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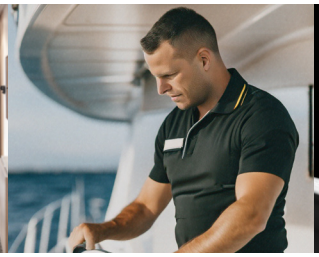
Reside and live onboard – what is important for the well-being and comfort of the crew?



A pre-study carried out within the Swedish Transport Administration's industry program Sustainable Shipping, operated by Lighthouse, published in May 2026

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Reside and live onboard – what is important for the well-being and comfort of the crew?

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A pre-study carried out within the Swedish Transport Administration's industry program Sustainable Shipping, operated by Lighthouse

Summary

Work onboard ships is widely recognized as both physically and mentally challenging. With the introduction of digitalization and automated processes, work roles are expected to face changes. Crew sizes are expected to decrease, raising work demands upon the remaining crew members. Under such daily conditions, opportunities for rest, recreation, and recovery during off-duty periods become all the more critical.

Indoor Environmental Quality (IEQ) is a general indicator of the quality of conditions within a space (e.g., air quality, noise, lighting) as well as functional aspects (layout, access to equipment, and adequacy of space for intended activities), aiming to enhance occupants' well-being.

This pre-study investigated, from the crew's perspective, which components constitute well-designed accommodation with high IEQ, with the intention of producing practical design suggestions and supporting crews in identifying the features necessary to foster well-being, targeting improved social sustainability, recruitment and retention, and providing inputs for future ship newbuilds and retrofits.

Key findings from semi-structured interviews (N=8) were organized into six overarching themes: Privacy (e.g. access to a private cabin and locker-room privacy); Personal Space (e.g. possibility to personalize one's cabin); Comfort and Homeliness (e.g. noise and vibration reduction, comfortable furniture, good sleep hygene); Social and Recreational Opportunities (e.g. hobby rooms, flexible social areas); Health and Wellness Facilities (e.g. functional gym and sauna facilities); Functional and Technological Aspects (e.g. reliable WiFi, function-based design of common areas).

These themes and user-defined requirements were translated into conceptual design implications for cabins, dayrooms, wellness areas, service areas and technical infrastructure, and subsequently transferred to professional interior designers. Spatial concepts were then generated, including 2D layouts and 3D visual interpretations for three selected domains: cabins, social/dayroom and hobby spaces, and wellness and fitness facilities. These conceptual outputs demonstrate how crew-defined requirements can be operationalized into concrete accommodation design proposals, supporting both future ship newbuilds and retrofits.

Sammanfattning

Arbete ombord på fartyg är allmänt erkänt som både fysiskt och mentalt krävande. Med introduktionen av digitalisering och automatiserade processer förväntas arbetsrollerna förändras. Besättningsstorlekarna förväntas minska, vilket ökar arbetsbelastningen på de kvarvarande besättningsmedlemmarna. Under sådana dagliga förhållanden blir möjligheterna till vila, rekreation och återhämtning under lediga perioder desto viktigare. Indoor Environmental Quality (IEQ) är en generell indikator på kvaliteten i en inomhusmiljö (t.ex. luftkvalitet, buller, belysning) samt funktionella aspekter (layout, tillgång till utrustning och tillräckligt utrymme för avsedda aktiviteter), med målet att främja välbefinnandet hos dem som vistas där.

Denna förstudie undersökte, ur besättningens perspektiv, vilka komponenter som kännetecknar en väldesignad bostadsmiljö ombord med hög IEQ, med avsikten att ta fram praktiska designförslag och stödja besättningen i att identifiera de egenskaper som är nödvändiga för att främja välbefinnande. Arbetet syftade till att stärka social hållbarhet, rekrytering och retention samt bidra med underlag för framtida nybyggnationer och ombyggnationer av fartyg.

Centrala resultat från semistrukturerade intervjuer (N=8) organiserades i sex övergripande teman: Integritet (t.ex. tillgång till egen hytt och integritet i omklädningsrum); Personligt utrymme (t.ex. möjlighet att personanpassa den egna hytten); Komfort och hemtrevnad (t.ex. reducering av buller och vibrationer, bekväma möbler, god sömnhygien); Sociala och rekreativa möjligheter (t.ex. hobbyrum, flexibla sociala ytor); Hälso- och friskvårdsfaciliteter (t.ex. funktionella gym- och bastuanläggningar); Funktionella och tekniska aspekter (t.ex. tillförlitlig WiFi, funktionsbaserad utformning av gemensamma utrymmen).

Dessa teman och användardefinierade krav översattes till konceptuella designimplikationer för hytter, dagrum, wellnessområden, serviceutrymmen och teknisk infrastruktur, och överfördes därefter till professionella interiördesigners. Rums- och designkoncept togs därefter fram, inklusive 2D-layouter och 3D-visualiseringar för tre utvalda domäner: hytter, sociala/dagrum- och hobbyutrymmen samt hälso- och friskvårdsfaciliteter. Dessa konceptuella resultat visar hur besättningens krav kan operationaliseras till konkreta förslag för utformningen av boendemiljöer ombord, som kan användas i både framtida nybyggnationer och ombyggnationer.

Contents

1 Introduction 5
1.1 Background and Motivation 5
1.2 Project Objectives 5
1.1 Project Contributors and Roles 6
2 Theoretical Framework 7
2.1 IEQ in the Maritime Context 7
2.2 Human-/User-Centred Design (HCD/UCD) Approach 8
3 Methods 10
3.1 Approach and Research Design 10
3.2 Study Participants and Demographics 10
3.3 Semi-Structured Interviews 10
3.4 Analysis 11
3.5 2D and 3D Designs 11
4 Results 12
4.1 Theme 1: Privacy 12
4.2 Theme 2: Personal Space 12
4.3 Theme 3: Comfort and Homeliness 13
4.4 Theme 4: Social and Recreational Opportunities 14
4.5 Theme 5: Health and Wellness Facilities 14
4.6 Theme 6: Functional and Technological Aspects 15
4.7 Example Sketches of 3D Interpretation of the Results 15
4.7.1 Cabins 16
4.7.2 Dayroom 20
4.7.3 Hobby Rooms 21
4.7.4 Health and Wellness Area 22
5 Discussion 24
5.1 Practical Implications 24
5.2 Feasibility and Implementation Considerations 25
5.3 Methodological Reflections and Limitations 25
5.4 Theoretical Integration and Added Value 25
5.5 Implications for Future Work 26
6 Conclusions 27
7 Acknowledgements 28
8 References 29

1 Introduction

1.1 Background and Motivation

Work onboard commercial ships is widely recognized as both physically and mentally demanding, with direct implications for safety-critical operations throughout a voyage. As technological aids, digitalization and automation expand, crew numbers have decreased (and are expected to continue to do so), placing greater demands on the remaining crew. In this context, accommodation design that enables rest and recovery is a key lever for sustaining health, safety and performance.

