

How Oil and Gas Leaders are Leveraging XR Technologies

Using intrinsically safe assisted reality to optimize asset management, management and inspection rounds amid the shift to cleaner energy.

The pandemic had an immediate impact on the capital-intensive oil and gas industry, accelerating a digital transformation decades in the making.

The industry, which underperformed against the S&P 500 in the 15 years preceding the pandemic,[1] has historically operated through long megacycles of shifting supply and demand,[2] including major price shocks tied to politically driven supply disruptions.[3]

Then, when the pandemic hit and governments imposed lockdowns and quarantines in early 2020, demand sank sharply, but it took months for oil companies to reduce their production accordingly.[4] The industry saw the largest-ever drop in oil prices as well as a significant decrease in the price of petroleum-based products, from heating oil to jet fuel and retail gasoline. A year later, prices soared due to a mismatch in supply and demand—while the world's economy was beginning to rebound, oil and gas companies were slow to ramp production back up.[5]

The widespread restrictions on travel driven by the pandemic not only disrupted demand but also impacted the industry's ability to keep operations running smoothly—companies no longer had experts on-site, ready to step in in the case of an outage or unplanned stoppage.

The pandemic had an outsized impact on oil and gas due to the nature of the industry: Whether upstream (onshore or offshore drilling), midstream (transportation of hydrocarbons) or downstream (refinement of petroleum-based products), oil and gas companies have high-value assets that have high capital costs and high costs of running.

> *The global COVID-19 pandemic caught the oil and gas industry unprepared for a completely changed landscape.*[6]
>
> *-- McKinsey*

realwear

This phenomenon affected a wide variety of industries but had an outsized impact on oil and gas due to the nature of the industry: Whether upstream (onshore or offshore drilling), midstream (transportation of hydrocarbons) or downstream (refinement of petroleum-based products), oil and gas companies have high-value assets that have high capital costs and high costs of running. These assets are often highly regulated as well.



The cost of an unplanned outage is significant. For example, leaving a drilling rig idle can run $30,000 to $50,000 per hour, and anything along the equipment chain can stop it from running. Other segments of the industry have even higher costs per hour when production stops; an outage at a polyethylene plant can total hundreds of thousands an hour. When you consider the need to send an expert to a remote location or offshore drilling site by helicopter to address an equipment failure, the costs spiral quickly.

Unplanned downtime can cost oil and gas organizations an average of $49 million annually—and as much as $90 million.[7]

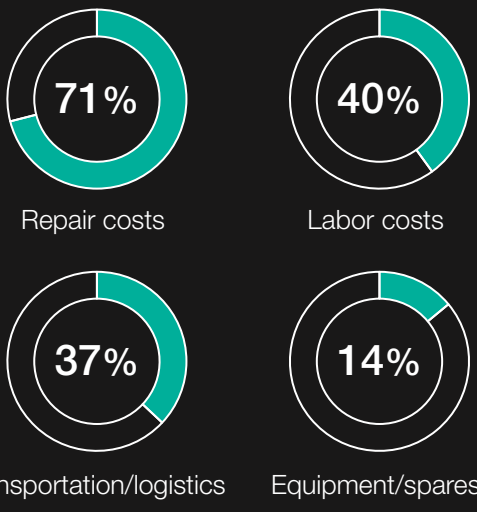
At the same time, the industry is under continued pressure to be part of the worldwide transition toward a cleaner energy future, with nearly all companies making public commitments to becoming carbon neutral or making their own operations less emissive. This transformation will increase the strain on organizations already struggling to replace and train an ageing workforce already affected by the Great Resignation. Younger workers are increasingly looking for oil and gas companies that are leading the push toward greener energy, and technology is not only helping make operations more efficient but also enabling workers to learn faster and be part of the transition. Simply put, leading-edge technology gets the younger generation of workers pumped up about coming to work.

Leaving a drilling rig idle can run up to $50,000 an hour.

> *Even during times of greater stability, oil and gas companies are slower than some other industries in investing and adopting new technologies and with current economic and operating environments, this is being perpetuated.*
>
> ***-- EY Report***

The Hidden Cost of Unplanned Downtime

Oil and gas companies say that when unplanned downtime occurs, major expenses accrue quickly in the form of:



Source: GE



Against this backdrop, oil and gas companies are embracing technology to reduce unplanned downtime and shave millions off operating costs while simultaneously reducing risks[8] and protecting their $3.4 trillion asset base.[9] Increasingly, companies are turning to assisted reality wearables to augment the workforce with information and technology to enable them to work more safely, smartly and productively. They're leveraging them to extract oil and gas more efficiently and with fewer emissions, which has the added benefit of attracting people who want to work in greener, cleaner energy.

