Methodical Experiences Gained During The Implementation Of Simulator Based Training Of Turkish VTS Operators

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ABSTRACT
The Turkish VTS System became operational for the Straits of Istanbul and Canakkale in December 2003. The Maritime Faculty of Istanbul Technical University (ITUMF) was appointed as the Training Institute for newly employed VTS Operators by Turkish Competent Authority. Pilots, nautical experts, hydrographers, salvage and legal experts have been closely consulted by the ITUMF, which has designed all the courses. ITUMF has also carried out the required training, using its own VTS and bridge simulators. All training courses for Turkish Straits-VTS personnel were based on IMO VTS Guidelines and VTS Manual of the International Association of Lighthouse Authorities.

This paper discusses experiences with process of simulator-based training of Turkish VTS Operators. The main parts of the paper cover in particular the following aspects:

- a brief description of the 'operational framework' of Turkish Straits VTS organization
- definition of training objectives and course development for VTS operators
- the design of effective VTS simulator Exercise
- differences between VTS simulator training and nautical simulator training
- evaluation of VTS operators (short time memory tests and eye mark movement records)
- feedback from VTS users in Turkish Straits

1. Introduction

Vessel Traffic Services (VTS) are shore-side systems that range from the provision of simple navigational information messages to ships (such as position of other traffic or meteorological warnings) to extensive management of traffic within a port or waterway. The International Convention for the Safety of Life at Sea (SOLAS) Chapter V on Safety of Navigation was adopted in December 2000, and entered into force on 1 July 2002. Regulation 12, Vessel Traffic Services states: "Vessel traffic services (VTS) contribute to safety of life at sea, safety and efficiency of navigation and protection of the marine environment, adjacent shore areas, work sites and offshore installations from possible adverse effects of maritime traffic".International Association of Lighthouse Authorities (IALA) is a non-governmental association that brings together services and organizations concerned with the provision, maintenance and operation of marine aids to navigation. IALA cooperates closely with the IMO and International Telecommunication Union (ITU), which are both specialist agencies of the United Nations with regulatory powers. It was the IALA that took on the task

of specifying VTS standards, and 1997 IMO adopted Resolution A.857(20) concerning the qualification of VTS operators. One of the objectives of the IMO Resolution A.857(20) is that; "The governments and authorities will need to establish a logical process for selecting and training of VTS operators in order to fulfill these requirements." The purpose of the IALA-Model Courses (V-103) is to provide a template against which training institutes are able to develop their training Programs for approval by National Competent Authorities. (IALA, 1998).

The concept of VTS has gained acceptance by Turkish Government as a means of advancing navigational safety by reducing the number and severity of vessel casualties in the Turkish Straits. The Under secretariat of Maritime Affairs of Turkey initiated to set up the VTS project in 1999. The Turkish Straits VTS (TS-VTS) was delivered to the under secretariat of Maritime Affairs on July 1st 2003, which is Turkish Cabotage and National Maritime day. Since then a number of acceptance tests had to be performed and the on the job training of all operators were carried out as a result of which TS-VTS became operational on 1st January 2004. The training of operators and supervisors was carried out by Istanbul Technical University, Maritime Faculty at Tuzla according to all International Regulations of IMO and Recommendations of IALA. The author of this paper has been involved in this training to a very large extent.

2. Operational Framework of the New VTS in the Turkish Straits

2.1 Characteristics of the Turkish Straits

The European and Asian part of Turkey is divided by a complex waterway that connects the Black Sea to the Sea of Marmara and the Aegean Sea, which leads to, Mediterranean Sea and the rest of the World. From the Black Sea to the Aegean Sea there is not any alternative route for shipping except passing through the Turkish Straits. The total length of Turkish Straits and Marmara Sea is 164 n. miles from the southern entrance of the Strait of Çanakkale to the northern exit of the Strait of Istanbul (Fig. 1).

