# Making Distance Learning Effective: A New Approach in Maritime Education & Training

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**Abstract**
This paper is in three parts. Part One "Making E-Learning Effective" explains benefit of and barriers to E-Learning, followed by issues for successful implementation of E-Learning program for distance learning.

Part Two "Electronic Training and Record Book with Competency Support for Cadets" is an E-Learning application for training the cadets and monitoring their progress by electronic means.

Part Three "Electronic Performance Support System for Ship's Officers and Engineers" is an E-Learning concept for Just-In-Time coaching applicable for operation of sophisticated ships.

Part Two and Three will include demonstration of prototypes.

## 1. Making E-Learning Effective

With arrival of web-technology, distance learning by electronic means is becoming popular. E-Learning is different from conventional face-to-face classroom teaching. It is a new way of teaching and learning. This paper highlights ways to make E-Learning a success.

### What is E-Learning?
E-Learning has many interpretations but in short it stands for learning by electronic means. This means learning not directly from lecture notes, books or face-to-face from teacher but through electronic means. Common forms are computer-based training and web based lessons or on-line lessons. With the advent of advanced technology, lessons may be taken anytime anywhere. These lessons can be made more interesting using multimedia i.e. combination of text, graphics, sound and animation. Lessons can be delivered to the learner via various means e.g. PC, PDA, mobile phone and TV.

E learning can be further categorised into formal lessons, which are structured, and informal means e.g. discussions, e-mail etc. The much talked about life-long learning through E-Learning includes both types of learning to help solve performance problems.

## Benefits of E-Learning

**Multiple Delivery Options:** E-Learning makes it easy for you to deliver training to your workforce through a variety of deployment options over Internet, intranet and CD ROM.

**Just-in-Time Training**: E-Learning is easily accessible to employees and students. There is no waiting for classes. It can be used just before doing a task at place of work. This has been described in Part Three of the paper.

**Administrative Control and Reporting:** With learning management software, administrators can quickly and easily access detailed reports to verify student progress, quantify training investments, and plan effectively for the future.

**Engaging and Effective:** Benefit from the powerful combination of audio, animation and software simulations that produce highly engaging multimedia training. Courses today use realistic simulations, hands-on exercises, and role-playing scenarios to help employees "learn while doing".

**Assessment:** Student assessment can be a powerful and helpful aid in the learning process. With many E-Learning products, pre-assessments are available to determine which topics students are already familiar with so that they can focus on key areas where they need help. This reduces the frustration of training on familiar content, and the amount of time spent training is condensed by as much as 50%! Students can also take quizzes throughout the training process to test their understanding.

**Increased Productivity:** Training is a proven benefit and incentive to employees, giving them the opportunity to advance their skills and careers. Employees that have the skills to successfully do their jobs will be more motivated, effective, and productive.

**Lower Cost:** E-Learning is available at a fraction of the cost of classroom learning and is provided right to student's desktops, eliminating the need for travel and expense.

## Barriers to Implementing E-Learning

If E-Learning is to live up to its expectations one must be overcome of its Technological, Social and Pedagogical barriers, including the change of mindset required. These restraints must be overcome before implementing E-Learning.

**Technological aspect:** E-Learning requires a reasonable technological infrastructure. Wherever this is lacking, E-Learning cannot happen smoothly.

The initial capital outlay for setting up the infrastructure for E-Learning can be high, including setting up of servers, PCs and Internet at reasonable access speed of atleast 56K. For synchronous or asynchronous learning event, the necessary tools are required.

**Social aspect:** Learners tend to feel isolated. Trainers are worried that they will lose their jobs. Learners and trainers need to pick up skills for On-line learning and training. (This is further discussed under E-Learner and E-Coach.)

**Pedagogical aspect:** It is imperative to Familiarise Learners and Trainers with new way of learning because education will become more learner-directed than instructor-directed. Learners need to discipline themselves, and learn a new way of learning, gathering information, getting resources, and sharing knowledge & experience with others.

**Mindset aspect:** E-Learning requires a total change of mindset. In any organisation that wants to implement E-Learning, strong support from senior management is extremely important. Major stakeholders may become the greatest limitations to E-Learning implementation if they are not ready for it.


