

# engageSubsea

## An agile platform for the asset digital life-cycle

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## The challenge

We are facing a world where a consistent connection over data leads, real-time information and expertise is expected.

Today's business complexity requires an evolution in the way we share project and service information in the energy industry – from a reporting culture to true transparency and collaboration. COVID-19 has made collaboration and connectivity more critical than ever before by asking us to adapt to a new normal. A digital foundational system able to embrace raw data, perform analytics, and display key recommendations and insights plays a key role on turning this unprecedented challenge into opportunities by making our industry more contemporary.

## Market requirement/ problem statement

Asset integrity management still represents almost 80% of our customers' OPEX.

Less than 1% of data sets available are currently leveraged in the oil and gas industry and usually – when they are monitored – most of the evaluations are based on human assessment of raw data.

The market and industry needs a way to use data, coupled with expertise, to pro actively manage assets and reduce OPEX.

## Background & evolution of engageSubsea

After the success of engageDrilling in 2014, we built on these foundations to create a subsea platform with a more ambitious goal – create a full-scale digital enablement to the customer, going beyond visualization of data, and provide a cohesive solution enabling proactive management of asset life-cycle.

engageSubsea is the digital foundational system of all Baker Hughes subsea activities and represents Digital Enablement within our Subsea Connect philosophy. It combines vertical industry experience with best-in-class technology and intelligent analytics to proactively support our customers throughout their project life-cycles. Built for collaboration, the platform unlocks value for both Baker Hughes and its customers through 3 main drivers: supporting live operations safely and remotely; predicting degradation and failure of subsea and topside assets; and supporting effective operations planning.

engageSubsea is a real-time modular platform for proactive asset management and instant troubleshooting which can be leveraged during any stage in a field's life-cycle.

The platform represents the point of digital dialogue between Baker Hughes and our customer. The modular nature of engageSubsea ensures flexibility and is capable of integrating raw datasets (Baker Hughes or 3rd party data). Leveraging almost 100 years of industry expertise combined with best-in-class hardware and software technologies, engageSubsea deploys an ecosystem of modules with proven ability to reduce non-productive time and OPEX for our customers.

Our engageSubsea journey has rapidly evolved from concept to reality – it has been the catalyst in supporting our, and our customers', digital transformations. We created the base platform and then consolidated multiple data streams to allow end-to-end visibility of the operation (e.g. from order creation, through equipment repair and maintenance, to installation and commissioning and Life of Field (LoF)).