Extensive occupational health research and industry experience underscore that Indoor Environmental Quality (IEQ)[1] significantly affects human health and well-being across workplaces and residential settings. The maritime environment is no exception and, in fact, IEQ may be even more critical at sea given that seafarers both live and work onboard for extended periods without access to other environments.

Historically, the design of crew accommodation on merchant vessels has been shaped by a combination of economic, technological, regulatory, and social factors. Commercial pressures traditionally incentivized maximizing cargo capacity, often limiting the space allocated to crew quarters. More rigid onboard hierarchies influenced the size, location, and quality of cabins, and larger crew sizes of earlier eras further constrained the amount of space available per crew member. Advances in ship design – from sail to steam and modern automated vessels – enabled gradual improvements in space allocation, layouts, and habitability.

At the same time, growing attention to safety, health, and hygiene drove the introduction of improved ventilation, sanitation, and fire protection measures. Over time, these developments were formalized through international regulation, particularly by the International Labour Organization (ILO), whose conventions culminated in the Maritime Labour Convention (MLC) [1], establishing minimum global standards for crew living conditions. Collectively, these regulatory, technological, and social factors have resulted in a progressive shift from over-crowded, basic quarters towards standardized, safer, and more comfortable accommodation on modern merchant ships.

Despite these developments, existing maritime research still often assesses satisfaction with current accommodation or focuses primarily on passenger comfort on ferries or cruise vessels, leaving a gap regarding crew-driven design requirements for improved rest, recreation and overall well-being.

1.2 Project Objectives

The overall goal of this pre-study was to develop a crew-centred understanding of what constitutes well-designed accommodation onboard by identifying the habitability elements and standards that are critical for IEQ and that support rest, recreation, and recovery, as well as explore how crew needs can inform conceptual design proposals for

[1] Indoor Environmental Quality (IEQ) is a general indicator of the quality of conditions within a space (e.g., air quality, noise, lighting) as well as functional aspects (layout, access to equipment, and adequacy of space for intended activities), aiming to enhance occupants' well-being.

key accommodation domains onboard. This work was part of an effort to recognize the demanding conditions under which seafarers operate with the ambition to strengthen social sustainability by improving the onboard work and living environment.

Practical outputs include both user-derived design suggestions and early-stage conceptual design proposals (including 2D layouts and 3D interpretations) that crews, designers, and shipowners can use to enhance key onboard accommodation spaces and promote good IEQ, thereby contributing to the improvement of the work environment and well-being of the crew, as well as supporting future recruitment and the retention of current experiences personnel.

The specific objectives of the pre-study were to:

- Elicit crew views on the components of well-designed accommodation with high IEQ.
- Capture user requirements via a user-centred design approach and translate them into actionable design implications.
- Provide recommendations and conceptual design interpretations applicable to both newbuilds and the redesign of retrofitted vessels, focusing on three primary spatial domains: private cabins, social/hobby areas, and health and wellness facilities.

1.3 Project Contributors and Roles

This pre-study was conducted through a triple-helix collaboration between industry, academia, and a research institute:

- **Chalmers tekniska högskola AB** – Coordinated the pre-study, including planning and executing research activities, facilitating stakeholder engagement, and preparing the final report.
- **Stena Teknik** – Project partner and needs owner. Provided materials related to vessel designs and supported the recruitment of crew members for interviews, while also liaising with the design team.
- **RISE** – Contributed to research activities such as data analysis, liaising with the design team, and co-authoring the report.
- **Furetank** – Project contributor and needs owner. Provided access to crew members, enabling data collection that informed insights into the design of shipboard accommodation spaces.
- **Donsötank** – Project contributor and needs owner. Provided access to crew members, enabling data collection that informed insights into the design of shipboard accommodation spaces.
- **Figura Arkitekter** – Translated the collected results and requirements into concrete design concepts and layouts by developing sketches and 3D visualizations.

2 Theoretical Framework

2.1 IEQ in the Maritime Context

The relevance and importance of Indoor Environmental Quality (IEQ) is not a new concept. It has been discussed for more than a century in different domains [2]. It is well established that indoor climate affects both health and well-being and this applies to workplaces, housing and personal spaces. The shipping industry is no exception. One could in fact argue that IEQ is even more important in this context since the crew works and lives onboard for extended periods without access to other environments. Ergonomic principles to improve IEQ have been explored but focus has often been on the bridge environment [3]. The studies that have been performed have often evaluated how satisfied crew members are with their existing accommodation areas onboard [3, 4]. However, little attention has been given to using the opinions of crew members on how the accommodation areas should be designed to offer better rest, recreation and improved well-being conditions.

Research has in the past paid attention to the design of accommodation onboard but mostly from the perspective of passengers and their comfort on passenger and cruise vessels. This research includes e.g. indoor air climate and how they experience their current accommodation and cabins. The views regarding preferred design of these areas are less researched [4, 5].

The topic of compact living and designing small apartments has been researched in other contexts, particularly being promoted as a tool for relieving strain on high-pressure urban housing markets [6]. In an era where social and environmental sustainability is discussed, this topic is widely researched in shore-based contexts [7, 8].

The work onboard is well recognized as being challenging, with a demanding work environment and a higher risk of accidents and mortality compared to shore-based industries [9-12]. More technological advances and the introduction of digitalization and automated processes have implied that the number of crew members has, and will continue to, decrease, thus adding more demands on the remaining crew members [13]. Given these harsh conditions, research findings reveal that the design of accommodation can influence mental well-being and restoration achieved during off-duty periods [4].

The effects that building environments and design have on individuals both at work and at home have been investigated in different contexts [14-17]. The area of IEQ and its effects on people's well-being is said to be complicated and challenging to comprehend [17]. Elements that are considered in discussions and evaluations of IEQ are e.g., thermal climate, noise, vibrations and light/natural light, as well as colours and the standard and comfort of furnishings [4].

Although international conventions and later binding international law aim to establish minimum working and living standards for seafarers [1], Ellis, Sampson [4] found differences in IEQ onboard depending on the characteristics of ships (e.g., ship type, age, place of build, flag and size). Given the situation onboard, severe weather conditions, shift work on a 24-hour schedule, getting enough quality, comfortable and uninterrupted sleep can be challenging and lead to both physical and cognitive fatigue [18, 19]. The

quality of sleep is dependent on many factors, e.g., indoor environment, bed microclimate, psychological state, body condition, and circadian rhythm, which further demonstrates the importance of a well thought-through IEQ onboard [20].

