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Transformare

Project overview

Research

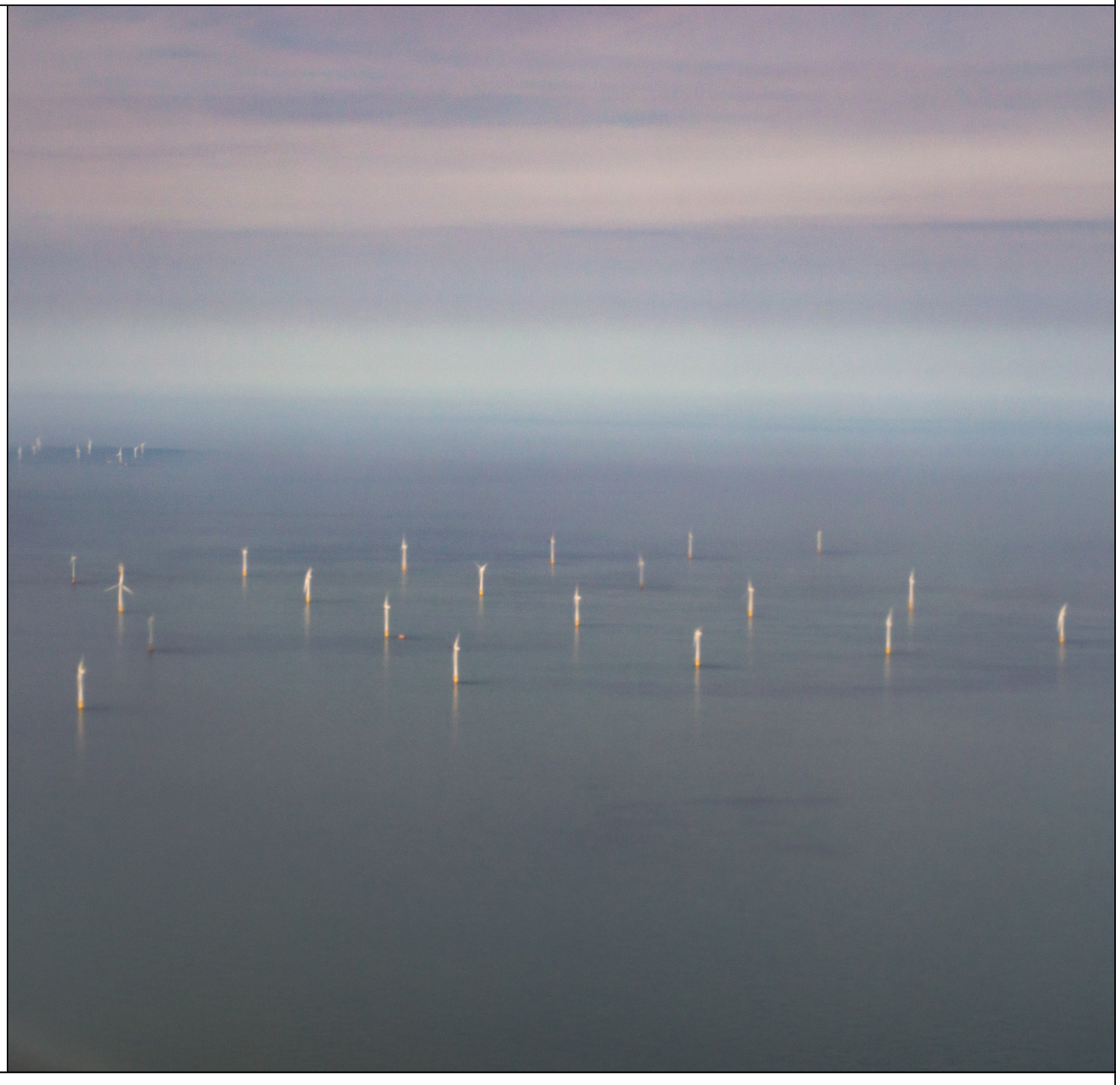
Scope

This graduation project focuses on the development of specialised modular workwear system for professionals working in the offshore wind sector.

