

CASE STUDY

Anchored in Certainty: Delivering system-level offshore analysis for anchor design



Location

North Atlantic
Ocean

Client

Reflex Marine

Product

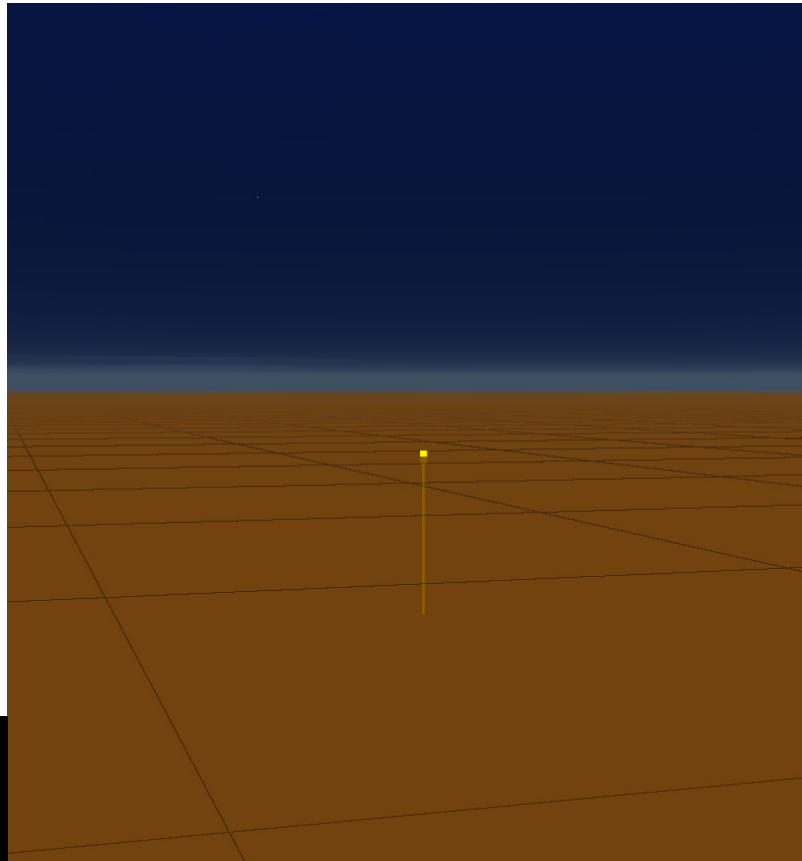
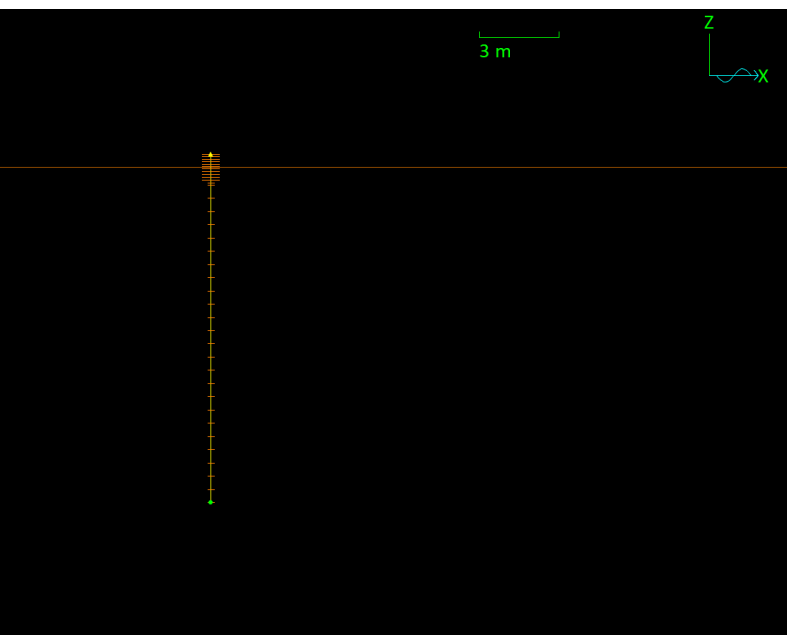
Offshore Analysis

Summary

When a novel anchor system for floating offshore wind had demonstrated early promise, progressing the concept required a much clearer understanding of how it would perform as a complete system.

Without slowing critical development, a system-level assessment had to be undertaken **under extreme mooring loads and across variable seabed conditions**—from soft soils through to hard rock.

Aquaterra Energy delivered a **system-level offshore analysis using its proprietary ORANGE platform**, creating a global model of the full anchor system. This enabled rapid, data-led iteration, revealed system-level risks, and provided a clear, evidence-based understanding of performance, reducing uncertainty and accelerating the path toward commercial readiness.



Solution

To progress the anchor concept with confidence, Aquaterra Energy delivered a **system-level offshore analysis approach** that moved beyond isolated component checks. By combining **global structural modelling, high-throughput analysis and clear visualisation of results**, the study enabled rapid, iterative design development grounded in robust engineering insight. This gave the developer a **clear understanding of system behaviour, allowing efficient comparison of design options and more informed decision-making** as the concept evolved.

