Cultural Calibration

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INTRODUCTION

There are discrepancies between where a vessel or installation is designed, built and used. Although many crews on sea-going vessels are native to Southeast Asia or Africa, the majority of these vessels are designed in another part of the world. Many of the offshore platforms, rigs and support vessels are being built for use in developing countries however the designers of these vessels and installations reside mainly in the western world where populations are physically larger and the cultural traditions, religions, and customs can differ significantly from the crews who will operate and maintain the vessels and offshore installations. Consequently, there is a possibility that the basic vessel or offshore installation, including the accompanying hardware and software technology, will not match the cultural expectations, experience, customs, and the size, stature and physiology of the eventual users (Salas, Ed., 2004).

It was succinctly said some years ago that, “Technology is not a good traveler unless it is culturally calibrated” (Kaplan, 1995). Anthropometrical designs for vessels and offshore installations are commonly based on European or North American standards. This point is particularly true when ergonomic standards are incorporated into these designs. The end result is a vessel or offshore installation that fails to fit the physical, cultural, social, or physiological needs of the ultimate end users.

1As an example, from an anthropometry perspective, a control mounted on a console for a seated operator that would be within functional reach of the 95th% male crewmember from Norway would be 3.3 inches (84 millimeters) beyond the reach of the 95th% male crewmember from the Philippines.

As another example, having only one food preparation area for the entire crew on a vessel or offshore facility comprised of crew members from different faiths with different food customs could be unacceptable.

And another example; ship labels, placards, and markings should be prepared differently depending on the origin of crew. The use of the color red as a “hazard” warning color may not have the same effect on vessels served by Chinese crew as it would on vessels with a Western crew, since the color red, in China, is considered to be associated with good fortune.

Terms/Definitions

Accessibility: The ability for personnel to easily access equipment that requires maintenance, inspection, removal, or replacement while wearing the appropriate clothing, including personal protective equipment, and using all necessary tools and test equipment.

Accommodations: Vessel areas in which the primary purpose is to rest or recreate. Accommodation spaces include cabins and staterooms, medical facilities (sick bays), offices, public, and recreation rooms.

Ambient Environment: Ambient environmental conditions that personnel are exposed to during periods of work, leisure, or rest. Ambient environmental conditions include human whole-body vibration, noise, indoor climate, and lighting.

Anthropometrics: The measurement of human variability of body dimensions and strength as a function of gender, race and regional origin.

Crew Member: Any person on board a vessel (ship or offshore installation), who is not a passenger, a rider, or an observer.

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.

Percentile: Given the range of variability of [human] bodily dimensions, anthropometric data are typically expressed as percentile statistics, such as 5th or 95th percentile. A percentile statistic defines the anthropometric point at which a percentage of a population falls above or below that value. For example, the seated eye height of a 95th percentile North American male is 33.5 in (853 mm), so by definition, 5% of North American males will have a seated eye height of greater that this figure, and 95% will have a lesser seated eye height.

Vessel: Any ship, boat, or offshore installation where people work and live, and who are subjected to the marine environment.

DISCUSSION

There are many important cultural issues to be considered as a part of integrating the eventual end user crew's capabilities and limitations into the original design of a vessel or offshore installation including:

- Anthropometry
- Physiology and Strength
- Communication and Language
- Social Culture and Status
- Religion Values, and Belief Systems
- Educational Standards

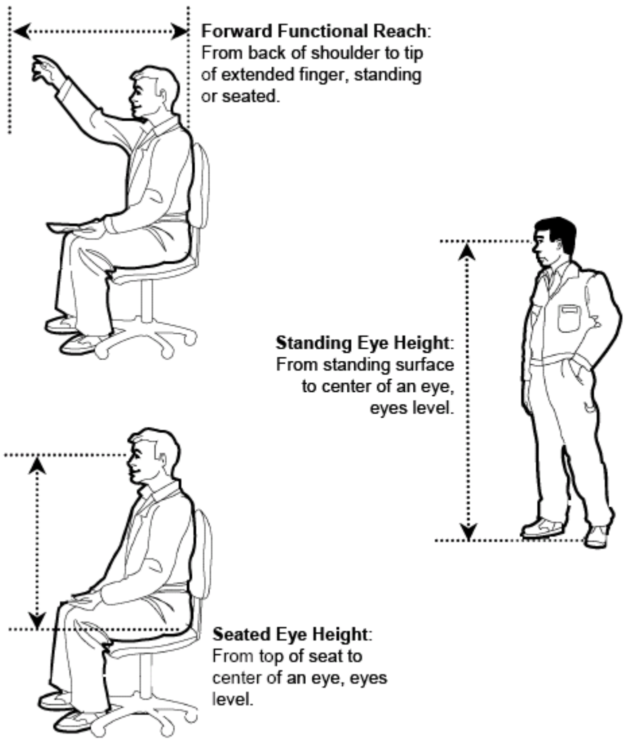
Each of these is discussed below:

