SOFTWARE DEVELOPMENT

Delivering UX UI and Front End Development for a Drilling Technology Company

Kelda Dynamics approached The Virtual Forge for assistance in the development of a breakthrough solution for precisely controlled drilling of depleted oil wells.

The Brief

The Virtual Forge helped Kelda develop an incredible project that is certainly going to revolutionise the controlled drilling of depleted oil.

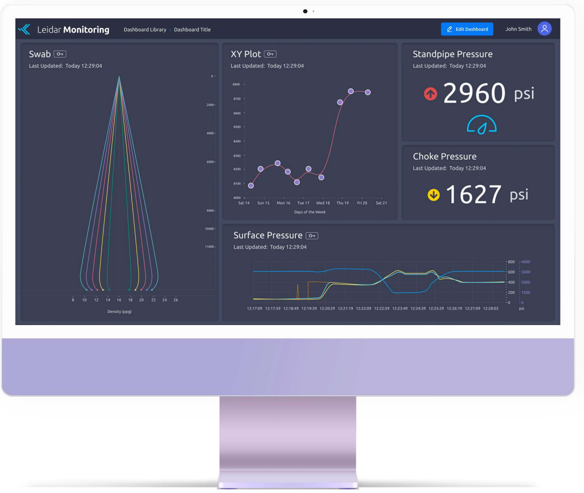
Kelda Dynamics is a Norwegian company specialised in drilling technology, hydraulics modelling and control system design. Established in 2013 as a spin-off from Equinor's (STATOIL) extensive R&D programme on automated Managed Pressure Drilling, their aim is to further develop MPD technology.

In line with their primary goal of providing cutting-edge technology and improved automation for pressure management in drilling, Kelda initiated a vast project aimed at revolutionising the controlled drilling of depleted oil wells. The SHIELD project, as it is known, revolves around an advanced autonomous monitoring and control system that enables effective MPD.

This advanced technology will diminish all the flaws that current MPDs suffer from, increasing safety by reducing the risk of a loss of well control by +450 times and decreasing costly non-productive time by 50%.

The Virtual Forge's expertise with UX UI Design, front end development and architecture consulting was greatly appreciated and deemed capable of supplementing Kelda's domain-specific of MPDs and pressure management in drilling.

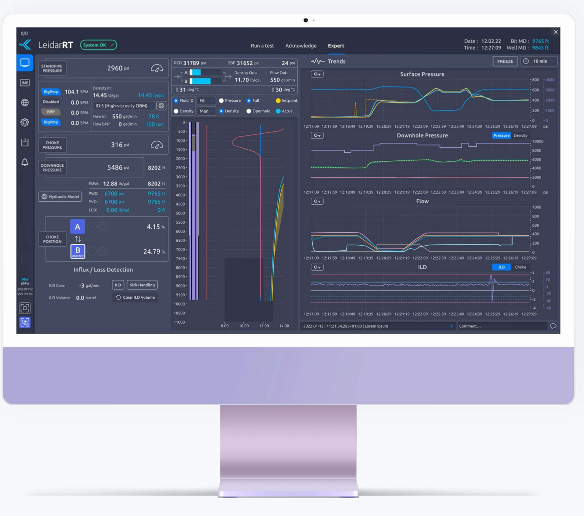
"We weren't looking for resources," says Glenn-Ole Kaasa , Chief Executive Officer of Kelda Dynamics, "We were looking for experts. And that's why we chose The Virtual Forge."



The Challenge

Given that the SHIELD project is absolutely novel and unheard of in today's market, there are many intricate technical touchpoints that must be addressed.

The Virtual Forge's expertise in state-of-the-art UX UI Design and cloud-based technology led to the partnership, with VF tasked with making design and user experience improvements to the advanced Human Machine Interface for uniform handling of the hydraulics model in all phases through the life-cycle of well construction.



The Goals

The goals were to create a tool that could improve safety and efficiency in an intelligent autonomous MPD control system. Such a highly technical product was associated with a strict set of objectives.

In addition to expanding and improving the current portfolio, The Virtual Forge is developing, alongside Kelda, a brand-new library of widgets that can be totally customised for their monitoring displays. Kelda customers will be able to construct dashboards that are perfectly tailored to their needs with the help of this new solution, completely eliminating a one-size-fits-all approach.

01.
Develop a solution with enhanced validation of configuration to reduce human errors

02.
Develop HMI for simulations of digital twin for scenario-based training and preparation

03.
Develop adaptive HMI for autonomous monitoring and control

The Team

A diverse team was created to verify that the designed human machine interface designs and subsequent construction of a dashboard of widgets met the essential functions.

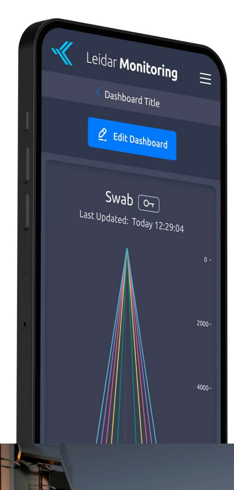
"We really feel that The Virtual Forge is a partner.," says Geir Arne Evjen , Chief Technology Officer of Kelda Dynamics, "We feel that we can actually work alongside each other, and we are very happy with that. We are pulling this project together."