As this industry develops, so do the demands on its workforce, especially people involved in installation, maintenance, and inspection. However, the garments currently worn by offshore wind personnel are predominantly inherited from oil and gas PPE categories. These garments lack the specialised requirements for the challenges and physical demands of offshore wind work.

The aim of this project is to propose a new approach to workwear, one that is purpose-built for the offshore wind sector, designed for real-world scenarios, and designed with adaptability, mobility, and safety in mind.

[Right] Offshore Windpark Egmond aan Zee (OWEZ), the first offshore windfarm constructed in the Netherlands; Aerial photograph, 2015.



This project is titled: *"Transformare"* which comes from the Latin verb 'to transform', although the presence of 'mare', meaning 'sea', makes the word particularly fitting.

The title refers to a broad sense of transformation, namely the shift from dependency on fossil fuels to renewable energies. It also represents the transformation within the offshore wind sector, which will reshape our marine landscapes, as well as the evolution of PPE from standardised garments to highly technical garments specifically designed for the sector.

[Left] Workers perform maintenance duties on top of an offshore wind turbine. Working at this altitude, on top of their standard garments, workers wear full-body fall arrest harnesses and helmets.

Sector context and relevance

The offshore wind sector has seen rapid development in the past 20 years. Turbines are now significantly larger, located farther offshore, and require more specialised maintenance.

This presents new challenges for the professionals working on-site, who must transition between marine vessels, climb turbine structures, and perform tasks in highly variable weather conditions.

While the sector is supplied by a handful of PPE manufacturers, much of the current gear is general-purpose, meeting safety requirements without fully addressing use-case-specific mobility, fit, or environmental factors.

There is a need for garments designed with the specifics of offshore wind operations in mind. These functionalities include temperature regulation, integration with other safety systems, and the ability to maintain comfort and flexibility in different climates and activity levels.

[Right, left] Vindeby offshore windfarm, the first ever offshore wind farm, installed in denmark in 1991.

[Right, right] Offshore Winpark Egmond aan Zee (OWEZ), the first offshore windfarm constructed in the Netherlands; Aerial photograph, 2015.

The following items were identified as essential for working in the offshore wind sector.

[First Row, Left to Right]
Base Layer: A moisture-wicking, insulating garment worn as a foundational layer for comfort and layering.

Middle Layer: An insulating but breathable layer worn in cold conditions to regulate body temperature.

Outer Layer: A versatile weather-protective garment used during transport or external maintenance, worn under a life jacket or with a fall arrest harness.

[Second Row, Left to Right]
Work trousers: Waterproof are durable, weather-resistant garments designed to keep personnel dry and mobile during offshore operations, with reinforced seams and adjustable features for comfort and safety.

Immersion Suit: A waterproof neoprene suit used only in emergencies, designed to insulate and keep the wearer afloat in cold sea water for 1–4 hours.

Constant Wear Suit: A multi-functional outer garment for maintenance that offers protection from weather and can function as an immersion suit.

[Third Row, Left to Right]
Hard Hat: Lightweight protective headgear with adjustable straps, worn during most turbine-related activities.

Fall Arrest Harness: Safety equipment used during turbine maintenance or evacuation to prevent falls, especially when working at height.

Life Jacket: Automatically inflatable gear for water safety, used when not wearing an immersion or constant wear suit.

Design response

In response to these sector-specific challenges, this project presents a modular workwear system geared towards the operational realities of offshore wind workers.

The design focuses on performance aspects identified through industry feedback and research: increased mobility for tasks requiring climbing, crouching, or overhead reach; improved fit across diverse body types; adaptability for varying risk scenarios and climates; and integration with required PPE, such as arc-rated protection, fire resistance, and flotation gear.

The system is built from the ground up to integrate mobility, safety features and activity-specific features into the garments from the get-go.

[Right, left] Transformare constant wear suit, this suit can be worn during normal operations, but can also function as an immersion suit in an emergency.

[Right, right] Transformare fleece jacket and foul-weather work trousers. This jacket can be worn in good weather conditions as an outer layer and in cold conditions underneath a water wicking top-layer.

The garments in this project are based on current industry standards, depending on what activity is being performed.

