_2 emissions. Avoiding one employee's single international round-trip flight can reduce approximately

400 kg of CO_2 emissions, giving a reliable estimate of potential emissions reduction for multiple travellers and trips.

This reliance on IIoT and M2M connectivity to improve productivity, streamline operations, and control costs, has created a demand for private wireless mesh networks.

Ensuring effectiveness

A high-capacity wireless network that supports reliable, real-time data delivery to and from the array of onboard sensors within these autonomous systems is paramount. It can aid in the precise diagnosis of equipment problems and provide efficient fixes. Wireless mesh networks are unique in delivering consistent, reliable coverage across any space, regardless of the environment's size, topography, physical obstacles, radio frequency traffic, and weather conditions.

Rajant's Kinetic Mesh network is dynamic, comprised of several communication nodes that can automatically identify and transmit data between them. These nodes can adjust to find the fastest and most stable connections. Mesh networks can scale up and down quickly by adding or removing nodes. The data travelling across the network can be rerouted depending on the bandwidth needs, signal strength, or competing traffic. Having a network with M2M connectivity is a bonus. With each mobile asset equipped with a mesh node, the mobile robots remain connected to the network with no dropouts.

Incorporating well and platform monitoring using cameras, smart meters, and sensors, the network integrates with WiFi or ethernet-connected devices to let operators monitor conditions and identify issues, often before they cause downtime or production delays. The network also allows real-time drilling activities to be monitored to help drive down non-productive time, which industry studies show equates to a loss of approximately one-third of an operation's average annual drilling budget.

Efficient networks empower companies to utilise efficiencies through equipment health monitoring. Using equipment performance data and a predictive maintenance model, companies can keep equipment operating at peak efficiency and extend the service life of onshore assets. New technologies enable up to a 30% decrease in maintenance costs, amounting to 60% of overall operational expenditure.

A mission-critical network provides operational confidence

More services, assets, and technologies are connected to onshore oil and gas projects than ever before, with augmented reality, drones, and robots playing a critical role. For many workers, the operational insights enabled by these technologies are indispensable, which elevates the importance of reliable network connectivity. Next-generation technology allows organisations to deliver business-critical field intelligence securely and reliably to closely manage and optimise unmanned remote operations, improve worker safety, and limit their impact on the environment.

Enhanced connectivity enables these technologies to drive value for oil and gas enterprises, as well as supporting a global movement towards a cleaner environment. With a reliable network, oil and gas leaders can analyse their current operations for inefficiencies and take proactive steps to ensure sustainability, and compete and thrive in this new era of oil and gas.