These narrow and sharp waterways have difficulties and are dangerous while currents are 5-8 knots for the big vessels passage. Several sharp turns have to be executed under the influence of strong currents, counter-currents and crosscurrents. The Straits witnessed two major tanker accidents

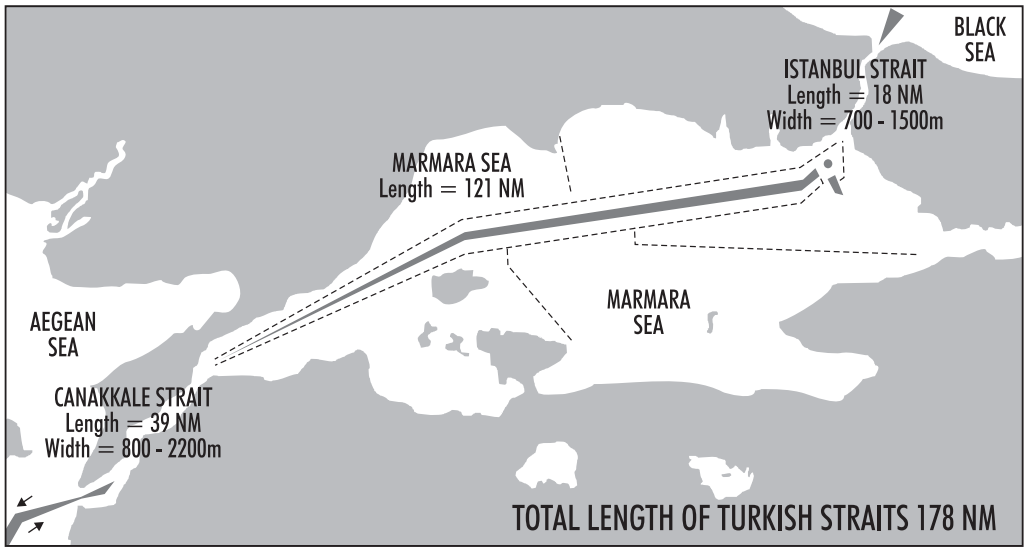

Figure.1 The Turkish Straits

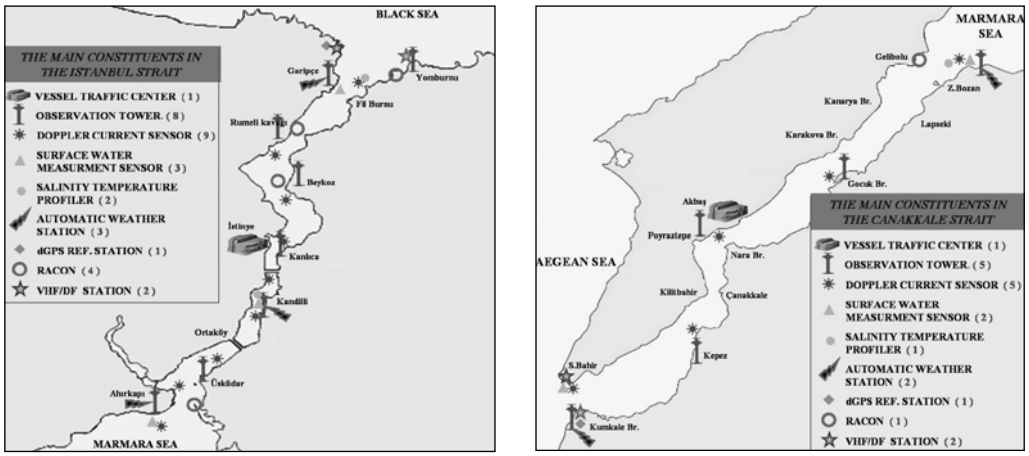

Figure 2: The Hardware for the Istanbul and Canakkale area

resulting in 125.000 tons of oil spilling into the sea during last decade. Based on a geometrical vessel casualty probability model which has been applied for 10 years specific real vessel casualty rates of ships shows the future casualty rate in the Istanbul strait to be 42 vessel collision and 37 grounding per 100,000 vessel transits. It is an established fact that the Turkish Straits are one of the most hazardous, crowded, difficult and potentially dangerous waterways in the world for marine traffic and consequently for the people living its borders. (Poyraz, 1999).