Each garment is designed to work in combination with other garments or PPE. For example, this includes making larger armholes on a life vest to accommodate being worn over a large jacket, as well as close-body-fit base and middle layers. This helps to prevent obstruction when worn under outer layers.

[Left, left] Transformare immersion suit. These suits are worn in emergency situations when personnel need to evacuate. A suit like this keeps a person afloat and maintains their body temperature for four hours.

[Left, right] Transformare base layer. This layer is worn by personnell as a way of maintaining body temperature, while retaining full mobility and comfort.

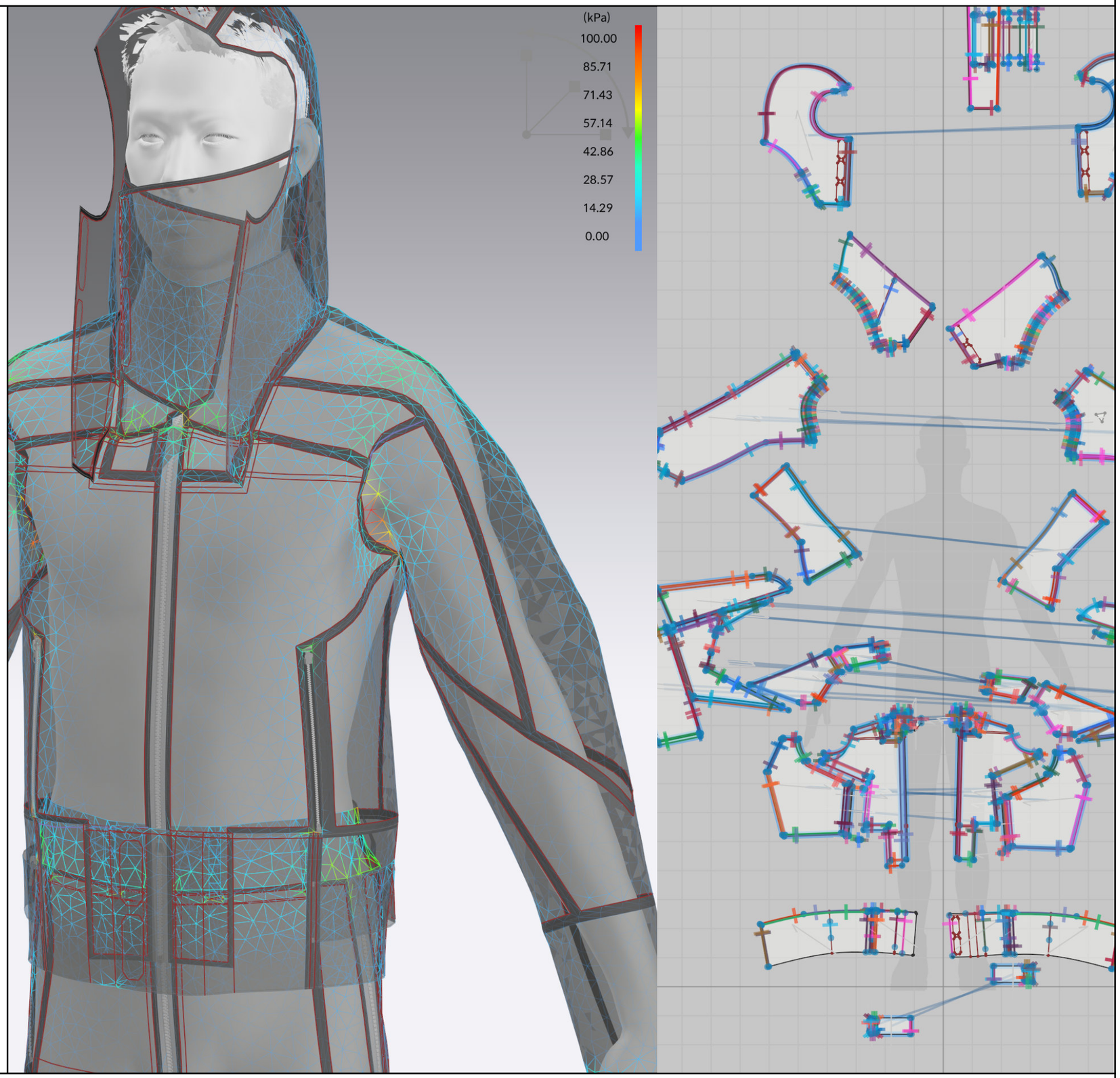
Methodology

The development process combined doctrinal research with engagement from industry professionals and technical experts.