The shipping industry is facing a shortage of people willing to start and pursue a career at sea. To understand the mechanisms behind turnover from the employee perspective is complex, but research suggests well-being as one component [21]. Ellis, Sampson [4] also argued that accommodation standards provided onboard contribute to positive recruitment and retention outcomes and are related to seafarer well-being.

As a well-designed IEQ is argued to positively affect well-being [17], the purpose of this pre-study is, from a user-centred design perspective, to investigate what components constitute a well-designed accommodation with a high IEQ. The aim is to give design recommendations for the accommodation and point out what features the crew find necessary to create a good IEQ that promotes recreation and rest.

2.2 Human-/User-Centred Design (HCD/UCD) Approach

This pre-study adopts a human-centred design (HCD) approach as the underlying methodological framework for understanding and improving crew accommodation onboard. HCD is defined as an approach that aims to make systems usable and useful by focusing on users, their needs, and their contexts of use, and by applying ergonomics and usability knowledge throughout the design process [22]. Central to this approach is the iterative identification of user needs, the specification of requirements, and the evaluation of design solutions with the involvement of users or their representatives.

The suitability of HCD in maritime contexts has been increasingly emphasized over the years, as seafarers both live and work in the environments to be designed, and therefore possess unique insights into their constraints, needs, and daily practices. Considering user perspectives is necessary to prevent the misalignment between design decisions and operational realities, a problem that has been identified in maritime human factors research when user needs are not captured early or systematically [23, 24]. Furthermore, HCD stresses that design solutions must reflect the physical, cognitive, organizational, and social conditions in which users operate – concepts that are central to maritime work understood as a complex sociotechnical system [25, 26].

In accordance with HCD principles, this pre-study employs a bottom-up, participatory approach in which seafarers are directly involved in defining what constitutes well-designed accommodation with high IEQ. Semi-structured interviews were used as the primary data collection method due to their recognized value in eliciting user experiences, tacit knowledge, perceptions, and everyday practices within maritime operations [27, 28]. Interviews are essential tools within HCD because they reveal how users interpret their environment, how they cope with constraints, what they prioritize, and what challenges they perceive – insights that cannot be captured through technical assessments alone. Through these interviews, the study captures crew-defined needs and requirements related to rest, recovery, privacy, comfort, socialization, and the broader lived experience of accommodation spaces onboard. These qualitative findings serve as the foundation for translating user input into design implications, a key step in HCD in

which user requirements are systematically converted into actionable guidance for concept development and later stages of design [23].

By grounding the project in a human-centred, user-driven methodology, the pre-study ensures that the resulting recommendations reflect real operational conditions and the perspectives of those who inhabit the spaces daily. In doing so, the work aligns with the core purpose of HCD: to create environments that better support well-being, sleep quality, recovery, social connection, and safe and efficient operations, ultimately contributing to more sustainable working and living conditions at sea.

3 Methods

3.1 Approach and Research Design

This pre-study used a qualitative user-centred approach using semi-structured interviews to elicit crew perspectives on onboard common areas and accommodation quality and needs for rest and recovery. Data were collected via six onboard ship visits and two online (Teams) sessions. Notes were entered into Excel; themes were generated via a thematic analysis and iterated among the researchers and then compiled into results and design implications.

3.2 Study Participants and Demographics

The selection of the participant sample was purposeful, targeting active crew members. In total, eight participants were interviewed (Table 1). All participants provided informed consent prior to data collection. Although the study involved only tanker crew, the findings may also hold relevance for other vessel types, including ocean-going ferries and cargo ships.

Table 1 Participants' demographics

Sex	Age	Nationality	Rank	Experience at sea (years)	Current vessel	Year built
Male	29	Polish	2nd officer	5	Tanker	2025
Male	33	Filipino	Cook	7	Tanker	2025
Male	24	Swedish	2nd officer	1	Tanker	2025
Female	24	Filipino	OS (ordinary seaman)	0.5	Tanker	2025
Male	59	Swedish	C/E (chief engineer)	40	Tanker	2006
Male	33	Filipino	2nd engineer	12	Tanker	2006
Male	36	Swedish	Captain	11	Tanker	2021
Male	36	Swedish	C/O (chief officer)	13	Tanker	2021
Average						
	34,2			11.2		

3.3 Semi-Structured Interviews

Interviews were used as a core qualitative method to elicit participants' experiences, interpretations, and tacit knowledge – types of insight that cannot be obtained through quantitative measures [28]. They were semi-structured conversations using open-ended questions, allowing participants to describe their work practices, challenges, and expectations in their own words [27].

The interviews centred on three main domains: Cabins; Public areas; and Service areas (e.g., laundry, galley, locker room). The participants were asked to describe what makes each domain good or bad, and desired features.

The findings were then translated into conceptual design implications and shared with interior designers for 2D and 3D suggestions of three selected areas (cabins, social and recreational areas, and health and wellness areas) based on existing vessel general arrangement (GA) drawings.

3.4 Analysis

Data analysis followed qualitative thematic principles, including axial grouping and iterative theme refinement [29] to identify patterns in crew perspectives concerning onboard common areas, accommodation quality, and needs for rest and recovery. Themes were validated through cross-review among the research team, and representative interview excerpts were selected based on relevance, clarity, and recurrence across participants. The final themes then served as structured input for the design interpretation process.

3.5 2D and 3D Designs

The thematic findings and user-defined requirements were translated into conceptual design implications and subsequently transferred to professional interior designers (Figura arkitekter). This process involved a structured handover session to ensure accurate interpretation of crew perspectives. The designers then used these inputs to generate spatial concepts, including 2D layouts and 3D visual interpretations for cabins, social/dayroom and hobby spaces, and wellness and fitness areas. These design outputs form an integral part of the Results section and illustrate how crew insights can be operationalized into concrete accommodation design proposals.

4 Results

Based on the interview data, the analysis was structured around six overarching themes.

4.1 Theme 1: Privacy

Subthemes:

- Private cabins
- Separation of sleeping and living areas within the private cabins
- Locker room privacy

Interpretation:
Privacy is strongly linked to psychological well-being and autonomy onboard. Mariners emphasized that having a personal cabin is not just a preference but a necessity for mental health and rest. Privacy in locker rooms and bathrooms also emerged as critical for dignity and comfort.

