List of functional requirements for the design

D7.1

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Executive Summary

The purpose of this report is to summarize and document the results of Task 7.2. In order to be able to make a suitable design for Living@Sea, the experiences, needs and wishes of current and future inhabitants are collected. A two-phased procedure was used. The first step was a survey of the WPs with the purpose to learn about their information needs. The second step was a qualitative questioning of experts (people with at least several months experience of living and working in artificial and isolated habitats). The interview guideline was based on the results of the survey of WPs. The outcome of the investigation is a list of functional requirements for the design from the users' perspective in terms of comfort, availability, working conditions, design of the living area and the outdoor area, communication, social life, leisure, safety, shopping, and ecology.

An environment under which the participants could imagine themselves living permanently offshore needs to fulfil several aspects: Regarding comfort the increase of the platform's stability, the provision of soundproof rest areas as well as odour-free living spaces was stated. The living area should be appealing and creative as well as provide increased space availability and intimate private retrieval zones. Outside spaces should be foreseen including green spaces and communal areas. If working offshore permanently shall become an attractive concept also changes from a regulatory point of view would need to happen. The participants would like to have regular working hours as on the mainland. Furthermore, the community size should be adjusted so that finding friends but also avoiding each other is possible. Lastly, the participants would like to have the possibility of taking and integrating or at least being able to receive visits and/or visit their family regularly.

1. Introduction

Task 7.2 is concerned with the perspective of the current and future inhabitants of the living space platform of Space@Sea. Their perspective is of great importance for further architectural and technological developments, especially as input for the rest of WP 7 (Living@Sea) as it provides insights which requirements differ from offshore inhabitants to inhabitants on land that need to be considered to design a comfortable living environment at Living@Sea.

Already in other multi-use offshore projects such as MERMAID involving stakeholders has had a valuable contribution to the development of the different designs. Using a participatory design process according to Van den Burg et al. (2016) *"(...) has been beneficial in generating new and shared knowledge. It brought new design issues to the table and increased knowledge and understanding (...)."* Even though a participatory design process as it was done in the MERMAID project including round table discussions was too early at this stage for Space@Sea, it can be assumed that the involvement of the stakeholder group "current offshore inhabitants (and potential future end users)" will have similar effects.

In chapter 2 the method and sample used in this research is discussed, subsequently chapter 3 describes the results and the conclusions are drawn in chapter 4 which gives the list of functional requirements. In annex 1 the references can be found and in annex 2 the questionnaire which was sent to the Work Packages has been attached.

1.1 Relation to the overall project

The results from this report aim to serve as input for the tasks of work package 7 as well as background information for the project partners of Space@Sea. Moreover, this report aims at providing a list of functional requirements for the design of the living area of a multi-use offshore platform for a permanent stay offshore. However, it is up to the expert judgement of the respective work package specifically task members in how far these suggestions will in the end be integrated into the final design.

1.2 Approach

The central question is: How should a living platform be designed from the users point of view?

For approaching the question, two procedures were chosen:

- Survey of WPs
- Qualitative and guideline-supported interviews

2. Method and Sample

2.1 Survey of Work Packages

The survey of the Work Packages (WPs) is an important factor in determining the subsequent parts of the study concerning contemporary and future users (Task 7.2 and 7.4). For the provision of the partner's required information, it is the aim to find the most suitable method for future surveys. Furthermore, it is important to integrate the partner's previous knowledge into the survey. Contact details received from the WPs are essential for further recruitment of future interview partners.

The survey of the WPs took place in November/December 2017. Each WP leader received an e-mail including a questionnaire and the request to fill it out as a representative of their WP. However, the completion of the questionnaire required the consultation of all members of their WP. The relevant question in Task 7.2 has been: "To make sure we will not forget about essential questions which will help your future research and to avoid the outcome of insignificant information, we want to ask you for your support in developing the interview's guideline. Please tell us what you want to know about future Space@Sea residents – which information do you need about them and which questions should we pose to them?" In order to prepare for Task 7.4, we asked for contact details of potential participants for interviews. Furthermore, we were interested in our partners' expectations of how the future Space@Sea target group should look like.

2.2 Expert interviews

Following the survey of WPs, semi-structured expert interviews for the purpose of qualitative research were conducted. Experts are considered to be people of a specific social sub-area who are being asked about their experiences concerning this specific field (Blöbaum et al. 2016, p. 175). They are valuable sources for gaining special knowledge about the investigated social issue (ebd., p. 174). Experts of this study are thus people who are experienced in living in an artificial and isolated environment. Such living environments include offshore platforms, container vessels, cruise liners and research stations. Exploratory expert interviews serve the purpose of creating a first orientation when it comes to thematically unknown or unstructured fields of research (Blöbaum et al. 2016, p. 178). They are fundamental sources of information in a new field which does not contain a fair amount of source literature yet. Moreover, the experts' exclusive and special knowledge is of crucial matter for further tasks of the overall Space@Sea project.

2.2.1 Guideline

A semi-structured interview is determined by "necessary candour and structuredness in a conversation" (Loosen 2016, p.139). The interviews started by welcoming the participants, followed by a short introduction to the project and some information on how the interview would be conducted. Furthermore, participants were informed about the anonymisation of the transcript and its further use. They were then asked for their agreement on recording of the interview. The voice recorder was subsequently switched on and respondents were asked about their demographic data. These included questions about their age, sex, occupation, family status and level of education. Afterwards, the actual interview, divided into three thematically classified sections with a total of four questions, started. The guideline's thematic structure was composed of 1) experiences, 2) suggestions for improvements and 3) expectations towards the living space platform. The specific order of sections served the purpose of leading over from the participants' experiences about their life at sea to their notion of a permanent stay on an artificial island.

