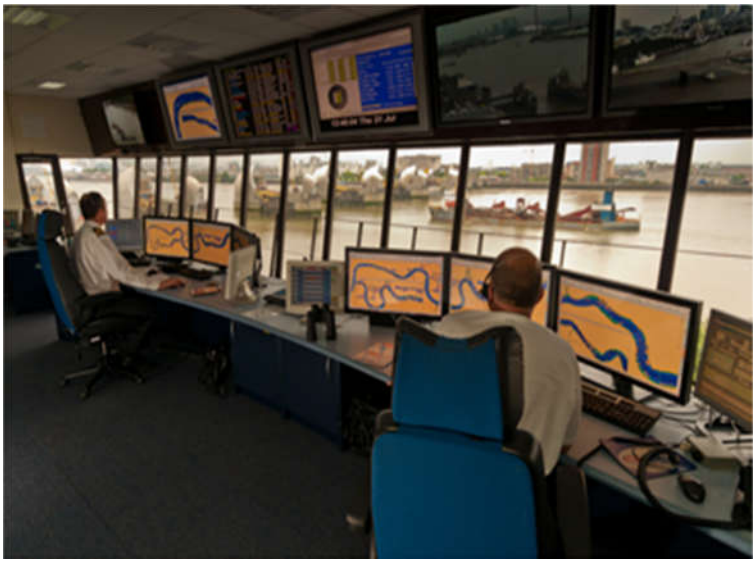
Report of the

IALA WORKSHOP

ON

HUMAN FACTORS AND ERGONOMICS IN VTS



Date
12 – 16 October 2015

Venue
Chalmers University of Technology
Gothenburg, Sweden

Executive Summary

IALA conducted a workshop on Human Factors and Ergonomics in VTS at Chalmers University of Technology in Gothenburg, Sweden (12 - 16 October 2015), in conjunction with Chalmers University of Technology, the Dutch VTS Operator Training Foundation and the Port of London Authority.

Sponsored by Transas, Kongsberg, Frequentis and SMA the workshop was attended by 47 delegates representing 18 countries (see Annex A).

The aims of the workshop were to:

- Explore strategies to enhance decision making processes, situational awareness and error management in the VTS environment whilst minimising the risk of stress and fatigue;
- Identify factors that should be considered when addressing staffing levels, working patterns and the health and wellbeing of VTS professionals;
- Describe the overarching principles of effective VTS Centre design and configuration to optimise human performance and operational efficiency;
- Identify and explore socio-technical factors in VTS that may enhance organisational and safety cultures.

Focussing on key themes associated with human factors and ergonomics the workshop embraced the expertise and experience of delegates to provide and develop strategies, concepts and examples of best practice to assist in the formulation of new IALA Guidance on Human Factors and Ergonomics in the VTS environment. In particular, the output from the workshop provides a key input document for consideration by the VTS Committee at its 40th meeting the following week.

Key outcomes from the workshop include:

1. Human Factors should be referenced, where appropriate, throughout IALA documents relating to VTS.
2. There is a need for IALA guidance on:
   - accident investigation regarding VTS.
   - raising awareness about safety culture and identifying the benefits and expected outcomes thereof.
   - operational effectiveness and staffing levels in VTS. This may best be progressed through an IALA workshop / seminar.
   - Positive performance and outcome indicators should be included in the development of guidance on. Measures to Evaluate the Effectiveness of a VTS (task 1.1.6 of the VTS Committees Work Programme 2014-2018)
3. When appropriate, the revision of V-119 should give reference to:
   - The use of a human centred design approach in the development, update and evaluation of VTS.
   - Measures to Evaluate the Effectiveness of a VTS (see above)
4. The application of the concept of human reliability needs to be carefully considered with regards to VTS and reflected in appropriate IALA documentation. Human Factors should be referenced, where appropriate.
5. Competent / VTS Authority should develop policy on Human Factors, Performance and Capability.

The conclusions from the workshop are in ANNEX D

The social programme consisted of welcome reception on the first evening and a workshop dinner on the third evening.

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IALA WORKSHOP ON HUMAN FACTORS AND ERGONOMICS IN VTS

1 INTRODUCTION

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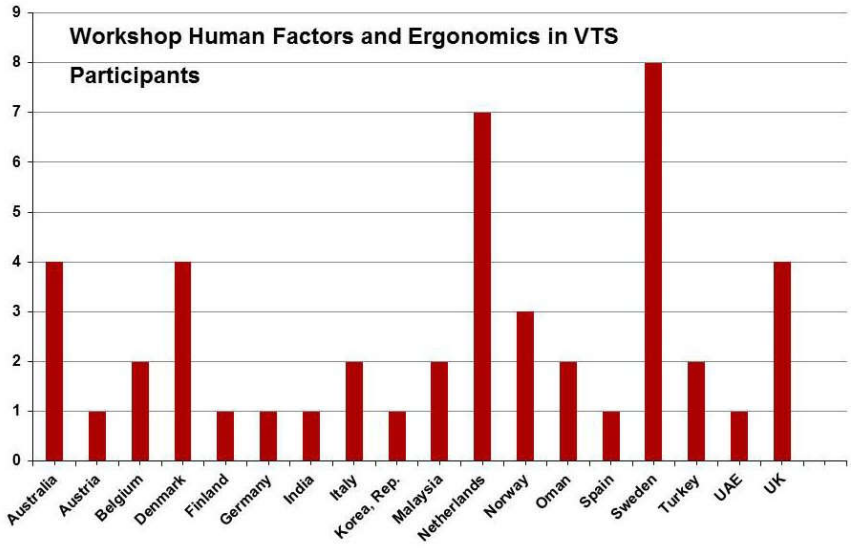
Sponsored by Transas, Kongsberg, Frequentis and SMA the workshop was attended by forty-seven delegates, representing 18 countries. See ANNEX A for the list of participants.



The report will be available on the IALA web site www.iala-aism.org : Publications – Reports and Proceedings.

The workshop's programme is at ANNEX C.

2 PRE-MEETING

The Steering Group for the Workshop held its final meeting prior to the workshop commencing to ensure all preparations / arrangements for the workshop were in place.

The members of the Steering Group were:

	Name	Organisation / Country
1	Tuncay Çehreli	DGCS / Turkey, Chairman VTS Committee
2	Neil Trainor	AMSA / Australia, Vice Chair VTS Committee
3	Kevin Gregory	Port of London / UK, Chair WG3 VTS Committee
4	Lilian Biber-Klever	NNVO / the Netherlands, Vice Chair WG3 VTS Committee
5	Anders Brödje	Chalmers University of Technology / Sweden
6	Monica Sundklev	STA / Sweden, National Representative
7	Gerardine Delanoye	IALA, WWA Programme Manager
8	Michael Card later replaced by Marie-Helene Grilllet	IALA, Deputy Secretary-General IALA, Technical Operations Manager
9	Wim van der Heijden	IALA, Secretary VTS Committee

The pre-meeting was also joined by the Chairs of the Working Groups.

3 SESSION 1 – OPENING OF THE WORKSHOP ON HUMAN FACTORS AND ERGONOMICS IN VTS

The session was chaired by **Tuncay Çehreli**.

3.1 Welcome from the Chair of the IALA VTS Committee and opening remarks

Captain **Tuncay Çehreli**, DGCS and Chairman of the IALA VTS Committee, welcomed the participants to the IALA Workshop on Human Factors and Ergonomics in VTS, focussing on key aspects of VTS such as personnel, equipment, procedures, culture, design of VTS centres and operational rooms.
In concluding, he highlighted the significance of the workshop to IALA and stressed that the output from the workshop will provide a key input to the VTS Committee in the development IALA guidance on the aspects of human factors and ergonomics in VTS at its meeting the following week

The full text of the opening remarks from the Chair of the VTS Committee is at ANNEX E.

3.2 Welcome from Chalmers University of Technology and opening remarks

Prof **Lennart Josefson**, Head of the Department of Shipping and Marine Technology of the Chalmers Institute of Technology welcomed the participants of the workshop and provided an overview of the role of the Chalmers University of Technology in the maritime sector.

3.3 Welcome from IALA and opening remarks

Mr **Michael Card**, Deputy Secretary-General of IALA briefed participants on IALA, focussing on the role and structure of the organization and the IALA World Wide Academy.
In addition, he provided an overview of the:

- new corporate image being released, including the IALA logo, web-site, documents and publications;
- key developments such as e-navigation and VDES for enhanced maritime communication; and
- the change of status from a Non-Governmental Organisation (NGO) to an Inter-Governmental Organisation (IGO), as approved by the General Assembly in 2014.

3.4 Human Reliability (WG1): From Human Reliability to Resilience & System Performance - Adapting to a Changing World

Dr **Gesa Praetorius**, World Maritime University, Sweden

Dr **Fulko van Westrenen**, Umantec, the Netherlands

The speakers highlighted:

- The increasing complexity of maritime operations due to technological changes, (e.g. e-Navigation), organisational changes (e.g. Motorways of the Seas and shore-based traffic planning) and the rapidly increasing competition for water space (e.g. wind farms, offshore infrastructure, etc.). These changes are accompanied by new demands towards the human operators ashore who need to adapt to task demands and cope with increasing complexity in everyday work.
- The application of human reliability assessment as an approach to understand how to design, analyse and improve the reliability of human behaviour in systems. While earlier developments focussed on human error and error prevention through quantitative analyses, current approaches, such as resilience engineering and functional modelling, offer a way to design systems for optimal everyday performance and safety.

The presentation also introduced the concepts of human factors, human reliability, and resilience and how these can be used to analyse and understand how the current VTS system copes with everyday complexity and how the human operator within the system can best be supported to be able to adapt to both today's and tomorrow's challenges.

3.5 Operational Effectiveness (WG2)

Mrs **Wendie Uitterhoeve**, Marin, the Netherlands

Mrs Uitterhoeve introduced the concept of operational effectiveness and the central role of the operator in complex systems.

In describing the complexity of a system and how this may affect the operator was presented, focussing on examples such as:

1. The number and complexity of screens to display information to the operator
2. Establishing the number of personnel and qualifications for operators and dependencies such as age (irt shifts), tasks, assistance, interaction
3. Duration working/rest hours depends on task
4. Training development (simulator)

3.6 Working Environment (WG3): Future Control Centres from the Human Factors perspective and the related psycho-social impacts in the working environment

Mr **Jeton Partini**, CGM, Sweden

Mr Partini described the paradigm shift in the working environment associated with technological developments, highlighting factors such as:

- The industry sector is trying to adopt and implement the best technological solutions to enhance the production quality and quantity with the ambition to increase efficiency in order to raise financial growth for the industrial sector.
- Sectors such as oil & gas, energy, aviation, rail and process based industries are really eager to implement new technology in their physical working environments (WE) with the intention of growing efficiency, safety, reducing fatigue and increasing well-being among their workers.
- Recent research is showing that the physical WE and automation process is not always the answer to above-mentioned factors.

3.7 Workshop Aim and Objectives

In introducing the aims and objectives of the workshop Mr **Kevin Gregory**, Port of London Authority and Chair of the IALA VTS Committee's Training Working Group, stated that there is increasing awareness, public perception of, and expectation for, VTS. This places an enhanced degree of accountability on maritime administrations and their subsequent management of VTS. VTS is firmly established as a focus for information exchange and plays a pivotal role in the maritime transport domain.
The full potential of VTS, specifically the optimisation of human performance and ergonomics, is still to be realised, particularly when compared to similar services in the aviation world.

In conclusion, Mr Gregory walked participants through the aims and objectives as described below:

- Explore strategies to enhance decision making processes, situational awareness and error management in the VTS environment whilst minimising the risk of stress and fatigue;
- Identify factors that should be considered when addressing staffing levels, working patterns and the health and wellbeing of VTS professionals;
- Describe the overarching principles of effective VTS Centre design and configuration to optimise human performance and operational efficiency;
- Identify and explore socio-technical factors in VTS that may enhance organisational and safety cultures.