Illustrative Quotes & Examples:

- *"Important to have your own cabin… Your sleep area should be separated from your dayroom."*
- *"Changing rooms should have personal lockers so that you can separate your private and your work clothes."*
- *"Locker rooms need to have an area with a curtain that offers some privacy for those who prefer it."*

Design Implications:

- Ensure private accommodation cabins with clear separation between sleeping and living zones.
- Locker/changing rooms should include work lockers, personal lockers and privacy partitions, for privacy and for division between work and private clothes.
- Bathrooms should be personal or semi-private, with separate shower and toilet facilities.

4.2 Theme 2: Personal Space

Subthemes:

- Ability to personalize cabins

Interpretation:
Personalization fosters a sense of ownership and identity in an otherwise standardized environment. Mariners want to make their cabins feel like "home" during long voyages.

Illustrative Quotes & Examples:

- *"Possibility to personalize your cabin, e.g., hang pictures… Maybe have a notice board."*
- *"Nice to have paintings that have familiar motifs… Plants onboard are nice."*

Design Implications:

- Provide neutral décor that can be customized.
- Include notice boards, shelves, and hooks for personal items.
- Allow flexibility in artwork and decorations to avoid sterile environments.

4.3 Theme 3: Comfort and Homeliness

Subthemes:

- Temperature control
- Noise/vibration reduction
- Lighting (including blackout curtains)
- Furniture quality
- Décor

Interpretation:
Comfort is essential for stress reduction and mental health in isolated environments. Mariners repeatedly mentioned temperature, noise, and vibration as major factors affecting sleep quality and overall well-being.

Illustrative Quotes & Examples:

- *"To be able to adjust the temperature and have it as quiet as possible is important for sleep quality."*
- *"Comfortable sofas and a quiet and clean environment… Real flowers are important."*
- *"Important with good lighting and that it is possible to adjust the temperature… blackout curtains are necessary."*

Design Implications:

- Install adjustable HVAC systems in cabins.
- Use soundproofing and vibration-dampening materials.
- Provide blackout curtains and dimmable lighting.
- Choose durable yet comfortable furniture and neutral tones for décor.

4.4 Theme 4: Social and Recreational Opportunities

Subthemes:

- Dayrooms for games and karaoke
- Hobby rooms
- Outdoor sheltered spaces
- Flexible social zones

Interpretation:
Social spaces are vital for crew cohesion and morale. Mariners value areas where they can relax, engage in hobbies, and socialize without rank-based segregation.

Illustrative Quotes & Examples:

- *"The leisure space should have one messroom… everyone should sit together. This promotes communication."*
- *"Nice to have a hobby room onboard where you could do carpentry or have a 3D printer installed."*
- *"It is good to have a sheltered place out on deck so that you can sit outside even if it is a bit windy."*

Design Implications:

- Create multi-purpose dayrooms for games, karaoke, and movies.
- Include hobby spaces for creative activities.
- Design outdoor areas with wind protection for socializing.
- Use flexible layouts (e.g., glass partitions) to allow quiet zones and group activities.

4.5 Theme 5: Health and Wellness Facilities

Subthemes:

- Gym design (machines vs free weights)
- Sauna
- Pool
- Ventilation

Interpretation:
Physical health facilities help maintain routine and reduce stress during long voyages. Safety and usability in rough seas are key considerations.

Illustrative Quotes & Examples:

- *"The gym should have a designated area with proper workout facilities, and the ceiling should be high enough for workout."*
- *"A sauna gives a rhythm of the week (e.g., Saturday is sauna day)."*

Design Implications:

- Equip gyms with bolted machines and safe alternatives to free weights.
- Include sauna and possibly a small pool for relaxation.
- Ensure good ventilation and natural light in wellness areas.

4.6 Theme 6: Functional and Technological Aspects

Subthemes:

- Wi-Fi connectivity
- Layout of galley and mess
- Laundry facilities
- Storage solutions
- Changing rooms

Interpretation:
Operational efficiency and convenience directly affect crew satisfaction. Poor layouts and lack of connectivity were common complaints.

Illustrative Quotes & Examples:

- *"Wi-Fi is very important… Unlimited internet is important."*
- *"The galley should be designed for one person working there, not too big."*
- *"Laundry facilities must be sufficient, two of each machine and to separate private and work clothes."*

Design Implications:

- Provide reliable high-speed internet throughout the ship.
- Optimize galley layout for ergonomics and workflow.
- Ensure adequate laundry capacity and separation of work/private clothes.
- Design storage and locker rooms with privacy and easy access to work areas.

4.7 Example Sketches of 3D Interpretation of the Results

Based on the results gathered from the crew, the design company Figura arkitekter developed several floor plan concepts and design ideas for private crew cabins, social areas – including hobby rooms – as well as the wellness and fitness area. The images

presented in this section are reference visuals intended to illustrate these conceptual interpretations.

The floor plan in Figure 1 illustrates a possible layout for the onboard social spaces, comprising the crew and officer mess room, dayroom, deck and sundeck with jacuzzi, gym, sauna, open showers and separate changing rooms with additional showers. It also includes hobby rooms, such as a workshop, a karaoke/gaming/cinema room, and a ping-pong room (shown in white), as well as private cabins (indicated in the greyed-out area).

