Protecting our environment

The oil and gas sector relies heavily upon satellite technology for offshore and onshore connectivity, creating more efficient and effective industrial production. However, satellite is arguably even more effectively used to monitor the dangerous greenhouse gas emissions generated by the industry, helping governments and world agencies to better protect our environment.

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The satellite sector has long played a vital role in the oil and gas industry, as for many other energy and utilities segments which involve remote and rural locations, often far removed from infrastructure and terrestrial connectivity, and in extreme weather conditions and harsh environments. Satellites serve every part of the oil and gas chain, providing valuable connectivity and Earth observation applications across the world. Indeed, satellite technology is key for the maintenance and continued growth of the oil and gas sector:

- **Data exchanges.** Data is constantly being collected from offshore rigs during drilling and survey activities, with everything from rock formations, pump and valve control, flow measurements, pressure and temperature monitoring, leak detection, and corrosion monitoring under examination. Satellite connectivity enables this data to be transferred to onshore experts so that any areas of note can be highlighted. Moreover, access to secure Internet connectivity allows offshore or remote workers to communicate effectively and efficiently with headquarters.
- **Efficiency boosts.** As for many other industries, oil and gas is reaping huge operational efficiency boosts from the Internet of Things (IoT), with connected sensors playing a huge role already throughout the sector. Satellite-supported IoT enables oil and gas entities to remotely manage their operations, controlling any aspect of their business from oil flow volumes through to drilling speeds and angles.
- **Crew welfare.** Just like any industry requiring staff to stay away from home – maritime, aviation, logistics, etc. – employees stationed at offshore rigs or on-board vessels for weeks or months at a time require a certain level of creature comfort to remain happy and mentally well. With global, ubiquitous Internet connectivity now commonplace, the best and brightest can pick and choose between employers based on their standard of living whilst away from home. Being able to stay in touch with loved ones, consume media and browse online makes all the difference.
- **E-health.** Working in remote and rural locations, potentially a 24-hour boat ride from land, health and safety have always been a key focus for oil and gas workers. The effective delivery of telemedicine services via satellite connectivity helps ensure crew wellbeing during times of illness or injury; real-time video calls with onshore experts can aid greatly the diagnosis and appropriate treatment of crew in the field.
- **Environmental safety.** The oil and gas sector is often called one of the worst environmental scourges of our plane today, and the risks of oil spills and other accidents is significant. Continuous remote monitoring via the satellite supported IoT can make a big difference to the relative safety of a specific rig, with many potential problems identifiable before incident.

The oil and gas sector is still in a state of cost-cutting measures as a whole following falling oil prices, necessitating certain luxuries to be cut. While some owners are questioning the value of some satellite connectivity services, others are increasing their spend, viewing it as a smart way to improve cost-efficiency and output.

Indeed, according to Maximize Market Research, the global mobile satellite services market is expected to grow to US$13.74 billion by 2026, with the oil and gas and mining sectors expected to grow at the largest CAGR between 2018-2026. The increase in demand for mobility, advancement in digital technology and rise in integration between mobile and satellite technology are highlighted as the major factor for driving the market.

It's inarguable that satellite delivers absolutely vital connectivity services for the oil and gas sector, improving operational efficiency and quality of life for tens of thousands of oil and gas workers globally. However, satellite also delivers vital emissions monitoring capabilities for the oil and gas sector too, a much-needed service in today's world.

Reducing oil and gas sector emissions

It's hard to be blind to the issue that is climate change – it is the 21st century, after all – and the impact that the energy sectors are having on global emissions volumes (try as climate change deniers might to deny it). Greenhouse gases, which absorb and emit energy within the thermal infrared range, maintain the temperature of planets throughout the solar system; the primary greenhouse gases in Earth's atmosphere are water vapour, carbon dioxide, methane, nitrous oxide, and ozone.

The media has historically focused on carbon dioxide – perhaps because human activities since the industrial revolution have resulted in a 45 percent increase in atmospheric carbon dioxide levels, from 280ppm in 1750 to 415ppm in 2019 – however, methane, which has more than 80 times the warming power of carbon dioxide during the first 20 years after it is released into the atmosphere, is coming increasingly into the spotlight.

The oil and gas sector is one of the largest sources of methane emissions today, releasing an estimated 75 million metric tons of methane into the atmosphere annually. However, the International Energy Agency estimates that the industry can achieve a 75 percent reduction using technologies available today. Recent years have seen a new wave of Earth observation satellites being placed into orbit in order to track greenhouse gas emissions, some with a particular focus on methane emissions. As well as the oil and gas sector, methane emissions are coming from landfills,

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wetlands, and, of course, livestock.

Like other Earth observation programmes, satellite has been a key technology in the monitoring of greenhouse gas emissions from all kinds of industrial and agricultural processes. Such projects have been so successful in creating a better understanding of atmospheric chemistry that governments and environmental agencies can act on that new satellites are now being created with highly niche capabilities, including the monitoring of single greenhouse gases from the oil and gas sector.