4 SESSION 2 - OPENING OF THE WORKSHOP ON HUMAN FACTORS AND ERGONOMICS IN VTS (CONTINUED)

The session was chaired by **Neil Trainor**.

4.1 Future aspects of VTS

Mr **Anders Brödje**, Chalmers University of Technology, Sweden.

Mr Brödje provided an overview of the developing e-navigation concept and highlighted a number of European Research projects and as an example of the likely impact on VTS and possible future developments in VTS. With Strategic and Tactical Route exchange, the planned route of a ship can be made available for VTS and some examples were given for NoGo areas in critical situations. Collaborative arenas were proposed between the different actors leading to a Maritime Digital Infrastructure.

4.2 WWA Presentation

Mrs **Gerardine Delanoye**, IALA WWA Programme Manager.

Mrs Delanoye described the role and purpose of the IALA World Wide Academy (WWA) and focussed on two Goals associated with IALA's Strategic Vision:

1. Ensure that aids to navigation systems and related services, including e-Navigation, Vessel Traffic Services, and emerging technologies, are harmonised through international cooperation and the provision of standards.
2. All coastal states have contributed to an efficient global network of aids to navigation and services for the safety of navigation, through capacity building and the sharing of expertise.

In concluding, she focussed on the capacity building programme being delivered by the Academy through actively facilitating technical missions and training events and the role of the Joint Capacity Building Working Group (IMO, WMO, IOC, the IAEA, the IHO and IALA) to enhance the safety of navigation and protection of the marine environment under the United Nations banner of "Delivering as One".

4.3 Introduction Working Groups

Mr **Kevin Gregory**, Chair of the VTS Committee Training and Personnel Working Group explained how the workshop was organized with working groups for the next three days.

Three Working Groups and Working Group Chairs were briefly introduced:

WG1	Human Reliability	Assoc. Prof. Dr. Serdar Kum
WG2	Operational Effectiveness	Dr. Benjamin Brooks
WG3	Working Environment	Prof. Margareta Lutzhoft

All participants were requested to make a choice for their Working Group for the week. An overview of the participants for each WG is given in ANNEX B.

5 SESSION 3, 4 AND 5 – WORKING GROUPS

Co-ordinators during the Working Group sessions 3, 4, and 5 were Kevin Gregory, Lilian Biber-Klever, and Anders Brödje.

During session 3 each Working Group was invited for the Technical Tour as scheduled in the Workshop Programme (ANNEX C). The technical facilities on simulations, bridge and VTS, were demonstrated. Also a demonstration of design tools for control / operator centres from CGM was included.

5.1 Notes from WG1: Human Reliability

Rapporteur: Cees Stedehouder

Day 1

5.1.1 What is the human reliability?

IMO\MSC\83\INF-2 (2007)
Human reliability: The probability that a person: (1) correctly performs some system-required activity in a required time period (if time is a limiting factor) and (2) performs no extraneous activity that can degrade the system. Human unreliability is the opposite of this definition.

Human error: A departure from acceptable or desirable practice on the part an individual or a group of individuals that can result in unacceptable or undesirable results.

Human error probability: Defined as follows:

$$HEP = \frac{Number\ of\ human\ errors\ that\ have\ occurred}{Number\ of\ opportunities\ for\ human\ error}$$

We prefer to use human performance, capability and limitations rather than human reliability.
The root cause of human error should be considered, based on working conditions.
Factors are physical and mental.
Firstly we try to understand the aim of WG1, and we define the frame by deduction, from top level to the bottom. First day we get the WG1's scope in three parts;
1) Recruitment Process (including tests)
2) Maintain/improvement/skills/ability/experience, etc.
3) Changes and developments

The factors of three main pillars are;

Recruitment Process (including tests)	Maintain/ improvement/ skills/ ability/ experience, etc.	Changes and Developments
1.1 Local/ English Language	2.1 Situational awareness	3.1 Conflict
1.2 Nautical background/ knowledge	2.2 Fatigue (how to cope personally)	3.2 New/additional VTS services/ functions
1.3 Occupational health conditions	2.3 Knowledge (VTS / Nautical / SMCP / Language / Technical, etc.)	3.3 New technology
1.4 Ability to perform daily job (workload, stress, team player, awareness, multi-functionality, etc.)	2.4 Stress (how to cope personally)	3.4 job satisfaction/ Burnout
1.5 Communication	2.5 Teamwork	3.5 Refreshments
1.6 Attitude / Responsibilities	2.6 Person-job interaction	3.6 Scheduling
	2.7 Emergency cases/ situations	

It is needed to have a management policy on Human Performance, Capability and Limitations.
VTS work consists of several solutions for one case.
VTSO's all over the world are very different.
We are assessing safety from a specific point of view.

- occupational safety
- ergonomics and human factors
- psychological impact
- first aid
- occupational wellbeing.

A safety manager on the level of psychological aspect is very much needed.

Psychological support is very much needed. We need to make employers more aware of the fact that the psychological health of employees matter and that it benefits to employer to provide psychological assistance when needed.

5.1.2 Jobs, tasks of a VTSO

1. What does a VTSO do a normal day on the job?
    a. What are less normal occurrences?

It is directly related to Situational Awareness. In addition, in a daily job of VTSO while monitoring, collecting, combining, analysing and giving information other parameters to affect VTSO are; Local / Eng. Language, Knowledge / Nautical background and attitude.
Handover, technical check, administration (writing report) task.
Training / ability for basic technical failure (not maintenance)
Emergency, navigational warning, technical failure

2. How is the handover conducted?
    a. Should there be company time for the handover and how much?

Face to face, logbook / record. Compulsory min. 5-15 minutes early / earlier / before taking watch (paid / not paid)

3. How does a VTSO make decisions?
   Huge amount of information
    a. What are possible pitfalls?
       Lack of experience, Local language vs. English language
    b. How can we better support decisions?

Mentoring (no time limitation will VTSO be ready). Correct feedback "understand".

4. With whom does a VTSO cooperate?
    a. How is the information exchange between actors?
       Internal (hierarchy), MRCC, Administrations, Vessels, Port (authority), Pilots, agents, media, public users, (coast guard).
    b. Are there potential conflicts / ~~differences of interest~~?
       Yes. Minor issues.
    c. How are they resolved?
       Dialogue, communication via procedures
    d. Do they see themselves as part of port ops or vessel traffic ops
       Traffic operations, and port operations (optional).

5. What are common communication issues for the VTSO?

   a. How could they be resolved?

External; Poor English, poor VHF contact (distance, technical capacity, etc.), no contact ship. Usage of SMCP, alternative solutions.
Internal; background noise, internal communication (handover, procedures, etc.). Proper usage of equipment.

6. What are the risks / issues she / he must manage?
   a. What can a VTSO do to manage error?
   b. What else can we do to avoid/manage error?

   External; accidents, weather conditions (fog, etc.). Follow procedures, communication.
   Internal; system failure, health problem (usage of medicine), fatigue, stress, social elements. Preventive maintenance (PMS), periodical check.

7. What are the different kinds of stressors present for the VTSO?
   a. How can these sources of stress be countered by the company, manager, VTSO?

   Workload, unusual situation, physical working environment stressors.
   Daily stressors; usability of equipment
   Personal stressors; individual factors / effects
   Sudden stressors
8. What happens in and after an emergency?
   a. Post incident investigation actions - rebuilding the person and the team

   Emergency = Incident/accident at sea / in VTS Centre
   In emergency at sea; collecting information about life/injury in danger. Checking situation at the datum, keep safety around the datum.
   Follow procedures/rules/etc. Immediate action
   After emergency at sea; provide the emergency information, analyse the event and response, state of the system (for improvements) lessons learns.
9. Identify factors causing stress / ~~fatigue~~
   a. Identify possible strategies to counter the mentioned stress factors.

Recognition, sharing responsibilities, stress coping techniques.
Self preparation (work, equipment, shift, etc.). Good organisation of resources. Technical checks, equipment
Fatigue is a state of mind in which the operator is not able to focus and function well after either a period of sleep loss or after a long(er) period of exhaustment.
Often there is not sufficient staff to replace a VTSO with a mental problem for several hours a day. Normally the employer will expect someone to be sick or not sick. Something in between is often not possible. It is recognised that fatigue is not only a personal problem but also an organisational problem. Sometimes it may be better for the employee to continue to work even if it is for a few hours a day. A temporarily change of task may be desired.
People with burn out are often hard workers or perfectionists.
Who could look after the employee's health?

Day 2

5.1.3 Teamwork

1. Describe the principles of teamwork in the VTS environment.
   Operational team
   a. team membership
      position / level in / on the team
   b. group dynamics
      jealous, too much speaking,
   c. advantages / disadvantages of teamwork
      more powerful, sharing ideas.
      Discuss too much. Difficult to taking decision, making action.
   d. conflicts, conflict management
   Age, culture effect, social parts (religion etc.), happy talker.
   e. Which is better a fixed team or a changing team?
      Yes / No. Depends on circumstances.
   f. What leadership style would be most appropriate for a VTS environment?
      Flexible
   g. multi-cultural aspects
      same as “d”.

5.1.4 Train the trainer

2. Who is responsible for the development of the VTSO?
   VTSO (him / herself). VTS S / Instructor (OJT). VTS M. Authority. International Agency (IALA; should).
   Training and working.
3. What level of skills/training is required in order to train people?
   Didactical teaching.
   Skill (professional/individual). Communication. Confidence. Self learning (interactive)
4. Could anyone be mentor / instructor / ~~examiner~~?
   No.
   Knowledge. Experience. Instructor (barrier/filter/training etc.) some of instructor can be Mentor (and they are different from each other). Instructor may be examiner (same / different) No consensus
5. Should you require refresher training for mentor / instructor / ~~examiner~~?
   Yes. Technical. Psychological. Methodological. Methodological. All is the refresher training.
   Regular based. How (the way of training) e.g. workshop

   OJT, YES. Some of them “no”.
6. Do you use model course V-103/3?

7. How can e-learning be used in the training process?
   Infrastructure (e-learning platform). Progress. All types of learning styles. Not for all training.
   Upgrade knowledge / skills. Language / exam, etc.

5.1.5 Train the individual VTSO

8. What are the key personal qualities and traits of a VTSO?
   a. to deal with high risk areas?
   Situational awareness. Confidence. Discipline. Flexibility. (rule based). Able to cope with pressure. Willing to risk. Responsibility. Decision making. Communicator. Patient.

9. What specific training is needed to deal with high risk areas?
   Risk management. Situational awareness. Fatigue / stress / workload / conflict / crew / crisis management. Team and leadership management. Human factors and ergonomics.
10. Are the current training types sufficient to cover HF matters, reference to V103, training documentation.
    Yes.
11. Should Human Factor Training be mandatory?
    Yes. Contents. Aim: improve the awareness of Human Factor as a TEAM.
12. Should on-the-job Training be structured? If yes, how?
    Yes. But nor to all countries.
    Based on the country / VTS Centre requirements. Different for new / qualified VTSO. Most important part of VTS training.
13. How updating training should be managed?
    Refreshment training.
    GAP analysis. New equipment / technology, etc. (2+1 days) in 3 years. One day in every year.

Day 3

5.1.6 Human performance – time block 1

1. What are the effects of age?
   a. How does attention change with age
      No relation.
   b. How does the use of automation change with age (reading and operating)?
      Skip, NIL.
   c. Is there evidence for deterioration of neural functions?
   d. Does experience compensate for the loss of neural functions by age?
      c and d together. No. not cognitive but may be physical.
   e. Should the VTSO have more frequent medical checks as he ages?
      Yes.
   f. What should be the age for retirement?
      Based on policy / national law. VTSO can work until he feels not to fit job.
2. What are the risks of fatigue, use of alcohol, sedatives, and sleeping medication?
   Lack of concentration, absence.
   Lack of attitude.
   Not to fit job.
3. What would be the optimal shift work scheme?
   Depends on the authority. Maximum 2 hours in front of the screen.
   a. Should the shift work scheme change with age?
      NO.