## Virtual College

**The Way Adults Learn**
The common principles for adult learning are:
- Significant learning takes place when the subject matter is relevant to the personal interests of the learner.
- Adult learning programs should capitalize on the experience of participants.
- Adults should have as much choice as possible in the availability and organization of learning programs.
- There is a need to explain why specific things are being taught
- Adults need to be involved in the planning and evaluation of their instruction.
- Experience (including mistakes) provides the basis for learning activities.
- Adults are most interested in learning subjects that have immediate relevance to their job or personal life.
- Adult learning is problem-centered rather than content-oriented.

**The Total Learning Environment**
The total learning environment for adult learning consists of many sub-environments put together to ensure a meaningful and memorable learning experience.  Learning does not happen only in the classroom or from one particular source.  It happens all the time, through various means, from different persons. In a total learning environment for adult learning, the following components are essential:
- Instructive environment
- Situating environment
- Constructive environment
- Supportive environment
- Communicative environment
- Collaborative environment
- Networking environment
- Evaluative environment

**Learning Management System**
"Virtual College" or E-Learning Portal aims to provide a total learning experience using Learning Management System (LMS).

 "LMS is a software that **automates the administration** of training events. The LMS registers users, tracks courses in a catalogue, and records data from learners; it also provides **reports to management**. An LMS is typically designed to handle courses by multiple publishers and providers. It usually doesn't include its own authoring capabilities; instead, it focuses on **managing courses** created by a variety of other sources".                                                                            -ASTD

"A learning management system uses Internet technologies to manage **interaction between users and learning resources**. A LMS is essential for creating an environment where employees can plan, access, launch and manage E-Learning on their own".

-Marc.J.Rosenberg

**What should an LMS provide and for whom?**
LMS provides a total learning environment for the learner as well as support for the course administrator, course author, trainer and course manager.

**For the E-Learner:**
- A catalogue of courses that we can choose from
- A discussion board for collaborating, sharing experience, exchanging knowledge
- An e-mail feature for communication
- An announcement board for putting up messages for all in the class
- A common whiteboard for discussion (synchronous learning)
- An evaluation tool to check learner progress
- A synchronous tool for synchronous activity
- A personal notepad for construction of personal knowledge
- A resource centre to hold other course related tools and references
- Access to classmates, instructors, experts and technical support

**For the Administrator**:
- Registration facility
- Issuing login passwords
- Payment

**For the Course Author**:
- Authoring tools
- Test and Assessment tools

**For the Trainer:**
- Reporting tools for assessment
- Analysis of results

**For the Course Manager:**
- Calendar tool
- Facilities booking etc

**Matching E-Learning environments with features of LMS**

| Components of E-Learning environment | Features of Learning Management System |
|---|---|
| Instructive | Courseware catalogue, course documents |
| Constructive | Discussion board, Synchronous tool, Virtual classroom |
| Performance Support | Resource centre to help in making decision E-mail to experts, FAQ, Tips, Threaded Discussion |
| Cognitive | Access to e-Tutor/Coach, experts, e-classmates |
| Evaluative | Tracking system on learner progress Assessment Instructor's and Course evaluation |
| Communicative | E-Mail, Discussion board, Announcement board, Synchronous tool |
| Collaborative | E-Mail, Discussion board, Announcement board, Synchronous tool |

**E-Learners:** Persons who can handle E-Learning best are those who are prepared for it and understand its environment. They should be able to use the computer or the electronic tool or willing to learn. They should be able to surf the Internet for information and use communication tools like e-mail, bulletin board, chats and synchronous tools like virtual classroom. They should form study groups in which they can share information, collaborate and communicate on line. An e-Learner would need to be disciplined, self-directed and independent.

**E-Coach**

What is the need for E-Coach? Can't we leave the learners to learn on their own or with other learners? After all the E-Learners are supposed to be disciplined and independent.

