ABS Human Element Notations
(HAB & ERGO)
## Agenda

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<td>Overview of S&amp;HF Group</td>
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<td>Crew Habitability Notations</td>
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Addressing the Human Element

- Mission is to:
  - Improve human performance and safety
  - Reducing human error
  - Increasing productivity

- ABS has organized its approach around four areas

- We have advanced projects and products in support of these areas
ABS Human Factors Products/Current Projects

- Design and layout/ambient environment
  - Guidance Notes on the Application of Ergonomics to Marine Systems
  - Guidance Notes on the Ergonomic Design of Navigation Bridges
  - Guides for Crew Habitability on Ships, Offshore Installations, Workboats and MODUs
  - Guides for Passenger Comfort on Ships and Yachts
  - Guide for Means of Access for Inspection
  - Guide for ILO MLC Title 3 - Accommodations (MLC-ACCOM)
  - Guide for Ergonomic Notations
  - Guidance Notes on Noise and Vibration Control
  - Guidance Notes for Implementing HFE into the Design of Offshore Installations
  - Guidance Notes for Ergonomics to Marine Engineering Spaces
ABS Human Factors Products/Projects

- Management and organization
  - Guidance Notes on the Investigation of Marine Incidents
  - Guidance Notes for implementing HFE into the design of offshore installations
  - Guidance Notes on the Safety Culture and Leading Indicators for Safety Assessments
  - Guidance Notes for the Development of Procedures and Manuals

- People
  - Mariner Personal Safety (MPS) project
What is Habitability?

- Providing the living (accommodations design) and working conditions (ambient environment) necessary to sustain personnel to the level required to perform tasks safety and effectively.

- Why design for habitability?
  - Important for recruiting
  - Important for retention
  - Improve crew performance
ABS Habitability Guidance

- Guides
  - Crew Habitability on Ships
  - Crew Habitability on Workboats
  - Crew Habitability on Offshore Installations
  - Crew Habitability on MODUs

- Notations Offered
  - HAB, HAB+, HAB++
  - HAB(WB), HAB+(WB), HAB++(WB)
  - HAB(OS), HAB+(OS), HAB++(OS)
  - HAB(MODU), HAB+(MODU), HAB++(MODU)
ABS HAB Guides Under Revision

- Modification of the accommodation area criteria
- Entry-Level (HAB) noise criteria to be updated to reflect the new IMO Code on Noise (IMO Res. MSC.337(91))
- Update of the lighting criteria
Guide for Crew Habitability on Ships

- Applicability
  - Oil or Chemical tankers
  - Bulk or Combination carriers
  - Container carriers
  - Multi-purpose cargo vessels
  - Passenger vessels (Crew Areas)
Guide for Crew Habitability on Workboats

- Applicability
  - Offshore support vessels
  - Tug boats
  - Tow boats
  - Dredgers
  - Research vessels
  - Anchor handling vessels
  - Any other vessel providing services to offshore oil and gas exploration and production (including SPS)
Guide for Crew Habitability on Offshore Installations

- Applicability
  - Tension leg platforms (TLPs)
  - Floating production, storage and offloading (FPSOs)
  - Spars
  - Fixed platforms
  - Any other buoyant or non-buoyant structure supported by or attached to the seafloor
Guide for Crew Habitability on MODUs

- Applicability
  - Drillships
  - Drill barges
  - Self elevating drilling units (SEDUs)
  - Column stabilized drilling units (CSDUs)
  - Any other vessel used for the purpose of drilling
HAB Guide Contents

HABITABILITY

Accommodation Design

Plan Approvals

Ambient Environment Qualities

Onboard Measurement
ABS Habitability (HAB) Guidance

- Crew Accommodations
  - Access/Egress
  - Crew cabins
  - Sanitary spaces
  - Offices
  - Food services areas
  - Recreational facilities
  - Laundry and medical areas

- Ambient environment
  - Human whole-body vibration
  - Noise
  - Indoor climate
  - Lighting
Human Whole-body Vibration (WBV)

