When Anadarko Corp. launched its most recent mega project in the deep waters of the Gulf of Mexico early this year, the 97-percent uptime it achieved during the first six months of production left many in a state of shock — in the best possible way.

“That is basically unheard of for a new facility and new platform,” said Huan Gamblin, a reservoir engineer for Anadarko who is part of the Gulf of Mexico Asset Development Team.

He attributes the success of the operation to efficient production operations and the management of new wells with a new tool developed by Anadarko with assistance from Landmark, a business line of Halliburton.

Called IPSO, which stands for integrated production surveillance and optimization system, the tool has become Anadarko's solution for an issue presently challenging the industry as a whole: the management of big data.

IPSO allows decisions to be made effectively and consistently by the right people at the right time, and it delivers value in exploration, appraisal, development and the production of oil and natural gas resources, Gamblin said.

“The global resource pool of personnel with direct digital oil field experience is still very limited. (Designing and implementing) IPSO required people with hybrid skill sets – with a mix of petroleum engineering, information technology, automation, real-time systems, system integration and machine learning,” explained Sathish Sankaran, subsurface manager, deepwater international reservoir development, Anadarko and project adviser for IPSO.

“By forming a small team of skilled and experienced personnel for development and support of installed solutions, we were able to build upon years of experience very quickly,” Sankaran said.

With IPSO now in place, geologists, geophysicists and engineers can glance at a dashboard and see in real time the productivity of each well, well degradation, pump failures, pressure and temperature changes, and a host of other measurements from downhole meters and sensors that pump billions of bits of data into their computers every year.

IPSO serves as a powerful filter and translator, allowing only the most helpful and critical information through for processing, integrating and analysis, Gamblin said.

“It is an integrated workflow tool that talks to all of our relevant data sources containing well telemetry,” he explained. “It performs routine surveillance using Anadarko-developed algorithms and models that automatically calculate well productivity, detect well anomaly, and provide inputs to advanced engineering software to enable expedited analysis.”

Furthermore, IPSO “absorbs” results from various engineering analysis software, further facilitating integrated analysis within the tool, Gamblin said. “It was custom designed by the company and built specifically to accelerate our engineering workflow.”

IPSO Facto

By the very fact that Anadarko, like other operators, has struggled to get its arms around overwhelming volumes of data produced from ever-advancing technology in the wellbores, tools such as IPSO are born out of sheer need.

“In a typical Gulf of Mexico deepwater field, more than 4 billion bits of data come shooting out of sensors inside wells in real time every year,” Gamblin said.

This data is then stored in different data warehouses for extraction and analysis. “The data is essential to the efficiency of our operations and something that must be well managed, he said.

The driver behind the IPSO system was the need to enable engineers to expedite routine engineering surveillance analysis and accelerate advanced reservoir analysis workflows, Gamblin explained. “This provides more time to focus on resource development while also maintaining routine well surveillance,” he said.

Charged with creating the tool in early 2014 was Anadarko’s Gulf of Mexico asset development team, which consisted of engineers across multiple disciplines who designed the tool, and two Landmark graphic developers who built it.

One of the main goals of IPSO was to tackle common challenges in today’s data-intensive digital oilfields:

- A massive influx of real-time data that has become unmanageable.
- An explosion of different software applications and data formats that make data gathering, processing and interpreting an arduous process.
- Global teams stationed in different parts of the world that are unable to see the same data in real time, leading to inconsistent decision making.

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- Workplace experience gaps caused by attrition, leaving companies with young talent that lack the knowledge of best practices.

**‘A Priori’ Digital Oilfields**

Before operators encountered the challenges of big data, data from oilfields were much more simple. In the late 1990s and early 2000s, operators in the Gulf of Mexico began developing fields roughly 2,000 feet deep. They consisted of dry tree wells with unreliable bottom hole pressure and temperature gauges and were deployed on spar platforms to extract oil and gas.

“Data from those gauges were kept in a low resolution format in individual spreadsheets for storage and analysis – because data storage was very expensive at the time,” Gamblin said.

As Anadarko and other operators ventured into deeper waters – roughly 5,000 feet deep – in the late 2000s and early 2010s, wells shifted to predominantly subsea wells with a multitude of sensors.