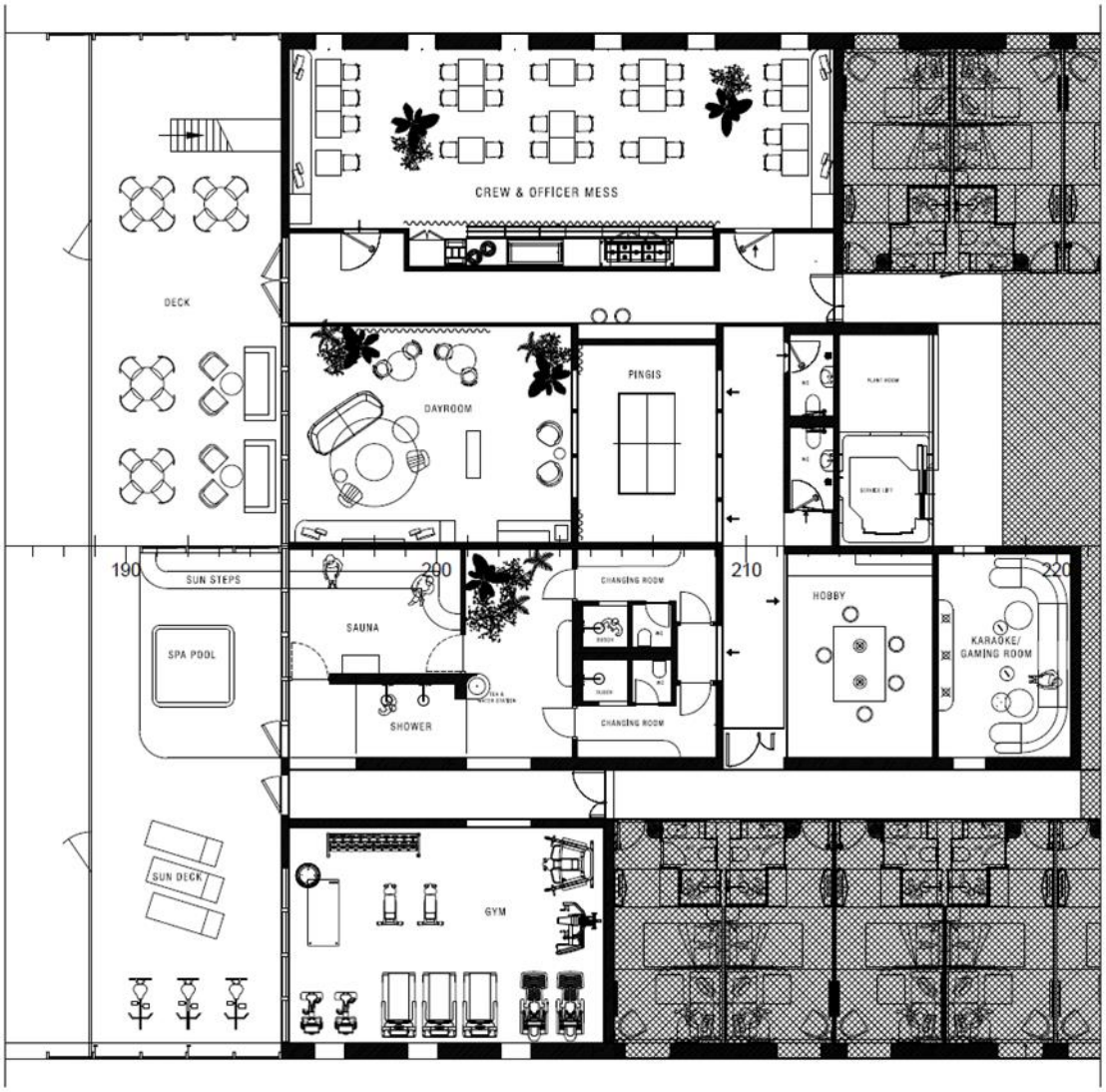

Figure 1 Floor plan of onboard social and private spaces

4.7.1 Cabins

Figure 2 illustrates a crew cabin in an existing tanker vessel built in 2006, while Figure 3 shows a crew cabin from a vessel of the same series built in 2025, constructed in a similar layout and fashion to the 2006 vessel. Both cabins feature a small single bed, a desk, a wardrobe, and a simple bathroom, with some configurations also including a sofa.

Figure 2 Example of a crew cabin in an existing tanker vessel built in 2006

Figure 3 Example of a crew cabin in an existing tanker vessel built in 2025

In the new proposals, the cabins remain compact yet are designed with a focus on homeliness and comfort, good lighting, sound absorption, the use of warm materials, and a separation between sleeping and living zones. Personalization is supported through a neutral interior palette with soft, earthy tones, together with a magnetic wall panel for displaying photos or other items, and opportunities for personal decoration (e.g., hanging paintings) (Figure 6), contributing to a more individualized and homely environment.

The layout of the cabins features a dedicated sleeping area, arranged with either a longitudinally oriented bed (Figure 4) or a transversally oriented bed (Figure 5). A large window allows natural daylight to fill the cabin, while a soft curtain and acoustic materials create a quiet, noise-reduced environment conducive to rest. The lounge zone includes a generous and comfortable sofa, providing a relaxed space for seating and social interaction.

The entrance area is designed for practicality, equipped with functional storage solutions such as a wardrobe and accessible compartments. Additional storage is integrated within the sleeping area to accommodate personal belongings. The wet unit/bathroom is designed for modern use, featuring an efficient layout and ample storage for toiletries and personal care items.

A foldable (Figure 4) or non-foldable table/writing desk (Figure 5, Figure 7) offers flexibility for work or personal use. The cabin also includes a modern integrated TV system with streaming capabilities, enabling seamless connection to personal devices.

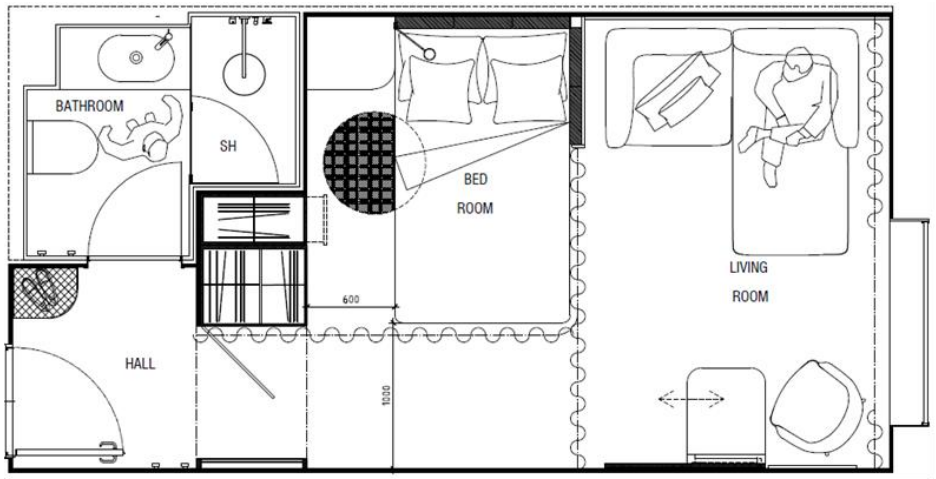

Figure 4 Cabin with longitudinal bed, with sofa and foldable table/ desk

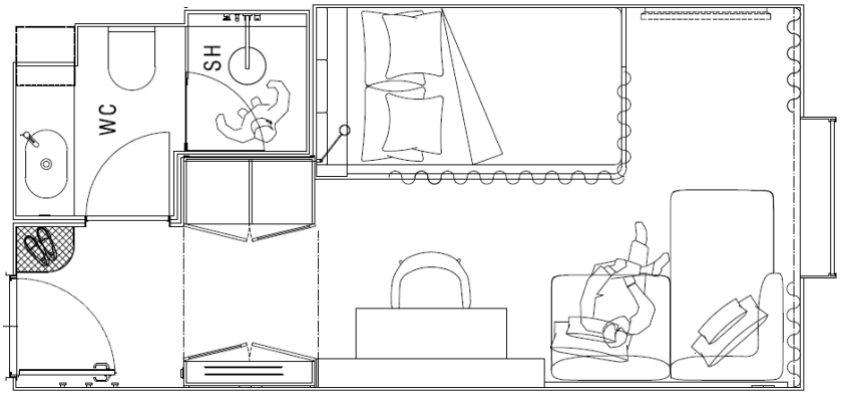

Figure 5 Cabin with transversal bed

Figure 6 Example of a magnetic wall panel for displaying photos or other items (left), alongside an example of personalized wall art (right)

Some cabins may be furnished with a pod-style bed (Figure 7) constructed with padded wall and ceiling elements to reduce noise. Curtains mounted on a rail serve multiple functions: they contribute to noise reduction, allow the sleeping area to be concealed during the day, and provide additional control over daylight. The pod configuration also enables integrated storage above the bed.