- There are two main types of human vibration:
  - Whole-body vibration
  - Hand arm vibration
- Whole-body vibration is transmitted to the body as a whole, generally through the supporting surface (that is, feet, buttocks, back, etc.)
- Frequencies of interest
  - 1.0 Hz to 80 Hz
  - This range has the most impact on human performance
    - Speech 1-20 Hz
    - Reading (instruments) 1-12 Hz
    - Reading (text or displays) 1-50 Hz
    - Control manipulation 1-30 Hz
    - Depth perception 25-50 Hz
    - Visual task performance 10-80 Hz
Human Whole-body Vibration (WBV)

- Basis of methodology
  - ISO 6954
  - ISO 2631
  - ISO 8041 (Instrumentation)

- Criteria based on:
  - Crew task performance
  - Enhanced habitability
  - Different sized vessels
  - Different operational modes
Noise

- Adverse and/or improper levels can:
  - Cause speech interference
  - Interfere with concentration and thought processes
  - Disrupt sleep
  - Cause fatigue and aggression

- Basis of methodology
  - ISO 2923
  - IEC 61672 (Instrumentation)

- Criteria based on
  - Activities in a space
  - Communication needs
  - Different operational modes
Big Contributor: HVAC Noise

- HVAC-induced noise as high as 8 dB

- Potential Solutions:
  - Design-related:
    - Configurations including largest feasible duct size, gradual turns
    - Use of HVAC silencers and/or resonators
    - Tuning of resonators to the blade frequency
    - Reduction of pressure changes
  - Installation-related:
    - Proper supports for exhaust and piping systems
    - Secure ventilation ductwork piping systems will reduce vibration against shipboard structures
Indoor Climate

- What determines comfort?
  - Ambient environmental factors
    - Air temperature
    - Air speed
    - Humidity
  - Individual factors
    - Age, gender
    - Fitness level
    - Activities performed
    - Clothing insulation
Lighting

- Objective is to provide lighting to accommodate crew visual task performance and safety
- Criteria provided for:
  - Entrances and passageways
  - Cabins, staterooms and sanitary spaces
  - Dining spaces
  - Recreation spaces
  - Crew work spaces
Lighting Requirements

- Relationship of age and light required for reading small print

![Graph showing light requirements vs age](image)

Source: Phillips Lighting
Test Plans

- Developed for each ambient environmental aspect
- Plans include:
  - Documentation and drawings
  - Test personnel
  - Test conditions
  - Measurement locations
  - Data acquisition and instruments
  - Test schedule
- Resulting test reports will go to the attending surveyor
Ambient Environmental Testing Specialists

- Testing personnel have the right equipment
- Testing personnel have the correct knowledge and skill to use the equipment
- Testing equipment has current calibration certificates
- Testing personnel can develop an appropriate Test Plan
- Testing personnel can develop an appropriate Test Report
- Testing personnel can act independently of any production related function within the yard
Process for Obtaining the HAB Notation

1. Request for notation
2. Create Accommodation design
3. Submit Accommodation design
4. Engineering review
5. Further data? Yes → Modify Test Plans
   No → Submit Test Plans to ABS
6. Review /Modify plans?
   Yes → Submit Test Plans to ABS
   No → Submit project status information
7. Surveyor verification measurements
8. Key:
   • Builder Activities
   • Engineering Activities
   • Survey Activities

Measurements /analysis - surveyor supervision
Submit Test Reports to ABS
Decision for notation
HAB: Event Schedule

- Prepare and submit data relating to Accom. criteria
- Prepare and submit ambient environment test plans
- Review ambient environment test plans*
- Surveyor Accom. verification measurements
- Measurements / analysis - Surveyor Supervision
- Submit ambient environment test reports

* Under certain conditions lighting and indoor climate measurements may be taken during construction or dockside after construction

Key:
- Builder Activities
- Engineering Activities
- Survey Activities
# Habitability Related Projects (July 2014)