Experienced UX and UI designers offered the necessary technical expertise to construct the HMI prototypes and mockups. Improved usability and user experience were essential for preventing human errors during system setting. The Virtual Forge team determined best practices for colour, text sizes, buttons, and static and dynamic information, delivering high-fidelity prototypes that closely mirrored the final result. They were also charged with completely redesigning the current real-time HMI to better autonomous control and situational awareness in critical operations and downhole anomalies.

The Virtual Forge front end development team ensures that the necessary technical capabilities for the brand-new library of widgets are present, ascertaining that the design of the system was deliverable in a way that conformed to Kelda's requirements for minimal latency given the critical nature of the systems involved.

To handle a vast quantity of transitory simulator data between the front-end and the back-end while supporting numerous concurrent users, the complete system requires a complicated data architecture. The Virtual Forge provided a specialised expert in data architecture consultation to ensure that the correct data intake was efficiently optimised in accordance with the solution objectives.

The Real Time HMI Interface



Completely redesigning a human machine interface responsible for the safety of multiple individuals is no easy user experience feat.

Across multiple workshops and technical meetings, the UX Team analysed all Kelda's legacy components. Their designs, colours, fonts and overall readability and position across every dashboard were thoroughly tested. The challenge revolved around enhancing and delivering cleaner and updated components, while not disrupting a workflow that users generally accept as familiar.

High-fidelity prototypes were delivered by the UX experts, fully developed in Adobe XD. Enhancements were made across all settings, and the overall feeling of the dashboards was modernised without compromising familiarity.

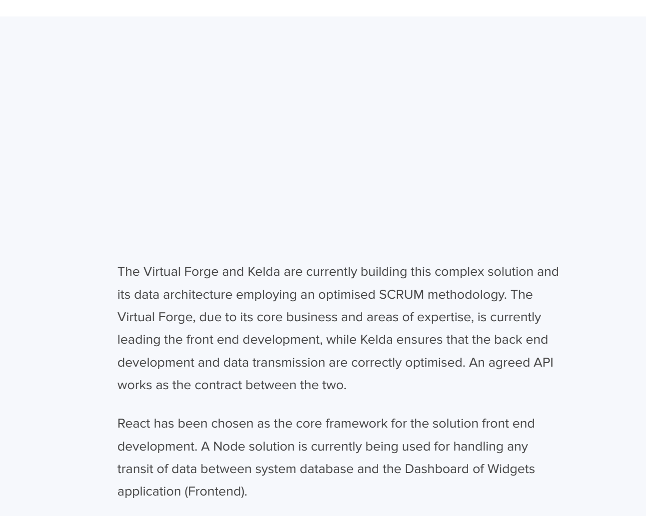
The Dashboard of Widgets

Creating an HMI for autonomous monitoring and control can only be considered fully adaptive by the users if they can, without aid or support, tailor it to its needs. The dashboard of widgets is the revolutionary feature that is going to bring that autonomy to the world of the Managed Pressure Drilling.

At a high level this will include:

- A visualisation components library (library of Widgets)
- A visualisation component builder based off the following core visualisation elements
- Custom dashboard library
- A custom dashboard builder allowing users to create their own dashboards from the visualisation components library and save them to the dashboard library

Using the considerable expertise acquired during the HMI enhancement, The Virtual Forge UX team brought all the initial ideas, sketches and wireframes to life in the form of an interactive prototype. This prototype was detailed enough to walk through the creation of a dashboard and the agreed priority widgets.



The Virtual Forge and Kelda are currently building this complex solution and its data architecture employing an optimised SCRUM methodology. The Virtual Forge, due to its core business and areas of expertise, is currently leading the front end development, while Kelda ensures that the back end development and data transmission are correctly optimised. An agreed API works as the contract between the two.

React has been chosen as the core framework for the solution front end development. A Node solution is currently being used for handling any transit of data between system database and the Dashboard of Widgets application (Frontend).

The Benefits

The SHIELD project is currently in development, but the benefits that the HMI redesign and the Dashboard of Widgets will bring to the MPDs market are clearly defined.

In short, a fully automated intelligent monitoring and control system for MPD, using advanced sensor technology and data fusion algorithms. SHIELD will have unique capabilities to automatically control pressure and handle advanced multiphase scenarios with gas influx. The Virtual Forge have so far:

01.
Completely redesigned visual components for Kelda Real Time HMI solutions (such as buttons, graphs, icons and other necessary visuals), enabling optimal and logical placement of input and output user interface elements as well as optimal grouping and placement of user controls under all normal drilling operations and contingencies;

02.
Created a new HMI UX and UI interface, modernised and delivering cutting-edge feeling, ensuring enhanced user experience;

03.
Enhanced the system architecture, capable of handling a new fully automated solution, in the Dashboard of Widgets;

04.
Enhanced the Front end development framework built from scratch to ensure the revolutionary Dashboard of Widgets is fully functional and perfectly adapted to its end user;