In 1994 Traffic Separation Schemes were also established in the Straits. These schemes have been adopted by IMO so that vessels using them must comply with Rule 10 of Collision Regulation. Since the introduction of the new rules in 1994 there has been a significant reduction in the number of the casualties occurring within the region.

2.2 Elements of the TS-VTS

VTS's have been established in ports and approaches all over the Black Sea area. The latest VTS to become operational was the Turkish Straits VTS. The TS-VTS is operated in accordance with the Turkish Straits Maritime Traffic Regulations, as promulgated in the Official Gazette no.23515 of 6 November 1998 together with the IMO Resolutions A.857 (20) and A.827 (19). The VTS is set up according to all internationally approved IMO and IALA documents and provides three services according to IMO resolution A.857(20):

- Information Service
- Navigational Assistance Service
- Traffic Organization Service

The TS-VTS covers two areas:

- Istanbul Strait plus northern and southern approaches

- Canakkale Strait plus northern and southern approaches.

Presently there are two VTS centers: Istanbul VTS center and Canakkale VTS center. At a later stage the Marmara Sea will be added to the VTS. It is expected that there will be two sectors in the Marmara Sea. The system is based on the various radar sensors, but more input to the system is provided via CCTV, AIS i.e. the various pieces of hardware for the Istanbul and Canakkale area are shown in Figure 2. The Straits are monitored 24 hours day from a single center in each strait. (Manual TS-VTS, 2003).

2.3 Authorities' Role and Manning of the TS-VTS

The Minister of Transport of the Turkish Republic is the Competent Authority of the VTS, while the General Manager of Coastal Safety and Salvage Administration (CSSA) is the VTS Authority. IALA Model Courses -V 103 are designed to foster universally common standards of training. They provide a basis for national VTS authority and training institutions to design and authorize the courses that they wish to offer to potential candidates.

A Department Head manages each TS-VTS Center. The Head of the VTS Department is responsible for the working schedules, vacations, substitutes in case of illness as well as the training of future operators. The VTS-supervisors are responsible for the work that is carried out by the operators. The VTS supervisors are responsible for the watches in the VTS Center to be carried out according to the internal procedures and any rules and regulations made by the Competent Authority and/or the VTS Authority or his/her substitute.

The Turkish Government decided that the operators of the TS-VTS should have the highest possible nautical qualification: master mariner. New personnel were recruited from the pool of Captains. In total, 80 operators are working in the VTS-Cs. TS-VTS- Centers provide a 24 hours duty with 2 watches, each 12 hours. In principle, the operators work behind the radar screen for not more than 2 hours in a row and are then relieved of duty by a colleague. During the 2 hours when they are not behind a radar screen, they are occupied with other non-radar related tasks.

3. Training of Turkish VTS Operators

3.1 Train the Trainer Program

In 2002, the work group 'Training of VTS Personnel' was founded in Istanbul Technical University- Maritime Faculty (ITUMF). The task of this work group was to develop a concept for position, tasks and training of future instructors. In the first phase, a special Train the trainer program was developed for a selected group of persons who would be involved in the actual training of the candidate VTS Operators for the new VTS in the Turkish Straits. A group of six people, four ITUMF lecturers and two future managers of the TS-VTS, accomplished this "Train the Trainer Program" in Maritime Simulation Rotterdam B.V. (MSR) to prepare them for their future job as VTS-trainers.