This initially involved researching developments in the field, the requirements placed on workwear and PPE, and recent advancements in this area.

Additional attention was devoted to researching finishes, materials, and techniques used in the production of workwear and PPE.

[Right] Use of digital tools like CLO3D, in this case the stress- and strain-maps. Simulating fit and comfort for complicated items. Here, the Transformare foul-weather jacket.



Industry engagement

Key insights were gained through an interview with a safety coordinator at Van Oord, who outlined the risks that offshore personnel are faced with and how PPE requirements change between personnel transfer, turbine maintenance, and emergency scenarios.

Further input came from professionals involved in PPE manufacturing and contracting within the wind sector, Viking life-saving systems, played a central role in this process.

To connect technical performance with wearable design, the project also consulted with outerwear designers from Mammut and ON Running, whose experience with movement, and functionality-driven garment construction informed the development of articulated patterns suitable for physically demanding tasks.

This approach ensured that the design solutions remained grounded in practical needs while incorporating insights from adjacent fields.

I extend my heartfelt thanks to the following individuals for their valuable insights and support:

Andrei Ivanov, Health, Safety & Environment Coordinator at Van Oord Maritime Contractors

Bettina Kjærgaard, Global Head of Sales – Offshore Wind, and Sarah Schulze, Design & Patterns Engineer at Viking Life-Saving Equipment