Online learners have no face-to-face contact with other learners or instructors. Sometimes the learners can get frustrated while taking course and don't complete the module because:

- There are bugs in the system and there is no technical help available
- They felt alone in taking the course, no one else to talk to, miss the conventional classroom
- They couldn't see the direction or where the discussion was heading over the internet
- They did not know their results after submitting their assignment
- They didn't have anyone to answer their questions

The solution is to ensure that E-Learners are not only interacting with the LMS but also with their classmates and another person who acts like an "instructor" in the class. This person is called E-coach, on-line tutor or moderator.
This person helps to create and shapes the E-Learning environment by doing the following:

- Welcome and encourage participants through the online course
- Send welcome e-mail at enrolment to course
- Manage class by encouraging all to participate in discussions
- Provide support by providing explanations and clearing misconceptions
- Monitor progress of students
- Send reminders about assignments through announcement board
- Provide assistance if there are any technical problem or "bugs" in the system
- Provide on-line feedback on progress
- Acknowledge receipt of assignments submitted by learners
- Facilitate synchronous tutorial session if required
- Moderate discussions on discussion board
- Assess participants, maintain records and provide feedback
- Identify learners who need further assistance
- Highlight areas in learning design for improvement

In short an E-Coach plays an Intellectual, organisational, social and technical role. The role of an E-Coach is a very challenging one. The E-Coach combines classroom teaching practices and technology to reach out to students. At the end of the day, it is the E-Coach and not the technology that drives student learning.

E-Coach may not be the course author. Just like in face-to-face teaching in a class, the teacher may not be the author of the subject textbook. An E-Learning development team consisting of subject expert, instruction designer, multimedia specialists, would have made the content for the on-line course.

## E-Learning Courseware Development Team

### Subject Matter Expert
This person or team of people, is responsible for the creation or gathering of information that will meet the aims of the training. Usually these persons are experts that have a sound knowledge and understanding of their field. They do not require any computing knowledge, and often have none at all. Instead they bring subject matter expertise and knowledge of the learning process. They should have fair knowledge of the development process.

### Instructional Designer
*To 'e' or not to 'e' is the question.* Designing the course for E-Learning is a crucial part of the course development process. To be effective, the instructional designer must become intimately familiar with the subject matter. The role of the instructional designer is to structure the subject matter in a way that takes advantage of the interactivity and Rich Multimedia experience of Computer Based Training. He or she achieves this by creatively presenting the subject matter in a way that ensures a

maximum learning experience. This may include adding new material to help reinforce key concepts or designing a new module or course from scratch. This activity is laid down in a **design document and storyboard**.

The Design document will include course outline, instructional strategy with rationale, assessments.

E-Coach will be provided with instructions to guide the learners and facilitate discussions for on-line activities and suggested responses from the E-Coach to the learner.

Storyboards are developed from the Design document to provide the overall 'look and feel' of the program and provide guidance to the graphics artist, programmers and other media specialist.

**Graphic Artists/Designer**: They are responsible for developing graphics and animations for the training.

Other specialist media developers whose skills may be required include:
**Sound engineers**: Record and edit narration, create and develop music and sound effects.
**Scriptwriters**:  They help to develop written content.
**Video specialists**: Shoot and digitise video.
**Programmers:** In order to achieve a high quality interactive experience, the skills of programmers are used. They take the produced materials, which includes animations, graphics, narration and sound files and create a finished high quality interactive multimedia-training program.
 **Beta Testers: T**o ensure a high quality product, testing must be done. The first part of the testing process begins in-house followed by field-testing.

**Content Providers as Computer Aided Learning (CAL) Developers**
The early development of CAL was carried out by 'enthusiastic amateurs'. They were teachers and lecturers with a strong interest in computing. They developed CAL packages on their own to teach their own students. The roles and responsibilities for all parts of development rested with a single individual. Although they still exist, the skills needed to develop CAL packages are now so specialised that development is now realistically beyond the scope of one person.


## Technology for Managing and Distributing E-Learning

**Portals**: There are millions of Internet web sites around the world. Some offer interactive services that allow you to search for information you need.  For example "Virtual College", an E-Learning portal offers its members many resources like learning materials, courses, bookstores, search engines and discussion forums. Members can share and learn from one another. Portals can either be operated for profit or non-profit enterprise.

**Multimedia**: Perhaps the most powerful aspect of computing technology is the ability to combine text, graphics, sounds, and moving images in meaningful ways.  With all

the promise of what multimedia elements can do to enhance E-Learning, we need also to be mindful of the limitations of multimedia over the Web. As multimedia elements are third party products, Internet browsers may not be able to handle them properly. Often multimedia elements fail to open up properly because some required software or "plug-in" was not installed on the PC.