3.2 Accreditation of ITUMF as VTS Training Institute

One of the functions of the Competent Authority pursuant to IALA Recommendation V-103 is to

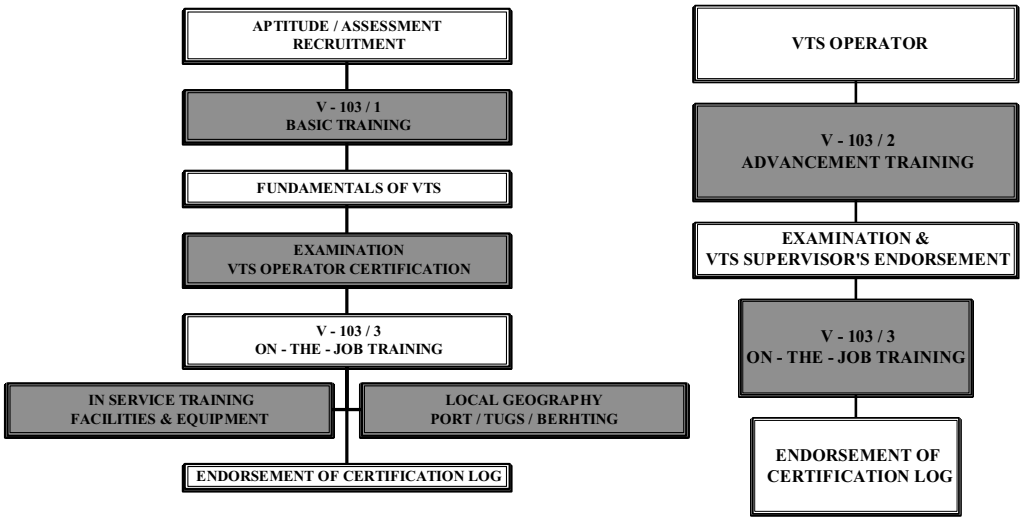

Figure 3: the Training Modules of the TS-VTS Operators

accredit VTS- training institutes. The aim of the IALA VTS Training Institute Accreditation Guidelines is to ensure conformance to the pertinent requirements of IALA Recommendation V-103, “Recommendation on Standards for Training and Certification of VTS Personnel” as applied to the provision of training for qualification of VTS Operators, VTS Supervisors and VTS Managers.

VTS Training Institutes that comply with IALA- Guidelines may receive a “Certificate of Conformity with IALA Recommendation V-103” issued by the Competent Authority of the country in which the VTS Training Institute is located, provided the organization responsible for the Competent Authority is a Member of IALA. The Figure 3 gives a summary of the different training modules within the framework of the TS-VTS training concept.

In this context, the Ministry of Transportation appointed the Coastal Safety and Salvage Administration for performing a formal accreditation assessment process**.** On 1 February 2003 ITUMF has been accredited by the Competent Authority based on the guidelines provided by IALA. However, Maritime Simulation Rotterdam (MSR) was formally requested to conduct the IALA accreditation process for ITU-MF on behalf of the Turkish Government.

3.3 Objectives of the Training and Task Analysis

In Turkish case, the operators and supervisors of this VTS are all master mariners. This was a choice of the Turkish Government that would shorten the training period considerably and increase automatically the mutual trust between the VTS and its customers. A very important item is also the acceptance of a VTS by the shipmaster and officers. However if his training is at least at the same level of a master, then a situation of mutual trust is easily established. But a VTS operator should never consider himself to be conducting the vessel; that is the task of the master.

At the beginning of the planning and preparation phase, the advantages and disadvantages of training master mariners as VTS operators and VTS supervisors became clear very quickly.
The advantages of this kind of training were:

- relatively short training period and low training costs for the VTS Authority
- customer-oriented view of VTS operators
- rather homogenous maritime experience of the candidates (easy to understand the maritime traffic risks)

The disadvantages were, in particular:

- inhomogeneous age spectrum
- low job satisfaction and less motivation of VTS operators
- prior learning of theory knowledge took place several years ago

A number of different organizations and organizational units such as Coastal Safety and Salvage Administration, agents, pilots, P&I Club representatives, maritime lawyers, coast guard officers were engaged in the planning, organization and implementation of VTS training.

