Shipboard Environment and Human Factors
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Human Systems Integration, Royal Canadian Navy
What is HSI?

Human Systems Integration (HSI) is a systems engineering process that ensures all human-related concerns are properly addressed during system planning, design, development and testing.
Goals of HSI

• Ensure that system, equipment and facilities incorporate effective human-system interfaces;
• Achieve the required levels of human performance;
• Manage risk of loss or injury to personnel, equipment or environment;
• Allocate sufficient space to human occupied areas; and
• Minimize life-cycle costs.
HSI Characteristics
The design features and operating characteristics of a system that serve to minimize the potential for human or machine errors or failure that cause injurious accidents (DAU, 2010).

Survivability factors consist of those system design features that reduce the risk of fratricide, detection, and the probability of being attacked, and that enable personnel to withstand man-made hostile environments without aborting the mission, objective, or suffering acute chronic illness, disability, or death. (DAU, 2010)
Occupational health factors are those system design features that serve to minimize the risk of injury, acute or chronic illness, or disability, and/or reduce job performance of personnel who operate, maintain, or support the system. (DAU, 2010)
Habitability factors are those living and working conditions that are necessary to sustain the morale, safety, health, and comfort of the user population. (DAU, 2010)

Optimizing habitability on a submarine = challenging
Human Factors Engineering

- The comprehensive integration of human capabilities and limitations into system definition, design, construction and validation.
- To promote effective human/machine integration for optimal total system performance and to minimize physical and mental fatigue.
Human Factors Engineering specialists conduct task analyses to assess operator workloads and human performance.

Talking to the users is critical to identify capability gaps with current system and to hear their views on how to improve a system.
Anthropometrics is the comparative study of human body measurements and properties.
Canada’s new Arctic/Offshore Patrol Vessel – HMCS Harry DeWolf
SHELL Model for HSI
SHELL Model for HSI
Breakdowns in interfaces

= potential MISHAP
COMPUTER SOFTWARE UPDATE BUT NO FLIGHT MANUAL OR TRAINING UPDATE

- Senior pilot
- Boeing installed a new system on 737 MAX jets that could command the plane's nose down in certain situations to prevent a stall.
- This new system could lead to the plane being forced to descend sharply for up to 10 seconds even in manual flight leading to difficulties controlling the plane
- Pilots could stop this automated response by pressing two buttons if the system behaved unexpectedly
- Flight manual was never updated to include this information and pilots were not aware of change
Operator Reaction Time

Operator 1: PERCEIVE, THINK, ACTION

Operator 2: PERCEIVE, THINK, ACTION

Operator 3: PERCEIVE, THINK, ACTION

Time in Seconds
Training
Sleipner Ferry Incident

- Lack of experience with navigation system
- Disorientation
- Design of information was insufficient

- 3 months after commissioning
- Crashed into rock
- 16 passengers and crew drowned
E-Navigation information displays

Exocentric (North-up) orientation

Egocentric orientation
Man vs machine

“MAN – A creature that was created at the end of the week when God was very tired.”

Mark Twain
Automation
How do we keep up?
Halifax Class bridge
Integrated bridge systems

Photo courtesy of Sperry Marine

Photos courtesy of Wartsila
Internationally Recognized User Interface Components

- Icons
- Radio Buttons
- Toggles
- Sliders
- Breadcrumbs
- Date pickers
Reference List

PHOTOS

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