Challenge

Early-stage analysis and testing had successfully validated key components of the anchor design. However, progressing the concept required a **step change in understanding**, moving from isolated performance to full system behaviour under real-world conditions.

To advance the design toward deployment, Reflex Marine needed to:

- Understand how **dynamic mooring loads transferred** through the complete anchor assembly
- Assess performance across **variable seabed conditions**, including soft soils and hard rock interfaces
- Identify **system-level weak points** not visible through component-only analysis
- Enable **rapid design development** without long analysis cycles or excessive cost

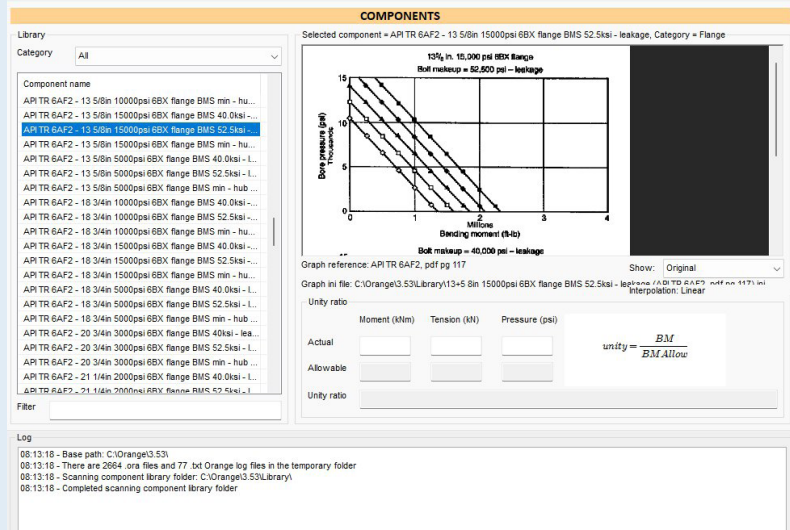
Without a global system model or high-throughput analytical capability, each design decision carried increasing uncertainty as the concept matured toward application in floating offshore wind environments.

ORANGE: Expertly Designed to Peel Back Uncertainty

At the core of the study was **ORANGE, Aquaterra Energy's proprietary offshore analysis platform**, developed in-house and continuously refined by the engineers who use it.

- Automates **model setup, load case generation and results processing**, reducing manual effort
- Enables **efficient evaluation of large volumes of load cases**, supporting deeper analysis
- Provides **traceable, repeatable workflows**, strengthening QA/QC

By removing repetitive tasks, ORANGE allows engineers to focus on interpreting results and optimising designs, **accelerating decision-making and improving overall analysis quality.**



Building a True System View of the Anchor

A global structural model of the complete anchor system was developed, **providing full visibility of load transfer from the mooring line interface through to deep seabed embedment.**

- Modelled the full anchor system** rather than isolated components
- Assessed **structural behaviour across multiple seabed conditions**, including sand, clay and rock
- Captured how **mooring loads were distributed** through the system
- Extended **earlier component-level work into a true system-level understanding** of performance

This established a **robust analytical foundation to support confident design evolution.**

Enabling Rapid Iteration with ORANGE

Using ORANGE, the study enabled fast comparison of multiple design options and efficient exploration of system behaviour at scale.

- Automated load case generation and post-processing, significantly reducing manual effort
- Enabled evaluation of over 400 design permutations, with capacity for further expansion
- Standardised workflows ensured outputs were traceable, repeatable and auditable, strengthening QA/QC
- Freed engineers to focus on interpretation, judgement and optimisation rather than repetitive setup

ORANGE transformed the analysis from a static verification exercise into a scalable, design-led tool.



Results

The system level offshore analysis delivered **a clear step change in understanding of the anchor's structural behaviour and performance** as the design evolved.

Key results included:

- A **global understanding of load distribution across the full anchor system**, extending beyond earlier component level studies
- Identification of **structural weak points that would not have been evident** without system level modelling
- The ability to **efficiently assess and compare over 400 design permutations**, enabling targeted optimisation rather than incremental change
- **Clear insight into design sensitivities and performance drivers** across different seabed conditions
- Analysis models that evolved alongside the design, **providing actionable feedback at the end of each iteration** to inform next step decisions

By combining **high throughput analysis with clear visualisation and interpretation**, the study transformed offshore analysis into an active design tool. This **allowed the developer to refine the anchor concept with confidence**, supported by robust engineering evidence rather than assumption.



Study Highlights

- **400+ design permutations** assessed
- **System-level load distribution** understood
- Structural **weak points identified early**
- Design optimised **using engineering evidence, not assumptions**
- **Faster, more confident** design decisions

Offshore analysis, intelligently engineered

Discover how we deliver advanced system-level offshore analysis to reduce risk and support confident engineering and design decisions.