5.1.7 Human resources

1. Aptitude / psychometric testing, what should be assessed and how?
   Situational awareness. Attention. Leadership. Skill / attitude. Stress coping. Decision. Aptitude. Memory.
   How. Simulator. Personality (psychological, cognitive) tests. Interviews.
2. How does personality influence the working style of the VTSO?
   Self-awareness (personal, group, team, etc.). Group skills. Drive (ambitious).
3. Is there any relation between personality and performance?
   YES. That's the human factor.

4. Describe the differences between social human relations and professional interactions.
   Family. Good human, being personal, Friendly / unfriendly. Poor on personal side.
   Job. Not necessary to be…..
5. Should the company have a system of appraisal interviews and personal development plans?
   YES.
6. Principles of promotion / selection for advancement training.
   Based on the staffing level.
   Job performance. Attitude factor. Willingness to learn and to take responsibility.
7. Post-stress management; critical incident stress technique.
   Need to carry psychological tests. As soon as need to be acted (immediate action). It is a serious issue not to be neglect. Make a procedure. Briefing (lessons from incidents).
8. How to deal with personal problems
   Understand of personal problems. Take (professional) help. Take care each other. Collaborating / Socialising.
9. Should companies have a policy regarding alcohol, sedatives, sleeping medication? How to deal with these aspects in relation to privacy?
   YES. Be fit / ready job. Problem; concentration and recognition. Policy should include information about the risks (how long before taking a watch, etc.). Procedures should also clarify usage and side effects of medicine.
10. How should relocation and transfer of VTSO's be handled?
    Based on time. Rotation (if available). Willing to relocate.
11. Dealing with medical issues / restrictions.
    Policy. Recruitment progress. Stop/retired.

5.1.8 Conclusions

Highlight statements:

- VTS work is not right or wrong.
- VTS work consists of several solutions for one case / situation.
- VTSO's all over the world are very different.
- There are a lot of solutions to solve (one) problem(s).
- Reliability is wrong definition for VTSO.
- We cannot make the human perfect.

Highlights conclusions and recommendations;

- Definition of human reliability should be re-considered. "The Human is just not good in being reliable"
- Authority needs to develop Policy on Human Factor, Performance, Capability and Limitations
- Human Factor Training should be compulsory in VTS.

5.2 Notes from WG2: Operational Effectiveness

Rapporteur: Kerrie Abercrombie

5.2.1 Introduction

Ben Brooks walked participants through the proposed sessions to be addressed in the coming days, including:

- Establishing the Context: Is the operational environment for a VTSO changing? If so, how?
- Defining, Measuring and Monitoring Operational Effectiveness
- Placing the Roles and Responsibilities of the VTSO in a Broader Context
- Building, Changing and Maintaining Organisational and Safety Culture
- Identifying and Embedding Principles for Accident and Incident Investigation

As the workshop progressed it became clear that the agenda was overly optimistic given the need for detailed discussion on many of the key issues.
The following issues were identified as important for operational effectiveness however time constraints did not allow the Working Group to attend to these issues. The Working Group suggests that IALA still give these issues due consideration in the development of further guidance:

- How do we build a management system for unique/novel situations? (defences-in-depth versus safety space or other approaches).
- How should Authorities communicate around changes in policies, procedures, regulations etc..? Who should they be communicating with?
- What factors affect how much variance in work approach is acceptable?
- The factors that should be considered when addressing staffing levels, working patterns and the health and wellbeing of VTS professionals;
- Does IALA need a guideline on safety management systems? (what is the overlap between QMS and SMS
- How should IALA address the growing focus on Team Work, Maritime Resource Management between VTS, pilots and towage providers?
- What principles should guide the development of policies, procedures and checklists/memory aides?
- Are the task demands and the complexity of the work for a VTSO changing?
- What are the principles of situational awareness that need to be considered in a VTS?
- What do we need to understand about Decision-making and sense-making in VTS? How might this understanding influence the responsibilities of individual operators with regards to issues such as use electronic devices such as mobiles, smartphones and tablets
- What merit should new physiological methods for assessing SA, workload, attention be given?

One additional topic was suggested:

- **Cyber security -** Noting this may be an item for WG3 to consider in the wider aspects of technology it was agreed that, pending on time, this should be considered in the last session on Thursday. It was also suggested that IALA could be requested to consider a future workshop where cyber security is a focus.

5.2.2 SESSION - Defining, Measuring and Monitoring Operational Effectiveness

Participations were requested to nominate five observations of how they see the VTS work environment is changing (for example: task demands, technology, complexity of the work etc.) and

how this may impact on operational effectiveness. The purposes of this exercise was to frame the subsequent discussion around more detailed issues about organisational effectiveness.
The results of this activity can be found in Appendix 1.
Participants noted that:

- The VTS Committee's 2014-2018 Work Programme includes a task to develop a Guideline in the Measures to Evaluate the Effectiveness of a VTS (Task 1.1.6).
- The responsibilities of the Competent Authority and VTS Authority as described in IMO Resolution A.857(20) Vessel Traffic Services with regards to ensuring that:
    - Objectives for the VTS are set, and
    - The objectives set for the VTS are met.
- The links between strategic, operational and technical objectives and the purpose of each of these.

The initial presentation on operational effectiveness by the Chair noted that:

- Effectiveness can be difficult because no one ultimate criteria exists.
- Organisations pursue multiple and sometimes conflicting goals
- Effectiveness may change over time and with organisational and system maturity
- Criteria may be different at different levels within the organisation.
- Criteria relate to outcomes and well as processes.

The presentation suggested that there are three pillars that underpin the effective management of safe operations:

1. Effective hazard identification and risk management
2. Effective development of a robust safety culture and positive safety climate
3. Effective mechanisms of governance and oversight

Measuring Operational Effectiveness - To assist in measuring operational effectiveness it was recognised both positive/leading and negative (or outcome) performance indicators need to be considered. This ensures that operational outcomes are measured in terms of the success of good practice and the preventative measures that need to be implemented.
Leading indicators are measures that measure actions to prevent ill-health and injury. Lag indicators are also called outcome indicators, measure accidents, other adverse outcomes, injury and ill-health. Leading indicators are also known as positive performance indicators (PPIs) and are measure those actions that provide good operational outcomes; they are a measurement of the success of good practice and therefore preventive measures that avoid accidents, incidents, workplace injury and ill-health.
The development of measures to assess operational effectiveness is a significant task, and often takes organisations many months to develop. A short exercise was conducted in the workshop to identify typical PPI and outcome indicators with respect to the objectives of a VTS.
Defining Performance Indicators - When testing the suitability of key performance indicators the following issues may be considered including:

- Are they relevant?
- Are they clearly defined?
- Are they readily measurable?
- Are they acceptable to people across the organisation?
- Are they comparable from one measurement to the next?
- Are they unambiguous?
- Are they statistically valid?
- Can it be collected in a timely and cost effective manner?

This should lead to a set of indicators which:

- Accurately and consistently measure the parameter to monitor,
- Are easily understood by users,
- Are relatively simple to collect,

- Are timely in that they support Authorities to identify and implement a response that can influence the outcome,
- Readily relate to the objectives of the organisation.

Participants identified examples of positive and negative performance indicators which included:

Objective	Positive Performance Indicator	Outcome Indicator
Minimise the risk of maritime accident and consequential ship sourced pollution and damage to the marine environment	- Percentage of vessels passing the VTS area without accidents / incidents / near misses - Number of vessels where VTS provided information / interacted which resolved the situation prior to it further developing. - How many times has a grounding been prevented (e.g. avoidance before entering shallow waters). - How many times has a collision been prevented - Relativity number of incidents / event by route or passage or VTS area	- Number resulting in accidents / incidents / near misses within the VTS area - Number resulting in VTS assisted accidents / incidents / near misses within the VTS area
Provide a VTS capable of dealing with and responding to developing traffic situations	- VTSO training conducted (for example. Number or days, quality of course etc.) - Looking at behavioural markers by conducting routine safety observation sessions with VTSOs using other colleagues or external parties	- Availability of VTS system (The percentage availability of key equipment on a monthly and annual basis). - Port / VTS area traffic statistics / density
Enhanced relationships with allied services, stakeholders and other interested parties	- Regular information meetings with stakeholders. Measured by numbers of people attending, over a time period. - Measurement of customer satisfaction surveys - Conduct interviews with pilot exempt masters – to obtain their views on VTS operators	- Stakeholder feedback
Provide a safe working environments	- Measurements of staff satisfaction levels through anonymous surveys - Number of complaints received, or incident reports received, or absences - Regular performance reviews - Equipment maintenance and service availability information	- Complaints from workforce

It was also noted that risk assessments can provide input into the development of performance indicators by identifying outcome areas that may need to be addressed.
To develop PPIs an organisation the following process can be followed:

1. List the hazards that are present in the workspace that have been identified and assessed. To do this it may be wise to refer to risk assessments that have been carried out in the past.
2. Identify which organisational and/or operational objective the hazard is associated with.

3. For each hazard found the current hazard controls that are in place must also be identified, these will be procedures that have been implemented to improve results already.
4. When these have been identified, a choice must be made as to which area it is most beneficial for the organisation to measure. This could be areas that need further improvement than the current system is providing, or those that you want to measure the operational performance from.
5. Then it is a case of creating and developing the PPIs. It is measuring aspects of performance in a positive way, to ensure that everything that is being implemented is working effectively.
6. After the PPIs have been developed it is necessary to develop the methodology, so select indicators that are the most relevant and cost effective to collect, easily understood by the majority of people in the workplace and can be quickly and easily measured. It must be understood how the information will be collected; and also how often this information needs to be collected for it to be useful.
7. Finally the performance and effectiveness of the PPIs must be reviewed by checking whether they are effective measures of the areas that have been identified. This review must be undertaken periodically or when processes and equipment changes, as PPI management is an on-going and ever changing process.

5.2.3 SESSION - Placing the Roles and Responsibilities of the VTSO in a Broader Context

Ben Brooks provided a presentation and a general discussion on three key issues that support operational effectiveness in the workplace:

1. What are the key elements to a career path for a VTSO?
2. What long term principles for manpower planning should be adopted? (transition strategy, manpower planning)
3. How do we manage personal responsibility in the workplace?

Managing Personal Responsibility and Behaviour in the Workplace

One of the key principles highlighted was that of shared responsibility – from this perspective both the VTS Authority and the individual employee have a shared responsibility with regard to achieving operational effectiveness. The Authority has certain responsibilities which include the management of the organisation with respect to its objectives and all that this entails, the individual has responsibility to act with respect to the policies and procedures of the organisation and importantly, to be fit for duty to the extent that this is controllable.
Several approaches might be considered with respect to changing or improving personal responsibility. It is possible to reflect on behaviours we seek to change (that are not consistent with the values and objectives of the Authority) and behaviours that week seek to promote (that are consistent with the values and objectives of the Authority).

1. Managing Incorrect behaviours

This approach identifies behaviour that we want to change? It assesses the behaviour to identify the causal mechanisms. It adopt a defences-in-depth (or perhaps a barriers) approach to resolving incorrect behaviour. It tends to require a reasonably heavy use of resources, and is most effective in a work environment that is stable, testable and controllable.
It should be considered with respect to a Socio-Technical Systems Approach: A systematic approach to the design of systems that recognises the interaction between people, technology (i.e. equipment and systems) and their physical and organisational environments.

