ERGONOMIC & SAFETY DISCUSSION PAPER

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Habitability and Comfort

INTRODUCTION

Appropriate habitability criteria and design practices may have significant impact on the safety, fatigue reduction, productivity, morale, crew retention, and overall well-being of vessel crews. Objectives of habitability design criteria include improving the quality of seafarer performance by improving their working and living environments in terms of ambient environmental qualities and in some instances the physical characteristics on board cargo vessels and passenger vessels. Additionally, the positive impact that appropriate comfort requirements and design practices have on the comfort, safety and overall well-being of passengers is recognized. Objectives of comfort design criteria include improving the level of comfort, enjoyment and satisfaction of passengers.

For ships and offshore installations there are five habitability/comfort aspects vessel design and layout that can be controlled, measured and assessed. These five (5) aspects are broken into two (2) major types in this Ergonomic and Safety Toolkit: accommodations and the ambient environment. Accommodations criteria pertain to dimensional or physical aspects of spaces and open deck areas where crew members eat, sleep, recreate and conduct their daily activities or where passengers where passengers dine, sleep, congregate, recreate and conduct their daily activities.

The ambient environmental aspects of habitability/comfort pertaining to the environment that the crew/passengers are exposed to during periods of work, leisure and rest. Specifically, this Toolkit provides an overview of accommodations, whole-body vibration, noise, indoor climate, and lighting.

TERMS/DEFINITIONS

Accommodations: Vessel areas where the primary purpose is to rest or recreate. Crew and passenger accommodations spaces include cabins and staterooms, medical facilities (sick bays), offices, dining areas, galley, scullery, and other public and recreation rooms, etc.

Ambient Environment: Ambient environment refers to the environmental conditions that crew/passengers are exposed to during periods of work, leisure or rest, specifically whole-body vibration, noise, indoor climate, and lighting.

Comfort: The acceptability of the conditions of a vessel as determined by its vibration, noise, thermal, indoor climate and lighting qualities as well as its physical and spatial characteristics, according to prevailing research and standards for human comfort.

Crew Member: Any person on board a vessel, including the Master, who is not a passenger.

Crew Spaces: All areas on a vessel intended for crew only, such as crew accommodations spaces and crew work spaces.

Habitability: The acceptability of the conditions of a vessel in terms of vibration, noise, indoor climate and lighting as well as physical and spatial characteristics, according to prevailing research and standards for human efficiency and comfort.

Manned Crew Space: Any space where a crew member may be present for twenty (20) minutes or longer at one time during normal, routine daily activities. Such spaces would include working or living spaces.

*Occupied Passenger Spaces: A*ny space where passengers may be present for twenty (20) minutes or longer at one time for transit, rest or leisure purposes.

Passenger: A passenger is every person other than the Master and the members of the crew or other persons employed or engaged in any capacity on board a vessel for the business of that vessel.

Passenger Vessel: A vessel whose primary purpose is to carry more than twelve (12) passengers for transportation or recreational purposes. This includes cruise ships and ferries (conventional and high speed craft).

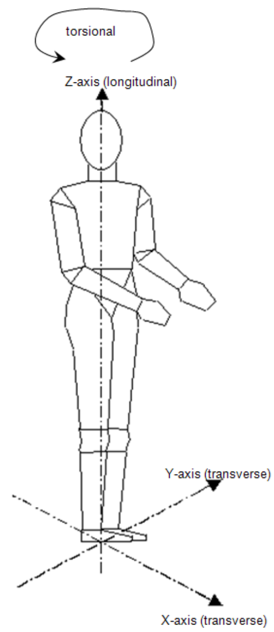
Recreational and Public Spaces: Those portions of the crew/passenger accommodations which are used for halls, dining rooms, lounges and similar permanently enclosed spaces.

DISCUSSION

Accommodation Spaces

With reductions in staffing and the increases in the complexity of on-board systems on commercial ships and offshore installations, it is vital that crew members maintain enhanced levels of mental and physical fitness while on board. To maintain such fitness, crew members must be provided with supportive accommodations spaces. Proper crew accommodations design will promote reliable human performance by reducing the potential for fatigue and human errors. Appropriate accommodations design has the further potential to enhance morale, retention and comfort. Conversely, improper accommodations design can adversely impact the crew members' ability to reliably perform their duties, fully relax, sleep and recover from mentally and physically demanding work activities. This in turn may impact their ability to carry out duties on succeeding watches with the required diligence and accuracy. Providing an on-board environment that increases crew member alertness and well-being should be of concern to responsible vessel owners.

Similarly, one of the major concerns of passengers on board cruise vessels, ferries and high speed craft is comfort. One factor that will help determine a passenger’s acceptance of a vessel is their perception of the quality and condition of the vessel’s accommodations. For passengers to perceive their sailing experience as rewarding, the vessel’s accommodations facilities must meet or exceed their expectations. Accommodations spaces where the vessel’s design can have a favorable impact on expectations include areas where passengers rest, recreate, relax and dine. Other accommodation considerations that will affect passenger expectations are the sanitary spaces as well as stair and walkway design. All of these factors as a whole or in part, affect the passengers’ perceptions about their experience on board the vessel and their willingness to use the vessel or the vessel’s services on future occasions.