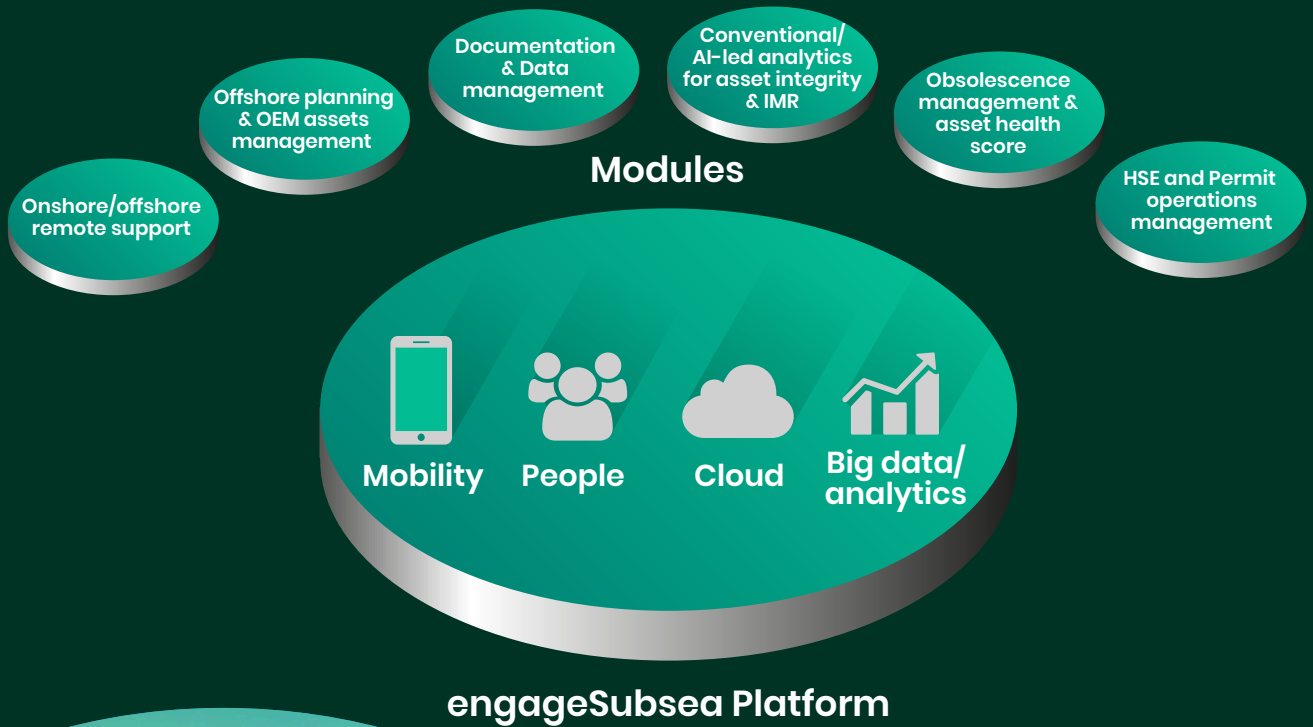
As planned and unplanned maintenance costs became more critical to our customers, as did our focus on production efficiency and asset health monitoring. We enhanced engageSubsea's capabilities and focused on these themes with the enablement of our predictive and monitoring capabilities, which can be enabled on new, or existing assets. This is key in supporting preventative maintenance strategies as the system allows not only immediate notification of equipment failure, but also early identification of system degradation. These insights, paired with Baker Hughes subject matter experts' experience, bring immediate valuable decisional support to our customers' operations.

The most recent upgrade to engageSubsea is to host our remote activities, engageSubsea Remote. From the platform, we are able to support both internal and customer operations without the need for personnel to be on site. This functionality has allowed a number of key projects to continue during these unprecedented challenging times. But the value does not stop there, we have realized operational efficiencies for Baker Hughes and our customers through improved lead time in troubleshooting and the ability to support multiple operations at once.

## The platform – main functions

engageSubsea offers a comprehensive suite of modules to get the most from operations planning and to support decision making. These modules deliver specific capabilities including, but not limited to:

- Saved 6-12 rig hours
- Future projections of electronic equipment lifespan and auto-detect at-risk systems
- Hypothetical operational scenarios with full production revenue impact modelling
- Live visibility of global offshore activities (personnel, activities, tooling, equipment)
- Equipment fleet management and maintenance planning
- Comprehensive project documentation library
- Equipment spares store
- Predictive algorithms matching historical data and operating data to get more accurate maintenance or physical inspections plans
- Controls upgrade plans with redundancies analysis



## Onshore & offshore remote support

engageSubsea allows business continuity for our customers during these challenging times and beyond. We can support live operations remotely, with technical experts in an onshore environment offering their support to one, or many, operations at one time:

- Support offshore operations from onshore
- Real time collaboration between Baker Hughes technical and operational teams



- Real time, dual-sense data flow between offshore and onshore
- Remotely host Customer's equipment and HSE inspections ( in field or during shop operations)
- Instant SME support from centralized knowledge base
- Provide training/knowledge sharing/AR
- Remote support workflows are embedded in our processes and integrated with other systems



Remote Support for Operational Excellence

## Equipment integrity and flow assurance management

Only a low percentage of subsea data from distributed control systems (DCS) is available onshore, and although analysis and visualization is critical it is also complex and time-consuming. Simplifying the decision-making process is operationally advantageous, but engineers need more evidence than they often have.

engageSubsea's modules for equipment integrity management connect the following:

- Sensors that can be integrated with well, riser and subsea production system (SPS) equipment in a variety of locations to give a broader view
- Agnostic application modules that can analyse and integrate data on equipment from any manufacturer
- Customisable screens for onshore personnel so they can make decisions that are right for each site, project or asset
- prognostic analysis that can predict failure points and expected lifetime of equipment

In terms of production goals flow-assurance is fundamental and already based on data analytics, from well testing to field characterisation. It also requires a lot of 'what-if' analysis to determine optimum operational set points, like minimum water production, or to optimise required chemical injections. On the other hand, subsea meters typically consolidate a number of measurements which are not always available at every well and also just one meter failure can affect accuracy of the measurement.

Baker Hughes will offer the best in class hardware (metering solutions covering SPS infrastructure, wells and risers) to support measurement with a distributed flow-metering (DFM) solution that combines the best of virtual and physical metering, and which integrates measurements from downhole, trees, and the wider Subsea Product System (SPS); while engageSubsea's module will support decisions around production enhancement with analytics embedding our expertise, in order to provide flow engineers with a whole-system view.

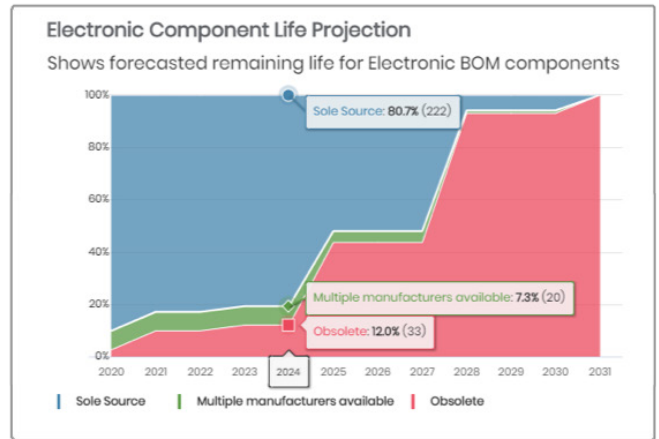
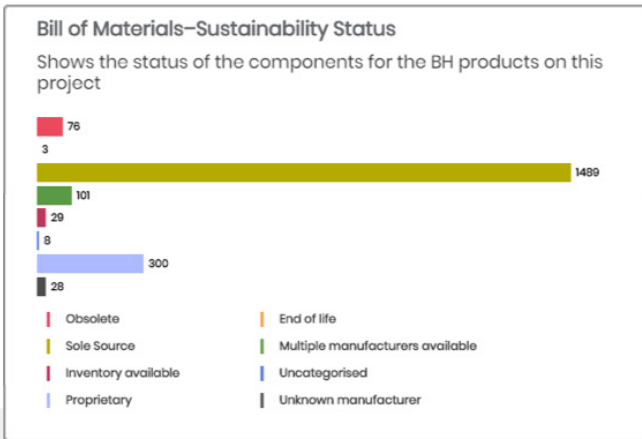
## Obsolescence management & asset health score

The objective of obsolescence management is to ensure that obsolescence is considered as an integral part of design, development, production and in-service support in order to minimize cost and detrimental impact throughout the product life cycle.

The engageSubsea obsolescence management module is essential to achieve optimum cost-effectiveness throughout the life cycle of a product. It uses a novel

