

Exploring Human Factors

Person

SKILL

Competence
Previous training
Experience
Currency
Leadership

CULTURAL DIFFERENCES

Religion, national tradition, dress, language

MOTIVATION

Work environment

Temperature, humidity, air quality, lighting, noise, vibration, cleanliness

Working hours

Continuous operations, watchkeeping

Habitability

Adequate tools & equipment

Manning levels

Organization structure

Authority, responsibility, communication

Actions by others

Reward

Recognition

Benefits

Job description

Instructions

Procedures

Continuation Training

KNOWLEDGE

Education & training

PHYSICAL STATE

Personal health & hygiene, fitness, balanced diet

PHYSICAL CAPABILITY

Strength, stamina, stress, fatigue, pain/discomfort, hunger, thirst, temperature extremes, vibration, movement constriction, lack of physical exercise, disruption of circadian rhythm

PSYCHOLOGICAL STATE

Task speed, task load, threat of failure/loss of job, monotonous, degrading or meaningless work, long uneventful

vigilance periods, conflicts of motives about job performance, reinforcement absent or negative, sensory deprivation, distractions (noise, glare, movement, flicker, colour), inconsistent cues

PSYCHOLOGICAL CAPABILITY

Perception, motor requirements (speed, strength precision), control-display relationships, anticipatory requirements, interpretation, decision-making, information load, narrowness of task, frequency & repetitiveness, task criticality, long/short-term memory; calculation requirements, feedback (knowledge of results), dynamic v step-by-step results, team structure & communication, man-machine interface

Job (task, environment and equipment)

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EQUIPMENT & WORKSPACE DESIGN

System Design

Usability

Human-system interface

Human-human, human machine, human-computer

Anthropometry

Body Size

Body strength & stamina

Limits of strength and endurance

Workplace design

User capabilities and limitations

Stresses and Hazards

Wind, whole body motion, motion induced fatigue, vibration, noise, darkness/dazzle, temperature, sleep loss

Vision and Lighting

Human vision, visual displays and lighting design

Auditory Information

Transfer of information to human operators using their hearing

Voice Communication

Characteristics of speech and hearing

Face-to-face and electronically assisted speech communication

Controls

Optimum size, shape, operating dynamics and spacing

Maintainability

Accessibility

Tools & equipment

Handbooks, Procedures

Organisation & management

TOP LEVEL MANAGEMENT

Safety policy

Budgeting

Resource allocation

Leadership philosophy

PERSONNEL

Selection and check of competence

Education and training

Leadership and supervision

Motivation

Modification of attitudes

Development of social climate

OPERATIONAL

Inspection methods

Maintenance methods and procedures

Operations procedures

System documentation

Manning and watch systems

TECHNICAL

Reliability and availability

System performance

Instrumentation

Monitoring

Automation

Man-machine interface

SAFETY MANAGEMENT

Management

Organisation

Routines

Inspection and auditing

Feedback

Learning

Emergency planning and training

Health

Environment

Safety at work



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Human Factors, or *The Human Factor*, are terms which are often misinterpreted and are used as a covers for the *Human Element* or even *Human Error*. A simple definition of *Human Factors* is: **the body of scientific knowledge about people and how they interact with their environment, especially when working.** Applying human factors to the design and operation of a ship or its systems means taking account of human capabilities, skills, limitations and needs. *Human Factors* should not be confused with the term

Human Resources which is a closely related activity that addresses the supply of suitably qualified and experienced staff.

When considering the operation or design of any ship and its systems both of these domains should be considered - *Human Resources* for the selection and preparation of staff able to do the required work and *Human Factors* to account for the use of people as a component of the system. Both domains contain a number of sub-domains:

Human Factors (Fitting the job to the person):

- **Human Factors Engineering** - The comprehensive integration of human characteristics into the definition, design development, and evaluation of a system to optimise Human-Machine performance under specified conditions.
- **Health Hazards** - The identification, assessment and the removal or reduction of short or long-term hazards to health occurring as a result of normal operation of a system.

- **System Safety** - The human contribution to risk when the system is functioning in a normal or abnormal manner.

Human Resources (Fitting the person to the job):

- **Manpower** - the number of personnel required, and potentially available, to operate, maintain, sustain and provide training for a system.
- **Personnel** - The cognitive (trainability and mental aptitude) and physical (fitness levels, physical size, gender) capabilities required to be able to train for, operate,

maintain and sustain a system and provide optimum quality and quantity of the crews to man the ship.

- **Training** - The instruction or the education, and on-the-job or part-task or full-mission training required to provide personnel with their essential job skills, knowledge, values and attitudes.

A simple way to view human factors is to consider three main aspects: *the person, the job (task, environment and equipment), and the organisation and management, and*

how they - together with the environment in which the organisation and person are operating - impact on the behaviour of people. This diagram attempts to show the various factors that can influence the interaction between a human and any system aboard ship, ie: *The Human Element!*

A practical example of how to apply human factors to the design and operation of a Ship Control Centre can be downloaded from the Alert! website: www.he-alert.org (ref: HE00130)