In this white paper, we explore current and emerging applications for assisted reality wearables in the oil and gas industry and detail how leaders can maximize the opportunity afforded by assisted reality.

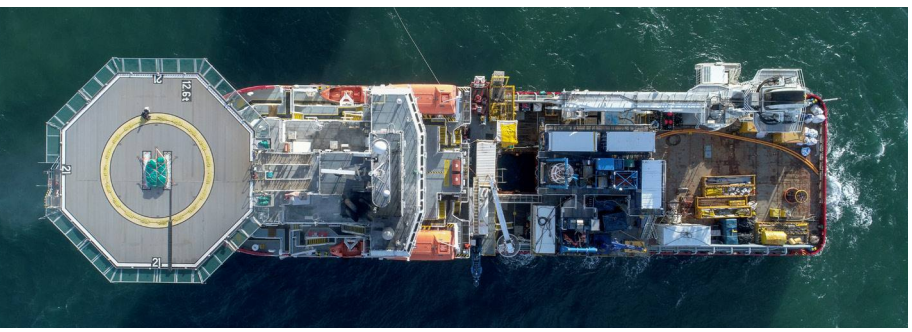
How Extended Reality Tech is Taking Hold

The revolution to eliminate paper across the oil and gas industry never happened at the level that was expected, and yet the advent of intrinsically safe assisted reality and better workflow applications now presents a new promising opportunity to re-energize digitalization.

"Even during times of greater stability, oil and gas companies are slower than some other industries in investing and adopting new technologies and with current economic and operating environments, this is being perpetuated," a report by EY concludes.[10]

The U.S. alone spends $8 billion per year on managing paper, and another study showed it's about $7500 per employee.[11] And yet it's not uncommon to see a worker walking the job site holding a clipboard and a ballpoint pen; in many settings, workers fill out a dozen or more safety checklists over the course of a shift to confirm that they're wearing a hardhat and steel-toed shoes, that they've checked in with a co-worker prior to beginning work, and more. These handwritten slips of paper are often pulled out of pockets and handed at the end of the day to another worker, who must input the data manually—a process that's labor-intensive and prone to error.

Digitalization in oil and gas has lagged behind that in other industries because the technology used elsewhere hasn't been a good fit in a culture known for an (understandably) heavy emphasis on safety. With many operations taking place in hazardous environments, the technologies need to be hands-free, often explosion-proof and be able to operate in very noisy environments.



Assisted Reality is Gaining Traction

Increasingly, oil and gas companies are turning to Assisted Reality wearables to augment the workforce with information and technology to enable them to work more safely, smartly and efficiently.

> *A new era of computing has arrived. Just as laptops and mobile phones are standard for desk workers, voice command and augmented reality for wearable computers will become commonplace for field staff in our industry, driving safety and productivity.*
>
> ***Michael Kaldenbach, [Former] Digital Realities Lead, Shell***



What is Assisted Reality?

In Industry 4.0, Augmented Reality (AR) and Virtual Reality (VR) are often hailed as the next great leap in boosting worker productivity. But these Extended Reality (XR) technologies aren't always practical when used as manufacturing or frontline tools—they're often inappropriate or even unsafe for workers in many use cases.

Unlike AR, Assisted Reality (aR) is a **reality-first, digital-second** experience. Assisted Reality allows frontline workers to have full situational awareness. Information is not typically overlaid with real-world view; Assisted Reality allows a person to view a screen within immediate field of vision, hands free, and gives the worker access to the right information right when they need it. Assisted Reality can be likened to a car dashboard that provides critical information at a glance.