<table>
<thead>
<tr>
<th>Category</th>
<th>In Operation</th>
<th>Design/Construction</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>HAB/HAB+/HAB++</td>
<td>3</td>
<td>16</td>
<td>19</td>
</tr>
<tr>
<td>HAB(WB)/HAB+(WB)</td>
<td>10</td>
<td>66</td>
<td>76</td>
</tr>
<tr>
<td>HAB(OS)/HAB+(OS)</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>HAB(MODU)/HAB+(MODU)</td>
<td>0</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>MLC-ACCOM</td>
<td>27</td>
<td>106</td>
<td>133</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>42</strong></td>
<td><strong>196</strong></td>
<td><strong>238</strong></td>
</tr>
</tbody>
</table>
Mariner Personal Safety (MPS) Project Overview

- Objective obtain and review incident and close call reports
- Collected approximately 85,000 records (injuries and close calls)
- Database represents more than 1,600 vessels and 45,000 mariners
- Constructed a database to:
  - Identify trends
  - Create benchmarking statistics
  - Identify potential corrective actions
  - Identify potential lessons learned
- Develop and share results
Near Misses Related to Access Aids

Chart data represents ~22% of all crew near misses

Data based on preliminary ABS research into mariner personal safety
Crew Injuries Related to Access Aids

Chart data represents ~24% of all crew injuries

Data based on preliminary ABS research into mariner personal safety
ABS Guide for Ergonomic Notations

- Addresses structural aspects of four vessel areas
- Can be applied to ships or offshore structures
- Ergonomic notations for:
  - Topside interface design (ERGO TOP)
  - Enclosed space and hull interface design (ERGO ES)
  - Maintenance access and design (ERGO MAINT)
  - Valve locations, access and operation (ERGO VALVE)
ABS Guide for Ergonomic Notations

- Requirements limited to human and vessel structure compatibility
  - Anthropometry
  - Biomechanics
  - Reach and working envelopes

- Cognitive factors not addressed (e.g., information display)

- Environmental factors not addressed (e.g., noise, vibration)
Ergonomic / Safety Hazards

- Appropriate design of the workplace?
Ergonomic / Safety Hazards

- Appropriate design of the workplace?
Ergonomic Notation Topics

- Stairs, walkways and ramps
- Vertical and inclined ladders
- Guard rails and climber safety devices
- Fall protection from secondary fall points
- Work platforms
- Handles
- Hatches
- Doors and scuttles
- Manual valve operation, access, location and orientation
- Maintenance access
ERGO TOP (example)

Staggered Vertical Ladder

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Stringer separation 400 to 450 mm (16.0 to 18.0 in.)</td>
</tr>
<tr>
<td>B</td>
<td>Horizontal separation between two vertical ladders, stringer to stringer ≥ 225 mm (9 in.) ≤ 450 mm (18 in.)</td>
</tr>
<tr>
<td>C</td>
<td>Distance between ladder rungs (rungs evenly spaced throughout the full run of the ladder) ≥ 275 mm (11.0 in.) ≤ 300 mm (12.0 in.)</td>
</tr>
<tr>
<td>D</td>
<td>Stringer height above landing or intermediate platform ≥ 1350 mm (53.0 in.)</td>
</tr>
<tr>
<td>E</td>
<td>Rung Design – (Can be round or square bar, where square bar is fitted, orientation shall be edge up) Square bar 22 mm (0.9 in.) × 22 mm (0.9 in.) Round bar 25 mm (1.0 in.) diameter</td>
</tr>
<tr>
<td>F</td>
<td>Horizontal separation between ladder and platform ≥ 150 mm (6.0 in.) ≤ 300 mm (12.0 in.)</td>
</tr>
<tr>
<td>G</td>
<td>Landing or intermediate platform width ≥ 925 mm (36.5 in.)</td>
</tr>
<tr>
<td>H</td>
<td>Platform ladder to Platform ledge ≥ 75 mm (3.0 in.) ≤ 150 mm (6.0 in.)</td>
</tr>
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ERGO ES (Enclosed Space)