**Problems with Plug-ins**: A plug-in is a software module that adds a specific functionality to an application environment. Macromedia's Flash player and Shockwave are examples of plug-ins needed in order to view specially designed web content the way it is intended.

**Capability of Learner's multimedia PC:** While web designers seek to create compelling websites that include media elements to attract users, the user's computer may not be properly equipped to view these elements. Multimedia for the Web is constantly changing. The basic requirement needed to view it properly is also constantly changing. Users need to keep abreast with new technologies, Internet browser upgrades, and versions of plug-ins in order to keep pace with developers. The gap between developers and users can create a lot of frustrations. **In an E-Learning environment, we have to minimise these frustrations. Failing this multimedia becomes more of a burden than an enhancement to learning.**

**Problems with bandwidth:** Bandwidth is the maximum amount of data that can travel a through a network in a given time. If you think of the communications path as a pipe, then bandwidth represents the diameter of the pipe that determines how much data can flow through it all at once.

**Bandwidth limitations** are caused by several factors. The type of cables used, the type of network cards, switches, hubs, routers, telephone networks and servers all contribute toward bandwidth limitations. In a LAN environment, narrow bandwidth means slower delivery of audio, video, graphics and animation. This annoys users and affects on-line learning.

**Multimedia demands a lot of bandwidth**. For example, to realise video-on-demand, a broadband network and video-streaming server is required. Even with such an infrastructure in place, the number of concurrent users (or streams) is limited by the available bandwidth. If designers do not comprehend the problems associated with bandwidth availability, then whatever they put up will only serve to annoy users and disrupt the overall flow of E-Learning. Ironically, increasing the bandwidth does not necessarily improve access speeds. Instead, it can create a situation that tempts developers into creating more intensive multimedia to tease a larger pool of users. The net effect is network congestion and slow access speeds. So it is a vicious cycle that never ends. A d**eveloper of E-Learning needs to make careful decisions on deploying multimedia over the Internet.**

**The problem is even more acute** over the Internet where 56Kbps telephone modems are commonly by used E-Learners to access E-Learning Portals. Broadband access such as ADSL and cable modem may ease bandwidth limitations imposed by telephone modems. However, the costs involved in accessing broadband services are still prohibiting.

## Infrastructure for E-Learning Platform

**The Personal Computer**
The Personal Computer is the basic tool required to access E-Learning. Listed below are some common components and their minimum configurations in a PC to support E-Learning.

**Processor:** The CPU (or microprocessor) is the "brains" of a computer. It processes the information that is fed into your computer. For the E-Learning environment, current Pentium-based PCs are more than adequate to meet the needs.

**RAM:** RAM is where the operating system, application programs, and data that are currently in use are kept so that they can be quickly reached. Typically 64MB of RAM is sufficient for E-Learning applications. More RAM is recommended if cost is not an issue.

**Input Devices:** The keyboard and mouse are essential input devices for a PC. . A mouse is essential in "drag and drop" interactive exercises.

**Storage devices:** All of the data in a computer comes mainly from a storage device. For permanent storage, mass storage devices such as floppy disks, hard disks, CD-ROMs, CD-RWs would have to be used. A typical computer today would have a hard disk in the 20 Gigabyte range, a 24X CD-ROM drive and a 1.44MB floppy disk drive. CD-ROM-based training programs today are usually multimedia in nature. As such, a CD-ROM drive that has a high transfer rate would be ideal.

**Video Adapter:** The video adapter is the link from your computer to your monitor. A good video adapter is essential for displaying clear, crisp text and images. Together with a good monitor, the strain on the eyes is much reduced when viewing the computer screen for extended periods of time. For the E-Learning purposes, a video adapter with 32MB of memory on board can help to speed up the screen displays.

**Soundcard, speakers & headphones**: Most sound files are optimised for E-Learning, high-end sound cards for playback are not essential. Any Sound Blaster or its range of compatible sound cards will be adequate for E-Learning purposes. Ideally, a good pair of speakers or headphones is needed to supplement the sound card.