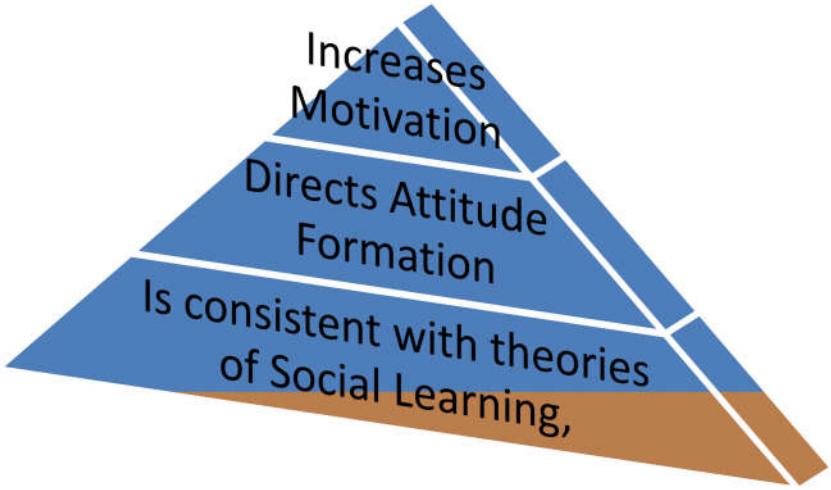
The presentation mentioned several challenges associated with this perspective:

- Resource and expertise intensive
- Only works to some degree
- Statistically flawed (most behaviour doesn't result in illness/injury)
- In many advanced management systems have moved beyond this perspective to focus on resilience.

2. Promoting the Behaviour that is consistent with our objectives

The presentation included information on three key elements associated with behaviour change:

- Motivation,
- Attitude formation and
- Social Learning.



3. Motivation:

The main 'fake' motivators are salary, company policy, supervision and working conditions (days of leave, working hours etc.).
Achievement, Recognition, The work itself, Responsibility and Advancement are true motivators that have been shown to provide long term positive effects in job performance.
Motivation can be considered from two angles, substantively on the basis of its content and mechanically according to the process.

4. Attitude Formation

Attitude formation is the idea that people have a perceived idea of what they should do and what they believe they will do. (Fitzsimons et al, 2007).
One way to describe attitude formation is an amalgamation of different approaches, mainly classical conditioning, operant conditioning and observational learning (inferring beliefs from own and others behaviour).

5. Social Learning

Necessary conditions for effective behavioural modelling (Bandura's social learning theory) include the following:

Attention – Retention – Reproduction - Motivation

- **Attention —** various factors increase or decrease the amount of attention paid. Includes distinctiveness, affective valence, prevalence, complexity, functional value. One's characteristics (e.g. sensory capacities, arousal level, perceptual set, past reinforcement) affect attention.
- **Retention —** remembering what you paid attention to. Includes symbolic coding, mental images, cognitive organization, symbolic rehearsal, motor rehearsal

- **Reproduction —** reproducing the image. Including physical capabilities, and self-observation of reproduction.
- **Motivation —** having a good reason to imitate. Includes motives such as past (i.e. traditional behaviourism), promised (imagined incentives) and vicarious (seeing and recalling the reinforced model)?

The presentation also examined 'fun theory' – the idea that we can significantly change behaviour by making activities fun. It was noted that exactly how this might be used, if at all, by a VTS was uncertain; however the example videos from funtheory.com provided a compelling case for giving this consideration.

Participants formed smaller sub-groups to consider if the following subject areas:

1. **What constitutes the VTSO being ready and fit for duty? And what do we do about those instances when they are not?** This question was adjusted to a more positive perspective: How do we promote the VTSO to be better prepared and for what they have to do?

Discussions concluded that policies and procedures have already been established in the QMS to provide guidance on organisational expectations to ensure the VTS authority meets its responsibilities and the individual has the physical and mental capabilities and competence required to be fit for duty. The use of a personal log/personnel file may also be appropriate.
Where there is a supervisor or manager present, they may be in a position to question whether the person will be able to fulfil the objectives of the VTS. As professional individuals, VTSOs should be aware of their responsibilities and are expected to be ready to commence duties as required.
In the recruitment process, consideration may also be given to personal attributes and ensuring the individual is suitable for the role. The discussion noted that psychometric testing can and is being used, however the results of such approaches are contested – some organisations support them strongly, others do not.
Participants noted that further guidance in the area of physical and wellbeing side of VTS may be appropriate.
It was recognised that in the scenario where a VTSO is not fit for duty, there will be different actions to be taken depending on the organisation and country. This may be due to the cultural differences and working conditions in the organisation.
Participants supported introducing procedures within an organisation along the lines of the diamond approach identified below, to correct situations and support and model positive behaviours in the workplace. Most organisations will have a formal process as identified in the lower part of the diamond, but may not have a formal process to reward or to remind/correct, coach or challenge.

2. How are, or should we capturing everyday work and managing other knowledge in the VTS?

Discussions concluded there should be:

- A high focus on refresher training
- Regular meetings held to consider case studies, debriefings post incidents and on the positive handling of near-incidents.
- Information collected and distributed around:
    - Non-conformities
    - New ideas and solutions
    - Challenges during the watch to ensure that information is transferred during handover from one person to the next without critical information being lost

It was also noted that when yearly performance review assessments are conducted there will be cultural and organisational differences to how this process is approached. Participants agreed that it was important to focus on the positive aspects and contribution of the role of the VTSO, role as opposed to only the poor performance / non-conformance related items.

3. Is there a career roadmap for a VTSO? Can you draw it?

General discussions recognised that there were significant differences between countries both culturally and nationally in terms of how VTS centres are structured and operate. For example, some VTS centres have a fairly flat structure where there are no supervisor positions and the VTS Manager would provide appropriate direction to the VTS operator as required. Whereas in other centres they have both VTS operators and supervisors present. It was noted that supervisor positions are often limited and vacancies can be rare.
Additionally, some organisations use the V103 structure to create a career path environment for a VTSO and actively promote VTS as a professional career.
Some VTS Authorities create levels within the V-103 structure (e.g., Junior / Senior) in order to provide more opportunities for progression.
Career progression can be vertical or horizontal within the VTS and / or VTS Authority. Other types of career progression may also be possible within the port management authority or lateral into other work environments.
Whether an individual is interested in progressing with career in VTS it will be largely a personal choice, as some operators will be satisfied to simply come to work to do their shift and others will want more responsibility to feel engaged and satisfied within their job. Individuals should be encouraged to take on additional tasks (e.g. OJT training, equipment experts, health and safety representatives etc.) within the VTS environment to assist with the cross-skilling of teams and allow others to become specialists in fields.

5.2.4 SESSION - Building, Changing and Maintaining Organisational and Safety Culture

General discussion on how organisations are addressing safety culture as a means to measure and monitor safety identified that most VTS authorities:

- have safety programs in place, albeit in varying forms
- collect of statistics on incidents/events
- examine potential hazards based on trends and identify areas to be addressed.

It was also noted that in some authorities VTSOs participate in the workplace and health and safety committees.
Key elements identified that should be considered regarding safety culture include:

- The personal dedication and accountability of all individuals engaged in any activity has a bearing on the safety culture

- Good practices in themselves, while an essential component of Safety Culture, are not sufficient if applied mechanically. There is a requirement to go beyond the strict implementation of good practices so that all duties important to safety are carried out correctly, with alertness, due thought and full knowledge, sound judgement and a proper sense of accountability.
- Culture can be described as "the way we do things round here". In simple terms, this is reflected in our values, our approach, our actions and the cultural boundaries
- Within organisations there are their own cultures, often which can be substantially vary between different areas in the one organisation.
- There are different types and a mix of safety cultures that may exist within organisation such as:
    - *'Just cultures'* encourage people to work safely and display clear lines between acceptable and unacceptable behaviour.
    - *'Reporting cultures'* encourage the flow of safety-related information.
    - *'Informed cultures'* contain people who have current knowledge about the factors and practices that determine the safety of the system.
    - *'Flexible cultures'* can break down organizational hierarchies in times of crisis or as required in response to risk, they are adaptable and respect the skill-set of the whole workforce.

The presentation identified cultural maturity as an important concept in safety culture – qualitative differences exist in the management of WHS and these correspond with different levels of cultural maturity.
The presentation identified the key elements of a just culture:

1. **Willing participation from all employees:** Everybody is on board with respect to the just culture activities within the organization.
2. **Clear delineation between acceptable and unacceptable behaviours:** A just culture must be transparent and all employees must know the parameters of acceptable and unacceptable behaviour. A just culture is underpinned by well-established safe-operating procedures.
3. **A strong reporting culture:** A just culture depends on strong hazard and near-miss reporting.
4. **Individual responsibility and organisational accountability:** A just culture is founded upon shared responsibility and trust.
5. **A clear framework for performance management:** A just culture is supported by clear policy and procedures with respect to incident investigation, decision-making and performance management.

A just culture also includes three types of justice:

- **Distributive justice**, which is the idea that individuals put in effort, ability and performance and expect to get an outcome deserving of their contribution.
- I**nteractive justice**, which refers to the perceived quality of interpersonal treatment employees receive when organisational procedures are implemented.
- **Procedural justice**, which is concerned with the fairness of the processes by which decisions are made.

Managing Change for Greater Operational Effectiveness

Regardless of what a VTS Authority is doing in order to meet the desire for continual improvement in the QMS or SMS, they are always engaged in a process of change management. The presentation identified one of the most popular models for managing change in organisations – Kotter's eight step program.

Safety Culture

Key elements to be considered when determining what is driving an organisation's safety culture includes:

1. Values and Leadership
    - Response to Work Pressures - Production v's Safety. For example, how we respond to work pressures from deadlines, demands, breakdowns and one-off jobs is crucial – in terms of how the risks are managed to get the job done.
    - Fairness, Justice & Responsibility – the key values around our interactions with each other and how we play our roles in the organisation
    - Supervisor & Worker Commitment to WHS. For example, a strong and positive safety culture is created through strong and positive leadership – not by chance or dictatorship.
2. WHS in Action
    - WHS Resourcing. For example, are there sufficient resources available to implement.
    - WHS Communication. For example, is the frequency, immediacy and quality of information communicated makes a difference to the positive tone or negativity of the workforce.
    - Risk Management. For example, are hazards at work appropriately managed and are issues followed up and corrective actions put in place.

General discussion on the definition of safety culture concluded there were many similar versions on the same theme. A couple of possibilities included:

Wikipedia	*Safety Culture refers to the ways that safety issues are addressed in a workplace. It often reflects the attitudes, beliefs, perceptions, (behaviours) and values that employees, share in relation to safety. In other words the way we do safety around here*. Note: Participants identified that the statement, while indirectly implied through attitude, missed behaviours from the statement. It was suggested that this should be included.
Evolution of safety culture in the IMO	Safety culture can be defined as a system of values shared by all the members of an organisation, by an underlying philosophy that serves and reflects its core mission, its reason to be.

Note that rewards and recognition systems needs to be used carefully as otherwise it may be misused. Members of the group identified instances where they had found both positive and negative outcomes from using these approaches within a QMS or SMS.
Participants formed smaller sub-groups to consider if the following subject areas:

1. Management of Change

Whether you're considering a small change to one or two processes, or a system wide change to an organisation, it's common to feel uneasy and intimidated by the scale of the challenge. You know that the change needs to happen, but you don't really know how to go about delivering it. Where do you start? Whom do you involve? How do you see it through to the end? There are many theories about how to "do" change. We look at his eight steps for leading change below.

