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‘Importantly, in arctic regions where icebergs are evident, industry can expect to gain an increased range of technical solutions for addressing these unique challenges.’
Ian Ball

Improving cold-climate confidence

An INTECSEA-led joint industry project headed by former Shell subsea specialist **Ian Ball** is looking to pave the way for increased step-outs, enhanced recovery and improved economics on upcoming subsea developments in arctic and sub-arctic waters, including offshore eastern Canada.

Scheduled for completion by the end of the year, the cold-climate subsea joint industry project is being run out of St John’s, Newfoundland, and among its participants are three oil companies involved in developments off Canada’s east coast, with Petroleum Research Atlantic Canada administering the contractual entity. It follows on from a 2007 subsea processing JIP, also led by INTECSEA, which focused on production solutions for deepwater and/or long offshore tiebacks to host facilities or to shore and highlighted available technology, current operational status and future strategic direction within this industry subset.

The partners in the new JIP foresee subsea processing requirements for both brownfield expansions and greenfield developments within the next decade.

Subsea processing encompasses a broad range of significant emerging technologies, which INTECSEA – a WorleyParsons business unit – collectively refers to as ‘subsea active production technologies’. All of these technologies contribute to the reliable flow of production fluids and are focused on either the conditioning or addition of energy to the wellstream at the seafloor.

Conditioning of fluids in a flow system includes application of pipe-in-pipe and thermal insulation technologies and chemical injection at the subsea wellhead, each of which can facilitate stability. Examples of adding energy to the wellstream include direct electric flowline heating, produced liquids pumping and gas compression.

In deepwater, supplementation of energy into the wellstream on the seafloor can improve production flow from a subsea wellhead to surface facilities. High-voltage electrical cables and connectors integrated into the subsea architecture design deliver power to the system.

Frontier developments in cold climates require robust subsea systems, such as hybrid pumps. The Framo hybrid boosting pump pictured adds pressure to a subsea system to improve production efficiency from a subsea well to a host facility.

Targeted benefits, says JIP project manager Ian Ball, include improved feasibility in terms of initial cost and life-of-field investment. In some cases, industry can anticipate an overall reduction in capital expenditures by reducing weight or space requirements on an associated surface structure, or even eliminating a surface structure altogether.

‘Importantly, in arctic regions where icebergs are evident, industry can expect to gain an increased range of technical solutions for addressing these unique challenges.’ This approach, adds Ball, mitigates higher back pressures on seafloor wellheads in deepwater and allows well fluids to flow more readily to surface facilities. The applied technology, therefore, can increase flow rates from individual wells and increase cost-effective total recovery volumes from each well.

For the transport of produced hydrocarbons, operators may potentially increase the tieback distance from wellhead to surface facilities—perhaps double current achievable distances. Using these technologies, operators also may be able to reduce the number of wells drilled using costly deepwater drilling rigs.

One deliverable of the new JIP is a user-friendly, system-design database that consolidates objective and up-to-date component information, allowing operators to match their asset needs with the most appropriate conventional, enhanced and active subsea production technologies.

‘In short, the JIP will offer industry a mechanism for optimizing design schemes and field development architecture for the efficient delivery of hydrocarbons in arctic and subarctic waters,’ notes Ball, whose 40-year career has focused in the main on cutting-edge subsea production developments. He served as Norsk Hydro’s technical manager in Oslo for the North Sea’s first FPSO, Golar Nor’s *Petrojarl 1*, led Shell’s deepwater multiphase subsea boosting and separation technology development efforts based in New Orleans (*OE* June 2002), and subsequently spent three years with Indian operator Reliance Industries in Mumbai as senior technical advisor on its two pioneering KG-D6 deepwater projects in the Bay of Bengal (*OE* January 2009).

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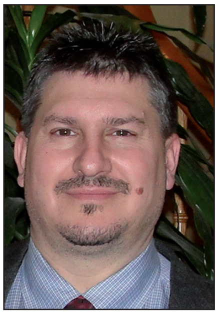
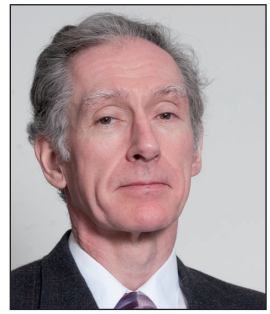


'The Labrador Shelf – with its water depths approaching 10,000ft and waves up to 43ft high - will require innovative solutions to overcome the challenges.'
Mike Paulin



'The prize is enhanced confidence in deeper waters and ice-prone regions worldwide while improving the availability of valuable hydrocarbons.'
Uri Nooteboom

Ball joined INTECSEA last year and also serves as its UK technical advisor for both conventional and enhanced subsea development projects.

Ball's team in St John's includes Dr Kalyana Janardhanan, group lead, subsea active production technology; executive engineer Richard Voight; subsea discipline manager Cody Moffitt, and subsea engineer Julie Burke.