Impulse questions are stimuli that create a narrative flow and serve the purpose of gaining new and unknown information. Posed questions were the following:

- Why have you decided to work offshore and for how long have you been working offshore? (Section 1)
- Please tell me something about the offshore-living conditions. What are the differences between living on land and living on water offshore? How do you experience and feel about it? (Section 1)
- Could you please tell me, how the offshore living conditions could be improved? What are your suggestions and desires? (Section 2)
- If you were asked to work and stay for a longer period or even permanently offshore: How should the living quarters on the artificial island look like? How should the conditions be in order to attract you? (Section 3)

Besides these questions, the interviewer's guideline included a list of questions about various subject areas. If participants did not talk about some of the topics on their own accord, they were simply asked about it. The thematic questions were composed by means of the results of the previous survey of WPs and included the subsequent topics: safety, comfort, communication, size of the crew and (social) potential for conflicts, privacy, leisure time, waste, design of the residential living space and outdoor areas, location, working conditions, social contacts (friends and families), environment, shopping facilities and food.

To demonstrate that the interview technique has been successful, respondant A will serve as an example. In section 3, when talking about the ideal equipment of home appliances, A claimed that there would be no need of a washing machine of his own, as he could simply share it with other inhabitants. However, he afterwards remembered the odours of the engine room which are very difficult to be removed from the clothes. That thought made him change his mind and to insist on his private washing machine. In a standardised survey, he would have impulsively ticked off that he would be willing to share a washing machine. Due to the open survey method and recapitulation of previous memories and experiences, he was able to give a different and more valid statement.

2.2.2 Sample

Overall, seven face-to-face interviews have been conducted in March and April 2018 in Rostock, Germany. Five men and two women participated in the survey. Interviewees were recruited by means of snowball sampling. Every participant had experiences in living and working in an artificial and isolated environment for at least several months. Five participants made their experiences on container or heavy-lift ships, while the remaining two worked and lived on a cruise liner and a research station located in the Antarctic. All participants had the German nationality and their level of education was the German highest secondary school degree. Additionally, all participants had either already finished their university degree or were studying in the realms of seafaring at the time of the interview. One interviewee was older than 60 years, whereas the other participants were between 20 and 36 years old and can therefore be counted among the Space@Sea target group. For subsequent interviews it might be interesting to investigate a broader variety of offshore professions, age groups as well as different cultural backgrounds.

	Sex	**Age**	**Education**	**Family Status**	**Profession**	**Platform**
A	m	26	Abitur	Single	Ship mechanic, ship operation engineer	Container ship
B	m	26	BA	Divorced	Ship mechanic, ship operation engineer	Container ship, heavy lift vessel
C	m	63	Diploma	Single	Ship operation engineer	Container ship
D	m	24	Abitur	Single	Ship operation engineer	Container ship, heavy lift vessel
E	f	20	Abitur	Single	Navigator	Cruise ship
F	m	30	Abitur	Single	Navigator	Container ship
G	f	36	PhD	Single	Scientist (chemist)	Polar research station

2.2.3 Transcription and evaluation

The seven interviews were conducted in 38 to 61 minutes. They have been recorded, transcribed and evaluated according to Mayring's method, which is a qualitative content analysis (2015). Therefore, transcription did not happen in a literal way, but in form of the aforementioned content analysis (Höld 2009). For the analysis, methods of the summarising and selective record were combined (ibid., p. 663). The method of the selective record only transcribes specific parts of the data. At first, a category system which matched the guideline's thematic questions and therefore the partners' required information, has been determined. The transcript is not a chronologically structured record but has been structured after the established categories. This specific type of approach corresponds with the structural content analysis (Mayring 2015). When applying the method of the summarising record, repetitions of a statement or text passages with no significance for the study, are being omitted. This approach corresponds with the first step of the summarising content analysis (Mayring 2015). When transcribing the interviews, it has been made certain to adhere to the participants' choice of words and manner of speaking.

3. Results

Even though the interviewed experts did not have any experiences with the permanent life on an artificial island, they did encounter the temporary life in another type of artificial environment. A ship distinguishes from a platform in respect to its mobility and the circumstance of entering a harbour regularly. A container and heavy-lift ship's crew consists of a rather small number of people (approximately 20 to 25 people), but has comparatively much space with few leisure facilities. Additionally to the guests on board, a cruise liner's crew is rather big in number (a few hundred crew members). The space on board is limited, but leisure facilities are manifold and large in number. Like a platform, the research station is of a fixed nature. However, the station's surroundings and place of erection is not water, but the Antarctic ice. The number of crew members varies between nine and 36, depending on the time of the year. Leisure facilities are limited. All examined environments have in common that they were set up for the purpose of a working environment. Stays are only temporary and crew members are changing constantly. Since life on board and at the research station is determined by work, its living space is not associated as a home. Stable social contacts such as family and friends as well as the private living space (flat, house) are located onshore, to which one always returns. Even though the project's aim is to create a more spacious habitat with the purpose to enable a permanent stay, the experts' experiences concerning their accustomed habitats are valuable for further project developments of Living@Sea.