**Internet connectivity for shore & ships**: As the Internet has become a primary mode for delivery of E-Learning materials a connection between the PC at home and the E-Learning service provider is needed. The telephone modem converts the binary data from the computer into analogue signals that is then sent through a phone line. At the other end, another modem receives the analogue signals and converts them into digital signals. Telephone modems are designed to transmit data at certain speeds. The fastest telephone modem available today is 56 kilobits per second (56Kbps).
For faster and broadband access, the Asymmetric Digital Subscriber Line (ADSL) is a better option over telephone modems. In Singapore, Singnet and Pacific Internet

provides an ADSL service for its subscribers through normal telephone lines. Another option for broadband access is the cable modem where speeds of up to 2 Mbps can be achieved. Singapore CableVision (SCV) offers a cable modem service through its cable TV network. ADSL and cable modems are ideal for video-on-demand services

Today, passengers and crew on modern cruise ships use phone, fax, email and Internet access just like at home through C-Band technology.

**Local Area Network in E-Learning Organisation**
For the smooth running of e-learning courses over the network, several common factors have to be considered carefully. This applies whether users are from within an organisation or on the Internet. In today's LAN set up, there is more than just a file server serving the clients. Depending on the nature of the business, you may find video, Web and database servers within a LAN connection. There may even be servers dedicated to one type of application (e.g. a Learning Management System). Inevitably, as the number of computers in the group increases, traffic becomes heavier and access speed gets slower. Computers have to be split up into groups (LANs) to maintain acceptable traffic levels. Individual LANs are then connected to other LANs.

**Emerging Technology for Mobile E-Learning**
**PDA**: A Personal Digital Assistant (PDA) is a handheld computer that allows the user to store, access, and organise information, such as events schedule, appointment calendar and address book. PDAs can be screen-based or keyboard-based, or both. It can also exchange information with a desktop or notebook.  The more powerful PDAs can also play audio and video. This means that lectures can be pre-recorded and download onto a PDA for viewing.

PDAs are ideal for anyone who needs portable information but doesn't want the size or expense of a laptop computer. PDAs can be useful on board ships  for arrival and departure checklists and simple step by step procedures using graphics, short video clips.

**Technology Plan for Effective E-Learning**
In the past most technology planning simply referred to deciding the quantity, brands of computers and software to be purchased as well as deciding the budget for such purchases. Today, as educational technology matures, technology planning goes beyond acquisition of hard- and software.
In particular, a good technology plan is one that would help us to answer the following questions:
    - what are the educational objectives that technology will help achieve?
    - what are we teaching now that we can teach better with technology?
    - what can we teach with technology that we couldn't teach before?

Successful technology implementations are not about computers; they're focused on student achievement.

## 2. Electronic Training and Record Book with Competency Support for Cadets

**STCW Requirements for Cadet's Training**
STCW 95 requires all cadets, both deck and engine to undergo a structured training program during their apprenticeship on board.  It also requires that the progress of such training be monitored by individual companies and reported to the Marine authorities responsible for the examination and certification of these cadets.  This training needs to be done on board ship under the supervision of a Designated Training Officer (DTO).

**Role of Training and Record Book (TARB)**
The Cadet's training is documented in an approved Training and Record Book (TARB). Each Cadet has a TARB that contains his particulars and record of assessments to verify the competencies achieved. It also guides him through a structured training program. The cadet is responsible for its safekeeping. However it is difficult for a shipping company to monitor the training progress of its cadets who are sailing on various ships, because the individual records are with the cadets. Further, if a Cadet loses his TARB he might have to repeat his training. Effective training of cadets by busy training officers is another challenge.

**Methodology for Assessment of Cadets**
A qualified Assessor assesses and determines that the cadet is competent. He conducts assessment activities related to skills and abilities needed by the cadet to achieve the desired level of competency. During assessment subjectivity can creep in to the assessment and cadets may not be assessed with same yardstick.

**Beyond STCW Rules**
Regulations on the technical aspects of ship operation can only partly achieve the objectives of safer ships and cleaner seas. The competence of seafarers is a critical factor in the safe and efficient operation of ships. Therefore three aspects need to be addressed: task-oriented specific skills training; on-the-job training and advice; assessment and monitoring of competency.

The characteristics of the marine industry and the requirements discussed above suggest the suitability of the competency support approach for training cadets.

**Solution - "E-TARB with Competency Support"**
An electronic system should be implemented which provides media-rich training lessons and also records the progress of training. This will consist of E-TARB and Competency Support System (CSS).

