

The MO4 (Mocean Forecast) operational decision support tool enables higher workability during offshore operations

Two generations, one goal: to make floating wind finally work

When Gordon Jackson of Arup and Jelte Kymmell of ECO TLP / Mocean Offshore BV joined forces, they set out to bridge four decades of offshore experience with the urgent need to industrialise deep-water wind. From concrete gravity bases to next-generation Tension Leg Platforms (TLPs), the pair are proving that the principles forged in oil & gas still hold the key to scaling renewables, if you keep it simple.



PES: Between you, Gordon and Jelte, there is more than 60 years of offshore engineering experience, from the formative years of the North Sea to the dawn of floating offshore wind. Your collaboration on the ECO TLP and ECO GBS platforms was born from a shared conviction that the next frontier of renewables must be smarter, simpler and buildable at scale.

By combining Arup's deep legacy in concrete gravity and TLP design with ECO TLP's drive for digitalisation, modular fabrication and local content, you are crafting solutions that bring oil and gas reliability to the renewable era. What first attracted each of you to offshore engineering, and what made offshore structure innovation so compelling?

Gordon Jackson: I had a childhood interest in meteorology and used to construct my own synoptic charts using data from the Shipping Forecast, long before these would be routinely shown in television weather forecasts. That sparked my interest in wind and waves, and it was the immense power of the waves and a desire to devise structures that could withstand them that ignited my interest in offshore engineering.

The early 1980s were also a time of significant development of oil & gas in the North Sea, and there was recognition that the harsh conditions required novel solutions to allow the fields to be economically developed, making this an exciting sector to work in.

Jelte Kymmell: I have always been fascinated by large-scale structures and heavy machinery. So, when a college friend at the TU

Delft introduced me to offshore technology, it took little persuasion to get me enrolled in the curriculum. The fact that offshore structures have such a great impact on our lives while being invisible to most of the population added to my fascination.

After being involved in this exciting industry for some years, I noticed that it has a strong focus on functionality and efficiency, and therefore not on aesthetic or less pragmatic requirements, making it a dream come true for a pragmatic and result-driven engineer.

PES: What would you say are the main principles behind a successful offshore project?

GJ: A successful offshore project starts with a clear client brief, comprehensive design data, appropriate risk allocation, and realistic budgets and schedules. In offshore wind,

clients may try to transfer as much risk as possible to the contractor, and essential design data, such as soil or turbine information, often must be gathered during the project.

While contractors can usually manage these risks with contingencies, the use of novel technologies or untested installation methods increases the likelihood of setbacks. Designing first-of-its-kind technology, I valued working with clients who understood the learning curve involved and allowed the necessary time to get it right.

JK: A good understanding of the impact of supply chain and logistical dependencies is key to ensuring success. Offshore projects are by default projects that require proper alignment of engineers, yards, equipment and material suppliers, a fleet of vessels and other contracted parties. Underestimating the impact of a limited yet unforeseen delay or the availability of one 'link' within this 'chain' may result in a knock-on effect that impacts the project.

The dependency on, for instance, vessel availability and the seasonal variations in metocean conditions may lead to increased downtime of an entire fleet of vessels spiralling into further delays and cost overruns.

To understand this and use it to maximise project performance requires a high degree of common sense, relevant experience within

the project team, both supported by rigorous engineering and logistical modelling to provide relevant data for decision making.

PES: Looking over your career, what have been your favourite projects and why?

GJ: My favourite projects pre-date Arup's decision not to take on any new energy commissions involving the extraction, refinement, or transportation of hydrocarbon-based fuels except the manufacture of hydrogen, which we consider part of the transition to a net zero future, and now I concentrate on offshore wind.

The Ravenspurn North gas development in the Southern North Sea, installed in 1989, marked a major step forward for concrete platforms. Newly built semi-submersible crane vessels could lift topsides of up to 10,000 tonnes, eliminating the need to mate them with a gravity base in sheltered inshore waters and enabling construction of concrete gravity substructures (CGSs) entirely in a graving dock.

This allowed more civil engineering contractors to participate, increasing competition. I was involved from start to finish in the detailed analysis and design of the CGS, which laid the foundation for my career in offshore engineering.