3.1 Experiences

3.1.1 Motivation

Mentioned motives to become a sailor or to live and work in another type of artificial environment were the following:

- Wanderlust
- Interests of job-related nature
- The romantic view on the life as a sailor ("*Seefahrerromantik*")
- Personal experiences
- Recommendation of a colleague

To leave their home and see the world has been the sailors' motivation to go on board (A, B, C, D, E, F). In case of the ship operation engineers and the ship engineer, wanderlust and the interest in the technical job were crucial factors. C and F named the romantic view on the life as a sailor, an adventurous impulse and the expectation of an all-round job as their motives. They were the ones whose expectations were disappointed the most. It turned out very quickly that working on a ship is awfully monotonous and that, even though the ship travels to many countries, most time is spent at the harbour. Only D mentioned financial reasons, however, in a rather negative way as he claimed that the wage is extremely low. The navigator (E) did encounter her future occupational field at a cruise and, later on, did an internship on a cruise liner. The researcher's interest derived from a colleague's recommendation.

3.1.2 Living conditions

The living conditions experienced by the participants can be summarized as follows:

- Full supply
- Predetermined daily routine
- Separation from the accustomed everyday life
- Life full of deprivation

People's life in their habitat is determined by a kind of "schizophrenic" lifestyle. As long as they are on board or at the station, many things are being arranged for them. Meals are being prepared, a cleaning service for higher ranks is provided and there is a strict set of rules everybody conforms to. The day is determined by work (G). Life is full of deprivation: there is not much leisure time, the time pressure is immense and one does not get an adequate amount of sleep (C). Time spent in the habitat equals time spent in the working environment. Even returning to the cabin at the end of the day does not feel like coming home. In the meantime, life onshore continues. D talks about a "second household" and his dependence on the people onshore who, during his absence, take care of his insurance, bills etc. On the one hand, one is completely separated from everyday life. In the case of the freighters and research station, there are no shops one can go to. It is not possible to go for a run in the morning or to ride the bike (B). On the other hand, platforms are constructed like a small town, equipped with its own water- and energy supply (B). While life on freighters is a life full of deprivation (C), the life on cruise liners is considerably more luxurious (E). In the state of separation, food becomes extremely important. All respondents concluded that life quality aboard and on the station highly depends on the capability of the cook.

3.1.3 Safety

Safety is a crucial topic on board. The perception of safety depends on various factors:

- Faith in technology
- Faith in the established rules
- Faith in or distrust of other people
- Awareness of risks

All interviewees expressed their faith in technology. Only D uttered concerns about potential safety issues on Chinese ships due to austerity measures. The sailors are also content with the existing SOLAS convention (Safety of Life at Sea). Human failure, on the other hand, poses a major risk to them. Safety drills which take place before and during the stay, are obligatory on all platforms. During the drill, different scenarios are being practiced. However, safety drills on cruise liner and the research station differ from the ones on container vessels and freighters. To assure the passengers' safety on board, cruise liners employ so-called security officers who are in charge of passengers' security as well as so-called safety officers. The latter are in charge of the maintenance of lifeboats and taking care of fires. Passengers receive regularly updated information concerning safety precautions (E). Safety drills on the research station are carefully undertaken as well. The safety situation on container vessels and freighters is different. Even though the SOLAS convention establishes clear safety regulations and people are generally feeling safe aboard, there seem to be problems concerning crew members' capabilities: "*Back on my last ship, if anything severe had happened, we would have been doomed*." (F) Safety drills frequently take place but are not being corrected nor closely examined by anybody. Thus, they are often sloppily conducted and not taken seriously (A, F). The perception of safety depends on the frequency of drills (B), on the crew's condition (C: not overtired, no tensions between crew members; A, B: the crew's level of training and their familiarity with the machines) and on the officers' level of competence (A, D, F):

"*Overall I did feel safe, but I usually knew about the level of training the crew had. You can tell from the drills, which can be realised in a more or less professional way. How a drill is conducted depends, on the one hand, on the officer […] but also on how serious the crew is taking it. Also, the crew's knowledge on how to handle the machinery on board is important.*" (A)

"*I'm afraid of being under the command of a complete moron who is in charge of a crucial task but is not able to live up to it*." (F)

Participants also point out a person's self-reliance (A, B). Due to their job, the ship mechanics are in charge of the crew's safety: "*It's easier to sleep well when you can say for yourself that you did a good job*"(B). All participants name fire and explosions as the greatest dangers. Water ingress, on the other hand, is perceived as less problematic due to people's faith in the ship's technology. Only B names further sources of danger such as the breaking ropes. In principle, the distance between the ship and the mainland does not pose a problem to the participants either. However, opinions about the distance do vary in connection with medical care. In case of cruise liners and research stations which employ at least one doctor, isolation is rather unproblematic. As there are no doctors aboard a container vessel or a freighter, concerns are uttered with regards to a case of a severe illness (A, F).

3.1.4 Comfort

The perception of comfort is limited by:

- Seasickness and ship's unsteadiness
- Noises
- Odours

Ship motions in waves are a problematic factor, even experienced sailors sometimes suffer from seasickness (A, B, D). Seasickness affects body and soul, especially when the immense swell of waves continues for several days. Wardrobes and drawers are then starting to clear themselves out. The motion of the sea also affects cruise liners. However, E does only mention seasickness with regard to its effect on the board hospital, which has been crowded due to bone fractures and vomiting passengers. Other factors which limit the feeling of comfort are noises and odours. A complains about the smell of the engine room which sticks to the working clothes and is thus carried back to the cabin and cannot be removed easily. C and F talk about a permanent noise level on board*: "There is always something that produces either a droning, clanging or vibrating sound"* (C) and *"The noise level has a strong influence on the crew's life quality. It can get very noisy because of the machines. Somebody who is not used to that kind of noise wouldn't even be able to fall asleep"* (F). The research station faces the same problem with noises: *"when there's a storm, when the wind bangs on the station's walls"* (G). Furthermore, the station is easily affected by certain movements, for example, when a storm creates vibrations which *"make the shelves shaking"* (G). Besides, the research station is not very soundproof.