- Establish a sense of urgency
- Forma a powerful coalition
- Create a vision
- Communicate the vision
- Empower others
- Plan for and create short-term wins and goals
- Consolidate improvements
- Institutionalise changes

2. Development of safety culture

- Training in all types of courses
- SOPs
- Establish a safety team
- Auditing (safety culture is a part of auditing process)
- Human Centred Design (HCD) in the development of new VTS equipment
- Recruitment – highlight the importance of Safety Culture in our organisation
- Marketing/promoting/communication Safety Culture

3. Relationship between safety culture and Safety Management Systems (SMS)

Safety management implies a systematic approach to managing safety, including the necessary organisational structure, accountabilities, policies and procedures. The objective of safety management is to prevent human injury or loss of life, and to avoid damage to the environment and to property. An SMS cannot be effective without an appropriate Safety Culture.
A properly implemented SMS operates in a complementary and interdependent way with the Safety Culture to create a safer organisation. The SMS must be actively improved and realised.
A SMS represents an organisation's competence in the area of safety, and it is important to have an SMS and competent safety staff to execute it. Safety Culture can be summarised as the degree of commitment to safety evident throughout the organisation. This includes a commitment to use the SMS as intended.
The following list shows tips to improve SMS through principles inherent to Safety Culture:

- Consider the SMS as a 'living system' that should reflect best practice matched against the particular needs of VTS.
- Review the content of the SMS regularly, drawing on new ideas and current best practice in order to ensure a continuous development of the system.
- Strengthen the SMS using internal feedback from the primary sources of safety data within your organisation.
- Conduct a gap analysis to identify areas where the SMS could be improved. These often surround issues like incident reporting, stress and fatigue management and competence in safety science.
- Make sure there is a clear focus on risks associated with human factors.

4. Responsibility for Safety Culture

The Competent Authority should be responsible for raising awareness, identifying both benefits and expected results of a safety culture within the VTS Authority.
The Competent Authority should also develop requirements regarding the establishment of:

- a safety policy including safety cultural aspects
- a Safety Management System including needed tools such as audits
- a systematic way for validation of safety performance of the organisation
- an ongoing process for improvements after validation.

The VTS Authority should be responsible for developing and implementing:

- a safety policy
- a Safety Management System including tools
- a safety awareness in the organisation, such as rules and procedures; and dedicated safety activities
- a systematic way for continuously improving measuring safety performance of the organisation including safety culture aspects.

The VTS Authority should ensure that VTS Centres are fulfilling the requirements in a consistent way.
VTS Manager/VTS Supervisor should be responsible for:

- ensuring and fulfilling the requirements from the VTS Authority
- establishing a high safety awareness among the VTS Personnel
- ensuring regularly evaluation and assessment of safety culture
- implementation of measures in order to keep and increase safety awareness in the VTS organisation
- promoting a just culture

VTS Operator should be responsible for

- following the requirements, rules and procedures
- contributing to the continuous improvement of the safety culture through their attitudes, perceptions, beliefs, values and behaviour.

5. Measuring safety culture

The following matrix was developed with regards to possibilities for measuring safety culture

What	How	Comments
Following the set procedures	Audit, interviews and observations	
Working environment and safety awareness aspects	Questionnaire (typically safety climate survey)	
Accident and near misses	By counting passages and incidents/near misses occurred	
Risks	Perform risk analysis and identify hot spots and cold spots	Important to evaluate and implement measures to mitigate the risks identified.
Number of sick leave days for VTSOs and other VTS Personnel	Counting sick leave days and evaluate them.	
Number of safety activities	Counting and evaluating	E.g. lessons learned seminars and emergency preparedness exercises

6. Benefits of a safety culture?

Internal to the VTS centre:

- For employees to stay healthy and promote overall a greater wellbeing
- Act as a driver for effectiveness
- Contributes to a more professional behaviour
- Build better interpersonal relationships
- Facilitates greater communication and awareness towards safety
- Can result in greater efficiency
- Potential to lower stress level on individuals resulting in better quality of life for their families
- Improve workplace atmosphere and work culture.
- Positive influence on the working procedures
- Helps build good morale
- Helps prevent adverse outcomes

External to the VTS centre:

- Influence on stakeholders through promoting safety culture into the wider community
- Improved reputation of organisation in the wider community
- Protection of the environment and contributing to the safely of lives
- Instrument to assist in the public relations (e.g. safest port in the world)
- Promote a greater public image
- Helps prevent adverse outcomes

7. Other factors that could be considered with safety culture:

- Cultural differences will need to be addressed and the affect it has on safety culture.
- That linkages with other existing IALA recommendations and guidelines will need to be identified
- Ensure the feedback loop on safety issues is closed out
- Consistency with training (e.g. IALA V103 model courses, BRM)

- Recognise the importance to strike the correct balance to ensure that safety culture promoted in a manner that it is not overbearing and can be practically adopted into the work environment
- Safety Culture in VTS will lead to Active Monitoring. Active Monitoring will prevent accidents and prevention of accidents will lead to saving in property damage cost for port operator and stakeholders.

5.2.5 SESSION – Accident and Incident investigation

The underlying reason to why do we investigate accidents and incidents is often because we have a responsibility to by one or more legal instruments. Investigating accidents assists us to identify the immediate and underlying causes and improve the health and safety management system to prevent a reoccurrence. It may also provide an indication the control of hazards has not been effective.
It was noted that the IMO have established a Code for the International Standards and Recommended Practices for a Safety Investigation into a Marine Casualty or Marine Incident (Casualty Investigation Code), which incorporates and builds on the best practices in marine casualty and marine accident investigation established by IMO resolution A.849(20) in 1997.
IALA is producing guidance material on establishing investigation processes for VTS accidents / incidents (work item 1.1.3) and this may include the potential tools and methods available for investigations. It was recognised that there should be a clear distinction between internal and external investigations.
Participants formed smaller sub-groups to consider if the following subject areas:

1. What level of investigation is appropriate?

It should be noted that any internal investigation shouldn't interfere or disturb with an official investigation as regards marine casualty investigation according to national legislation.
If an accident or incident has happened in the VTS area, or within the vicinity of, the VTS Authority should consider initiating an internal investigation or evaluation. The consideration of further investigation or evaluation should be based on objective criteria or subject of interest. The object of criteria should be defined in order to support a systematic approach.
Examples of working processes are:

- Reports of deviations (need for reporting system)
- Regularly statistical evaluations
    - Find trends
    - Define events needed for further investigation

2. Who should investigate? What are the requirements to be an investigator?

The VTS Authority should consider who should investigate / evaluate the reported incident or near miss. The person or team in question should have good knowledge about the internal procedures and routines for the SMS or QMS, but should not be directly involved in the operational activities for the case in question. The VTS Authority may consider using an external investigator when deemed necessary to ensure impartiality.

With regards to evaluating trends for a series of reported events (accidents / incidents), the evaluator may have other relevant qualifications but knowledge of the VTS activities and procedures should always be considered.
Composition of investigation team:

- Members should have suitable competences which may include several disciplines (e.g. human factors, VTS experience, management)
- Additional external expertise may be included as deemed necessary

3. What are the steps in the investigation process?

Based on the IMO Code for the International Standards and Recommended Practices for a Safety Investigation into a Marine Casualty or Marine Incident, the following steps should be considered

when conducting an investigation. Depending on the accident/incident, not all steps may be relevant,

1. Initiating investigations
    - What triggers an investigation?
    - Information about an occurrence of an accident / incident.
2. Notification to parties involved and commencement of an investigation
3. Coordinating an investigation
    - Designation
    - Development of strategy
    - Ensuring the methodology
    - Take into account SMS/ QMS
4. Gathering and Preserving data (evidence)
    - Flow chart- given example
    - Collect data that is related to the accident
    - 'Be aware of confidential information'. The data should be available
    - Store and secure the data
5. Protection of the witness and involved parties* (National legislation)
    - If a person is required by law to provide evidence that may incriminate them, for the purposes of a marine safety investigation, the evidence should, so far as national laws allow, be prevented from admission into evidence in civil or criminal proceedings against the individual
6. Analysing data
    - Check for similar cases (conclusions and recommendations)
    - Whether additional data is needed
    - Need for external experts
    - Need for another type of investigation
    - Or another needs….
7. Identifying other contributing factors
    - Example: causes, root causes and contributing factors.
8. Draft report including conclusion and recommendations
9. Release of draft report for comment - Commenting Phase
    - Where it is requested, and where practicable, the marine safety investigating State(s) should send a copy of a draft marine safety investigation report for comment to interested parties. [MSC-MEPC 3/Circ 2 13 June 2008]
    - Consider comments
10. Final report
11. Publication of the report
12. Re-opening an investigation

4. What advice can we provide about choosing an accident investigation tool?

When choosing an accident investigation tool:

- Don`t focus on the responsibility (no blame)
- Be aware of benefits and limitations of various tools [Pros and cons]
- Be aware of the competence in Organisation. Irrespective of which investigation tools are used, there should be at least one person who has a good knowledge of the tool.

Some examples of accident investigation tools are (not a comprehensive list):

- Interviews
- checklists
- forms
- techniques
- simulator
- models (e.g. swiss cheese, bow-tie etc.)
- methods

5. What principles of accident causation / contribution are fundamental to a good accident investigation?

Key elements to be considered when conducting an investigation:

- Determine the level of accident (e.g. minor or major incident) based on IMO Resolution A.849(20) - Code for the investigation of marine casualties and incidents
- Define the scope and goal of the investigation process
- Identify the relevant personnel to be involved in the investigation
- When gathering evidence it is essential to consider multiple information sources such as records / procedures from the VTS centre and other external sources
- Compare the accident situations with normal operations
- Use a relevant investigation tool / model for situation

It was recognised that it is important to examine all the factors surrounding the incident

6. What advice should we provide about the results of the investigation?

The investigation outcomes should take into account:

- When considering the lessons identified it is important to highlight both the positive and negative aspects of the incidents
- Produce an action plan highlighting areas of concern
- Review existing systems (e.g. technology, training, equipment, procedures, QMS / SMS)
- Develop mechanisms to ensure to that corrective action measures are adopted to resolve issues identified in the action plan
- Ensure the outcomes are appropriately promulgated to all interested parties
- Consider conducting a gap analysis and / or risk assessments
- Periodically review new or amended processes / risk assessment post the incident investigation
- Share investigation reports and results with others

5.2.6 Conclusions

- The working group recommends IALA produce guidance on accident investigation covering the aspects mentioned in paragraph 5.2.7 of the WG report. This guidance may be incorporated in the ongoing work associated with Task 1.1.3 or in a stand-alone document.
- The working group recommends that the VTS Committee should initiate work on raising awareness about safety culture and identifying the benefits and expected outcomes thereof. This may be achieved by means of incorporating this work into existing IALA documentation, IALA recommendation V103, or development of new recommendations/guidance.
- The working group requests that IALA VTS Committee consider arranging a separate workshop or seminar on operational effectiveness and staffing levels in VTSs to cover the points not covered during this workshop as outlined in section 5.2.3.
- The working group recommends that V-119 is revised in conjunction with the development of guidance on Measures to Evaluate the Effectiveness of a VTS to include positive performance indicators and outcome indicators

Appendix 1 – Categorisation of the changing nature of the VTS work environment

Common themes identified were:

Themes	Observation comments from participants
Recruitment, Training and Quality of VTSO competencies	- No maritime background. How can I fill the gap in training - We focus on procedures but VTSOs should not be discouraged to think - New type of VTSOs (non-master mariners) might replace the old ones - The knowledge of new equipment among elder VTSOs - Growing average age in western world in VTS and maritime environment - Succession plan on human replacement of the older staff as a result of retirement, transfers etc. - Limited personnel to do the job - Not many young seafarers choosing this as a career. Problem of aged employees. - Manning situations (e.g. number if operators, competencies) - Extension of competencies for VTSOs or VTS personnel reflects organisational levels and training experts - Higher expectations on operators (e.g. more tasks, more complex traffic situations) - Older VTS operators - Focus on training fundamentals of navigation - Growing cultural differences in maritime industry - Different levels of English
Administration, Policy and Procedures	- More administration - The growing demand of documentation from VTS will place extra workload on the VTSOs - Quality Management - Shift away from paper based SOPs to electronic versions, especially with younger generations - Extra tasks like administration - Many different types of services under the same label as “VTS” - Greater reporting of information to management at all levels (e.g. incidents, statistics, day-today matters) - Burden with more office administration work
Standard Operating Procedures	- Bad handovers, for example missing information - Harmonisation of SOPs - VHF language not simplified. VTSOs not following SMCP or procedures in VHF radio - More standardised communication

Themes	Observation comments from participants
Situational Awareness	- A lot of tasks at the same time cause fatigue - More tasks to accomplish (e.g. monitoring, SAR) - The varying workload at one centre (e.g. low / highs) – impact on situational awareness - More communication because of more admin - Demands from outside stakeholders (e.g. tax, environment) removing the focus from “real work” - Value the information - Shore based navigational assistance / guidance may replace or combine VTS and pilots
Distractions	- Focus on own phone, computer etc.
Technology/ System / Equipment related	- Focus on technical development strategies - The amount of available information in the decision support systems is increasing - Working environment is improved – circardiums, daylight, screens, noise etc. - Growing use of sensor data and integration of that - Growing automation in information exchange between vessels and VTS - Growing differences between vessels ability to handle automatic data exchange. Ship to VTS and ship to ship, AIS, DSC. Integrated Navigation systems. - Sophistication of technology - Rationalisation of equipment (e.g. smaller more compact hardware, use of virtual servers, larger monitors etc.) - More screens to monitor specifically CCTVs (asking - I see differences worldwide in technology between highly developed countries to poorer countries and the cultural effects that this has. - I see changes in the way to communicate within the cloud, digital environment - Equipment should be more user friendly - Development in system and how things can be done - Quality of service - Faster reaction times needed - Changes in the level of automation and decision support tools - Rapidly development and changing of technologies and instruments - Growing amount of accessible data and information to be analysed - Looking up ships on websites - Old designs not supporting the higher demands (e.g. complexity / noisy) - The availability of more and larger data screens - Automation of information collected
Working Environment	- The room at the VTS is often small when changing systems, equipment etc.