Next-generation solutions

Garry Mahoney, INTECSEA's senior vice president, business development, and chief technology officer, says the JIP will be encouraging the use of proven and evolving technologies from deepwater Gulf of Mexico, offshore Brazil and the northern North Sea. 'Our joint efforts will facilitate next-generation subsea solutions and improve confidence in the economic appraisal of offshore cold-climate developments while creating an open platform for industry collaboration,' he says.

INTECSEA president Uri Nooteboom adds: 'The prize is enhanced confidence in deeper waters and ice-prone regions worldwide while improving the availability of valuable hydrocarbons.' Frontier developments in cold climates – where ice floes and icebergs are prominent much of the year – and in remote offshore arctic areas require robust subsea systems that effectively manage the extraction of produced fluids and transportation to the end user, he stresses.

The current JIP will incorporate information from the 2007 study with additional updated information on conventional and emerging subsea technologies and relate them specifically to the participants' interests offshore Newfoundland, Labrador and arctic environments globally.

With Hebron expected to begin development in the near term, joining Newfoundland's existing Hibernia, Terra Nova and White Rose developments, a growing number of step outs from existing facilities are contemplated, with one already completed on the White Rose field.

According to Mike Paulin, INTECSEA operations director for Canada, prospective frontier and deepwater areas targeted by the JIP include Orphan Basin, Laurenian Basin, Central Ridge/Flemish Pass and the Labrador Shelf. He describes the Labrador Shelf – with its water depths approaching 10,000ft and waves up to 43ft high – as a very harsh environment that 'will require innovative solutions to overcome the challenges'. Ice conditions here are also significant, with pack ice reaching a thickness up to 23ft and icebergs posing a serious threat from July through October.

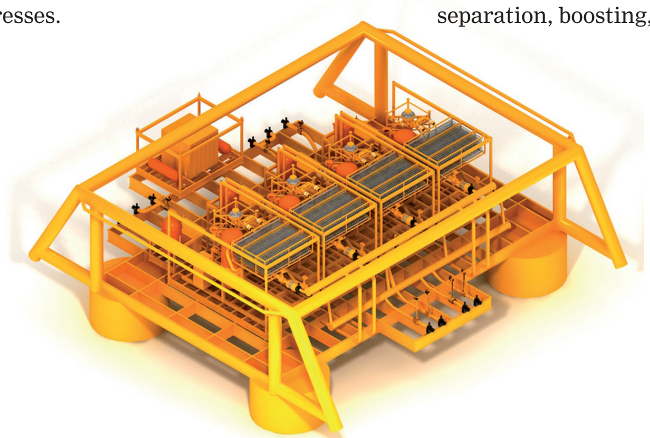
To address these and other frontier issues, the JIP will generate a database with an interface tool that allows operators and developers to screen and select from a broad array of active production technologies, including separation, boosting, compression and direct electric heating systems, suitable for stranded and existing field developments.

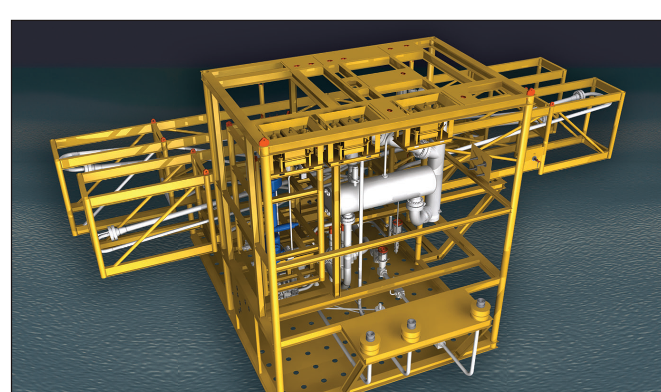
Inherent evaluations include system installability, operability, reliability and maintainability issues specific to the environment, as well as technology maturity and any additional fit-for-purpose qualification programs.

Efforts of the JIP will redefine current industry limits for field development architecture in cold-climate regions while improving expectations for robust systems that are flexible and responsive, says Paulin.

Intelligent, experienced application of these subsea active production technologies, he believes, may deliver new strides in field development, for example extending present arctic oil tieback limits from 10km to around 50km and tying back subsea wells in potentially 10,000ft of arctic water to a floating production facility in shallower, more protected waters.

The JIP also is tackling prominent offshore arctic issues, including the impact of iceberg scouring on subsea facilities. 'A floater can be relocated but subsea facilities cannot,' explains Paulin, pointing out that operators offshore Eastern Canada, excavate large 'glory holes' in the seabed deep enough to site a subsea well and protect it from iceberg scouring. 'This approach is costly, time-intensive and will not sustain the level of subsea development the industry anticipates,' he adds. OE





Typical of the existing or emerging technologies that can enhance the viability of reliable production in hostile offshore environments, including cold-water regions and remote offshore arctic areas, are this subsea compression station (left) *from FMC Technologies and Cameron's two-phase compact separation system* (right).