3.1.5 Communication

In the state of isolation from the mainland, communication is a crucial way of being connected with the outside world and to keep in contact with family and friends.

- Communication is essential!

Hand in hand with the technological progress came the improvement of communication possibilities. However, those possibilities are still of meagre kind (B). Problematic for the communication on a ship is its constant motion. Telephone and internet reception works via satellite which is, however, highly expensive and low in power. The connection via satellite on the Antarctic research station on the other hand, is of decent quality. Internet access is stable and keeps improving. G reports that during her stay, making a video call would not be possible and streaming services would not work either (which has been improved by now). However, everything else could be done with the provided internet access. Online television and radio services are available, downloading the daily newspaper is possible as well. Using all of these services, G was able to stay well informed during her entire stay in the isolated environment. Talking to someone over the phone is unproblematic as well, however, getting a call from somebody it is cheaper than making a call. Internet provision on cruise liners is decent as well (E). It is possible for people to contact their families at any time. WLAN access on board is provided, crew members are paying less money than the cruise liner's passengers. However, its capacity is lower than on the mainland. The use of a satellite telephone is possible as well, however, it is very expensive. Due to the cruise liner's almost daily access to the mainland, it is also possible to use local SIM cards on the private phone. E also mentions the availability of newspapers on board and the decent possibilities to catch up on the daily news.

The men working on freighters and container vessels keep quiet about their need for and possibilities of getting information. However, they agree on the fact that the possibility of contacting their families is very limited (A, B, C, D, F). Availability of internet access often varies, depending on the shipping company and the ship itself. An obligatory way of communication nowadays is sending e-mails. On older ships, however, it is only possible to send e-mails via a non-private account. The e-mail is typed and sent by the ship's captain who would hence be able to read it along (A, B). Some ships do provide private e-mail accounts, while best equipped ships provide low power WLAN which enables the crew members to use WhatsApp or Facebook. However, its use is extremely expensive. Using a ship's satellite telephone is also very costly. C states that a call costs about 7, -€ per minute and talks about how some people "*waste all of their money on telephone calls*". In principle, availability on board is given, but not being used by everybody: "*The significant other has to manage everyday problems by themselves. You are just not able to leave, you're not going home for the weekends. Everyday problems are not a topic to discuss, only severe things are.*" (C) D gives a similar statement: "*Whenever people receive bad news while they're aboard, it's hard for them, because they're so far away from home.*" Other factors which influence making a phone call in a negative way are poor reception and different time zones. Strongly used by the sailors are local SIM cards and WLAN when being on the mainland (A, B, D, F).

3.1.6 Social aspects

Factors which increase the conflict potential in artificial habitats are:

- Small and culturally mixed groups
- Limited space
- Social and spatial isolation

A already expected a potential for social difficulties due to close contact with a limited number of colleagues. Even though the number of crew members on freighters or container vessels (around 20 people) might be comfortable in the realms of work, social interaction can turn out to be difficult, as one cannot choose their colleagues. In the case of antipathy, there is no possibility of avoiding that person. According to A, a fixed hierarchy hinders striking up a friendship. Nonetheless, he favours the ranking system because it regulates, how to act in case of a conflict. Most of the time, a certain situation requires a prompt solution and does not allow any form of discussion. Problematic, on the other hand, is the distance to family and friends which, unintentionally, are being neglected. A also mentions the consumption of alcohol on board.

To B, the small number of crew members is problematic as well. One encounters the same people day by day and even leisure time is often spent together with the colleagues. He points out the importance of the right tone among each other. One should "*not be willing to run riot and instead be diplomatic. That's a hard thing to do, especially when you're on a long trip without reaching a harbour once in a while. If that's the case, it's getting difficult to avoid each other."* Also of importance are regular crew events such as barbecues, as they strengthen the team spirit.

C talks about the feeling of loneliness, regardless of his colleagues presence on board. Due to the small crew number, everybody is operating day and night and only a few contacts are made. "*Because of the watch system, we sometimes don't see each other for weeks*." Potential conflicts also emerge from the lack of space on board and the fact that most of the crew members are male. Internationality and cultural diversity pose problems as well. Other reasons for potential arguments are the incapacity of the cook or different opinions in regard to cleanliness. C, too, considers it to be difficult and also not worthwhile to strike up friendships on board. Because at the end of the day, one's main task is to do their job. It is also common to have a drink together after working hours.

D also mentions contact difficulties when it comes to international crews. In that case, he mostly spends his time off in his cabin. He then talks about common activities such as playing board games with German crew members which would strengthen the cohesion of the group. He also states, that it is not very frequent to make friends aboard. Just like B, he points out the necessity to avoid potential arguments. That necessity is usually enforced by the strict set of rules and the fear of being dismissed from the job. Like C, he mentions the importance of food and how it influences the crew's mood. He is the only participant who does not seem to be affected by the absence of family and friends: "*When a German decides to become a sailor, he usually doesn't want to be at home, otherwise he would make that decision.*"

For F, the social isolation with only 20 crew members which he is not able to choose, poses a problem. If one does not make a friend or cannot find somebody to talk to, time can pass by very slowly. F sees the potential for conflicts, but agrees with B and D statements, that one rather swallows their feelings to not antagonise anybody and to keep up a relaxed working atmosphere.