- Areas within the hull, below the main deck
- Similar coverage as topsides, tailored for cargo and machinery access including:
  - Ladders and walkways
  - Hatches and passages
  - Lifting devices
  - Doors and scuttles
ERGO ES (example)

Inclination of Ladders

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inclined Ladders</td>
<td>45 to 60 degrees</td>
</tr>
<tr>
<td>Vertical Ladders</td>
<td>80 to 90 degrees</td>
</tr>
</tbody>
</table>

For Inclined Ladders:

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Handrail/guardrail diameter</td>
<td>≥ 40 mm (1.5 in) to ≤ 50 mm (2.0 in)</td>
</tr>
<tr>
<td>B Handrail/guardrail height (from leading edge of tread)</td>
<td>≥ 915 mm (36.0) and ≤ 1000 mm (39.0 in.)</td>
</tr>
<tr>
<td>C Tread/step spacing – equally spaced along entire ladder</td>
<td>≥ 200 mm (8.0 in) and ≤ 300 mm (12.0 in.)</td>
</tr>
<tr>
<td>D Step depth Use of square bar is optional</td>
<td>≥ 100 mm (4.0 in.)</td>
</tr>
<tr>
<td>E Handrail/guardrail to handrail width</td>
<td>≥ 450 mm (18.0 in.) ≤ 560 mm (22.0 in.)</td>
</tr>
<tr>
<td>F Angle of inclination</td>
<td>45 to 60 degrees</td>
</tr>
</tbody>
</table>

Front View
ERGO VALVE

- Addresses design and accessibility of valves
- Manual and motor operated (for maintenance)
- Topics include:
  - Valve criticality and location, access, reach envelopes
  - Mounting heights and orientations
  - Mode(s) of operation, biomechanics of operation
  - Force requirements, support devices (extenders, bars)
ERGO VALVE (Valve Criticality Analysis)

- Category 1 – valves critical for safety or operations or are also used frequently for routine maintenance
  - Example
    - Emergency shutdown valves
- Category 2 – valves not critical for operations but required for routine maintenance
  - Example
    - Condensate drain valves
- Category 3 – valves not critical for operations and are infrequently used
  - Example
    - Valves used in drydock only
Criticality Analysis: Valves

- Analysis to determine Category 1 and 2 valves
- Analysis participants:
  - Vessel designers
  - Construction yard
  - Owner’s representatives
  - ABS Engineering and Survey
- Category 1 and 2 valves follow the ERGO VALVE criteria in the Guide
ERGO MAINT (Maintenance)

- Addresses maintenance accesses and workspace, generally on or below the main deck

- Topics include:
  - Access openings, maintenance platforms
  - Reach and access envelopes
  - Space for tools and parts storage
  - Provisions for storage
  - Lifting and moving devices
  - Safety devices
ERGO MAINT (Maintenance)

- Category 1 Maintenance or Operational Access
  - Maintenance/operational actions that are system and safety critical
- Category 2 Maintenance or Operational Access
  - Maintenance or operational actions that are performed frequently
- Category 3 Maintenance or Operational Access
  - Maintenance or operational actions which are considered to be non-critical
Criticality Analysis: Maintenance

- Analysis to determine Category 1 and 2 maintenance activities
- Analysis participants:
  - Vessel designers
  - Construction yard
  - Owner’s representatives
  - ABS Engineering and Survey
- Category 1 and 2 maintenance activities follow the ERGO MAINT criteria in the Guide
Obtaining a Notation

● Design Compliance Verification
  ■ The following plans and information shall be submitted to ABS Engineering for the purpose of review in the context of the ERGO notations being sought
    – Details of arrangements of the components and structures appropriate for the notation(s)
    – Diagrammed details of each of the above components and structures
    – Any vendor documentation or certifications pertinent to applying the requirements to the design.
  ▪ Surveyor follow-up physical verification of ergonomic criteria

● Results
  ■ The ABS Engineering ergonomic assessment, and ABS Surveyor verification measurements, shall be reviewed by the ABS Surveyor for determination of notation confirmation
...one final point

- Your thoughts?