Themes	Observation comments from participants
Organisational issues/Centralisation issues	- Centralisation of VTS centres - VTS stations with one VTSO. Is this outdated? - VTS becoming an interesting partner for other stakeholders in the maritime domain - Unmanned / autonomous vessels
Limited resources	- In general overall – limited resources to conduct VTS operations
Waterspace Management	- Decreasing navigational space - Environmental considerations - Increasing volume and diversity of traffic in a decreasing manoeuvrability area - Spatial planning of waterspace will lead to a limitation of possible navigable waters
Performance at work (e.g. Fatigue, stress, workload)	- Multi-cultural groups. Diversity is here to stay - Stress and fatigue which needs management attention - Demotivation – same job every day - Very long shifts where VTSO's need to monitor technical systems
Attitudes at the VTS centre	- Disturbances of using private phones and watching TV programmes at evenings - Less formal working attitude with centre - The absolute trust in data - I see the next generation of employees (e.g. young, experts in multi-tasking, risk of boredom, social experts) - Fatigue. How many hours rest in relation to total number of hours worked

5.3 Notes from WG3: Working Environment

Rapporteur: Nathan Rowsell

5.3.1 Introduction

The group consisted of 11 participants; 3 industry representatives, 1 pilot, 1 academic and 6 VTSO/managers. The format of the workshop was open-ended – introductory presentations from the chair at the beginning of each day, discussions using the questions as a guide and sharing of photos and drawings by participants.

5.3.2 Outcomes

The outcomes consist of a number of lists and tables, with details on VTSO job content and needs for fulfilling their tasks.

5.3.2.1 What does a VTSO do? Primary tasks, Core Functions

Function, task	Tool	comments
Radar/Safety	Radar, overlays	
AIS		
Comms (with whom, see below)	Email, Phone, VHF, Online	
DMA info		
Planning		Type of traffic / operational plan and ongoing plan, 12hr Plan and short term plan.
Admin		
Information		
Traffic Organisation		
Nav assistance		
Investigations / Reports / Information		
ISPS		
Contact Ships agent		
Clear AIS messages and Class B from Screen.		Blocks out operator's picture – Signalis is French and will not do it automatically! Class B-AIS and alarms will activate when small vessels leave the fairway
Safesea net / Manually input information		Safeseanet or seaweb – different data bases
Other tasks in VTS / Guidance on regulations (e.g. Australia)		
Communications with outside agencies. Information flow on going both to and from VTS		

5.3.2.2 What do we need to see, reach and hear? Basic information as a guide to design of workstation

See	Reach	Hear
Routes – Radar / AIS	Sound volume	Manoeuvring / Nav info
Vessels – (presentation, category)	Radio / handsets / comms and telephone (landline) em.mobile	Nationality
Charts – Depths, Route, Cables, Airdraft, Layers, Updates, AIS, ATON	Controls (Multiple)	Level of alertness
Weather / Metop – Wave height, currents, wind, sea state, visibility – Actual / predicted, Ice	Keyboard shortcuts	Confidence/Reliable Indecisions
Situation prediction / Now (Traffic Organisation)	Chair / table – adjustable	Vhf channel use
Prediction / now	Reading distance	Intended route / Passage plan
Replay (time limited) retrieve "clip" (very clear representation)	Adjust lighting	Alarms
Data Base	Paper / Books	Internal communications
Transmitting Ship	Coffee	Replay
CCTV	Bag	Weather
DF	Power outlets	
Trends		
Same Picture as other actors		
Database MIS		
Transit??		
Radio		

5.3.3 Design feedback from presentations

Southampton VTS was invited to share their new redesigned working space for discussion and evaluation by the group. ABP talked the group through Southampton VTS's proposed new operations room. The design was sketched on the white board for open discussion. It was noted a separation (a trainee's desk) between the two operators would reduce disturbance due to noise. One observation was that it was very much set up like a bridge of a vessel, and it was also noted there was a great deal of daylight. ABP showed the group a Power Point presentation of the current layout. The group discussed the layout of the operations room. Some key words were listed;

- Connect to task/Job role
- Watch Manager position
- Bridge layout?
- Windows
- Flooring
- Sound/Noise
- Heating and fresh air
- Communication internal
- Joint activity
- Visitors

The watch manager

Group chair suggested the design has picked up the bridge resource management design. The Watch manager has the overview of the watch. The group discussed in depth the layout of

Southampton's layout. The question was asked on what the watch manager was looking for? The place of the WM has been given to correspond with the overall view of the ops room and view in general. It was asked why you need a Watch Manager. ABP described how they operate in Southampton. This opened a good discussion within the group. A great deal of explanation was required so the rest of the group understood how it worked. It is very different from VTS sectors. A representative from Amsterdam described the differences very well. Personnel in Amsterdam were on different rooms/floors which did not work. It was better to have all staff in the same operations room (VTSOs, pilots, canal, locks, admin and port staff, even a wish to include a tug person but that did not work due to commercial considerations).

Visitors

Discussion was made about persons visiting the Ops room and possible disruption to the day to day running of the room. A steady flow of visitors was common during the day which keeps the information flow coming. Distractions were raised as a real issue and discussed at length. The chair asked how this issue is solved. A viewing window was suggested but was thought it would be like working in a fish tank. It was thought that even with this, visitors would still want to come into the operations room. It was suggested that you should have a designated person to assist with visitors to ensure the pressure is taken away from the operation room staff. Should space for visitors be taken into consideration when designing the layout of a new operations room?

Desks and screens

The chair invited Todd from Kongsberg to present several slides of various VTS operations room. The slides included current and future operations room design. Furthermore the use of advanced technology including large touch screens etc.

Todd continued to show the process of designing desks for Singapore VTS starting from scratch with sketches through to the final product. It was apparent there were many cultural topics to take into consideration. Within Singapore VTS there were many female operators who wanted a place to put a bag or personal items. Again it was apparent the cost was a big consideration. Desks and equipment need to last for 15 years so should be robustly built albeit at a cost.

Todd then continued to talk about many operations centres have desks surrounded with screens? Is it necessary? Desks now move so an operator can stand. Eric Wagner commented that there is a great discussion on large screen displays. The question is who uses these displays? Rarely the operations room staff but high grade visitors to the centre. 56 inch displays have been installed in Singapore, however it is questioned whether they are suitable for the job required. In addition to this these screens are extremely heavy and cost around 30K.

Paperless

The group was then shown some slides of an operations room in Vardo, Northern Norway. This ops room is older than Singapore. Todd said they used their large display screen however, could not confirm how much the operators used it. A suggestion from the group said the desk seen at a Norwegian ops centre seemed rather cluttered. There was not much room for a log book. The Norwegian attendee then explained they were going through a process to upgrade their operations room. It is anticipated the new room will be paperless.

Amsterdam then showed the group a slide of their new operations room which the group found to be excellent and fairly modern.

It was asked why most operations centres have their screens east west, north south or on their side. Alex from Frequentis showed the group a picture of the Danish Coastguard ops room containing 4 different charts and 6 screens.

Goteborg VTS also shared their re design progress. They have four different operations room including their computer hardware. Finland VTS was discussed, their equipment and their sectors by Eric Wagner. The group also discussed how to best use of the space.

Headsets or not?

Chic (ABP) made an observation that there was no headsets for the operators. A VTSO from Norway explained that they preferred to have speakers so the operators could hear each other. The majority of the group agreed it was good. However, head phones were available for operators. It very much depends on each different ops room preferences and approach.

Physical environment

The physical environment was discussed at length. A/C, heat, light fixtures and fittings, power supplies, network supplies. PC monitors and VDU's were then discussed. The number of screens was questioned as to whether you need a great number of screens? Software integration was questioned. ABP said that the current system was limited but the new system would be fully integrated with each other.

Fu from Korea showed his geographic VTS stations. They have 16 different stations. There are different VTS types. Coastal VTS and Port VTS. Busan VTS was explained. There are 3 sectors. Fu took the group through the picture slides of Busan VTS. Each sector has their own station within the operations room. The VTS team would fill out a form which is time based containing the communications from each vessel. They also have their own Port information data base. Each sector has its own designated are divided by small walls. The sectors consist of one operator in each sector. They also have a project team within the operations room developing certain aspects of the port area which include environment etc. The group noted a fan under each of the work stations. This supports comments for discussion earlier. There is A/C in the room but operators still wish to use fans.

Kongsberg explained about HARTS (Class B) one operator looking on class A and another looking at Class B? The chair and group suggested this not a good idea?

Do you need to have a window on the VTS?

Danish VTSO support the operator's wellbeing by claiming the VTS station should have a view of the sea and the area they are working. In support of this an Amsterdam pilot and ABP say the VTS station should have a view of the sea. The operators will have a better "feeling" of the weather conditions. A good example from Amsterdam is on simulator sessions the one thing bridge teams miss is when the wind etc. changes even though they all have meters and gauges in front of them. The chair and the group said situational awareness will also be affected. Safety of the VTS sector will also be affected. A Swedish representative stressed that a good view of a VTS area is so important to ensure safety of the VTS sector / Port. The whole group agreed.

Design for task

We were then shown a booklet for small ships that do not regularly go to dry dock. It is called how to do the right thing! The booklet contained information on the correct posture, the heads position so as not to strain a person's neck. Frequency of use should be considered too. There are design guidelines available for the process of standing and seated work. (make a version for VTS?)

A Norwegian VTSO said it is quite difficult to come up with a way forward on a recommendation or mandatory code as each country/ports/Sector is working differently. There are many different expectations by vessel and crews. Considering customer expectations are very much connected to the service provided within a VTS. The chair suggested and it was agreed that when you are creating a VTS you need to be clear on what services you are providing. Don't build it just for its own sake! You need to be cautious of a National and international standard. Some ports and countries may not have the finance to become a VTS. How do you come up with a minimum requirement? NAS for example; what equipment should the VTS have and who in VTS should be responsible for issuing NAS or remote Pilotage. A pilot explained what tools they had to provide remote Pilotage. The say it's not about the technology at the moment it is the person communicating with the person on the bridge of vessel. Explaining face to face is much easier than using VHF. The chair asked the group; would a VTSO be comfortable to do this? ABP said some would some would not depending on their experience. Amsterdam do give shore based Pilotage, up to four ships at one time. The operator has to be sharp. Prefer 1 or 2.

A Norwegian VTSO described an Air Traffic Control project to reduce ATC for the airports from 34 stations to 1. There is a big project that has started which will be very interesting as to how they will do it. He showed the group a slide he had on his PC. The worry is if one centre is down then it will be 34 centres down. So there is no redundancy available or do they leave them up just in case!