This group of people prepared the curriculum for the theoretical part of the basic course. To make clear the level of knowledge and capability a person must possess to perform properly in his/her function or task; the working group executed a "Didactic Task Analysis"(DTA). DTA is the fundamental basis for a functional or task oriented training. Within the stipulated field of knowledge, a connection is made between the level of required Attitude, Skill and Knowledge (ASK methodology). This DTA reflects the IALA Recommendations V-103. At the end of the task analysis, the working group decided that objectives of VTS trainings rely on a proper interpretation of the radar image, correct identification of the traffic, and an adequate use of both radio communication procedures and standardized Maritime English with regard to internal and

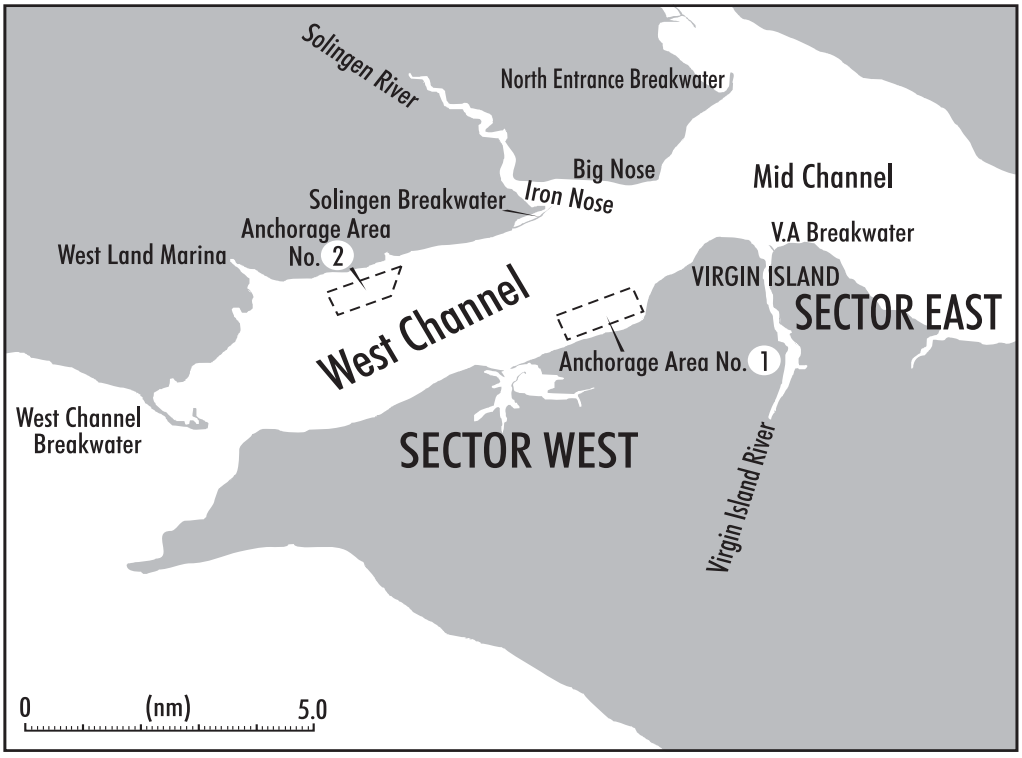

Figure 4: All scenarios were based on this generic area

external procedures of the TS-VTS. (Poyraz and Van t'Padje 2004)

3.4 Use of Simulators

IALA Recommendation V-103 on "Standards for Training and Certification of VTS Personnel" and its associated model courses, refer to the need for simulated training exercises in addition to lecture room presentations. Therefore ITUMF has carried out the required training, using its own VTS and bridge simulators.