The success of Ravenspurn North led to further CGS opportunities. In 1994, Ampolex

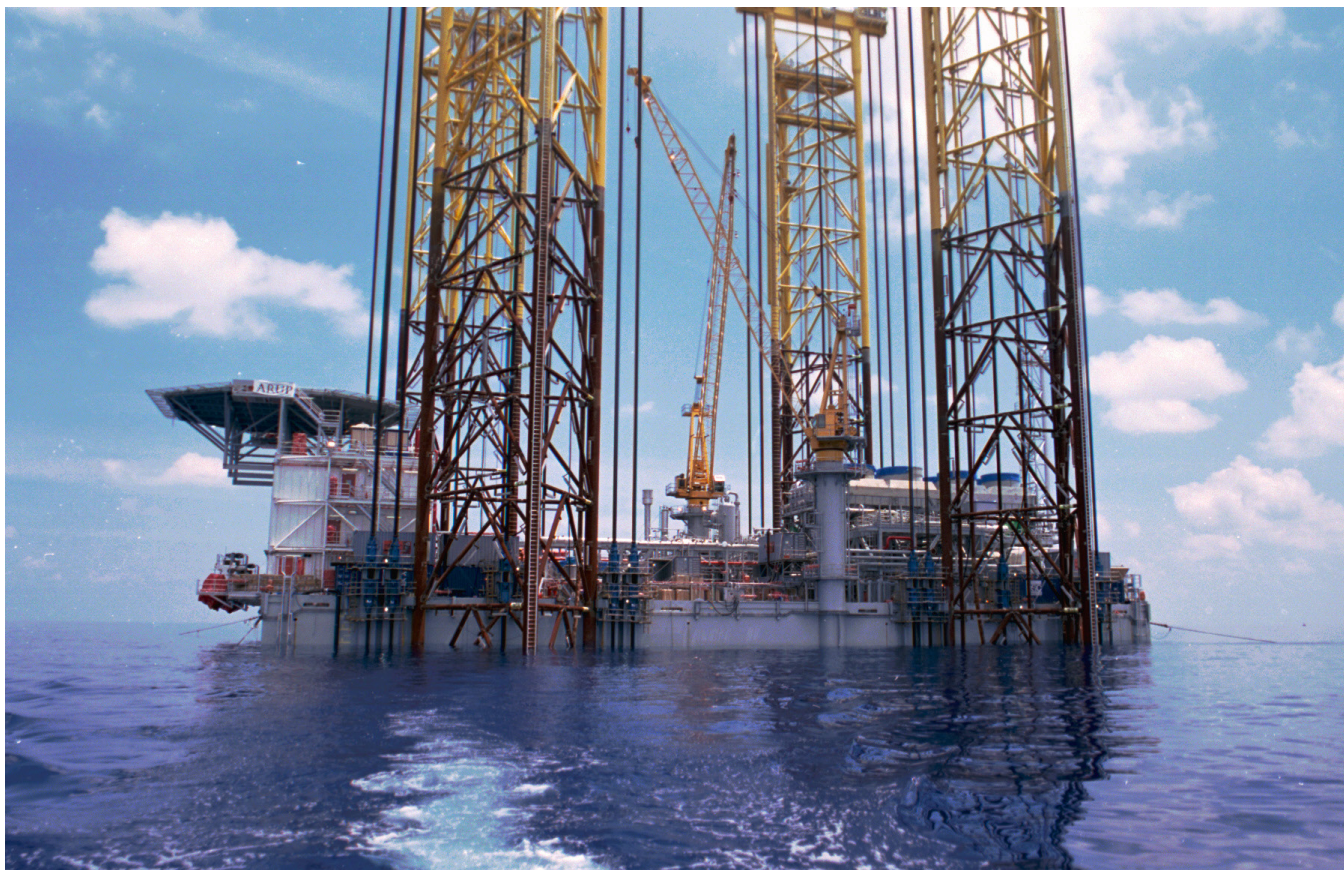
planned the Wandoo oil field development offshore Australia and established an Alliance delivery model. Arup helped assemble a team of designers and contractors, and I worked from the interview stage through to installation in October 1996. Acting as engineering manager for CGS, I gained invaluable experience in team coordination, construction support, and collaborative project delivery.

Earlier, I had worked on a self-installing steel gravity platform concept. On returning to the UK, I presented this concept, ACE, at the Offshore Technology Conference in Houston in 1997. Shortly after, Conoco Indonesia approached me to adapt ACE as a movable gas compression platform for West Natuna.

I led the front-end design study in 1998 and became Project Director. Hyundai Heavy Industries won the turnkey contract, and working with them in Korea and offshore offered valuable insights into design, fabrication, and installation under real-world pressures. Despite the challenges, seeing the concept realised was immensely satisfying.

While Jackson's work advanced the concrete foundations that defined early offshore development, Kymmell's projects reflect the next frontier, digitalisation and data-led design.