**Turning TARB into an E-TARB**
E-TARB is an electronic solution by which Shipping Company can track the progress of all its cadets. Instead of a conventional TARB a cadet will keep all his information in digital format on a floppy. The Assessor will update E-TARB and a copy of report is sent to Company via e-mail for processing.

Information required by the E-TARB for tracking the progress of trainees is listed below.

Information input:
- Personal information of a cadet
- Sea service information
- Particulars of trainer and assessor who trained and assessed the cadet
- List of tasks and assignments which a cadet has to do and what is completed
- List of correspondence course lessons completed.
- Records of competency assessment
- Evaluation report by the assessor

Listing of Reports generated by E-TARB for monitoring and analysing a Cadet's performance:
- Personal Particulars of a cadet
- Assessment report
- Evaluation report
- Assessor's report
- Sea time report of a cadet.
- Assignment report
- Shore Supervisor report
- Task report
- List of correspondence course lessons completed.

The reports are encrypted. A Cadet can view all his records with Acrobat Reader.

**Competency Support System (CSS)**
CCS aims to provide **support** to the Deck and Engine Cadets, Training Officer and the Assessor for:
- Task-oriented specific skills training;
- On-the-job training and advice;
- Assessment and monitoring of competency.

CCS doesn't automate the training process and neither it takes over function of the Training Officer or the Assessor making them redundant. It provides support to make training effective using the principles of E-Learning.

**Features of CSS:**
- Detailed menu of tasks for deck and engine cadets
- Task Planning tool to plan the tasks during the attachment on current ship
- Display the tasks completed by the Cadets
- E-Coach to motivate and guide the cadets as well as answer queries
- Interactive lessons consisting of introduction, procedure and reference.
- Assignments for the cadets
- Quiz to test the understanding.
- Assessment Techniques for the Assessor

**Using - "E-TARB with Competency Support"**
E-TARB will be loaded in the computer of the Trainer and the Assessor. CSS will be located in a common study area on board the ship. CSS computers can be standalone or networked to each other. If the computers are networked then CSS can reside in a server and a number of cadets can do their lessons at the same time.

Each cadet will be issued with an E-TARB floppy disk, in which his personal information, sea service information, lists of tasks and their status and competency assessment records will be stored in an encrypted format.

The cadet will log into the CSS using his floppy and the Training Officer will review the tasks already completed in previous vessels and plan the tasks that have to be carried out on the current vessel.

There will be about 300 media rich interactive lessons each for deck and engine cadets. The cadet will go through the interactive multimedia lessons and carryout the self-test at the end of each lesson to test their understanding. There will be a reference list and glossary of commonly used terms. To clarify doubts, the Cadet can use the E-Coach feature to ask questions to the Training Officer. The cadet will then report to the Training Officer and complete the tasks with the knowledge acquired from the CSS. On the other hand The Training officer will encourage, motivate and provide advice cadets through their training via E-Coach. He can also organize group activities among cadets using this feature. Training can be done using synchronous and asynchronous communication.

 The Assessor will assess the cadet once the tasks are completed, using a formal assessment and update the records on the cadet's E-TARB floppy disk. The Assessor can refer to the assessment guidance in the CSS to bring objectivity in evaluation.

Information on the cadet's disk will be transmitted to the Company via e-mail as an attachment file. The Company will have a database where all the e-TARB records of cadets are collated and stored. The Company will be able to generate reports and monitor the cadet's progress.

Incase the cadet's E-TARB floppy gets corrupted a new set of records can be generated from the information available in the company's office.

The cadet will submit his records in electronic format to the Marine authorities responsible for the examination and certification of the cadets as an evidence for completing the training.

**Benefits to Cadet's Training**
The main benefits expected from the "E-TARB with Competency Support" approach is:
- Improved instructions using E-Learning and multimedia.
- Consistent information on each task and assignment.
- Plan and Learn at their own pace

- Advice, guidance and encouragement through E-Coach
- Objectivity in evaluations done by Assessor.