The development of the simulator scenarios was the core task of instructors. As a result of the training objectives derived from the DTA and V-103, the development of training scenarios for the practical part on the VTS simulator was started. The ITUMF- VTS simulator is designed to train personnel in handling shore-based ship radio communication services as well as using radar and communication equipment by means of a computer simulation system. The simulator consists of three stations for the instructors/ ship-operators by making use of parts of the radar simulators, three stations for trainees, one debriefing station stations. The stations for instructor/ship-operators and trainees are equipped with all essential radar, geographical electronic maps and communication means required to fulfill the training objectives. The instructors were able to train the operators in a one-to-one situation (1 instructor for 1 trainee). This set up was chosen to optimize the interaction between the student and the instructor, which results in a very steep learning curve. All scenarios were based on generic geographical area. Figure.4

The development of an exercise does not begin with the 'programming phase' at the simulator; instead, a VTS exercise requires a complete 'development process'. Therefore a collection of scenarios developed in the form of the 'building blocks' for future simulation exercises. Since the 'guest instructors', in most cases, did not take part in the development of the exercise itself, a comprehensive and standardized documentation of the exercise was provided. (Förster and Wismar, 2002)

Scenario	Training Objectives	Environment / Traffic
F	Familiarization equipment, topography of the area, message structure, standard communication procedures, using English language, take over shift, standard communication procedures (*SMCP-GENERAL*)	Good visibility 2 ships in the each sectors
1	standard phrases (*SMCP- VTS phrases, A1/6*), standard communication procedures, using English language, using message markers, using message markers, use of voice (*intonation*), radar observation	Good Visibility 4 ships in the each sector
2	standard phrases (*SMCP-external communication phrases, A1/1-A1/5*), standard phrases for identification, standard phrases for VTS sailing plans (link with MANOPS), combining traffic information, set/select priorities by radar observation, providing feedback (*is everybody informed?*), Handover procedures	Poor Visibility 4 ships in the each sector
3	Unknown vessels, vessels overtaking and approaching each other, passing/proceeding with caution and other arrangements, hydrological and meteorological reports, broadcast method and warnings	Good Visibility 5 ships in the each sector Diving operation by tugboat
4	Position information in latitude / longitude, position information in bearing/distance, position information relative to the fairway, position information including additional information, identification of targets	Good Visibility 5 ships in the each sector
5	Relay instruction from authority, Navigational Assistance Service, Instructions to vessels on the basis of rules and regulations	

Table 1. The List of Training Objectives of the Scenarios

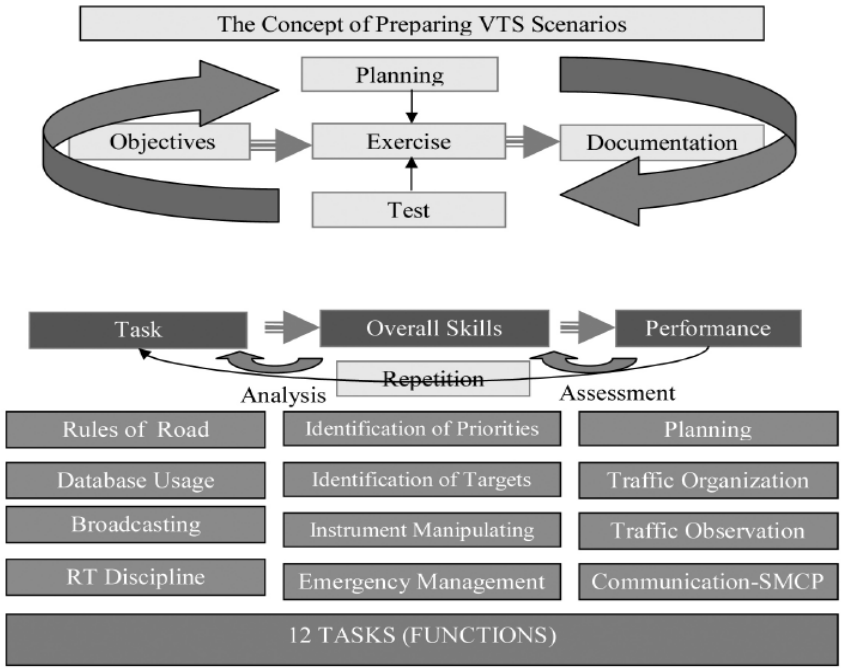

Figure 5: The Concept of Development of VTS Scenarios

As a result of above mentioned task analysis, the instructors created six scenarios. Events were planned in the scenarios to ensure all of the various tasks that were identified by Subject Matter Experts. Moreover, each task was developed into elemental techniques such as identification of targets, communication, instrument manipulating and etc. Figure 5. (Endo & Kobayashi, 2000)