JK: Stepping into uncharted territory has always fuelled my enthusiasm because it challenges me and our team's creativity and it



West Natuna ACE platform installation

has a potentially large impact. The Ocean Clean Up project was clearly uncharted territory. Innovative due to the type of structure, a long flexible floater, the location in the mid-Pacific Ocean, the water depth at 4000m, and the business model, a non-profit based on public funding.

Developing new analysis methods, wild out-of-the-box conceptual solutions and radically different design and performance criteria made this stand out from more conventional projects.

Another very different yet equally challenging development was the creation of MO4, a software tool that allows vessels to achieve much higher operability simply by adopting a smarter use of weather data and operational limits. Conventional procedures to determine the GO- or NO-GO decision in weather-critical operations resulted in overly conservative decision-making, resulting in low workability.

Recognising the flaws in the alignment of marine engineering reports, weather forecast data, classification prescribed procedures, and the offshore crew sparked the idea. Completely redefine how GO and NO-GO decisions are made and develop the tools to enable the offshore industry to move a step forward.

PES: What indicates a red flag on a project for your design teams?

GJ: For designers, the red flags are usually contractual. If the client is picking designers on price alone, then the chances of building a good working relationship are reduced. If there is unlimited liability, if the client wishes to own all the designer's output, or if there are 'fitness-for-purpose' provisions, then it may be better to seek out different clients.

JK: I have seen projects where the contracting methods have not been supportive of good cooperation between key parties responsible for the project execution. For instance, using overly simplistic 'adverse weather criteria in combination with ill-defined 'weather downtime compensation' clauses. This has resulted in incentives for contracted parties to maximise their commercial gain at the cost of the project execution performance.

PES: How does design impact or mitigate risk around schedule and cost overruns? What design decisions have led to successful project executions?

GJ: The design of offshore facilities is often driven by installation methods and construction approaches. I have aimed for lower-cost solutions and shorter schedules, using 'loose-fit' designs at key interfaces. For example, generous weight contingencies ensured draft limits and lifting capacities were not exceeded, and open-topped CGS cells allowed additional ballast if soil conditions proved less favourable.



Gordon Jackson

On Ravenspurn North, loose-fit supports for external gas risers allowed rerouting after the Piper Alpha disaster without redesigning the supports.

Wherever possible, vertical CGS elements were built using slip forming, which improved productivity and shortened schedules compared with fixed or jump forms. On the ACE platforms, the open barge deck simplified equipment layout and installation, avoiding the need for integration into a conventional truss topside structure, another practical example of loose-fit design.

JK: In the design of floating offshore WTG foundations, such as the ECO TLP, the structural complexity and material of choice, concrete or steel, is highly correlated to the scalability of the fabrication of the structure. From an engineering perspective, the simple design is elegant from a physical point of view and requires high performance. We have taken into account scalable fabrication of large quantities using locally available facilities and a reliable supply chain.

To ensure a financially competitive floater and mooring system design, we have therefore simplified the floater shape to a more blunt and therefore somewhat less optimal 'aerodynamic' shape. The low complexity of this design enables a higher degree of automation in the fabrication process. Reducing costs by more than 50% compared with many existing floaters while de-risking the fabrication phases.

PES: Ove Arup developed a formula for excellence for onshore projects: $E = (C + EC + D) / (P + SP)^1$. What would be a formula for excellence for offshore projects?

GJ: Maybe when Ove Arup proposed his formula for excellence in 1971, offshore projects were judged merely by his starting point of $E = C / P$, but the wider impacts of offshore projects on the public and on the owner must now be considered. For example, the social price of environmental disturbance and the need to consider decommissioning and who pays for it are important now.



Jelte Kymmell

The only change I would make is to replace delight with a measure of operational effectiveness, such as by reducing inspection and maintenance requirements.

JK: For the last 60 years, offshore engineering has been primarily focused on oil & gas. This typically involved a single large structure with sub-structures and components, each designed with a high cost and degree of redundancy to minimise the consequence of failure of the entirety of the project. Heavily subsidised, the projects promised large margins on their by-products that infiltrated multiple markets. Their formula for success puts high value on component reliability. The O&G projects have a binary status of being either in operation 100% or in total shutdown.

Today, many offshore projects involve renewable energy generation consisting of a large number of structures, limited subsidy, each contributing a percentage of energy to the total yield.

The array provides a form of 'insurance by quantity' and places value on cost efficiency, ease of repair and low complexity over the single component redundancy or component reliability. The margins in building these offshore power plants are much tighter so the engineering demands the lowest CAPEX and OPEX solutions in the design process.

A project formula would consider the complexity of construction and operational risk in relation to maximising electron yield. Advancements that we now have in predictive modelling can help us optimise the project outcomes and fine-tune this formula.