Anthropometry:

There are significant differences in bodily dimensions, shape, weight, and proportions of people from different parts of the world. An example, the difference in male stature among the tallest sea-going population (i.e., Northern Europe) and the smallest (areas of the East Pacific Rim) is about 15 inches (381mm).

Anthropometry is more pertinent to the design of a seated workstation on a vessel or platform as the difference in seated eye-heights for sea-going populations is 8.7 inches (221mm) and functional forward reach is 8 inches (200 millimeters). The real world consequences of these differences in anthropometric dimensions affecting design of the work place was aptly demonstrated in the attempt by the International Organization for Standardization (ISO) to establish world-wide design standards for earth-moving equipment. If adopted, the machinery would nicely fit European and North American operators but would have excluded all but 10% of the Vietnamese and a majority of the female operators in the world (Jurgens, 1990; ISO, 1995).

Another example involves the design of lifeboats for use in the Gulf of Mexico (GoM). U.S. Coast Guard design standards for persons in a lifeboat are a weight of 165 pounds (75 kilogram) per person with a seat width of 17 inches (432mm) (U.S. Coast Guard, 1995). Research, however, performed by a major oil and gas exploration and production company in the GoM found their employees to be an average of 210 pounds (95 kilograms) in weight with a seat width of at least 21 inches (533 millimeters). This oversight of cultural calibration for the predominately male work force on GoM offshore oil rigs meant that although the standard allowed from three to five more persons to be assigned to a lifeboat, in reality that number could not actually fit in that boat. As a result, some lifeboat manufacturers have down-rated the capacity of their craft if they are used in the GoM. This study also resulted in the USCG modifying their requirements for lifeboats in the GoM in terms of both weight and seat width, in order to be consistent with the study.



Attempts have been made in the past to accommodate the variation in differences in crew anthropometrics by establishing an “average” crewmember dimension. This proved to be unsuccessful. Instead, a range in physical sizes that should be accommodated by the design is typically established by the vessel or offshore installation design team. Alternatively, an accommodation range can be stated (by the buyer) as a contractual requirement in the acquisition specification. Normally, this range is set to accommodate about 95% of the potential end user populations. If females are expected to be employed on the vessel or installation, the range would be from the 5^{th}% female to the 95^{th}% male.

A suitable way to culturally calibrate anthropometric differences in diverse populations of people is to use HFE design standards that provide that information. For example, the standard ASTM F-1166, “*Standard Practice for Human Engineering Design for Marine Systems, Equipment, and Facilities* (2007) provides a significant amount of anthropometric design data for populations from around the world (ASTM, 2007). Promoting a standard such at ASTM F-1166 to form the HFE basis of project design activities will encourage a culturally calibrated anthropometric design to be achieved. A guidance document that that also presents anthropometric information is the ABS “*Guidance Notes on the Application of Ergonomics to Marine Systems”* (ABS, 2013).

Physiology and Strength

There are human differences in the capacity to perform sustained work, as well as different inherent strength capabilities. These differences occur in all areas of the world, but more typically are a function of gender, general health, and physical age (Abeysekera, 1987).

Manual lifting research on different populations has resulted in multipliers (or “modifiers”) for determining the limits of what is considered a reasonable maximum lifting/carrying weight for different populations. Usually, these multipliers are based on a percentage of the maximum acceptable lifting weight for North American worker populations, or a reduction in the height to which the object is recommended to be lifted (ABS, 2012; ASTM, 2007). Realizing that there are differences in human work capacities and strength (and endurance), vessel or offshore structure designers may need to rethink designs in order to ease lifting, carrying, or reaching tasks based on the population of people performing those tasks. Engineering approaches can include means such as adding lifting/carrying aids, or designing equipment to be more easily lifted and carried by attending to weight, size or shape of man-handled components. Careful engineering of ramps, ladders, accesses, and openings can also help ease physical demands.