Today, many organizations are dipping their toes, to varying degrees, into extended reality (XR) technologies. The XR is a spectrum of technologies for different use cases and includes:

- **Virtual reality:** The user has no direct view of the world around them, for example, running a 3D simulation of what an oil rig or refining location will look like to familiarize the worker with safety hazards they will encounter in the field.
- **Mixed reality:** The user has some ability to see through the device to the real world, with some digital elements overlaid, for example helping a worker in a service depot or training facility learn how to repair a pump or valve.
- **Intrinsically Safe Assisted reality:** The user has full situational awareness, allowing them to see and hear any hazards around them, even where natural gasses are present. "It's not intended to be an immersive experience," explains Sanjay Jhawar, Co-founder and Chief Strategy Officer at RealWear, adding that too much assisted reality can be a distraction for users. "It has contextual information below your line of sight that you can refer to, kind of like the dashboard in your car, but it doesn't take over your entire field of view, which frankly, would be a safety issue in most cases."

Among XR technologies, assisted reality is scaling to a greater extent in the oil and gas industry because it's built for scale and is compatible with legacy backend systems.

"A new era of computing has arrived," says Michael Kaldenbach, former Digital Realities Lead, Shell.[12] "Just as laptops and mobile phones are standard for desk workers, voice command and augmented reality for wearable computers will become commonplace for field staff in our industry, driving safety and productivity."

How Assisted Reality is Transforming Oil and Gas

Intrisically Safe wearables can be used with a wide variety of software solutions targeted to specific business outcomes. The enterprise applications already in widespread use with wearables include Microsoft Teams as well as Librestream, which is a remote collaboration solution that can be fine-tuned for low-bandwidth scenarios; Simply Video, which allows a handheld to join the call separately to show a third-person view of the scene to a remote expert; Intoware, which offers guided workflows; TeamViewer, which offers a wide variety of solutions for frontline workers that range from remote inspections and workflows to remote expert guidance; Transition Technologies (a systems integrator), which offers simultaneous localization and mapping (SLAM)-based solutions that are customized for IoT sensors and other site labels; and IBM's defect-recognition software.

Key areas of opportunity for assisted reality in the oil and gas industry include remote assistance, industry compliance, and asset management and maintenance. Assisted reality wearables are already helping companies:



Facilitating Inspections with Remote or Lone Workers

When COVID-19 hit, restricting travel by its commissioning team, Maersk Drilling turned to assisted reality wearables to perform a Special Periodic Survey (SPS) remotely on its harsh-environment jack-up rig Maersk Resolute. An SPS includes detailed structural investigations and inspections to ensure that a rig is structurally sound and watertight.

"As COVID-19 ruled out the traditional approach to commissioning of having external service engineers on board, this seems to be an alternative option whenever there is sufficient internet bandwidth available," Technical Section Leader Erik Vandel Jensen said.



Act as eyes and ears for remote experts

Just as the automotive industry is using assisted reality wearables to connect the global workforce and enable frontline workers to get assistance from an expert remotely, oil and gas can leverage these devices to resolve any complex issue and reduce unplanned downtime. Shell, for example, has deployed RealWear intrinsically safe assisted reality devices in a dozen countries.[13] For instance, if equipment needs maintenance, a worker can get real-time assistance via a video call, allowing an expert to essentially see through the eyes of the onsite worker and offer over-the-shoulder assistance. In one example, an expert uses Augmented Reality to remotely "draw" on the worker's screen which is visualized on the head-mounted screen. The technology is seen as making repairs more efficient and safer.[14]

And, with a skilled workforce retiring in the next five years, the number of technicians to travel offshore will be reduced, further increasing the importance of remote assistance.