PES: You have been collaborating on ECO TLP and ECO GBS over the past few years. The original design came from an offshore engineer who worked on many of Phillips Petroleum's first platforms, including Ekofisk and its LNG tankers. He believed 'salt water is not our friend' and that simplicity and efficiency are key to scaling offshore wind. Does this align with your own philosophies?

GJ: Design simplicity has guided my offshore work throughout my career. Using rectilinear elements on CGSs simplified formwork and reinforcement detailing compared with curved shells or domes, reducing construction complexity and costs, even if it required slightly more concrete reinforcement.

Maximising slip-forming in concrete construction further sped up schedules, improved reliability, and allowed productivity gains through learning in serial production.

JK: Affordable reliability, considering the impact of component failure on the total project, is what we really want. With increasing investments and growing dependency of communities on offshore wind farms, it is affordable reliability that makes a project successful. To achieve that I fully agree that a simple design should always be preferred over a complex design.

Simple type structures are surely advantageous in combination with more sophisticated analysis techniques. Design and engineering should be based on probabilistic methods instead of simplistic conventional methods using fixed safety factors. This allows for a better understanding of the levels of conservatism and avoids excessive conservatism or unknown optimistic design load estimates.

PES: As collaborators on ECO TLP and ECO GBS, you embody how offshore engineering's past and future can converge. Your partnership fuses the analytical discipline of traditional platform design with the creativity, digitalisation and modular thinking that renewable energy now demands.

The result is not just a new floater, but a blueprint for making offshore wind commercially and technically sustainable: locally buildable, globally scalable, and grounded in engineering that simply works.



ECO TLP provides high static vertical stability to ensure maximum power generation and minimizes motion experienced by the nacelle to allow constant and reliable power generation

For developers and policymakers seeking proven, low-risk pathways to deep-water wind, what would you say is the most powerful lesson about simplicity as a form of innovation?

GJ: Analysis can be performed in seconds now that would have taken a day when I started my career. Tools such as Grasshopper and Rhino 3D are transforming the design process such that complex parametric designs can be readily devised and tested.

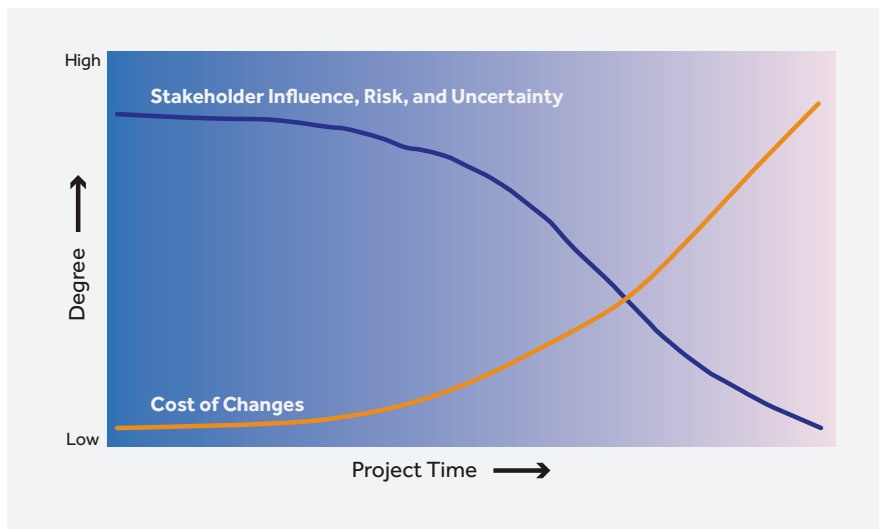
Such tools may bypass the process by which engineers satisfy themselves that their designs are feasible. I would therefore encourage the next generation to retain the ability to do a simple sense check and to build their intuitive skills to evaluate whether something looks right before committing to detailed design.

JK: One of the most relevant graphs that I would use to illustrate a myriad of 'lessons learnt' is the one below. As projects become increasingly more capital-intensive and dependent upon limited available vessels and scarce suppliers, the relevance of detailed preparation cannot be overstated. Identifying and mitigating project risks at an early stage can inform design decisions associated with supply chain, local regulations, political events, and public opinion. These risks have to be monitored throughout the project's iterative design cycles.

PES: Thank you both for sharing your insights and experiences. It's been a pleasure hearing how your collaboration is helping to shape the future of floating wind.

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Source: <https://4squareviews.com/2013/01/30/5th-edition-pmbok-guide-chapter-2-project-life-cycle-general-characteristics-of-phases/>

¹ Excellence, Commodity, ExcessCommodity, Delight, Price, SocialPrice