A foldable table/desk provides a functional workspace for a laptop and other equipment and saves space when not in use (Figure 4), while a slightly larger non-foldable desk offers additional counter space and a fixed surface for various items (Figure 7).

Figure 7 Pod-style bed (left), non-foldable desk (right), for reference

4.7.2 Dayroom

Figure 8 illustrates a dayroom in an existing tanker vessel built in 2006, featuring a large sofa and a TV.

Figure 8 Example of a dayroom in an existing tanker vessel built in 2006

In the new proposal, the dayroom (Figure 9) is designed as a flexible and inviting social area that supports relaxation, interaction, and everyday onboard living. Daylight from large windows, together with the option to incorporate plants, enhances the atmosphere and contributes to a natural and balanced environment that accommodates both social engagement and quiet retreat.

The room is organized into several social zones, offering a variety of settings for different activities. Multiple seating arrangements, including sofas, armchairs, and standard seating with tables, support casual activities such as enjoying coffee, reading, or playing cards. The area is situated between an outdoor seating space with comfortable furniture and a table-tennis room, creating a fluid connection between relaxed and more active social environments (Figure 10).

Figure 9 Dayroom

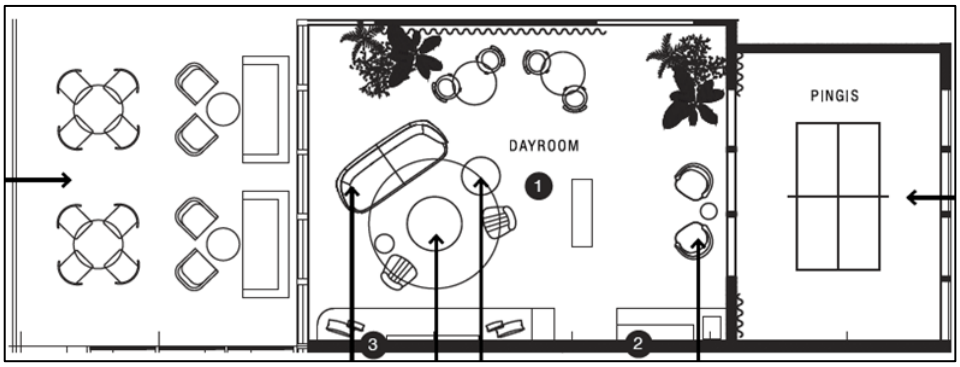

Figure 10 Floor plan of the deck, dayroom, and ping-pong room

4.7.3 Hobby Rooms

The hobby rooms (Figure 11, Figure 12) include a variety of spaces dedicated to entertainment and creativity, combining areas for crafts, sewing, painting, and other handicrafts with rooms for karaoke, gaming, and table tennis. Together, these facilities encourage both creative expression and active social interaction.

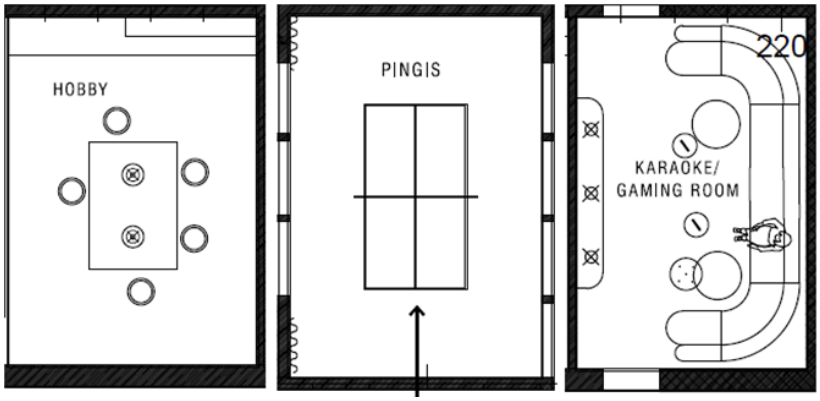

Figure 11 Floor plan of hobby workshop, ping-pong room, and karaoke/gaming/cinema room

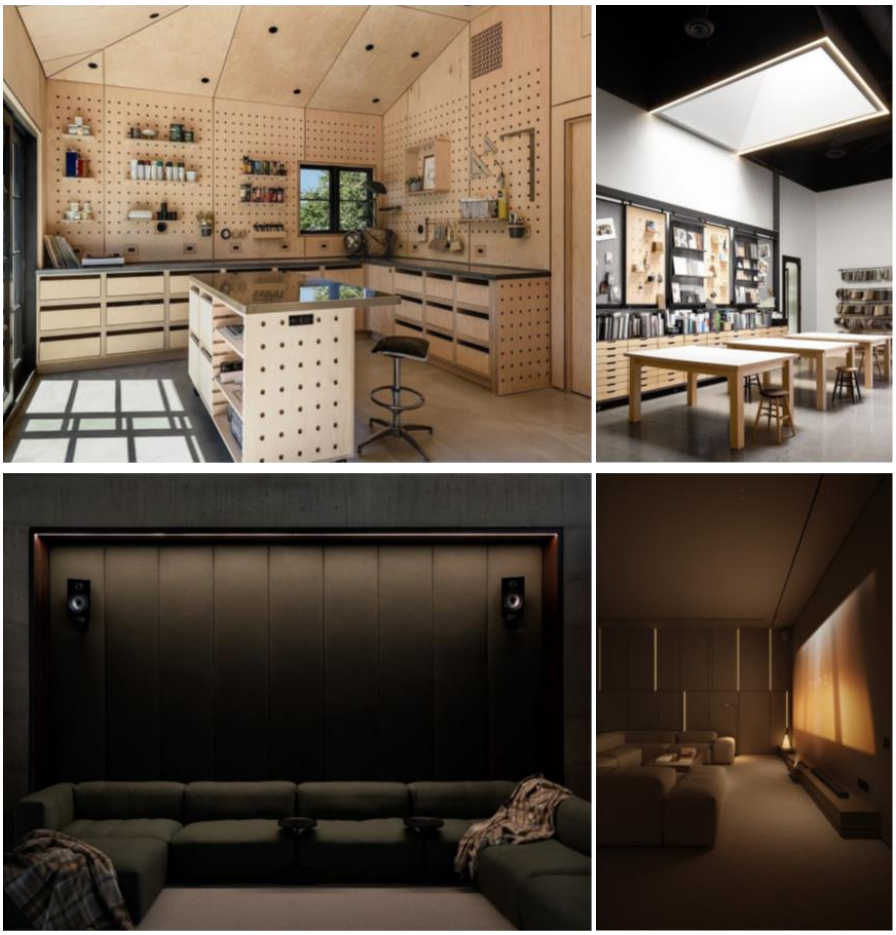

Figure 12 Hobby workshop (top), karaoke/gaming/cinema room (bottom)

