Oil exploration and exploitation is sufficiently difficult at the best of times, especially when most fields are in inaccessible, inhospitable parts of the world, where temperatures can fluctuate from minus 50 to plus 50ºF. As more and more wells come online, it becomes even more imperative to know just what each well is producing and how that matches up to planned targets.

Senior executives, often operating thousands of miles away from the oil field, face an enormous challenge to make decisions about the future of their business when the basic data about reservoir status, production capacity, etc., are not easily available.

Comprehensive reservoir simulation studies form the engineering backbone or basis for field planning and exploitation and investment strategies. Reservoir models require large amounts of reliable information in order to generate meaningful results. Often this information is inaccessible and sampling procedures are employed. Some data may be considered too expensive to obtain. For instance, it can be costly to obtain a well's production history for matching purposes, an important step in the reservoir model-building and model-calibration phase. The difficulty arises because, even today, commercially viable multi-phase metering at every wellhead is unavailable.

The industry has been grappling with this issue since the beginning of reservoir modeling. While indirect model-based measurement solutions do exist, it's unlikely that they will deliver this type of information. Thus, it is often a balance between the oilfield's stage of growth and the capital investment available.

Even if the decision is made to invest in these technologies, the remote geography of these locations, where wells are often miles apart, makes it very difficult to IT-network these wells together and aggregate the data from each of these production facilities.

And, when you are dealing with more than 200 wells, coming into three processing facilities, each operated by different automation systems that don't talk to each other, it's even more of a challenge. This was exactly the situation faced by a client of Invensys. The client also needed to monitor production from each well and reservoir and know the composition coming out of the oil/condensate reservoirs in order to configure the processing plant and optimize production. But they didn't
have access to the data to provide this information and couldn't justify the investment in detailed well-head technologies (such as multiphase digital coriolis meters).

Invensys engineers, working through the Centre for Hydrocarbons Innovation, developed a solution that addressed the problem by modeling the flow from the well, through the field's gathering flowline network to the processing plants, to the export pipeline, and finally through the application of three integrated technologies.

They decided to implement the PipePhase simulation program from Invensys' SimSci-Esscor™ business unit. The PipePhase program rigorously models steady-state multiphase flow in oil and gas networks and pipeline systems and can model a wide range of applications.

In addition, the PipePhase program takes basic information such as surface IPR information, based on well-test data and stream composition, and current shut-in WHP and network-end (sink) pressure to compute flow, temperature, pressure and flowing composition data at each well, pipeline and node. This analysis gives the engineers vital information that they've never had before -- the flow rate of the well over time.

By coupling the PipePhase technology with SimSci-Esscor's ARPM technology, engineers operating the process plant can model the plant ahead of time to optimize production. The ARPM performance-monitoring solution calculates expected phase flows, temperatures, pressures and compositions, in a process flow sheet and produces a reconciled mass balance within the processing facilities.

This means that engineers know what's coming into the plant, and know what should be coming out. It can therefore optimize the processes and machinery for maximum efficiency and minimal losses. It also facilitates energy efficiency gains along the way, thus reducing overall operating costs.

The normalized data then passes into SuiteVoyager portal software from Invensys' Wonderware business unit. SuiteVoyager software benefits from Invensys' ArchestrA technology, which is designed to make every system in a plant work in concert.

In this project, ArchestrA technology connected an I/A Series system from Foxboro, another Invensys business unit, with a Honeywell (Prosper) system. It drew on the process data generated by the PipePhase program and ARPM solution, as well as the data from the automation and control system, to generate periodic custom reports to be accessed in multiple locations, in different countries, in multiple languages. The Invensys solution is also used to monitor the field and activate alarms and warnings based on user-defined criteria.

A key benefit of the system is the way it provides daily, weekly and monthly data to the different people who need it throughout the organization. In a predictive mode, the system can predict how things will change in the short term and for future planning.

Getting staff to work in these remote and inhospitable locations is always a challenge, but with this solution, the remote-monitoring capability of the Invensys system enabled plant personnel from around the world to monitor the wells solve problems without leaving their offices. Additionally, when the system flags a problem or deviation from the norm, local plant staff can resolve the problem right away and then return to an indoor environment.

As the oil field and processing facility expand, the Wonderware Industrial Application Server, which is built on the ArchestrA software architecture, will save the company considerable engineering time by using standardized application objects for faster engineering and commissioning of new well sites. It will reduce site commissioning time, risk and set-up, and ease deployment with advanced scripting capabilities, thus ensuring better use of available staff resources.