Life on a research station is socially challenging as well. G talks about the diverse personalities of people, spatial constraints and the difficulty of leaving the station. The potential for conflict increases during winter season, as there are only nine people working on the station who cannot avoid each other. The situation eases down during the summer because of the presence of between 30 and 50 people at the station.

The situation on a cruise liner is of a completely different nature. Even though E also mentions that life is different without family and friends, she states that it is rather easy to meet people and to make friends.

3.1.7 Privacy

Up until now, the display of conditions on the research station and on board of the cruise liner have been the more positive. Concerning the matter of privacy, freighters and container vessels are now in the lead, which is mainly due to:

- The provision of space and accommodation

Modern freighters and container vessels provide a private cabin for each crew member (A, B, C, D, F). That cabin is one's sanctuary and usually includes a private bathroom. The size of the cabin varies between 7 and 20m^2 (D). The possibilities for an individual design and also the desire to do so varies, depending on how long and how often one is going to sea and if one is always accommodated in the same cabin. It is very easy to attach posters to the cabin's metal walls (D).

On cruise liners, double cabins (B, E) or single-share-cabins (two single cabins sharing a bathroom) are obligatory. In comparison to the container vessels, a cruise liners' cabin sizes are only 6 to 7m^2, including the shared bathroom. It is also possible to share a cabin with one's significant other, but apart from that are no further options to choose with whom to share a cabin (E). Different notions in terms of tidiness (E) and hygiene (F), especially with an international crew, increase the potential for conflict.

At the research station, it is also common to share a room (G). During the winter season, rooms are shared between two people, in summer it comes down to at least four people. Everybody has their own cupboard, shelf and desk, but the furniture is not of a very homely kind. To create a homely feeling, one needs to bring their private decorations. Bathrooms are shared a well. Whoever wants to spend some time on his own has the option to visit the library in the middle of the ice (a small, green container with a small library which is located about 100m from the station).

Besides, the necessity of privacy, an appealing design and cleanliness are crucial requirements:

"*You spend a lot of time in these rooms, which is why it makes a huge difference if the place is nicely furnished or if the bathroom facilities are acceptable. Sometimes everything is just a little disgusting and shabby.*" (F)

3.1.8. Leisure time

Leisure facilities on freighters and container vessels are defined by the *International Labour Organization*, depending on the ship's size. Nonetheless, they are usually quite similar and include: a fitness room (to some extent including barbells made of metal debris: B, D), a treadmill, fitness bikes, sometimes a ping-pong table, a pool and/or a sauna, common rooms with a television, DVDs, books, a PlayStation and karaoke. Nevertheless, many things are being done on private laptops, because the mentioned facilities are perceived as not adequate enough or effortlessly designed (A, B, D). According to F, one has "*too much alone time and not enough films on the hard drive."* C on the contrary has the experience that there is too little time to use the leisure facilities.

The cruise liner's crew members have permission to access and use the passengers' leisure facilities with the exception of the pool areas and the casinos (E). Crew members' leisure facilities and offers include: use of the guest restaurants and bars, an own bar for the crew and a crew cafeteria with a whole selection of foods (including vegetarian options), vending machines, use of the guest fitness area and own crew fitness area, a crew sauna, a sun

area including a pool, outdoor areas with chairs and benches, a flower shop and the provision of newspapers and films. Other crew activities are karaoke parties and tours on the mainland with bikes brought on the cruise liner. E's conclusion: "*We're super spoiled!*"

The research station is equipped with a fitness room, a sauna and a small living room including a bar, pool table and a foosball table. A striking activity for G has been trips to a colony of emperor penguins. The colony was located about 10 kilometres from the station and has been a great way of clearing one's mind.

3.1.9 Waste

Regarding handling waste two factors play a role on board of a vessel:

- Strict separation of garbage/waste
- Strict rules whose compliance is being supervised

The handling of waste on ships is regulated by the international MARPOL convention (International Convention for the Prevention of Pollution from Ships) (B, D). The strict separation of the produced waste on freighters and container vessels is written down in form of "*waste-log*" (A, B, C, D, F). Only the organic waste (in a shredded form) is permitted to be disposed into the ocean. The separated waste is then usually handed over at the harbour. Some ships do have their own waste incineration plants. The disposal of waste is strictly supervised. =

"*When we're having a party on board, it's likely that a glass bottle is chucked into the water. But we always make sure that no plastic goes overboard, because that's just really harmful.*" (D)

"*When somebody chucks a crown cap into the ocean and is being filmed while doing it, he's taking the risk of getting an official warning*." (C)

The waste production on board of a cruise liner is much higher, which is why the process of organisation is more complex. E reports, that cruise liners employ a so-called environment officer. Often, the person in charge is female and not very popular among the crew, as she is in charge of checking on the adherence of the rules. Furthermore, there are two binmen working for the waste department. Produced waste on cruise liners is also very strictly separated. Because of the lack of space on board, waste is shredded, food leftovers are being burned or further processed, bones are shredded, glass crushed, paper and cardboard are converted to bales, oil and fat are processed separately. Batteries and paints are collected separately.

The research station's waste is carefully separated as well, stored in containers and transported elsewhere in summer. "*Everything what's being brought into the Antarctic has to be brought back again.*" (G) There is no sewage work on the station.