4.7.4 Health and Wellness Area

The fitness and wellness area consists of a gym with daylight and direct access to a sundeck, a spa jacuzzi, and a sauna with separate changing rooms and showers – all connected seamlessly to create a cohesive and well-integrated wellness environment (Figure 13, Figure 14).

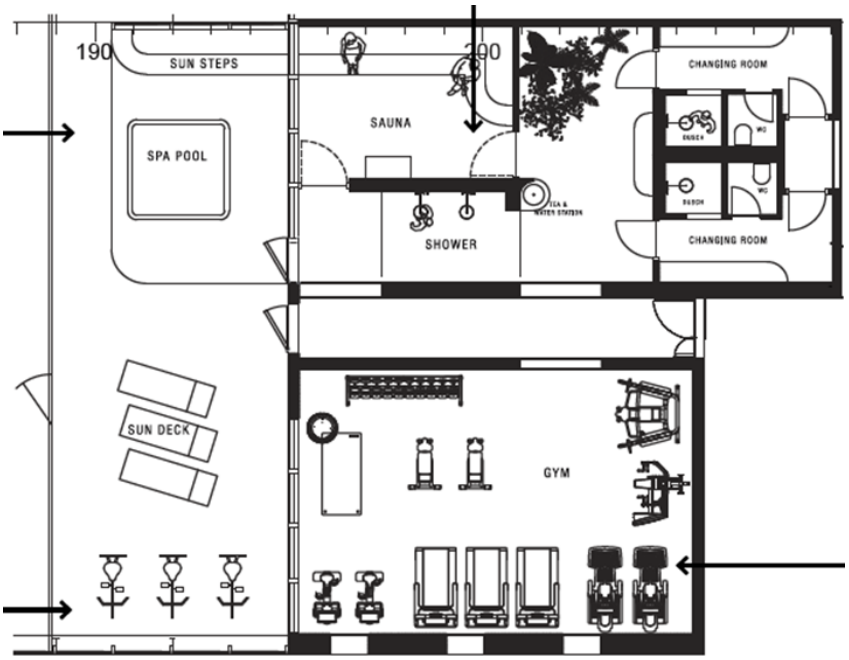

Figure 13 Floor plan of the gym, sauna, spa jacuzzi and sundeck

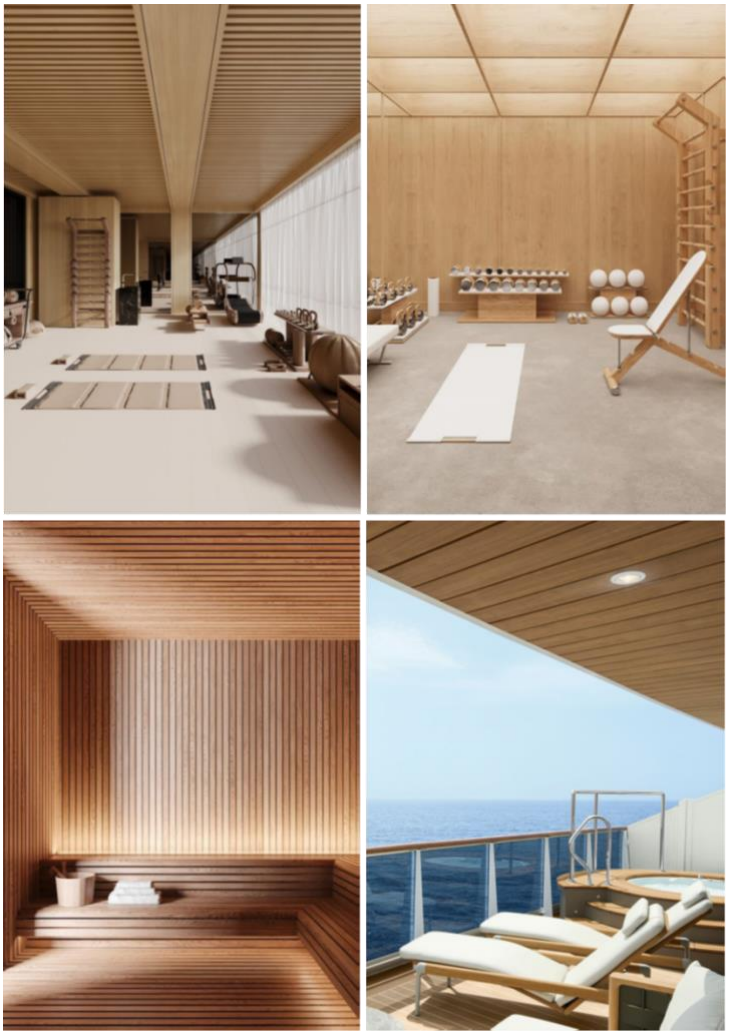

Figure 14 Gym (top), spa (bottom) with sauna (left) and jacuzzi and sundeck (right)

5 Discussion

This pre-study set out to develop a crew-centred understanding of what constitutes well-designed onboard accommodation by identifying key habitability and IEQ factors that best support rest, recreation and recovery. Using a user-centred, interview-based approach, lived experiences were translated and needs articulated into practical design implications that informed the development of conceptual layouts and 3D visualizations applicable to both newbuilds and retrofits. Semi-structured interviews with eight active seafarers yielded six overarching themes: **Privacy; Personal Space; Comfort and Homeliness; Social and Recreational Opportunities; Health and Wellness Facilities;** and **Functional and Technological Aspects**. Collectively, these align with established IEQ dimensions (thermal, acoustic, lighting, spatial/functional qualities) and underscore privacy, personalization and comfort as central determinants of well-being onboard. Design guidance should, however, be applied with sensitivity to vessel type, operational profile and spatial constraints inherent to different ship configurations. In addition, the integration of user-defined requirements into early-stage spatial concepts demonstrates the value of combining qualitative insight with iterative design interpretation in maritime accommodation development.