Each simulator scenarios was prepared and validated based on concrete training objectives. For example, in the first scenario; the participants were given tuition on how and when to "Instruct", "Inform" and "Advice" vessels in an area, and the situations and the authority required for the different forms of assistance. In the fourth scenario VTS operators were trained on how to communicate effectively with ship officers for learning the ship's position in the VTS area. Table 1 shows the objectives of the scenarios

During the simulator training strong emphasize was laid on communication procedure. After the first draft of the Standard Maritime Communication Phrases (SMCP) was circulated by IMO as MSC Circular 794, relevant phrases have been incorporated into the syllabus used at the ITUMF for training TS-VTS Operators. A communicative approach or methodology, together with a VTS simulator was the main training tools used and these ensured that the phrases were taught in context with normal maritime operating procedures and practices.

More time was spent on the simulators, where most items learned could be practiced under almost real life circumstances. It might be interesting to mention that not only a VTS-simulator was used for training purposes, but also a full mission bridge-simulator. By doing this instructors were able to confront the shipmaster on the bridge-simulator with the behavior and attitude of the "VTS-operator". Once the shipmaster had to act as a VTS-operator he was very much aware that another attitude had to be adopted, as then he was "only" assisting in the decision making process on the bridge of the vessel concerned. This training combined with lectures about the possibilities of the VTS-operator to influence the decision making process in a pro-active way established a proper groundwork for the future. (Hofstee, 2004)

3.5 Assessment

All candidates were very motivated and enthusiastic. They worked hard to reach the required level of competence as stipulated in the objectives of the basic training for VTS Operator for the Turkish Straits. Without the dedication and enthusiasm of instruction team the candidates could never have reached this level in such a short time. Before and during training the operators were tested with regard to attitude and short-term memory capacity as well as their general proficiency in the English.

Before any test was administered, Instructors conducted a job analysis to identify the IALA requirements and operators' duties. Tests were chosen to measure aptitudes and abilities related to the jobs in VTS Centers. Assessment procedures were supported by the PC based software, which has been developed by our team.

The Instruction team provided a group of tests, which consist of cognitive, perceptual, and psychomotor ability tests, based on the result of this task analysis. Some of the tests are:

- Visual Pursuit Test: designed to measure the ability to make rapid scanning movements of the eyes without being distracted by other irrelevant visual stimulation.
- Verbal Reasoning Test; designed to measure the ability to analyze verbally stated facts and to make valid judgments on the basis of the logical implications of such facts; and thus, the ability to analyze available information in order to make practical decisions.
- Manual Speed and Accuracy Test: designed to measure the ability to

make rapid and precise movements with the hands and fingers. Also measures, according to the authors, the temperamental willingness to perform highly repetitive, routine, and monotonous work.

- Short-term Memory Test: A form of cognitive ability test that were exemplified by short-term memory tasks such as forward digit span and serial rote learning, which do not require mental manipulation of inputs in order to provide an output.

The aptitude of the TS-VTS operators can be divided into two stages: the expected attitude during the intake-process and observed aptitude during the training. When the training was started with various lectures, there were a number of future operators who had the idea that any training was hardly necessary for them. Within a period of two weeks, this attitude changed completely, especially once the training on the VTS-simulator started. In principal the aptitude observed during the training was in the majority of the cases high. Here we must stress that the debriefing should be more a kind of a moderated process, dealing not so much with 'right' or 'wrong' actions, but instead with 'possible' and 'good' actions. The performance of the trainee is evaluated by his/her peer group, while the instructor should play the role of the moderator in this process. (Förster and Wismar, 2002)

It might be interesting to mention that eye-movement recorder used in this field for first time, most notably scene perception and situation awareness, to study cognitive processing. The eye mark recorder is a head mounted, monocular eye tracking system that uses the corneal reflection method of tracking. The eye movement data of VTS operators will help us to understand how to maximize the efficiency of the human-machine interface. The result of this study could be the subject of an additional analysis.

