Supporting human performance in ice and cold conditions

Des Upcraft
and
Andrew Sillitoe

Sept 30, 2010

With thanks to our colleagues:

Karl Rich
Marcel LaRoche
Bjarte Knappen Røed
Jan Reier Huse

And Presented by Dustin Pearson
Agenda

• Shipping activity in cold regions

• Hazards and performance-influencing factors

• Measures for managing performance and risks

• Summary
Shipping activity in cold regions
Increased marine activity in cold regions

- Longer shipping season with reduced ice intensity is facilitating:
  - an increase in resource exploration and extraction (hydrocarbons and minerals)
  - serious consideration of northern routes for trans-polar shipping
  - an increase in cruise ship activity (eco-tourism)

This will result in greater shipping activity in cold regions in the future, and more seafarers exposed to the hazards
Hazards and performance-influencing factors
Icing on ships

- Spray icing occurs forward on a ship
- Atmospheric icing
- Hazardous operational issues:
  - Stability and manoeuvrability
  - Access and operability to equipment and systems
  - Slips, trips and falls
  - De-icing - ice removal
Sea ice

- Risk to safety of the ship
- Need for constant vigilance
- Pressure of schedule
Ice navigation

- Navigation in convoy – ships in close proximity
- Short notice passage plan alterations
- Circumnavigation using uncharted waters
Weather and light conditions

• Reduced visibility

• Sea states, cyclonic conditions, “Polar lows”

• Ice conditions change at short notice

• Extremes of daylight and darkness

• Glare

• Ultraviolet light
Low temperatures – physical effects on people

• Mean temperature of -20°C, with extremes to -50°C
  ➢ Hypothermia
  ➢ Frostbite
  ➢ Non-freezing cold injuries

• Bare skin
  ➢ Wind chill
  ➢ Contact with metal

• Respiratory difficulties

• Manual dexterity

Courtesy: PRISCO
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Frostbite possible in 2 minutes or less
Frostbite possible in 3 to 5 minutes
Frostbite possible in 6 to 10 minutes
Frostbite possible in 11 to 25 minutes
Frostbite possible in 26 to 42 minutes
Frostbite unlikely

Source: Transport Canada TP14335E 1/2005
# Cold water immersion - hypothermia

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<th>Exhaustion or unconsciousness *</th>
<th>Expected time of survival *</th>
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* Time range is due to individual weight and size differences.

Source: Shawn Baker/University of Sea Kayaking

Courtesy: Viking Life-Saving Equipment A/S
Low temperatures – cognitive effects

• Natural responses use energy

• Performance degradation
  ➢ Decision-making
  ➢ Judgement
  ➢ Risk perception

• Demands on attention capacity
  ➢ Conditions become a constant distraction
Other stresses

- **Noise and vibration**
  - Volume and clarity of communication
  - Stress of impact noises
  - Quality of sleep and rest

- **Remoteness**
  - Self-sufficiency
  - Search and rescue, medical assistance
  - Navigation and communication aids

- **Morale**
  - Isolation
  - Communication and shore leave
  - Productivity, teamwork, retention
Measures for managing performance and risk
Managing performance – Competent people

- Personnel
- Manning
- Training

Human resources
Fitting the person to the job

Competent people

Courtesy: Neste Oy
Fitting the person to the job:

Personnel

- Recruitment
- Pre-employment medical assessment

Manning

- Higher manning
  - Exposure times
  - Crew rotation
  - Rest breaks
  - Extra tasks
Fitting the person to the job: Training

- On the job and advance induction

- Transferability of experience
  - Simulators
    - Bridge and engine room teams

- Considerations for drills
  - Cold water survival

- Ship and shore based personnel
Managing performance – Usable systems

- System safety
- Habitability
- Maintainability
- Operability
- Manoeuvrability
- Controllability
- Survivability
- Occupational health and safety

Human factors
Fitting the job to the person

Usable systems
Fitting the job to the person:

System safety

- Role of people in the system
- Potential for error
- Human-centred approach

Habitability

- Suitable accommodation
- Changing and storage spaces
- Lighting
Fitting the job to the person:

Maintainability

- Planned maintenance
- Self sufficiency

Operability

- Minimise exposure time
- Clothing
- Signs and instructions
Fitting the job to the person:

**Manoeuvrability**

- Propulsion and steering
- Ballast water freezing
- Anchor release freezing

**Controllability**

- Instruments
- Bridge windows
- Radar systems and searchlights

*Courtesy: Transport Canada*
Fitting the job to the person:

**Survivability**

- “The ship is its best lifeboat”
- Remoteness
- Life saving equipment

**Occupational health & safety**

- Loss of body heat
- Appropriate clothing
- Nutrition and hydration
Summary

- Increased shipping activity in cold regions
- Hazards and performance-influencing factors
- Measures for managing performance and risk
Thank you

Des Upcraft
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