Protect against regulatory risk

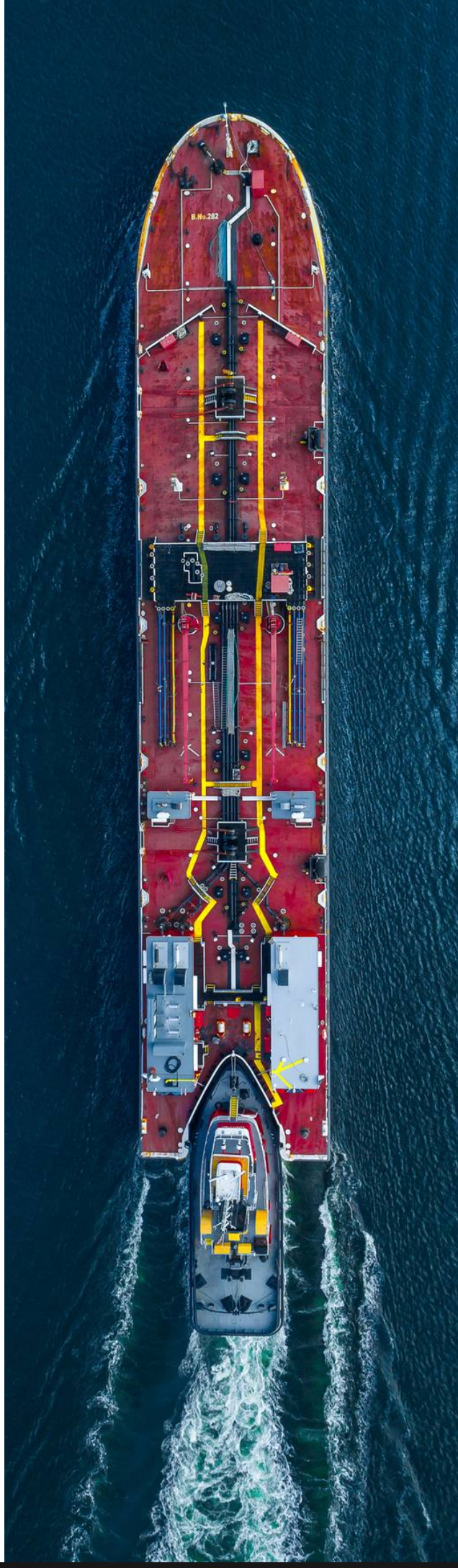
With oil and gas companies subject to extensive regulations to protect the environment and ensure the safety of the workforce and the communities in which they operate, industry compliance is a significant part of doing business. Companies along the value chain are required to take ownership of their upstream suppliers, and any extraction sites they build and operate on. Failure to do so may lead to strong penalties or closure. Engineers must also inspect the quality of work completed by a large number of subcontractors. With intrinsically safe assisted reality wearables, technicians can capture photos and videos as work is done, review, archive them at shift change. They can also troubleshoot work issues and remotely perform live inspection via two-way video as supervisors watch on a laptop.

Keep equipment up and running

With high-value assets, asset management is increasingly important—and a key driver of asset maintenance as well. Assets range from pumps and heating elements to compressors, flow control valves and more-any piece of capital equipment that needs to be installed, commissioned, maintained, inspected, modified and ultimately decommissioned, removed and replaced. With growing complexity, asset management can no longer be accomplished using a clipboard.

Consider the case of a refinery. Intrinsically safe assisted reality wearables can have a particular impact on the day-to-day work of three key roles:

- Mechanical technician: providing step-by-step instructions to perform maintenance and repairs.
- Process technician: streamlining work orders and optimizing processes.
- Job planner: digitalizing error-prone, manual processes associated with creating jobs and assigning work orders.



How to Achieve the True Potential of Assisted Reality Wearables



View intrinsically safe wearables as a valuable solution, not a gadget

A common mistake is to use assisted reality wearables as a gadget or tool; intrinsically safe assisted reality wearables are better viewed as a new core piece of a larger digital system connecting people, plants and processes. Head-mounted displays are often used to solve a point problem, but in reality they are general-purpose connected devices that can do many things when used with appropriate training. If you are considering assisted reality wearables for your organization, think of them not so much as a hammer as a digital toolkit; you can solve a lot of problems with the right set of digital tools at your command.

Honeywell Sets New Production Standards with Assisted Reality Wearables

One of Honeywell's divisions, Honeywell Process Solutions, is devoted to developing, engineering, designing, and installing automation control systems for industrial customers such as chemical plants, pharmaceutical companies, pulp and paper producers, and refineries. When travel restrictions and social distancing requirements made such meetings impossible, Honeywell quickly turned to RealWear and Teams to help create a virtual version of its acceptance testing process.