5.3.4 The Future and connected development needs

- Big data is coming; can we get better patterns / trends / predictions?
- Information can be automated / Smart / contextual / filter / integrated.
- Communications: Keep the essential, and informative communication / can judge unreliable operators by voice.
- Shipping safety INS / TOS / NAS – take into account.
- Sectors and Job Division – interaction.
- Security – anomaly detection, will it affect?
- Automation-lose capability-expecting too much from people.
- Job design for wellbeing / Engage the operator / Keep them in the loop.
- Focus / reminders / Alarms. Keep operator informed, remind them, but not overloaded.
- Data integrity – important.
- Physical modularity / flexible to enable additions without new design or hardware configuration / open source.
- One request for the functionality of showing on VTS display which ship is transmitting on the VHF.
- It was said that 3d was going to be introduced in time.
- Future innovations can be inspiring but be careful about giving it jobs that people should be doing. Google glasses are still available to the commercial sector not public. Kongsberg are wary of these.
- Danish VTSOs asked if a reporting system could be designed and built to allow the VTS centre to know what they have achieved, stopped dangerous situations. Avoidance manoeuvres. The Kongsberg representative said it is not out of the question but would take some designing and could well be produced. Another question was whether efficiency could be measured. Kongsberg is working on a project that is looking at fuel efficiency. This could be related to VTS.
- E Navigation is to become part of VTS so this could be implemented in the future. Consider MSP.
- The group discussed AIS messages and whether they were a good reliable tool to have. A pilot explained after his return to sea; in his experience AIS text messaging is being used to the limit of its capability. The system itself is a continual stream of messages with most of the useful or important messages lost and only read after the event or when time has passed. Some ships officers and crews would only check AIS messages once or twice in a 12 hour period. Taking the officer or Master away from core duties perhaps? He touched on the same thinking for Navtex and continued to say “Navtex does is keep the paper industry in Finland in business!” Others in the group had the same opinion about AIS messaging. If AIS was to continue to be a tool that was more and more used then an effective way of filtering or identifying by some prefixed code on sending and receiving equipment. AIS systems can be subject to hacking by persons around the world!

5.3.5 Conclusions

- Cannot ask a VTSO to design a workplace alone, it will look like before with small adaptions. No innovation, no leaps. Need a multi-disciplinary group to support updates, new or re-design. Need leader / translator (HF) in team, and follow-up and feedback.
- Guidelines not user-friendly 11064:
    - Good information;
    - Structure – design?
    - Procurement phase to be included;

    - Design process needs to be included;
    - Implementation.
- Communication is an important part of VTSO work:
    - Broadcasting;
    - Making the same mental image.
- We cannot make only one solution? But suggest to start standardising the following:
    - Symbols;
    - Terminology;
    - Representation.
- See the same image across the socio-technical system is important.
- Content of screens / How many / size / location / orientation.

5.3.5.1 Perspectives on an IALA guideline

- Generic, applicable? There is no universal solution for standardising VTS internationally
    - Area of responsibility
    - Level of service
    - Scope of service
- Kongsberg added there is a guideline for symbolic representation for VTS. However, this is no assistance on what the symbol should look like.
- Include customer focus.
- What is VTS there to do?
- Can we have VTS levels
    - “MSP service levels”
    - basic, premium…
- Who approves?
    - What if you do not fulfil?

5.3.6 Appendix 1

Day 1 - Introductions

1. Existing standards
    a. Can we use SOLAS V15?
2. What is a VTS?
    a. How much can/should we standardise?
    b. How do we link to VTS objectives?
    c. What will the future hold?
3. What does a VTSO do during a day
    a. Normal and less frequent jobs?
    b. How do they communicate and record information?
    c. What do they need to see?
    d. What do they need to reach?
    e. Have access to?
4. Who else works there physically?
    a. How is cooperation, coordination performed?
    b. What is communicated?
    c. How often?
5. Who are they communicating with
    a. Operationally
    b. Administratively
    c. Others?
6. Separation of tasks into areas?
    a. Special needs?
    b. How many in the workspace?
    c. Who else needs to be there?
    d. Meetings, breaks, training – flexible spaces?
7. Design of layout of room/space, furnishings
    a. How build for adaptation and change, updates – also software
    b. Task centred
    c. Effect on performance
    d. Effect on emotion
    e. Effect on health and wellbeing – ergonomics & physical
8. Automation & displays
    a. How much can you influence the software tools, content and display, interaction
    b. Division of work
    c. Effect on performance
    d. Effect on “main task”
    e. Alarms and management
9. Location
    a. Environment
    b. Security
    c. Area of responsibility

5.3.7 Annex 2 Methods

QUISS – Quality in use scoring scale

The quality in use scoring scale used here is made by Brian Sherwood Jones, Process Contracting Limited, v1.0 17 March 2008. It can be freely used under a creative commons licence. Effective, Safe, Efficient, Satisfying. All using scales from 0-5. They are available on the internet

Effective

0	Useless	No useful functionality at all. Might as well not have it.
1	Inadequate performance	It provides very little help with performing a task. Even if you use all the features, you still get a very poor result.
2	Does the job	You can achieve adequate performance but nothing more than that.
3	Functional	You can get a good outcome. It enables you to perform your tasks.
4	High performance	You can achieve your goals completely. You get very good outcomes under all circumstances.
5	Transforms the task	You get outstanding results and can achieve exceptional performance. Even a regular user will award this score very rarely.

Efficient

0	Impossible	It takes so much time and effort that it prevents you from doing the task. Dysfunctional, and prevents you achieving any outcome.
1	Tedious	So long-winded that you can hardly get the task done. You waste a lot of time and effort with it.
2	Workmanlike	You can perform the tasks without hindrance but it does not provide any real assistance.
3	Helpful	It is efficient, and tuned to your needs.
4	Slick	It really helps you achieve your goal with no effort at all.
5	Almost psychic	Anticipates what you want to do next. Even a regular user will award this score very rarely.

Safe

0	Dangerous	It puts people in harm's way, or provides no protection whatsoever .
1	Risky	Using it puts you or someone else at risk, and it can only be used with considerable care.
2	Neutral	It has no impact on safety or security.
3	Dependable	It provides good protection and you would feel safe if you used it again.
4	Trusted	It provides very good protection against all threats.
5	A real protector	It provides completely assured protection. Even a regular user will award this score very rarely.

Satisfying

0	Horrible	You refuse to use it unless it is absolutely necessary.
1	Unpleasant	Unpleasant to use, and is only used with considerable resentment. A pain in the neck.
2	Bland	Using it is just something you do when necessary.. You are not involved or interested.
3	User friendly	You are happy to use it and you use it out of choice.
4	Joy to use	You get a kick out of using it. Using it provides real enjoyment.
5	A miracle of rare delight	Possibly the most enjoyable system you are ever likely to find. Even a regular user will award this score very rarely.

6 SESSION 6 – CONCLUSIONS WORKING GROUPS

The session was chaired by **Neil Trainor**.

The three working groups gave a presentation of the work done, the method used during the week and the results of the discussions as described in the previous chapter.

7 SESSION 7 – CLOSING OF THE WORKSHOP

The session was chaired by **Tuncay Çehreli**.

7.1 Conclusions of the workshop

Neil Trainor explained how the conclusions had been derived. He then walked the participants through the draft conclusions and recommendations, which were presented.

1 The application of the concept of human reliability needs to be carefully considered with regards to VTS.

2 Competent / VTS Authority should develop policy on Human Factors, Performance and Capability.

3 Human Factors should be referenced, where appropriate, within IALA documents related to VTS.

4 There is a need for guidance on accident investigation regarding VTS. This should cover the aspects mentioned in paragraph 5.2.7 of the WG report. This guidance may be incorporated in the ongoing work associated with Task 1.1.3 or in a stand-alone document.

5 There is a need for guidance on raising awareness about safety culture and identifying the benefits and expected outcomes thereof. This may be achieved by means of incorporating this work into existing IALA documentation, IALA Recommendation V-103 (on Standards for Training and Certification of VTS Personnel), or development of new Recommendations / Guidelines. Expert assistance may need required.

6 That IALA consider organizing a workshop / seminar on operational effectiveness and staffing levels in VTSs to cover the points not covered during this workshop as outlined in section 5.2.3.

7 That IALA consider revising V-119 (on the Implementation of Vessel Traffic Services) in conjunction with the development of guidance on Measures to Evaluate the Effectiveness of a VTS to include positive performance indicators and outcome indicators.

8 That a human centred design approach be reflected in the development, update and evaluation of VTS.

9 Voice communication is a critical component of VTSO work.

10 There is a need for standardisation with respect to portrayal, symbology and terminology.

11 There is a need for generic and common information to support joint activity with allied services.

7.2 Closure and thanks from IALA

Captain **Tuncay Çehreli** concluded that 47 people from 18 different countries participated the workshop with many subjects, many ideas and many other practical issues.
This workshop has reached its expected and desired goals with very useful conclusions.

He then thanked in particular:

- The Chairs of the three Working Groups for leading their groups and stimulating the discussions.
- The speakers for the good and informative presentations.
- The IALA Steering Group for the organisational aspects.
- And last but not least Kevin Gregory, Lilian Biber-Klever, and Anders Brödje for the organisation and to make the workshop a success.

Special thanks for Chalmers University of Technology as host of the workshop.

He thanked everyone for attending and working so hard and productively, adding that the results from the workshop would be reflected in the 2014 – 2018 Work Programme of the IALA VTS Committee.

He wished everyone a safe journey home.

There being no further business, the Chairman then declared the workshop closed.

8 SOCIAL PROGRAMME

On Monday 12 October there was welcome reception at Chalmers University of Technology.

On Wednesday 14 October there was a workshop dinner on board of the historic steamer “Nya Skärgården”, kindly sponsored by Transas and SMA.

All morning coffee breaks were sponsored by Frequentis.

All afternoon coffees were sponsored by Kongsberg Norcontrol.

9 ACKNOWLEDGEMENTS

Thanks are due to Chalmers University of Technology and their staff, for the significant part played in organizing and hosting the workshop.