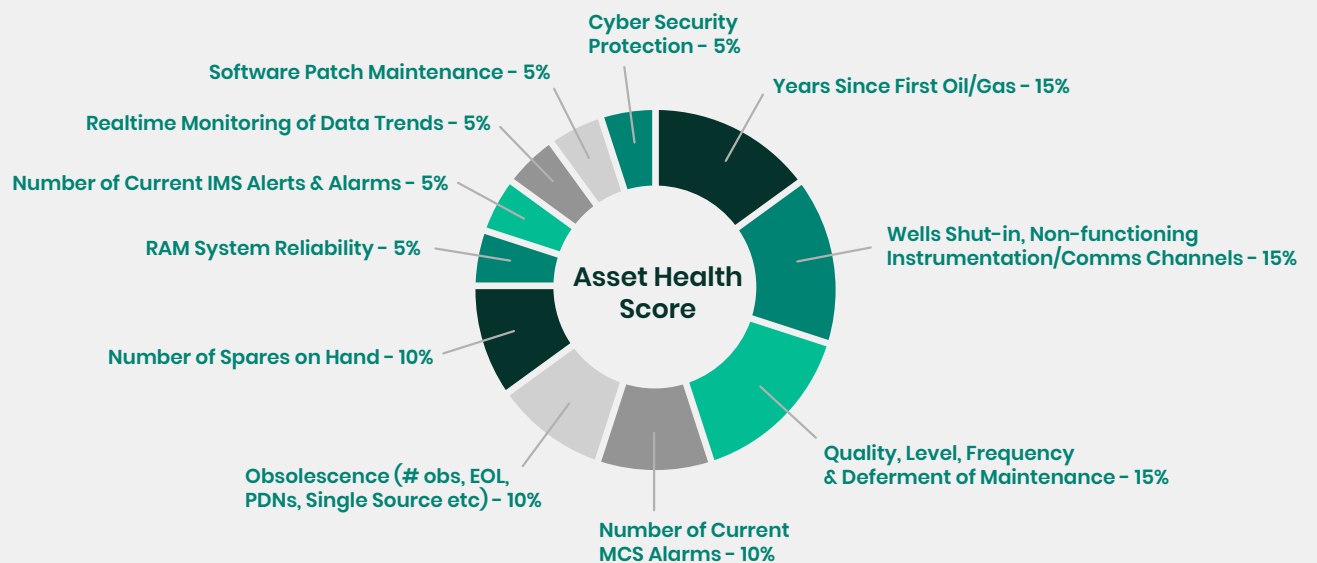
multi-stage process which is robust and standardized, to facilitate the rapid identification of those components posing the highest obsolescence risk.

The process begins with uploading equipment Bills of Materials to the asset management application and includes a detailed manufacturer's obsolescence status analysis, risk assessment, and reliability analysis (including economic modelling).



Our asset health score provides the opportunity for oil and gas equipment owners or operators to have an objective view of the overall health status of their asset(s), field(s) or infrastructure, considering those elements which have greatest bearing on health and longevity, with the possibility of monitoring health trends over time and actively working with the subject matter experts at

Baker Hughes to improve asset health scores and hence prolong operable life and optimise productivity. It is the definitive benchmark standard in asset health, providing a snapshot metric of health. Much like the BH Rig Count, is the widely accepted metric for oil and gas drilling activity and brings together the various asset health considerations into a single, all-encompassing whole.



## Offshore planning & OEM assets management

NPT is a direct consequence of poor planning. engageSubsea is designed to eliminate those planning inefficiencies. The dashboard provides full and live status of any offshore activity – past, present or planned, and gives specific details around progress, tooling, spares, personnel, and houses the end of well report. Visibility of tooling and spares is essential to effective operation planning – engageSubsea gives a view at a fleet and part level to show availability, history and forecast of cost impact per operation.

## Documentation & data management

Full project documentation is visible from engageSubsea and aligns specifically with the related activity. Equipment MRBs can be accessed alongside viewing the part information and history, as can the 2D drawing and 3D model. Documentation is visible throughout engageSubsea, in the right place, at the right time.

## Conventional /AI-led analytics for asset integrity & IMR

Once engageSubsea is installed so that the foundational system becomes a powerful enabler to make customers display and manage different data sets and information, the next step is building a series of increasingly more complex correlations, among the different data sets inflowing in engageSubsea, with the ultimate goal of predicting degradations and failures of subsea and topside assets in a faster and more accurate manner.

engageSubsea performs proactive conventional analytics of subsea equipment systems, subsystems and controls to support our customers' predictive asset integrity strategy. Conventional analytics are algorithms based on Baker Hughes' vertical experience in subsea production assets integrity, as integrated with best-in-class data scientists' support. Combining different data flows (either historical and real time ones) with simple correlations, Baker Hughes is able to convey asset health and recommendations both at a field and component level. It enables our customers to future oriented decision making:

- Proactive detection of equipment failure
- Prediction of asset, equipment, systems, subsystems and controls failures
- Early identification of system degradation
- Optimization of equipment operational performance

## HSE digitization and digital work permits

HSE plays a primary importance our industry, segment and day-to-day operations. A smart HSE data management impacts operations management, production scheduling, training and ultimately reputation of our customers, suppliers, and Baker Hughes.