> *On one project, we saved more than two weeks of testing time and got the system up and running ahead of schedule, helping our customer start producing faster than expected," says Hank Wrenn, Vice President and General Manager of Americas Projects and Automation Solutions at Honeywell Process Solutions. "We have proven that we can do things in a better way, a more efficient way, and with logistics that are much easier for everyone.*

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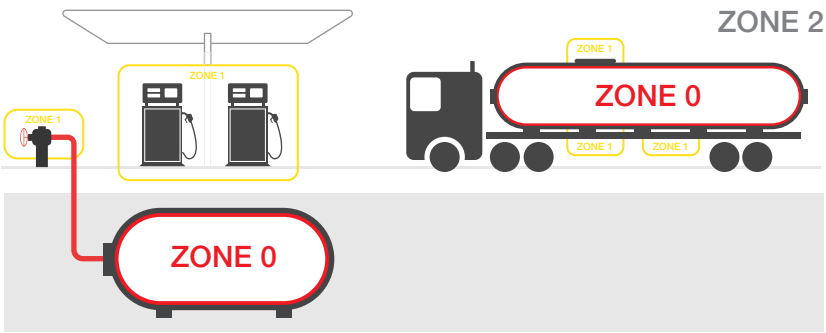
Use tools that fit your safety culture

Not all devices created are the same: Intrinsic Safety and the RealWear HMT-1Z1

In the oil and gas industry, safety is paramount; while consumer mobile phones are off-limits, even intrinsically safe devices such as mobile phones or tablets pose safety hazards because worker's hands are occupied and their heads are down looking at the handheld display. The option of digital transformation-forward companies is using intrinsically safe, hands-free, ruggedized head-mounted displays that keep heads up and eyes forward. If an employee is supposed to watch a three-minute video before touching a heat exchanger, use assisted reality wearables to present them with that video right before they begin using the equipment; the best time to remind people about safety is just in time. If you're considering some aspect of assisted reality, choose tools that are going to be a good fit for how your safety culture currently operates—and the regulations to which it is subject. According to BP's technology principal, Blaine Tookey, certification hurdles will have to be overcome first.[15]



Hazard - Gas / vapor / mist	
Zone 0	A place in which an explosive atmosphere consisting of a mixture with air of dangerous substances in the form of gas, vapor or mist is present continuously or for long periods or frequency
Zone 1	A place in which an explosive atmosphere consisting of a mixture with air of dangerous substances in the form of gas, vapor or mist is likely to occur in normal operation occasionally
Zone 2	A place in which an explosive atmosphere consisting of a mixture with air of dangerous substances in the form of gas, vapor or mist is not likely to occur in normal operation but, if it does occur, will persist for a short period only



Read our white paper to find out more about intrinsic safety (https://bit.ly/3LKkli6).

RealWear HMT-1Z1 is ATEX Zone 1 and CSA C1/D1 certified

The oil and gas industry is host to some dangerous and extremely volatile environments, many of which involve explosive gases. In these hazardous areas, most electronic equipment is banned as the smallest spark could be all it takes to cause an explosion.

To mitigate the risk of combustion, there are globally certified Intrinsically Safe standards that involve directives for gasses, vapors, and mists. While some devices may claim certain standards to be broadly considered Intrinsically Safe, the Oil & Gas industry uses the strictest of these, not all intrinsically safe devices are created equal. RealWear HMT-1Z1 assisted reality wearable meets the ATEX Zone 1 and CSA C1/D1 certification.

The HMT-1Z1 is completely enclosed, ensuring that the battery is never exposed to the elements. It's also dust tight, water resistant, and shock resistant, PPE compatible, and will operate within a wide range of temperatures and noises.

Approach adoption with clear intention

Find champions within your organization—people who tend to be most enthusiastic about and receptive to new technology—and deploy assisted reality wearables with them first. They can then help you build acceptance for change, step by step, throughout your workforce. Look for someone who has expressed interest in the technology, who is trusted or looked up to by others within the organization, who believes that assisted reality can help improve the way work is done and who understands the unique culture within your organization. By building a network of champions across the adoption, you can smooth the path for adoption.