Jamie Maguire, Senior Buyer at Mammut Sports Group AG

Stephanie Kamber, Outerwear Production Specialist at Craft Design Studio

Petra Vuletic, Senior Global Merchandise Lead at On Running

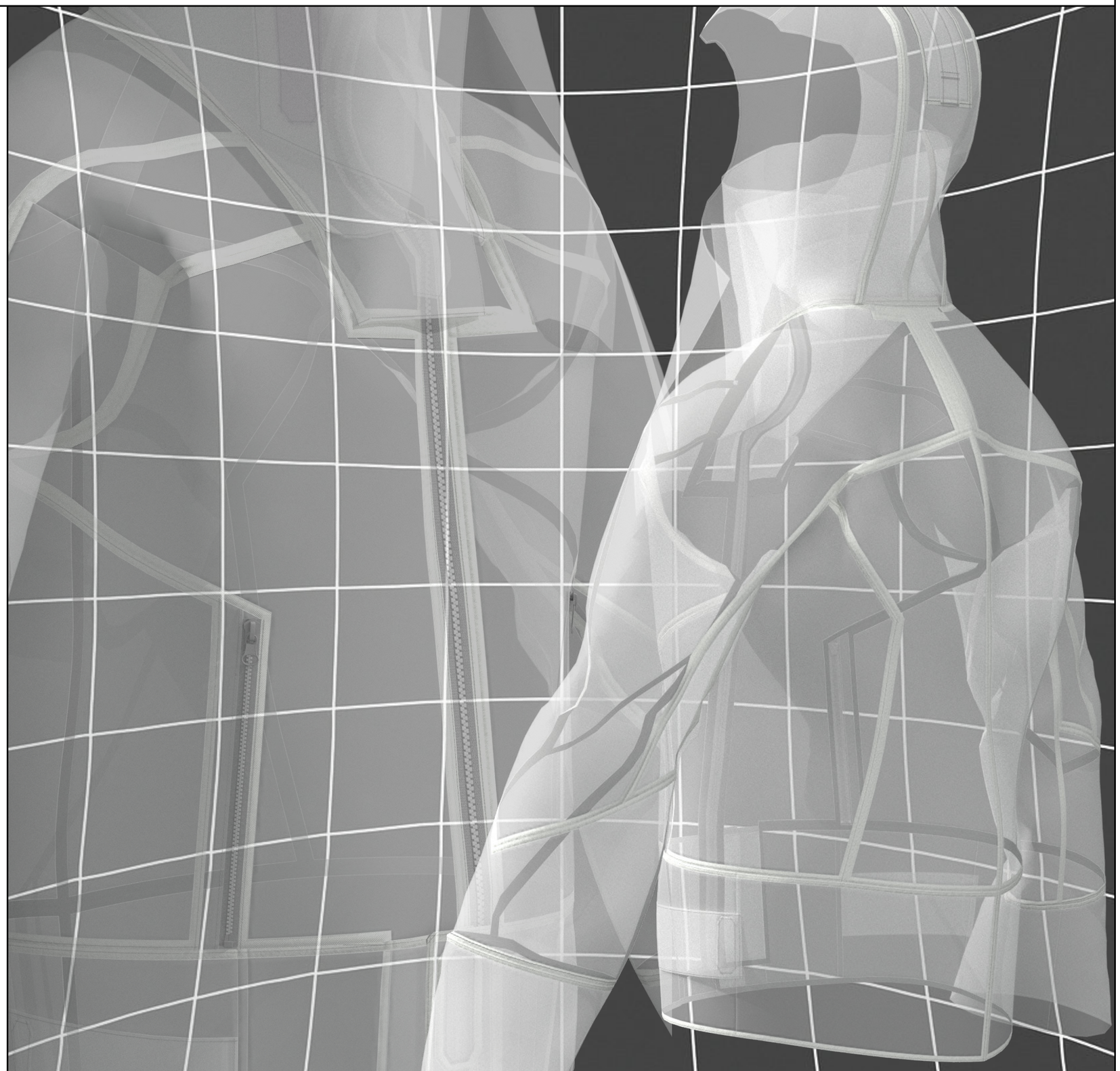
3D Design tools

A key component of this project was the integration of digital design and prototyping using programs like CLO3D. This tool allowed for visualisation and pattern development for garment designs rapidly. It streamlined the process of testing form, fit, and equipment compatibility.

3D garment development enabled the exploration of complex construction and layering systems without the cost or time associated with physical sampling. It also allowed integration of real-world constraints, such as the placement of harness openings or life vest dimensions.

Rather than being an supportive tool, CLO3D was the central platform for developing complex garment construction and experimenting with shape and form in this project.

[Right] Detailed CLO3D render of internal heat seam-taping and finishings. Giving insight into the technical construction of the Transformare foul-weather jacket.



Another software that served as an indispensable tool in this project was Blender, which was used to create what this project calls 'environment animations.'

These animations serve to provide an impression of the designed garments in their use-specific environments. This includes, among other scenarios: airborne rescue of personnel, personnel transfer via CTV, and the installation of turbine blades.

This tool made it possible to visualise the designed garments in their intended environments and make an initial assessment of whether these items are fit for purpose.

[Left, left] Environment animation of personnel transfer taking place with a CTV; the garments worn in this scenario include foul-weather trousers and a foul-weather jacket.

[Left, right] Another scenario is that of an airborne search and rescue mission. In this scenario, a worker would be floating in open water, wearing an immersion suit, before being located and rescued.

Results

The final outcome is a specialised modular workwear system that responds to the operational requirements of offshore wind personnel.

The designs introduces greater mobility, better thermal and ergonomic adaptability, and compatibility with industry-standard safety equipment.

Just as importantly, the project demonstrates how digital tools can play a central role in the development process, particularly during early-stage conceptualisation and prototyping.

[Right] Still from a Blender environment animation, one of the elements of this project. In this scenario, personnel are transferring from a Crew Transfer Vessel (CTV) onto a wind turbine. In the animation, the worker is wearing a constant wear suit and an inflatable life jacket.

Industry potential

This project serves as a design proposition, with the designs remaining at a prototype level. The developed methodology, outlines clear steps to move forward, these include:

The development of real-life samples based on the prototype designs.

Selection and refinement of materials and finishes to ensure optimal performance.

Conduction of prototype trials and testing in real-world conditions.

Compliance assessments, ensuring designs meet relevant industry standards and regulations.

Finally, scaling up for eventual production, ensuring that the design is ready for mass manufacturing and deployment.

[Left] CLO3D render of a constant wear suit, part of this project. Constant wear suits function like immersion suits, only they can be worn during normal operations and are much more comfortable.

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