By means of specific modules leveraging best in class digital technologies, engageSubsea is able to extend the data management to this specific matter, unlocking a broader data integration (and circulation) and delivering analytics which take also in account HSE data sets for more accurate analysis and insightful recommendations.



The HSE digitization journey starts from a full configuration integrating business rules, relevant legislature and regulations and the related procedures and standards. This sets the ground for more accurate monitoring and knowledge storage and transfer standardization. A second layer is the digitalization of the permits to work in order to ensure compliance and maximize safety and operational efficiency. While the former has a static value, the latter allows customers to be dynamically aware of what is going on across the asset with real-time graphical overviews and integrated conflict detections.

But the real purpose of this integration is the connection with the overall asset data management: engageSubsea's modules will connect and make interdependent HSE data sets and the consequent digital risk assessment with the asset-related modules, including for example MMS, DMS and DCS, or interactions with P&IDs, heading a full digital shadowing of the plant. engageSubsea will drive the following capabilities:

- HSE compliance digital check
- HSE digital training
- Workflows HSE monitoring
- HSE analytics for process safety monitoring
- Full integration with asset 3D model and asset related data sets

## Customer benefits

From a technical perspective, engageSubsea may be leveraged for different purposes: once big data will populate the platform, numerical value may be leveraged – as example – for the following purposes:

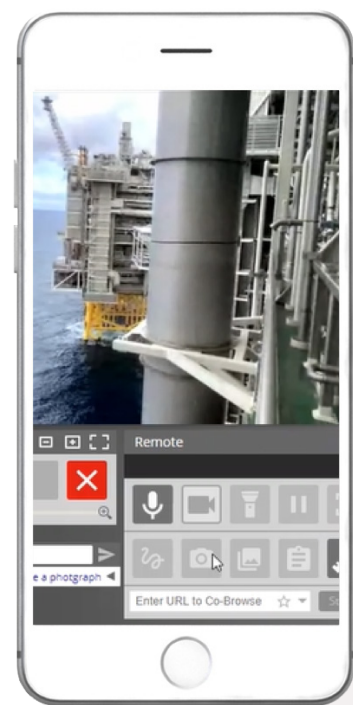
- to design conventional analytics to understand redundancy status of specific systems or sub-systems
- to set a predictive rule to minimize unplanned interventions
- to support customer's predictive maintenance strategies for an equipment system or the overall asset
- to design a predictive alert system for component failures in the field
- to support life of field extension strategies
- to minimize equipment downtime
- Remote support for onshore and offshore operations

With the help of engageSubsea, support to customer's decisions may also trigger proactive interventions in terms of asset integrity management. In other words, Baker Hughes will internally leverage analytics and predictive plans to pivot business as usual operating models, offering lump sum and performance based contracts like smart life of field management, smart IMR contracting, smart physical inspections plan and so forth. The customer will benefit from an agnostic approach to field servicing, an improved lead time to interventions, a lower and more programmable OPEX related to asset integrity and an operational and financial risk hedging.

## Conclusion

Why should our customers adopt engageSubsea as a foundational digital platform?

1. Because this user interface provides a digital support to customer's decisions through the field life cycle.
2. Because this user interface will impact on equipment/ controls design and engineering to improve the quality of Baker Hughes products.
3. Because this user interface will unlock a new collaborative operating model where decisional support and specific intervention categories will be tied within the same process.



We serve our customers from our headquarters in Bristol, United Kingdom and have a network of offices across the world to meet the needs of our global customer base.

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