4. Conclusion

The training of TS-VTS Operators was in most cases conducted on a "peer to peer" basis. By means of confronting the operator with his behavior on the two simulators (in one case as a shipmaster in control of his own vessel, and in the other case as a VTS-operator) we were able to make necessary adjustments quite naturally. The same was done during the lectures with regard to SMCP, procedures and liability aspects.

VTS simulation training shows that there are considerable differences between VTS simulator training and nautical simulator training. For VTS exercises there is a much higher need for the careful planning of the situation development over the whole run time. An 'effective' VTS scenario cannot be developed without careful planning. The development of an exercise does not begin with the 'programming phase' at the simulator; instead, a VTS exercise requires a complete 'development process. Learning objectives should be the 'starting point' of any exercise development.

Immediately after termination of a course the persons involved (lecturers, guest instructors, members of the work group) were requested to fill out questionnaires in which they could rate the training. On average all groups of training subjects score reasonably well. Definite conclusions with regard to the fact whether the operators and supervisors have been properly trained can only be established once the TS-VTS is operational for a specific amount of time.

Abbreviations

CSSA: Coastal Safety and Salvage Administration
DTA: Didactic Task Analysis
IALA: International Association of Lighthouse Authorities
ITU: International Telecommunication Union
ITUMF: Istanbul Technical University, Maritime Faculty
SMCP: Standard Maritime Communication Phrases
SOLAS: International Convention for the Safety of Life at Sea
TS: Turkish Straits
VTS: Vessel Traffic Services

References

1. IALA (1998): Resolution V.103 Recommendation on Standards for Training and Certification of VTS Personnel
2. Poyraz (1998): Coastal Crisis Management Following Vessel Casualties and Application of This in the Turkish Straits, Doctorate Thesis, Istanbul
3. Manual TS-VTS (2003): External Procedures, CSSA, Istanbul
4. Poyraz, O. and Van't Padje, W. (2004): The Turkish Straits VTS and Training Program of Turkish VTS Operator, Training Report, 2004, Rotterdam
5. Hofstee, R., Ustaoglu, S., Tozar, B. Poyraz, O. (2004): Training Program of TS_VTS Operators and Analyses of Advantages and Disadvantages of Training Master Mariners as VTS Operators, 10th International Symposium on VTS, Hong Kong
6. Förster, W. and Wismar, H. (2002): 3 Years of Experience with Simulator Based VTS Training in Germany, Paper presented at the 2002 IALA Conference, Sydney, Australia
7. Endo, M. and Kobayashi, H. (2000) The Development of the Simulator Training System, Proceedings INSLC 11, Kalmar Maritime Academy, Sweden, 2000.

BIOGRAPHY

Methodical Experiences Gained During the Implementation of Simulator Based Training of Turkish VTS Operators

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Captain Dr. Özkan POYRAZ is currently the advisor to Undersecretary for Maritime Affairs in Turkey. He was previously employed by the Maritime Faculty of Istanbul Technical University (ITUMF) as the Director of the Simulators Centre. Dr. Poyraz holds a PhD in Maritime Transportation Engineering from Istanbul University in 1999 specializing in "Coastal Crisis Management Following Vessel Casualties and Application of this in the Turkish Straits". He also holds a Turkish Master Unlimited Certificate of Competency.

He has successfully completed the group-training course in Seafarer's Management System at Ministry of Transport, Maritime Technology and Safety Bureau and JICA in Japan (1997). Dr. POYRAZ has also successfully completed "the Ship Handling Practical Training Course for masters and chief mates of large ships" in Gdynia/Ilawa in Poland (1998) and VTS operator course at MSR in Holland (2002). He was a visiting scholar at U.S. Merchant Marine Academy.