Communication and Language

Difficult or unclear person-to-person communications has been noted as a challenge to maritime safety. The International Maritime Organization (IMO) highlights the potential for communication difficulty in the Maritime Safety Committee's (MSC) Circular 813. One maritime industry report states that approximately 20% of maritime accidents and incidents involve communication problems (De la Campa-Portela, 2003). These problems included crewmembers speaking different languages, cultural traits that prohibit persons of lower rank or status from contradicting, correcting, questioning or even offering (without being asked) inputs on decisions and actions from those above them, and inappropriate use of communication equipment due to lack of training or technical skills.

Communication difficulties are not limited to verbal communication but also exist with written or pictorial information such as hazard warnings or posted safety instructions, an example being the correct procedure to deploy a life raft.

While English is the language of the sea, the large number of native languages spoken by sea-going populations of the world often leads to translation problems, misinterpretations, misunderstanding, and confusion in the verbal and printed information found on vessels and offshore installations. The consequence of ineffective communication is most noted in the areas of vessel and personnel safety, where misunderstandings result in incidents. For this reason, safety and procedural information is often presented in highly visual formats that may be better understood by all workers on a vessel or offshore installation.

Specific suggestions for circumventing the language barrier to create a good hazard warning identification and procedural protocol system is provided in Standard F1166, "*Standard Practice for Human Engineering Design for Marine Systems, Equipment, and Facilities*" and in the ABS "*Guidance Notes for the Application of Ergonomics to Marine Systems.*"

Social Culture and Status

The old phrase that "rank has its privileges" is certainly true in the maritime world. One's progression up the chain of command is accompanied by bigger and more comfortable living accommodations and increased privacy. These differences are reflected in the habitability design standards at sea (ABS, 2012).

In some cultures, social status is also reflected in other ways. For example, workers who live in some countries derive social status from their membership in a tribe, or the geographical region in which they live or were born. As a result, when at sea the tendency to live together in close proximity (or conversely, separately) can make this culturally objectionable and difficult. As an example, on one offshore installation off the coast of Africa, a group of workers, all from the same region of the country, wanted to room together. They abandoned the provided living quarters of four men to a room, and crowded into a few close spaces where all eight men could sleep together.

Religion, Values, and Belief Systems

Different religions, values, and beliefs practiced by crew members can impact the design of facilities. As an example, ample room for prayer rugs, or a prayer room, is sometimes provided for the routine prayer practices of members of some faiths. Also, separate food storage, preparation, cooking and eating facilities may be expected. In addition, the perception of risk may change among nationalities. Crewmembers might come from countries where safety culture is more relaxed, with less stringent safety management systems. These crewmembers might be less inclined and aware to identify hazards and raise safety issues.

Educational Standards

Educational standards for similar professions, in general, or specific jobs in particular, can and do vary between countries. For instance, the knowledge of an engineer in an industrialized country can be much broader than that of an engineer from the same discipline in a developing country (Abeysekera and Shahnavaz, 1987). In areas where people have not had exposure to technology or automation, designing workplaces that require a high level of skill can result in operating and maintenance difficulties.

SUMMARY

Finding data that guides cultural calibration for a design can be difficult. A recent source of anthropometric and physical strength data is from the UK Department of Trade and Industry entitled "*Adult data: The Handbook of Adult Anthropometric and Strength Measurements: Data for Design Safety".* Another is the 2012 revision of the ABS "*Guidance Notes for the Application of Ergonomics in Marine Systems",* and in ASTM F1166, information has been provided to allow anthropometric calibration of maritime workplaces for different sea-going populations.

Valuable resources for cultural calibration are the mariners themselves. Experienced crew members from the expected end user populations can contribute input to the design throughout the design life cycle.

It is important that a vessel or offshore installation be designed and fabricated to fit the maritime population. This signifies that the physical facility should be sized, shaped, labeled and outfitted to match the expected end users' physical, psychological, and social needs and capabilities. This "cultural calibration" can be a difficult task and should be accomplished by HFE specialists who have experience in prior design projects in which cultural calibration was required.

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