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ANNEX B WORKING GROUP PARTICIPANTS

Working Group 1

	Name	Organisation / Country
1	(Chair) Capt Serdar KUM	Istanbul Technical University / Turkey
2	(Rapporteur) Captain Poul Vibsig PEDERSEN	SIMAC / Denmark
3	Capt. Jose RODRIGUEZ CORDON	SASEMAR / Spain
4	Ibrahim BIN HRAIZ	Abu Dhabi Ports / UAE
5	Izzammudin IBRAHIM	Malaysia Marine Department / Malaysia
6	Tom van BEVEREN	Agency for Maritime Services & Coast / Belgium
7	Cees STEDEHOUDER	MARIN / Netherlands
8	Tom DEHMEL	Wismar University / Germany
9	Lt. Paolo RENZI	Italian Coast Guard / Italy

Working Group 2

	Name	Organisation / Country
1	(Chair) Dr Ben BROOKS	Australia Maritime College / Australia
2	(Rapporteur) Kerrie ABERCROMBIE	Australian Maritime Safety Authority / Australia
3	Malin DREIJER	Norwegian Coastal Administration / Norway
4	Marco SVANTESSON	Swedish Maritime Administration / Sweden
5	Niels Jacob MYGIND	Danish Defence Command / Denmark
6	Lt Michele LANDI	Italian Coast Guard / Italy
7	Naif AL MAHADHOUR	Royal Navy of Oman / Oman
8	Mohammed AL MAMARI	Royal Navy of Oman / Oman
9	Dr Fulko van WESTRENEN	UMANTEC / Netherlands
10	Liane HAEFFLER	HRG / Sweden
11	Wendie UITTERHOEVE	MARIN / Netherlands
12	Monica SUNDKLEV	Swedish Transport Agency / Sweden
13	Stefaan PRIEM	Flemish VTS, Shipping Assistance Division / Belgium
14	Dr.Gesa PRAETORIUS	World Maritime University / Sweden
15	Hairizam ALBUKHARI	Malaysia Marine Department / Malaysia
16	Mika HALTTUNEN	Finnish Transport Agency / Finland
17	Wim VAN'T PADJE	STC B.V. / Netherlands

	Name	Organisation / Country
18	Capt Christopher BOSTOCK	Harwich Haven Authority / UK
19	Capt. Ankit A. VAISHNAV	M/S Aatash Norcontrol Ltd. / India
20	Pieter PAAP	Ministry of Infrastructure & Environment / Netherlands

Working Group 3

	Name	Organisation / Country
1	(Chair) Pro Margareta LUTZHOFT	University of Tasmania, AMC / Australia
2	(Rapporteur) Nathan ROWSELL	Associated British Ports / UK
3	Charles STEWART	Associated British Ports / UK
4	Eric WAGNER	MSI Design AB / Sweden
5	Todd SCHUETT	Kongsberg Norcontrol IT / Norway
6	Captain Ed VERBEEK	Dutch Pilots Corporation / Netherlands
7	Per Einar JOHNSEN	Norwegian Coastal Administration – Brevik VTS / Norway
8	Alexander NEUHAUS	Frequentis AG / Austria
9	Jun Hyuk JANG	KRISO / Republic of Korea
10	Capt Per Baek HANSEN	Royal Danish Navy / Denmark
11	Mats RENSTRÖM	Swedish Maritime Administration / Sweden
12	Kim SKOVGAARD NIELSEN	Great Belt VTS / Denmark

ANNEX C WORKSHOP PROGRAMME

Date
12 – 16 October 2015

Venue
Chalmers University of Technology
Gothenburg, Sweden

Kindly sponsored by

DAY 1 - MONDAY 12 OCTOBER 2015

Time		Activity	Speaker or lead person(s)
1100 - 1230		Registration at Chalmers University of Technology	
1230 - 1515 Session 1 - Opening of the Workshop on Human Factors and Ergonomics in VTS			**Chair: Tuncay Çehreli**
1230 - 1235	1	Opening Workshop Human Factors and Ergonomics in VTS	Tuncay Çehreli (Chair)
1235 - 1245	2	Welcome from Chalmers University of Technology & opening remarks	Prof Lennart Josefson, Head of Institution
1245 - 1300	3	Welcome from IALA & opening remarks	Michael Card
1300 - 1315	4	Administration & Safety Brief	Anders Brödje, Research and Innovation Group SMA
1315 - 1350	5	Human Reliability (WG1)	Dr Gesa Praetorius & Dr Fulko van Westrenen
1350 - 1425	6	Operational Effectiveness (WG2)	Wendie Uitterhoeve, Marin
1425 - 1500	7	Working Environment (WG3)	Mr Jeton Partini
1500 - 1515	8	Workshop aim & objectives	Kevin Gregory, Chairman VTS Committee Training and Personnel working group
1515 - 1600		**Coffee break**	

1600 - 1730 Session 2 - Opening of the Workshop on Human Factors and Ergonomics in VTS			**Chair: Neil Trainor**
1600 - 1630	9	Future aspects of VTS	Anders Brödje
1630 – 1650	10	WWA Presentation	Gerardine Delanoye
1650 - 1710	11	Introduction Working Groups *Participants required choosing their Working Group for the week*	Kevin Gregory, Chairman VTS Committee Training and Personnel working group
1710 - 1730	12	Questions - Summary and findings	Chair

End of Day 1

1800 Welcome reception

During the workshop all morning coffees are kindly sponsored by FREQUENTIS

And all afternoon coffees are kindly sponsored by KONGSBERG NORCONTROL

DAY 2 - TUESDAY 13 OCTOBER 2015

Working Groups		**Co-ordinator:** **Kevin Gregory, Lilian Biber-Klever, Anders Brödje**
WG1 Human Reliability TRAINING AND DEVELOPMENT Chair: Assoc. Prof. Serdar Kum Rapporteur: Poul Vibsig Pederssen	**WG2 Operational Effectiveness** ORGANISATION AND STAFFING Chair: Dr. Benjamin Brooks Rapporteur: Kerrie Abercrombie	**WG3 Working Environment** PHYSICAL ENVIRONMENT Chair: Prof. Margareta Lutzhoft Rapporteur: Nathan Rowsell
0900 - 1030	**Session 3**	
1030 - 1115	**Coffee break**	**Display of Sponsors systems**
1115 – 1245	**Session 3 – continued** *WG1 Technical Tour*	
1245 - 1345	**Lunch**	**Display of Sponsors systems**
1345 – 1515	**Session 3 – continued** *WG2 Technical Tour*	
1515 - 1600	**Group photograph** **Coffee break**	**Display of Sponsors systems**
1600 – 1730	**Session 3 – continued** *WG3 Technical Tour*	

End of Day 2

Free evening

DAY 3 - WEDNESDAY 14 OCTOBER 2015

Working Groups		Co-ordinator: Kevin Gregory, Lilian Biber-Klever, Anders Brödje
WG1 Human Reliability TEAMWORK AND COMMUNICATION Chair: Assoc. Prof. Serdar Kum Rapporteur: Poul Vibsig Pederssen	**WG2 Operational Effectiveness** PROCEDURES, ROLES AND RESPONSIBILITIES Chair: Dr. Benjamin Brooks Rapporteur: Kerrie Abercrombie	**WG3 Working Environment** EQUIPMENT & WORKING CONDITIONS Chair: Prof. Margareta Lutzhoft Rapporteur: Nathan Rowsell
0900 - 1030	**Session 4**	
1030 - 1115	**Coffee break**	**Display of Sponsors systems**
1115 – 1245	**Session 4 – continued**	
1245 - 1345	**Lunch**	**Display of Sponsors systems**
1345 – 1515	**Session 4 – continued**	
1515 - 1600	**Coffee break**	**Display of Sponsors systems**
1600 – 1715	**Session 4 – continued**	

End of Day 3

Workshop dinner on board a historic steamer, courtesy of Transas, starting 18:00 returning 22:00 (possibly 21:00)

Dress code – Smart casual

DAY 4 - THURSDAY 15 OCTOBER 2015

Working Groups		**Co-ordinator:** **Kevin Gregory, Lilian Biber-Klever, Anders Brödje**
WG1 Human Reliability TEAMWORK AND COMMUNICATION Chair: Assoc. Prof. Serdar Kum Rapporteur: Poul Vibsig Pederssen	**WG2 Operational Effectiveness** ORGANISATION AND STAFFING Chair: Dr. Benjamin Brooks Rapporteur: Kerrie Abercrombie	**WG3 Working Environment** EQUIPMENT & WORKING CONDITIONS Chair: Prof. Margareta Lutzhoft Rapporteur: Nathan Rowsell
0900 - 1030	**Session 5**	
1030 - 1115	**Coffee break**	**Display of Sponsors systems**
1115 – 1245	**Session 5 – continued**	
1245 - 1345	**Lunch**	**Display of Sponsors systems**
1345 – 1515	**Session 5 – continued**	
1515 - 1600	**Coffee break**	**Display of Sponsors systems**
1600 – 1730	**Session 5 – continued**	

End of Day 4

Free evening

DAY 5 - FRIDAY 16 OCTOBER 2015

Time		Activity	Speaker or lead person(s)
0900 - 1030	**Session 6 – Conclusions Working Groups**		**Chair: Neil Trainor**
0900 - 0930	13	Working Group 1: Human Reliability	Chair WG1: Assoc. Prof. Serdar Kum
0930 - 1000	14	Working Group 2: Operational Effectiveness	Chair WG2: Dr. Benjamin Brooks
1000 - 1030	15	Working Group 3: Working Environment	Chair WG3: Prof. Margareta Lutzhoft
1030 - 1115		**Coffee break**	
1115 - 1245	**Session 7 – Closing of the workshop**		**Chair: Tuncay Çehreli**
1115 - 1145	16	Workshop review and discussion	Neil Trainor
1145 - 1215	17	Conclusions / Recommendations of the Workshop	Tuncay Çehreli, DGCS and Chairman of the IALA VTS Committee
1215 - 1245	18	Closure and thanks from IALA	Tuncay Çehreli, DGCS and Chairman of the IALA VTS Committee
1245 - 1345		**Lunch**	

End of Seminar

ANNEX D WORKSHOP CONCLUSIONS

1 The application of the concept of human reliability needs to be carefully considered with regards to VTS.

2 Competent / VTS Authority should develop policy on Human Factors, Performance and Capability.

3 Human Factors should be referenced, where appropriate, within IALA documents related to VTS.

4 There is a need for guidance on accident investigation regarding VTS. This should cover the aspects mentioned in paragraph 5.2.7 of the WG report. This guidance may be incorporated in the ongoing work associated with Task 1.1.3 or in a stand-alone document.

5 There is a need for guidance on raising awareness about safety culture and identifying the benefits and expected outcomes thereof. This may be achieved by means of incorporating this work into existing IALA documentation, IALA Recommendation V-103 (on Standards for Training and Certification of VTS Personnel), or development of new Recommendations / Guidelines. Expert assistance may need required.

6 That IALA consider organizing a workshop / seminar on operational effectiveness and staffing levels in VTSs to cover the points not covered during this workshop as outlined in section 5.2.3.

7 That IALA consider revising V-119 (on the Implementation of Vessel Traffic Services) in conjunction with the development of guidance on Measures to Evaluate the Effectiveness of a VTS to include positive performance indicators and outcome indicators.

8 That a human centred design approach be reflected in the development, update and evaluation of VTS.

9 Voice communication is a critical component of VTSO work.

10 There is a need for standardisation with respect to portrayal, symbology and terminology.

11 There is a need for generic and common information to support joint activity with allied services.

ANNEX E OPENING REMARKS BY CAPTAIN TUNCAY ÇEHRELI

Welcome to IALA Workshop on Human Factors and Ergonomics in VTS, which is being organized in conjunction with Chalmers University of Technology, Dutch VTS Operator Training Foundation and Port of London Authority. On behalf of myself and IALA VTS Committee, I would like to thank organizers for organizing this workshop and special thanks to Chalmers University of Technology for hosting. And many thanks to you for your participation.

You know, VTS consists of personnel, equipments and operating procedures in general and there are many IALA documents related to these constituents. In addition to that, there is a need for something more such as quality management system, auditing and assessing procedures and human factors management system in order to integrate all VTS components and to ensure service quality and optimization of VTS. Besides, we should not forget the measurability, because all factors within optimization, quality management, risk management and human factors management must be measurable, such as human reliability.

Another matter that I want to draw your attention is the culture. It is not easy to manage human factors in the VTS in situation where blame culture is existed. You know, normally people are less willing to inform the organisation about their own errors and other safety related matters such as near misses due to fear of being blamed. So, the system or culture has to encourage, even reward VTS personnel to provide safety related information. I believe that establishing a contemporary Safety Culture could be one of most appropriate options to solve this problem.

The other important issue with human factors is designing VTS centre and VTS operation room which has become a complex issue today because of developing technology and number of options. You know there are many options for VTS equipments and it is really not easy to choose optimum system and equipments among them. For instance display technology, 20 years ago there was only CRT display in limited size, but today, there are different types of displays (plasma, LDC, LED), in different quality and in almost unlimited size. During my visits to VTSs in different countries I saw many different operator consol designs with different size displays, from 19 to 56 inches. It is obvious that using high technology with advanced equipments improve our capability and service quality but it may have also negative effect on human performance and human error if it is not well designed.

As you may know, IALA, through its VTS Committee already started to develop guidance on human factors and ergonomics in VTS as to be finalized in 2017. In my capacity as chairman of IALA VTS Committee, I believe that, outputs of this five days workshop will be very helpful and guiding for us in developing subject IALA guidance.

Thank you once again and I wish you a very good and successful workshop.