Realize that integration takes sustained effort

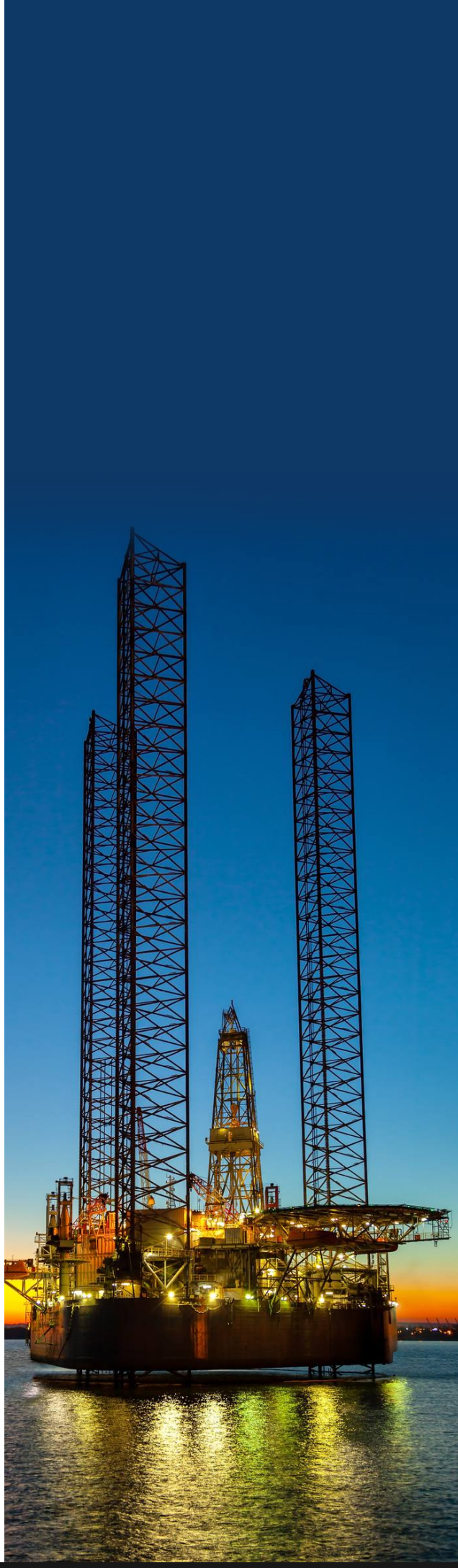
Every organization's IT environment is unique, and any deployment of assisted reality devices will necessarily require customization, integration and management. Start small and give it the appropriate governance and resource support—after all, success breeds success. System integrators can help you integrate and deploy assisted reality at scale, but the key is to start with a simple, single use case. Understand what business problem you are trying to solve—and the ROI you expect from the deployment—and expand to other use cases only after you've proven the first one. This will allow you to scale up in a controlled manner, without losing momentum in the process.

Preparing your workforce now for the future of energy

Technology is not the panacea for the oil and gas industry's challenges, and neither is AI. Humans are going to be the core of the future of energy, and they must be equipped with the intelligence to stay connected and run these massive operations safely, efficiently and with fewer emissions.

Now is the time to invest in the training and equipment to make that a reality. Oil prices are surging, giving oil and gas companies a critical window to prepare for the transition ahead. Building workforce skills to thrive in the new future of clean energy won't happen overnight—in fact, it will likely take several years, which means if you don't start now, you won't be ready.





1. “Oil and Gas After COVID-19: The Day of Reckoning or a New Age of Opportunity?” McKinsey, May 15, 2020.
2. Ibid.
3. “Oil and Petroleum Products Explained.” U.S. Energy Information Administration, Feb. 25, 2022.
4. “Where the Oil Industry Is Headed in 2022.” EnergyWire, Jan. 1, 2022.
5. Ibid.
6. “Downstream Oil and Gas Amid COVID-19: Succeeding in a Changed Market.” McKinsey, Sept. 3, 2020.
7. “The Impact of Digital on Unplanned Downtime: An Offshore Oil and Gas Perspective.” GE Oil & Gas, Oct. 2016/
8. Ibid.
9. “Digital Transformation in Oil and Gas.” Deloitte.
10. Mortlock, Lance. “Rethinking the Oil and Gas Workforce in 2040.” EY, Aug. 8. 2020.
11. “The Cost of Managing Paper: A Great Incentive to Go Paperless!” informIT, Sept. 16, 2009.
12. “RealWear Announces that Shell Selects HMT-1Z1 and HMT-1 Hands-Free Computers for Field Workers.” RealWear, April 1, 2019.
13. “RealWear Announces that Shell Selects HMT-1Z1 and HMT-1 Hands-Free Computers for Field Workers.” RealWear, April 1, 2019.
14. “Shell Deploys AR Headsets to Facilities in 12 Countries.” Journal of Petroleum Technology, April 4, 2019.
15. Shea, Tim. "BP Says Wearable Technologies Offer Huge Potential to Oil and Gas Industry." ARC Advisory Group, March 23, 2016.