5.1 Practical Implications

The findings point to actionable interventions in core onboard areas:

- **Cabins:** Single-occupancy where feasible; clear separation between sleep/day functions; adjustable climate and light control; noise/vibration reduction[2].
- **Social and recreational zones:** Flexible, activity-based layouts; inclusive mess arrangements; hobby rooms; sheltered outdoor areas and seating.
- **Health and wellness facilities:** Well-ventilated gyms with bolted equipment for safety; sauna facilities and, where possible, small pools to support routine-building and relaxation.
- **Service areas:** Ergonomic galleys sized for realistic staffing; ample laundry capacity with drying/folding space and separation of work/private clothing; robust storage solutions; private changing facilities.
- **Connectivity:** Reliable, ship-wide internet access as a baseline expectation to support communication and well-being.

A further practical implication is the demonstrated feasibility of translating crew-expressed needs into spatial concepts through structured designer collaboration,

[2] In the cabins, additional provisions can be considered to enhance comfort, safety, and functionality. These can include a three-quarter-width bed, sufficient wardrobe capacity, and additional storage solutions for books, personal belongings, and everyday items. A fixed table or desk should provide a stable surface for a laptop, documents, personal items, medication, food, and books. A mini-fridge may support personal dietary needs, and electrical outlets should be positioned to enable convenient charging of devices such as laptops, phones, and hairdryers. In-cabin safety and fire-extinguishing equipment, a first-aid kit, and basic toiletries (e.g., soap and toilet paper) can contribute to increased safety and essential comfort. Further amenities, such as a small personal laundry machine in the bathroom for private items, may also be considered to improve convenience and autonomy for crew members.

highlighting an approach that could be formally integrated into shipowner–designer workflows.

5.2 Feasibility and Implementation Considerations

While these implications are concrete, real-world deployment requires step-wise prioritization considering space constraints, retrofit vs. newbuild trade-offs, and costs. Implementation should also respect regulatory baselines such as the Maritime Labour Convention (MLC) [1] and acknowledge that IEQ conditions and achievable standards vary by ship type, ship age, place of build, flag and size. In practice, owners and designers must balance crew-preferred features with technical, spatial and budgetary realities, sequencing upgrades (e.g., light/thermal control, basic sound/vibration mitigation, laundry capacity) ahead of larger structural interventions. The conceptual 3D proposals provide a visual basis for evaluating feasibility, enabling early identification of spatial conflicts, circulation challenges, and opportunities for modular or phased implementation.

5.3 Methodological Reflections and Limitations

As a qualitative pre-study, results should be understood as indicative rather than statistically generalizable. The sample size (N=8), the sampling strategy, and the tanker-specific context may constrain transferability across different vessel categories and operating profiles. Nonetheless, the findings may still hold relevance for other vessel types, including ocean-going ferries and cargo ships.

The findings are based on self-reported experiences. While interviews are well-suited to eliciting tacit and experiential knowledge, additional triangulation (e.g., observations, measurements) may strengthen causal attributions between specific design elements, IEQ aspects and outcomes such as sleep quality.

Future work must incorporate iterative cycles including that include further focus groups with crew, naval architects, and other stakeholders involved in newbuilds and retrofits.

5.4 Theoretical Integration and Added Value

The six themes support prior evidence that IEQ variables (thermal comfort, noise/vibration, lighting, spatial/functional quality) materially influence well-being. This study extends the literature by articulating crew-defined, preferred designs – an area less explored than satisfaction studies or passenger-focused research – and by converting those preferences into actionable design implications for concept development. In short, the findings both confirm the importance of IEQ highlighted in prior work and operationalize it for designers through concrete, crew-validated requirements. It also adds methodological value by demonstrating how HCD principles can be operationalized within the maritime domain through a structured flow from interviews to thematic analysis, to design implications, to finally spatial concept proposals. This step-wise chain provides a replicable model for future studies.

5.5 Implications for Future Work

The next phase should (i) co-develop and iterate design concepts with interior designers and shipowners using existing GA drawings; (ii) validate concepts with a broader and more diverse crew sample (different ranks, nationalities, vessel types) to test transferability; and (iii) where feasible, evaluate impacts on well-being through targeted pilot studies (e.g., pre-/post-changes to lighting, acoustic treatments, climate control) and user feedback cycles. In parallel, it would be valuable to explore cost–benefit and space-efficiency analyses that compare retrofit packages vs. newbuild options, and to consider how design choices can support operational/personal routines and maintenance (e.g., durable finishes, safe gym layouts in rough seas).

6 Conclusions

This pre-study set out to develop a grounded, crew-centred understanding of what constitutes well-designed accommodation onboard, and how improved Indoor Environmental Quality (IEQ) can support rest, recovery, well-being, and long-term sustainability at sea. From semi-structured interviews with active seafarers working onboard tanker vessels, six interconnected themes were identified – Privacy; Personal Space; Comfort and Homeliness; Social and Recreational Opportunities; Health and Wellness Facilities; and Functional and Technological Aspects – that together describe the qualities crew members consider essential for supportive and restorative onboard living environments.

After mapping needs and preferences, the user-defined requirements were translated into concrete design implications spanning cabins, social and recreational spaces, wellness areas, service areas, and technical infrastructure, and these were shared with professional interior designers to demonstrate how these requirements can take shape in reality and to develop conceptual layouts and 3D visualizations for three selected accommodation domains: private cabins, social/dayroom and hobby areas, and health and wellness facilities. This translation bridges experiential, practice-based knowledge with early-stage practical and context-aware design guidance for both newbuilds and retrofits, and provides a concrete starting point for design dialogue between shipowners, designers, and stakeholders engaged in newbuild or retrofit planning. It also underlines the importance of incorporating user-centred design early in ship development processes, ensuring that user needs are not only documented but also made actionable in concept development. Doing so strengthens alignment between operational needs, crew well-being, and technical feasibility, and contributes to improved IEQ and accommodation standards across the fleet. The findings establish an evidence-informed foundation for further development and also speak directly to how improving onboard conditions offers a tangible pathway to enhancing social sustainability, strengthening recruitment and retention, and mitigating the pressures associated with reduced crew sizes and increasing automation.

The next stage should include iterative refinement of the proposed concepts with a broader and more diverse crew sample and vessel type sample, assessment of feasibility through collaboration with naval architects and classification societies, and evaluation of design impacts through pilot implementations or field studies. In this way, the pre-study can evolve into a robust framework for developing accommodation environments that actively support health, well-being, and performance in an evolving maritime industry.

7 Acknowledgements

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