**Benefits to Shipping Companies**
- E-TARB will electronically record information about each tasks and assignments completed by each cadet, and generate reports of their progress.
- Supports Training Officers with planning the tasks to be done and promoting self-learning among cadets.
- CSS reduces the Training Officer's workload of giving detailed instructions to the cadets.
- Educational tool for shipping companies in providing continuous training and developing competent personnel.
- Uniform standards of competence in job performance
- Well-trained cadets will improve the quality of future officers who will operate the ships.

Since the training will be based on STCW, all shipping companies around the world can implement it.

## 3. Electronic Performance Support System for Ship's Officers and Engineers

**Challenge of Sophisticated Ship Operation**
With the reduction in ship's manning, and increasing sophistication in ship's machinery, the task of carrying out maintenance has become difficult. There is considerable pressure on ship's officers to operate & maintain the ship's machinery at top efficiency within the tight sailing schedules. Today, ship owners & operators have problems getting skilled personnel to man their ships. High turnover of personnel on the ships is another critical problem. Moreover, the short span on board ship is inadequate for crewmembers to acquaint themselves proficiently with each of the ship's machinery. All these factors continue to challenge the way sophisticated ships are operated.

Maintenance and operation of ship's equipment whether in engine room, deck or on the bridge requires expertise. There are instances of expensive damage to the equipment or an accident due to incorrect handling by ship-staff.

**Solution... Electronic Performance Support System (EPSS)**

**We all need support from time to time**. How many times do you wish some guru would look over your shoulder when you are doing something new, trying to operate equipment after a very long time or overhauling a different make of machinery, which you are not familiar with? Think of a performance support system as an expert helping you to do your job better.

The computer-based EPSS is a comparatively new concept that is gaining much attention and is being used in a variety of industrial situations. It is equally applicable on board ships.

EPSS is a computer terminal where the user can call up lessons on any part of the particular machinery. He can review step-by-step procedures; he can look up technical information and get expert advice. He can do this immediately before he has to operate the equipment, service the machinery or any time he requires the assistance. EPSS supports lifelong learning as mentioned in Part One of the paper.

It provides training, information and reference material through the computer and making these available at the point of need or while performing a particular job. Studies have shown that it can cut down training time by half in comparison to reading a manufacture's manual.

A junior officer or an engineer who is new to the equipment can use the EPSS to learn the concepts. An experienced engineer can refer to the EPSS to enhance his knowledge, refresh his skills or familiarise himself with a particular model of the equipment.

The computer-based EPSS package optimises the use of multimedia technology through the use of text, hypertext, graphics, animation, video, simulation and knowledge management.

EPSS uses a new set of interface design principles, "performance centred design" which lends itself to help a person perform his task.

**Turbocharger EPSS Prototype**
Turbocharger EPSS is a prototype of the performance support system for the marine industry. It has been made as an E-Learning technology demonstrator for the shipping companies.  It has been tested for its effectiveness in performance support at the Singapore Maritime Academy (SMA). The marine engineering students use this EPSS for their exercise in dismantling, inspection and assembly of a turbocharger with minimal supervision of an instructor. This paper suggests that the shipping companies should implement such productivity tool onboard ships. SMA has the capability and experience to develop EPSS systems.

**Benefits of EPSS**
There are several benefits of computer-based EPSS:
1.  Just-in-time training, reduces the chance of knowledge loss due to time lapse between knowledge acquisition and its application. This means improved performance with fewer errors.
2.  Ready access to the latest information and procedures and less information overload on the personnel.
3.  Expert and consistent advice always available
4.  Reduction in training costs, in comparison to conventional refresher courses for ship's personnel.
5.  Customised tools to support work functions, spare parts control, record of maintenance history and learning. EPSS can create a seamless mix of learning and performance.
6.  Experience-capture facility can create a database of problems and resulting solutions for trouble-shooting and maintenance of machinery, which is of use to both novices and experienced officers.

**Conclusion**

For effective E-Learning, it is critical that on-line course is provided in a manner that keeps the interest of the E-Learner. This is possible by understanding the way adults learn and providing a well managed total learning environment. For cadets on board ships their Training and Record Book (TARB) should be converted to E-TARB to allow their shipping company to track their progress. For each of the tasks, they should be provided with media-rich lessons for an effective learning experience. Officers and Engineers should also use E-Learning, to provide Just-In-Time coaching when performing critical tasks. This is also known as Electronic Performance Support System.

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