When talking about how the waste is handled at the harbours, uncertainty is uttered by the sailors:

"*What happens with the garbage then, is left to the harbour. Out of sight, out of mind. We don't know what the harbour does with that stuff. It happens, that everything we carefully separated is being dumped into one large container and then brought to the closest waste disposal site or simply dumped right into the water."* (A)

"*I've often got the feeling that at some harbours, the waste is simply chucked into a single container. I don't know, who's in in charge of it eventually*." (F)

"*I've really got the feeling that we are doing well on separating the waste back on the ship. But for instance in the Caribbean, even when they tell you that they're verified and would dispose it properly, you still don't know where it'll end up.*" (E)

3.2 Improvement of the living conditions

Even though participants' suggestions for improvements were made for their particular platform, the suggestions are also of interest for the Living@Sea design as they would improve the physical and psychological wellbeing of the inhabitants:

- Reducing the time spent separated from significant others, family and friends
- Permission for bringing pets

- Nature
- Intellectually challenging activities
- More comfortable furnishings of living quarters and improvement of leisure facilities
- Rest areas
- Improvement of sporting facilities
- Improvement of internet access

To many participants, the separation from significant others, family and friends is perceived as gruelling. A talks about an "*antisocial life*". Hence, sailors would appreciate a shorter stay on sea and a faster way to get back home in the case of an emergency (A, B, C). Also, the participants wish to receive visits from their family members (A, C) and to have the possibility of bringing their pets to the island (such as dogs) (E). Furthermore, participants mentioned their desire for green areas (A, B, C, E):

"*You're surrounded by nature, but trapped in an industrial environment, on a colossus of steel. […] A nice and quiet piece of nature, where you can relax, is missing. Maybe a forest or a park*." (A)

A complains about the lack of leisure and recovery time on board. E perceives the watch system as exhausting because "*you're never able to sleep for eight hours straight". A, B and F complain about monotony and "the lack of mental challenges*". They would also appreciate a more pleasant design of the leisure facilities and living quarters, "*cabins which are not so cheaply furnished*" (D) and better furnishings of the private area in general. That includes properly secured wardrobes with adequate storage capacities (D, F), proper mattresses (F) and larger beds (G: single beds are not very convenient for couples). Furthermore, they ask for a "*decent desk with a chair" (F) and for "nicer sanitary facilities*" (F) with a bathtub (G). Disagreement arises concerning the rooms' flooring. Because of its cleanliness, D prefers PVC, while F is in favour for fitted carpet due to its cosiness. To avoid these kinds of disagreement, different option to choose from would be appropriate in terms of the living quarters' furnishings. C and F would like to have a soundproof rest area and C large, possibly full-length windows. Of great importance to the participants are a more stable internet access (A, B, D, G) and better sporting facilities (A, D, G) such as a "*sports hall for playing football*" (A). G also misses the possibility to go to a restaurant or a supermarket once in a while.

3.3 Expectations concerning a permanent stay

The idea of staying permanently on an artificial island caused diverse reactions. A, together with his significant other, would give living on the island a try. Initially only for one or two years, afterwards it could be a stay forever. Life on the island should be as similar as possible to the life on the mainland. E considers the thought of living on the island as "*cool*" if it would come close to the life aboard of a cruise liner. D is not completely averse to the thought either. As a start, he could imagine staying for 12 month, "*but if everything is cool, decently furnished and fun, it's likely that you extend your stay*." F does not think that a person who has been socialised on the mainland could be happy in the permanent state of isolation from the mainland. To him, the maximal length of a stay would be between six and nine months. However, he does think that life would be perfectly normal for the next generation born on such an island. G limits the maximal length of a stay to 14 and 16 months. According to her, returning home after an even longer time of isolation would simply be too much for her in regard to crowds and the huge range of goods in the supermarkets. C's stance on a permanent stay on an island is very negative, as he is not able to imagine it at all: "*I don't want to live on such an island."* C and D act on the assumption that a stay on the platform would be for bare working reasons. According to C, this stay could last up until one year.

The participants had different notions on the size of an artificial island and the purpose of their stay. Hence, the subsequent statements vary from one another.

3.3.1 Living conditions

Participants agreed on the point, that the living conditions for a permanent stay should equal the living conditions on the mainland (A, B, C, E, F): "*A whole city on a platform*" (A), "*the entire living space should be as on the*

mainland: family, shopping and leisure facilities, cinemas, sporting facilities, discos, pubs. Simply everything that's part of your life." (B), because "*it's supposed to be a home, a place where you feel comfortable and where you're not just a guest.*" (E) Furthermore, the platform needs to be easy to reach in order to receive guests and to be able to leave the platform for holiday. Passenger transport should be cost-efficient, happen on a regular basis and associated with the slightest effort possible (A).

3.3.2 Design

A imagines a permanent stay on the island including the entire family. He furthermore likes the idea of self-catering and would therefore need a kitchen, which should be equipped with a dishwasher and a washing machine. B would like the furniture to be more comfortable, visually more appealing and of better quality than the one on the ship. He thinks that furnishing the place in term of his own ideas would be ideal. C emphasises the necessity of common areas. D (who, just like C, thinks of the island as a mere working environment) does not need a spacious cabin but names various furnishing features such as a large bed, enough stowage, handles at the cupboards, PVC flooring and leather sofas which can be easily wiped clean. Everything should be adjusted to the motion of the sea and should not clatter. He is not very convinced of the self-catering aspect and therefore pleads for a professional cook instead of a private kitchen. However, he would like his place to have a spacious bathroom. E is so content with her current situation that she would not change anything except for a more spacious living area and a private kitchen for the purpose of self-catering. For F self-catering is an important matter as well. He would also like to have a wider range of groceries. The design of the outdoor area is not much of an interest to him, as he only considers it as a bare working environment. However, he would very much appreciate the strict separation of the working and living environment. Concerning the latter, privacy, cleanliness and functionality are of major significance. Privacy does also matter to G; however, she would welcome a more homely than functional design as well as her own kitchen and her own bathroom.

