

The next digital frontier

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We live in a world that continues to change and adapt to different industrial, technological, political and social realities. As the world changes, the oil and gas industry will inevitably need to adapt. The industry is responding to unprecedented levels of change driven by factors such as an increased focus on improving sustainability, new economic realities, and adapting to the future of the workforce.

As such, it is important to rethink the role of industrial digital transformation, which is now expected to deliver the next step change in ensuring safety, improving sustainability and reliability, enabling people, and increasing margin predictability. Making this a reality requires a shift towards industrial autonomous operations.

Envisioning industrial autonomous operations

Industrial autonomous operations is a vision for the future, where functions in operations embed higher levels of

intelligence and close the loop with people and systems. This will enable people to focus on higher-level tasks. Although the industry has not reached the highest level of full autonomy, technology advancements have provided a good set of ingredients to allow for autonomous operations.

Automation and control systems in a closed loop are becoming pervasive, and they continue to be complemented by different software-enabled capabilities such as advanced process control, alarm management, asset performance management, and remote monitoring. As automation and control systems get closer to software and converge, current advances in cybersecurity, self-learning intelligent systems, and digital twins allow for increased autonomous operations.

With industrial autonomous operations, systems and processes will have increased adaptive capabilities enabled through self-learning capabilities. These systems and processes will be bound by guardrails of cybersecurity, safety and reliability. This will be built with explainable

artificial intelligence (AI) systems that utilise multiple simulation models serving as digital twins. Together, this will bring the next step change for industry, unlocking benefits that current digital capabilities do not allow by intelligently, reliably and securely closing the loop with people and systems.

Setting objectives for the next digital frontier

The next frontier in industrial digital transformation will be the move towards intelligent and autonomous operations. Industrial autonomous operations will provide a step change in how the oil and gas industry can create its digital future. Over the past 40 years, some of the defining moments in the digital evolution of the industry include the adoption of automation systems and manufacturing execution systems, the implementation of applications such as advanced process control, and the use of enterprise resource planning systems. Currently, we are in a phase of broader adoption of cloud and AI/ML technologies as more use cases become scalable.

The next major step will be closing the loop between intelligence displayed on a software application to an action through either people or systems. This will allow the



Figure 1. Technologies such as drones and robots will ensure safety and elevate people to focus on higher-level tasks.



Figure 2. The next frontier in industrial digital transformation will be the move towards intelligent autonomous operations.

industry to envision higher targets for digital transformation. Ambitious targets of digital transformation that can be envisioned include:

- Zero-harm operations that keep people away from harm, predict operational risk, and ensure the integrity of operations.
- Significant improvement of sustainability, achieved by maximising efficiencies or supporting new products such as renewable fuels.
- Maximisation of human potential by allowing people to focus on higher-level tasks.
- Unlocking of additional margin by optimising across a much broader envelope.
- Elimination of unplanned downtime, made possible by prevention of failures or autonomous recovery.

Accelerated innovation in the last decade has allowed us to create a path toward achieving this vision. As digital technologies continue to mature, they also become more affordable, secure, and capable of faster value realisation.

The need for industrial-grade software

The road to an intelligent, autonomous future will require a change in how software is built. Industrial autonomous operations require industrial-grade software, which adds greater levels of trust, safety and reliability to software. This predictability is needed for autonomous operations. Some of the ingredients that make industrial-grade software are:

- Zero trust cybersecurity: cybersecurity must move to a higher level of zero trust where we eliminate implied trust within each interaction, and verification is built at each interaction.
- Explainable AI: AI provides intelligence, but autonomy requires AI to be self-learning to adapt to changes in the world over its life cycle. AI should also be explainable because we need to know why AI does what it does in order to let it autonomously control. Similarly, we should ensure that AI-enabled actions are always safe and reliable.
- Digital twins: digital twins support deep learning for new AI models, and provide for verification before implementation. They can also evaluate many what-if scenarios to verify safety and expected results, before recommending or performing controlling actions.
- Secure integration with machines: software must also be able to safely integrate with smart machines such as control systems, robots, drones and other systems.
- Openness and interoperability: software must embrace a nature of being open, vendor-agnostic, and interoperable in order to allow industries to maximise their existing investments on multiple systems

Opportunities for the industry

The future of autonomous operations is a vision that should not be relegated to the impossible or an all-or-none ultimatum. Several aspects of industrial autonomous operations have already been implemented, and have generated value for the industry. Opportunities for applying autonomous operations include:

- Remote operations: decoupling the need for a physical presence near the control system or at any part of the operation is a big step forward – enabling control remotely, digitally enabling and connecting field workers with the control room, and permitting execution away from the control room.
- End-to-end optimisation: scaling optimisation from a single unit to multiple sites through integration with economic planning and scheduling allows for the achievement of a much broader optimisation envelope. Plantwide Optimizer is a proven technology in the market that empowers autonomous operations with intelligent closed-loop optimisation.
- Enterprise intelligence: setting the foundation for closing the loop between man and machine, industrial analytics deliver production insights at an enterprise scale, which delivers real-time monitoring of operations and analysis of multiple what-if scenarios to support decision making.

Keeping people at the centre

Moving towards autonomous operations is a journey. This journey is human-centric and should not be viewed as a means to replace people. It allows us to rethink the future of work in the industry and adapt to changing workforce realities. As the industry continues to struggle with rebuilding lost expertise, worker enablement provides support for the emerging workforce through greater degrees of human inclusion, and elevates the current workforce to focus on higher-level tasks. Leaders who embark on a journey of autonomous operations must continuously embrace a human-centric approach.

Where to begin?

Realising value through intelligent operations requires a shift in mindset and the execution of a structured plan. In addition to setting targets for digital transformation, leaders should take the following steps:

- Prioritise the right function to prove value with autonomous operations: prove value with a digitally-mature use case of high business value. Opportunities such as end-to-end process optimisation or closing the loop with economic planning and scheduling demonstrate results that can create interest in attaining even higher objectives.
- Create an organisational foundation with supporting policies and practices: adapt organisational policies and digital practices to support industrial autonomous operations. Carefully designing organisational roles and responsibilities, security and audit policies, safety functions, and technology governance is a necessary practice.
- Create a technology foundation with industrial-grade software: while industries can reuse most of their technology investments, leaders must strategically rethink the need to adopt new capabilities. Capabilities such as OT cybersecurity, explainable AI, monitoring for AI, and managing digital twins must be set up to ensure reliability of closed-loop functions.



Figure 3. Decoupling the need for a physical presence and connecting field workers to execute away from the control room is a big step forward.

- Continue to keep people at the centre and organise for change: everyone should be taken along as part of this journey toward autonomous operations. Managing change for people, supporting them through new processes, and elevating them towards higher-level tasks is necessary to ensure the long-term success of autonomous operations.
- Build the right governance and guardrails: increasing levels of AI and self-learning capabilities will require proper governance and guardrails to manage safety and reliability, including organisational practices that monitor the health and functioning of all AI systems.

Honeywell is building towards industrial autonomous operations with industrial-grade software that profitably improves safety, sustainability and productivity. Honeywell brings learning through experience in shifting the industry towards greater levels of autonomous operations, and can effectively help drive this transformation. [i+e](#)