Whole-body Vibration

Vibration can be transverse (at right angles to the rest line), longitudinal (orientated along the rest line) or torsional (twisting around the rest line). Transverse vibration is the most commonly encountered. Torsional is frequently present but its effects are subversive. Longitudinal vibration is comparatively rare but can cause significant problems. The human body's sensitivity to vibrations is at its most sensitive within 4-8 Hz in the longitudinal direction and 1-2 Hz in the transverse direction. Longitudinal direction will be the vertical direction for a standing person. Passengers and crew members on board vessels/installations can be exposed to a series of low- and high-frequency mechanical vibrations as well as single-impulse shock loads on the human body. Low-frequency vibrations (i.e., oscillations) are generally imposed by vessel/installations motions, which are produced by the various sea states in conjunction with vessel speed. Oscillation may result in motion sickness, body instability, fatigue and increased health risk aggravated by shock loads induced by vessel slamming. Owners, operators, and design engineers should consider the potential negative impact of excessive vibration on passenger comfort, human performance, direct acquisition expenditure (acquisition life cycle cost), delivery schedule, and total ownership costs (TOC = lifecycle cost plus infrastructure support costs). Optimal use of existing technology can reduce risk factors and produce a superior product while protecting the safety and health of system operators/maintenance personnel and enhancing passenger comfort.

Noise

Noise is any unwanted sound, which may result in annoyance, disturbance of sleep, speech interference or hearing impairment and annoyance. Compliance with noise level criteria specified for various passenger and crew member accommodations and recreation spaces will contribute to the performance, comfort, and well-being of crew members and passengers when using these spaces for their intended purpose. To determine appropriate noise levels for a habitable/comfortable space, answers to the following questions should be found and a review of available noise data should be completed:

1. What activities typically take place in the space?
2. What is the frequency of occupation of the space (e.g., continuous, intermittent, or infrequent)?
3. What are the communication requirements within the space?
4. What noise levels do people typically expect in the space?

Indoor Climate

Thermal comfort is largely subjective and will vary from crewmember to crewmember or passenger to passenger. Perceived thermal comfort is affected by differences in metabolism, acclimatization, habits, and expectations and is a function of temperature, humidity, and other atmospheric characteristics. These individual differences make it difficult to specify a single thermal environment that will be satisfactory to everyone. Therefore, a thermal environment is typically defined to be acceptable to at least eighty percent (80%) of the occupants of an interior space. This favorable thermal environment can have a positive impact on crewmember performance and comfort.
Individually, the perception of thermal comfort is largely determined by the interaction of thermal environmental factors such as air temperature, mean radiant temperature, air velocity, relative humidity, and factors related to activity and clothing.

The thermal control or Heating, Ventilation, and Air Conditioning (HVAC) systems on vessels/offshore installations should be designed to effectively control the indoor thermal environmental parameters to within acceptable limits to facilitate the thermal comfort of the crewmembers in manned crew or occupied passenger spaces.

Lighting

The lighting of passenger and crew spaces should facilitate visual comfort, task performance, support passenger/crew activities, facilitate the movement of passenger/crew members in the space, and aid in the creation of an appropriate visual environment. Lighting design involves integrating these aspects to provide adequate illumination for the safety and well-being of passenger/crew as well as for the various tasks/leisure activities performed onboard vessels and offshore installations.

The selection of appropriate illuminance levels for specific tasks, activities, and passenger/crew spaces is an important consideration in the design of lighting systems. There is a difference of opinion as to what levels of light may be considered best for visual tasks. Since illuminance recommendations are generally consensus values, for any task, a range of illuminances may apply.

Since visual tasks performed, passenger accommodations, and recreational spaces in passenger/crew spaces onboard a vessel/offshore installation are generally similar to tasks encountered ashore, requirements for illuminance on vessels generally correspond to those tasks performed in living, working, and recreation areas on shore.

Visual tasks encountered on vessels vary widely. In addition to the illuminance level, external factors such as contrast with respect to the background, object size, brightness, time available for viewing or recognition, and reflectance determine the visibility of an object within the visual field. Other considerations include task duration, visual fatigue, task criticality, discomfort glare, veiling reflections, shadows, and the age and visual acuity of the observer. From a subjective viewpoint, aesthetics, color, and the psychological effects of lighting should also be considered. These factors are all interrelated and should be considered together with objective qualities during the process of selecting illuminance levels, but shall not be separately quantified.

SUMMARY

The information contained in this ABS Ergonomic Design and Safety Toolkit Module is based on currently available standards and were selected to provide a basic introduction to crew habitability and passenger comfort.

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