3.3.3 Living space and size of community

Almost all participants agreed that the number of community members on the platform should be larger than the number of crew members on a freighter or container vessel. Thus, the community size would count more than 25 people. Only D argues for a smaller community as he supposes that the potential for conflict would decrease. According to A, the probability of meeting someone he gets along with, would increase with a larger number of people (just like in a city). B assumes that crew members will be allowed to bring their families. A crew number of 20 people would imply a total of 20 families. He therefore imagines the island to be like a small village with at least 100 inhabitants. G agrees with him on that matter. F also imagines a platform about the size of a village instead of an entire town. However, people on the platform should be "*not as herded together as they are on the cruise liner. An autonomous and functioning community needs at least a few thousand people*." For C, there cannot be enough people on the island. For E, on the other hand, the number of people depends on the size of the island.

The interviewees' notions of the island's size differ as well. A envisions a normal sized flat for families including a living room, a parents' bedroom, a bedroom for each child as well as a kitchen and a bathroom. B's vision of the accommodation is not as precise as A's, but he would also need more space for family and children as he does only for himself on the ship. E would be contented with a studio flat with 18 to 22m^2, G would appreciate a two-room flat with approximately 40m^2.

3.3.4 Location

A and C prefer a location close to the shore as the passenger transport could be of easy, spontaneous and fast nature. "*But as long as I'm settled in and, in principle, would be able to leave any time I wanted to, distance wouldn't really matter to me.*" (A). D, E, F and G do not have any preferences concerning the platform's location. B states that a long distance would not pose a problem if the island was fully equipped and had all essential supplies at its disposal.

3.3.5 Working conditions

A and B assume that locations on the platform could be easily reached by foot. A proximity between place of residence and workplace is perceived as comfortable. However, A pleads for a strict separation and an approximate 10-minute walking distance between the both. A and G think that the amount of working hours and leisure time go hand in hand with each other. When staying on the island permanently, A, B and E would like the working hours to similar to the mainland (8 hours per day, 40 hours per week). To E, the location of the platform and the adaption of working hours to the environmental conditions, such as day-night-rhythm, are important. C and D, who assume the platform to be for working purposes only, have a rather different notion:

"*When you're looking for comfortable working conditions, you don't have to live on such an island, you can just go and look for a job on the mainland. I like having a lot of work to do. Especially when you're living that closely together*." (D)

To C, working hours are a matter of payment. However, he does not give any information about a concrete amount.

3.3.6 Bringing the family

With no exception, participants stated that they would like to bring their family and friends to the platform. However, their notion of the stay's length depends on their notion of the platform as workplace or as their permanent home. D does not need the permanent company of his family:

"*It'd be great to see them temporarily, for about week or so. But I wouldn't want them to be around permanently, that's just too much of a distraction and increases the conflict potential. They'd just annoy me when they've got nothing to do, just sitting around and watching TV. I wouldn't wanna work with my family.*"

C would approve of arrangements concerning temporary visits as well. Other participants would like to permanently bring their significant others and family members (however, G points out that grandparents would not have to be included), "*if they were willing to come. It's nice to have the family around.*" (E) E would also like to take her dogs with her. A and B stress, that it would be of importance to provide part or full time jobs for their significant others (dual-career-concept).

3.3.7 Environment

In the realm of environment, three topics are of important matter to the participants:

- Nature
- Power generation
- Waste disposal

The majority of interviewees (A, B, C, D, E) have the strong desire for a green area on the platform. An open deck decorated with flowers (C) and some lawn (D) would be the least elaborate solution. A's requirements are of different character: "*If a forest isn't possible then at least a park would be nice. Definitely an outdoor area with some green, some real plants.*" B would like to be surrounded by plenty of greenery as well: grassland and animals. He misses the twittering of birds and "*idyllic places that don't feel like work environment. Without any noises or vibrations, only silence*." E, too, would appreciate some lawn and a forest. However, she is aware of the "*enormous interference in the existing ecosystem.*"

Furthermore, the majority of participants (A, B, D, E, F, G) speak out against the use of fossil fuels. Instead, they would prefer an environmentally friendly way of generating power such as wind power, water turbines or solar power. The issue of waste is being similarly addressed. A suggests to "*recycle the waste in an environmentally friendly and power-saving, maybe even in an energy retrieving way.*" Other crucial topics are new technologies concerning water treatment and waste water treatment as well as private electric power consumption and a decent thermal insulation.

3.3.8 Leisure time and entertainment

The participants who consider the platform as a working environment, settle for the leisure facilities they are already accustomed to. That includes activities such as sports, reading and watching movies, but also the provision of a jacuzzi, an outdoor pool, a sauna and clubrooms. "*You don't have a lot of leisure time, you're supposed to work*." (C). D would be pleased by the provision of a smoking area and a kind of pub, because "*alcohol brings people together*". B, E and G would also like the platform to have a pub, a disco as well as restaurants or bars. Furthermore, extensive in- and outdoor sporting facilities (B, F, G) including equipment for sports like badminton or squash as well as watersports (A) are in demand. A barbecue area should be provided as well (F). The necessity of cultural offers is uttered as well (B, E, G). E imagines "*cultural offers just like on the cruise liner, […] a wide selection for people of all ages*": theatre, dance events, circus arts and readings. B, too, mentions the lack of cultural events such as visits to the cinema, musicals and theatre performances. He furthermore brings up the desire for training courses which are not relevant to one's job such as language classes, dance classes and music lessons.