At the same time, the gauges’ reliability increased along with data bandwidth, increasing exponentially the amount of telemetry from each well, Gamblin said.

Real-time data also was made available for well monitoring. However, because the data came from different sources and in different formats, there were many discrepancies that needed to be addressed before it could be effectively interpreted and analyzed.

“The previous low-frequency engineering analysis spreadsheets were no longer adequate to provide proper timely engineering analysis,” Gamblin said. “This created a strong motivation to develop a specific automated engineering analysis tool.”

Hence, the idea for IPSO was born.

**Problem Solver**

IPSO was charged with no small task. It needed to:

- Measure, control, model and integrate workflows to allow engineers to make good decisions quickly.
- Listen to wells and reservoirs using a real-time surveillance system to avoid well and reservoir productivity degradation.
- Collaborate between different disciplines so each could look at the same data before making recommendations.
- Incorporate best practices of Anadarko’s senior employees so consistent decisions could be made in their absence.

If IPSO could deliver, issues with reservoir connectivity and drive mechanisms could be assessed, and engineers would gain the ability to predict well performance and mitigate well performance issues. “What is the well doing? Do we have degradation of the well? Are there opportunities to drill infill wells?” These are questions that IPSO was designed to answer, Gamblin said.

Engineers needed a surveillance system to know how each well was performing at all times. They needed to measure productivity drawdown, to perform pressure transient and material balance analyses, and to history match reservoir simulation models for calibration purposes.

Once a reservoir simulation model is calibrated and history matched, it can be used to forecast well performance over time and determine future infill drilling locations, Gamblin said.

“It was essential to recognize fit-for-purpose models to keep the solution design simple for implementation and support,” Sankaran added. “Strong project management (also) was required to deliver on-time work products to the engineers.”

**Implementing IPSO**

When up and running, IPSO operates in two phases. Phase One consists of:

- Monitoring and visualization of the well telemetry.
- Automatic and routine well surveillance analysis.
- Quick data preparation for advanced engineering analysis.
- Data integration from industry-standard engineering analysis software.
- Metering and allocation check to ensure proper production allocation.
- Tracking and reporting a well’s key performance.

“We are 11 months into this and all is working well,” Gamblin said. “The idea behind Phase One is to enhance but not replace the current workflow, so we take less time preparing data and more time analyzing it.”

Phase Two, which is expected to start development in 2016, will focus on production operations including:

- Root cause analysis, which identifies the cause of any abnormalities encountered by topside production equipment.
- Reservoir simulation.
- Pipeline performance.
- Asset integrity, which is the routine surveillance of the telemetry from topside platform equipment to ensure it remains within operating tolerances for the sake of longevity and reliability of the equipment.

“Going forward, I envision all deepwater fields of Anadarko will embrace IPSO right from the development phase, and it will become a way of working in this digital era,” Sankaran said.

“It will help us deploy a global workforce trained on best practices and cross-functional workflows.”

**Adding Value**

Through automating reservoir surveillance and production, emphasizing value-driven workflows, and supporting engineers through common-sense concepts, “IPSO is adding value especially in a $40 per barrel market where increased efficiency is key to profitability,” Gamblin said.

“The value that IPSO is adding is the early identification of production issues and performance, the prevention of expensive well works and production loss, accountability and transparency – as all can see how the wells are performing – and an impressive increase in uptime and efficiency,” he said.

Specifically, IPSO is streamlining well surveillance so that problems, such as sleeves plugging or fines migration, can be quickly identified and addressed. It is automatically calculating key performance indicators, tracking well degradation, and decreasing the downtime for wellbore engineers. And, the number of employees using IPSO is on the rise.

That is likely because IPSO’s intuitively designed dashboard – which shows well flows, choke changes, real-time pressures and real-time flow rates in intuitive colors including red, yellow and green – makes using the tool rather easy.

IPSO also communicates information in terms of trends, charts and in reports. “These provide engineers a quick visual analysis of well performance and identifications of well anomalies,” Gamblin said.

Sound like a lot?

“For Anadarko, this is just a start,” Gamblin said. “We are now asking ourselves, ‘What else can we do?’”