GHGSAT gears up for new launches

Global emissions monitoring company GHGSat has made major advances in the remote sensing of greenhouse gases, air quality gas and other trace gas emissions over the past few years. In June 2016, the company launched the world's first high-resolution satellite capable of measuring carbon dioxide and methane emissions – which combined account for more than 90 percent of all global emissions - from any industrial facility in the world. The Claire microsatellite provides greenhouse gas emissions monitoring data and services globally, with better accuracy and at a fraction of the cost of comparable alternatives, enabling owners of industrial facilities to monitor all of their facilities, anywhere in the world, with a common technology, in near-real-time.

Following on from the success of Claire, GHGSat is now moving further afield, with a new series of high-resolution satellites and very-high resolution aircraft for measuring greenhouse gases.

The first of its next-generation satellites, Iris, is due for launch imminently, having suffered delays due to Arianespace's Vega rocket failure last year. Iris will deliver better resolution, precision, and throughput with a more sensitive spectrometer, and, reportedly, will be focusing solely on methane emissions. Iris also holds a game-changing optical communications downlink, a world-first for a microsatellite, which will reduce the operational bottleneck and enable GHGSat to take many more observations per satellite.

The new satellite has garnered a great deal of interest already; in August 2019, GHGSat confirmed a CAD$3.3 million funding agreement from Sustainable Development Technology Canada (SDTC) to provide emissions measurements of oil and gas facilities in the Montney region of British Colombia. The project's primary objective is to demonstrate that a tiered monitoring system using GHGSat's Iris satellite and under-development aircraft instruments can detect more leaks quicker and at a lower cost than the regulatory standard, based on optical gas imaging cameras. Meanwhile, in September 2019, GHGSat signed a memorandum of intent with the Canadian Space Agency (CSA) and the European Space Agency (ESA) in which GHGSat will provide five percent of the Iris satellite capacity free of charge. The CSA and ESA will use this capacity for remote sensing, climate research and data validation projects. During the same month, GHGSat Inc. and Shell Global Solutions International B.V. signed a framework agreement for the provision by GHGSat of monitoring services with the aim to obtain methane emissions data of certain agreed Shell facilities globally. The initial pilot phase is intended for GHGSat to demonstrate its technology and the reliability of the data recovered and will cover initially four of Shell's assets.

GHGSat is also planning on a second 2020 launch, for its third emissions monitoring satellite, Hugo. This third satellite is reportedly a culmination of many improvements upon Claire and Iris and will in fact be the basis of the company's following 10 satellites. Expected to provide an order of magnitude improvement in performance compared to Claire, Hugo will also increase GHGSat's observation capacity, enabling GHGSat to monitor more sites, more often.

MethaneSAT plods towards completion

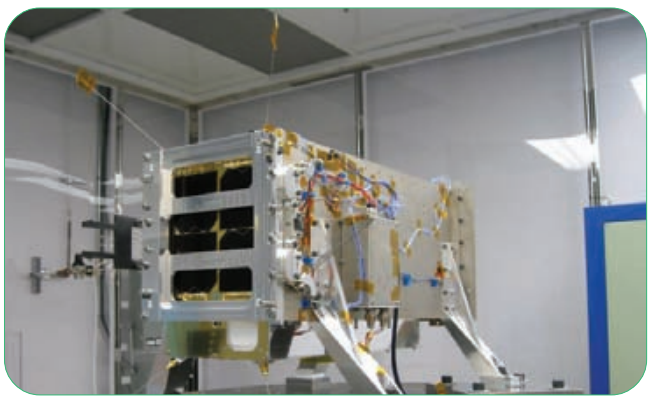
One of the most important projects underway in the satellite/oil and gas sector today is the MethaneSat satellite, designed to locate and measure methane from human sources worldwide as a step forwards in reducing emissions.

Under development by a wholly-owned subsidiary of the non-profit Environmental Defense Fund (EDF), MethaneSat will monitor more than 80 percent of global oil and gas production regions with unprecedented accuracy, generating data that will enable both companies and countries to identify, manage, and reduce their methane emissions, slowing the rate at which our planet is warming. MethaneSAT will cover a wide 200km view path passing over important target regions every few days, utilising advanced sensors which will pick up the sun's reflected infrared radiation as it passes through the atmosphere and parse them to reveal methane's unique fingerprint. A series of sophisticated algorithms will sort through the data - factoring in the influence of clouds, tiny particles of air pollution, and reflectivity of ground cover - to calculate even small changes in methane emission rates.

In September 2019, MethaneSAT signed an agreement with Ball Aerospace to design and build the upcoming satellite's advanced new sensing instrument, consisting of two spectrometers, as well as flight integration and testing, launch support, and commissioning services.

Shortly after in November 2019, the government of New Zealand announced that it will contribute NZD$16 million to MethaneSAT, and also plans to host the ground-based mission control centre and develop an expanded scientific research effort using data from the satellite. This investment marks New Zealand's first government foray into space.

More recently, January saw Blue Canyon Technologies (BCT) selected to develop and build the bus for MethaneSat, scheduled for launch in 2022. The satellite will be designed using BCT's newest X-SAT line of spacecraft, the X-SAT Saturn-Class, which can carry payloads up to 200kg. The high-agility platform will enable the onboard instrument to collect data and revisit sites frequently, while its compact profile is designed to maximize the volume, mass, and power available for the methane measuring instrument. ■



Claire microsatellite delivers greenhouse gas emissions monitoring data. Photo courtesy of GHGSAT