3.3.9 Support and Care

For single people or people who only stay short terms, B can image a full time service including activities such as cooking, cleaning or doing laundry. D is in favour for a cleaning service as well. The provision of childcare is an important matter for families (A, B).

3.3.10 Shopping facilities and delivery services

When living permanently on a platform, A wants to leave the "*comfortable life*", where everything is being arranged for him, behind and look after himself instead. To do so, food shopping possibilities are an essential feature (A, B, E, G). B emphasises the provision of a selection of foods to enable special diets such as vegetarianism. He would like delivery services and shopping possibilities to be just like on the mainland. D would also like to purchase less healthy goods such as beer, cigarettes, chocolate and crisps. Shopping for clothes and everyday items should be possible right at the shop as well as online (A, G). On that account, delivery services (mail and parcel services) need to be sorted out.

4. Conclusion: List of functional requirements

By means of the participants' statements about their experiences, suggestions for improvements and expectations, a preliminary list of functional requirements for a permanent artificial living space at sea can be composed. Life at sea should be adjusted to the life conditions onshore, especially in relation to comfort, safety, design and supply in order to make a permanent stay more attractive:

1) Comfort:
- Increase of the platform's stability.
- Minimisation of industrial noises and odours in housing spaces.
- Soundproof rest areas.
- Filter for odours or airlocks including lockers for working clothes.

2) Availability
- Provision of passenger traffic back to the mainland in a fast, frequent, safe, cost efficient and unproblematic way. If that can be achieved, the distance to the mainland becomes irrelevant.
- Mail- and delivery services inside of the platform and from the outside world.

3) Working Conditions
- Same working hours as on the mainland.
- Work-Life-Balance.

4) Design of the Housing Space
- Assurance of privacy.

- Sizes of flats should equal flats' sizes onshore. Size of flat is depending on the size of the household. In relation to the household size, number and size of rooms can be determined.
- Private and spacious bathroom including a shower and/or a bathtub as well as an own kitchen with a full range of kitchen equipment.
- Different options concerning the design of the living space (e.g. flooring material) and individual furniture.
- Large windows in living quarters.
- Elaborate and appealing design / self influence on the design
- Enhancing the feeling of being at home.

5) Communication

- Provision of high-powered, safe and cost-efficient internet access for the inhabitants' use.

6) Design of Outdoor Areas

- Adequate amount of space for outdoor activity.
- Extensive green area (a park or a small forest) including animals.
- Barbecue area.

7) Social Life

- Adequate amount of people to increase the probability to make friends, but also to be able to avoid each other. Minimal size of a group: approximately 20 families.
- Recruitment not only in relation to occupational competence, but also with regard to social and intercultural abilities.
- Fostering private contacts.
- Possibility of bringing the family to the island.
- Permission for taking pets to the island.
- Visits from the mainland.
- Work opportunities for the significant other (dual career concept).
- Childcare.

8) Leisure Facilities

- Many and appealing leisure facilities for people of all ages.
- Sport: fitness rooms with equipment adequate in amount and quality, sports fields and/or sports halls for all sorts of ball games, in- and outdoors swimming pool.
- Wellness- and sauna area.
- Restaurants, pubs, bars, clubs.
- Cultural offers: cinemas, theatres, concerts.
- Possibilities for further education and a variety of courses (language classes, music lessons, dance classes etc.).

9) Shopping Facilities

- Food shopping (same kind of shopping like onshore, large and many offers, fresh products).
- Shopping (clothes, everyday needs).
- Online shopping: assurance of delivery services.

10) Safety

- Assurance of health care.
- Examination of the adherence to security rules.
- Examination of safety drills' quality.

11) Waste and Electricity Generation

- Ecologically friendly waste disposal.
- Environmentally friendly power generation: wind power, water turbines or solar power.
- Environmentally friendly water treatment and wastewater treatment.
- Decent thermal insulation.
- Minimisation of private electric power consumption.

Annex 1: References

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Annex 2: Questionnaire

Task 7.2: Survey of WPs

November/December 2017

Please fill out the questionnaire in simple notes and send it back to corinna.luethje@uni-rostock.de until **11/12/2017**. We only request one single questionnaire per WP.

Thank you in advance for your support and participation!

WP: _____

Section 1 – WP1 to WP10

Current Users

In Task 7.2, we will be conducting interviews with people who already experienced living on artificial islands or working platforms (e.g. oil platforms). For the recruitment of participants we need the support of our colleagues in Space@Sea and therefore would like to ask you to function as our gatekeeper. Please write down the contact information from colleagues who work for eligible companies and whose information could be of help for us.

Company:

Contact Person:

Reference:

Section 2 – WP1 to WP10

Input & Support

To make sure we will not forget about essential questions which will help your future research and to avoid the outcome of insignificant information, we want to ask you for your support in developing the interview's guideline.

Please tell us what you would like to know about future Space@Sea residents – which information do you need about them and which questions should we pose to them?

Section 3 – WP6 to WP9 (Optional: WP1, 2, 3, 4, 5, 10)

Target Group

3.1 Who will be the future residents of Space@Sea? Please write down your existing information and your expectations about the target group of Space@Sea, e.g. including age, gender, profession, family and leisure time activities.

Information and expectations about the target group of Space@Sea:

Age:

Gender:

Profession:

3.2 What is the expected number of inhabitants and their expected duration of stay?

Expected number of inhabitants:

Expected duration of stay: