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MARITIME ENGINEERING Journal

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Send letters to: Editor - Maritime Engineering Journal
Director General Maritime Engineering and Maintenance (DGMEM)
National Defence Headquarters
Ottawa, Ontario
K1A 0K2

(Messages: NDHQ Ottawa for DGMEM)

THE COVER

The crest on the cover of the MARE Journal is an unofficial MARE crest which was circulated through the DGMEM organization for comments and suggestions. The first edition of the MARE Journal provides an opportunity for a much wider distribution for additional comments. This is a "first run" effort which is open to unlimited revision. You are encouraged to comment on the crest, suggest improvements, and/or submit a completely new design. Over the next year all inputs will be considered and an official MARE crest will be completed and submitted for approval.

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COMMODORES' CORNER

During the 1980 MARE Conference you expressed a need for a publication that would be a forum for the dissemination of Maritime Engineering information. This is the first edition of the MARE Journal which is designed to meet that need. The Journal aims to achieve the following objectives:

a. to promote professionalism among Maritime engineers and technicians;

b. to develop consensus concerning major issues;

c. to provide announcements on MARE programs;

d. to present practical engineering articles of interest to Maritime engineers;

e. to provide personnel news of a type not covered by existing publications;

f. to provide historical perspectives on present situations or events.

In order to initiate the MARE Journal a number of Headquarters personnel were directed to write and assemble it as they saw fit, therefore you may note a very strong Headquarters flavour in this first publication. It is not my intention that this always be the case, and I solicit your comments, views and input. In the future the following format is intended:

a. Index;

b. Editor's Note;

c. Letters to the Editor;

d. Commodores' Corner;

(1) space to address developments in the Maritime engineering field; (All MARE Commodores welcome)

e. Papers -

(1) three engineering papers will be contained in each issue;

f. Book Reviews -

(l) reviews of recent learned publications dealing with items of interest to Maritime Engineers.

On each coast there is a MARE Journal representative, tell him what you would like to see in the Journal. You may be working on a new project, use the MARE Journal to tell us about it. Have you read a good Maritime Engineering related book recently? Send a review to the MARE Journal. It is intended to print the MARE Journal twice a year. However, if enough response is received the publication frequency can be increased. The MARE Journal is your publication, it will be what you make it.

It has been my experience that it is not" what is true" that causes problems but rather "what people think is true, but isn't". Let the MARE Journal be a means of communication to get at the truth of matters which concern us in order to progress and develop as the highly capable technical force we know ourselves to be.

LCDR GARY N. WISEMAN

- Joined RCN in 1961 as an Ordinary Seaman Apprentice (Hull Tech);

- HMC Ships Sussexvale, Mackenzie, Columbia, Cresent, Chaleur, both "stone frigates" and 280 in new construction;

- Graduated Carleton University 1975;

- 1975 NDHQ/DMEM;

- 1978 University of London UK
  MSc in Naval Architecture;

- 1979 CDLS London UK SSO Subs;

- 1980 NDHQ/DMEM Subs
  Currently Project Manager Canadian Submarine Acquisition Project.

The "Mean" Look edited by LCdr G. Wiseman

This paper is an abstracted reproduction of some work that was done as a part of the run up to CPF. The subject has been understood for some years and it will be interesting to see whether the CPF design consortia incorporate its theory into their submission.

The full article is too lengthy to be published in one newsletter, hence it has been broken into installments. This is, therefore, the first of two parts which will, hopefully, lead into a series on the CPF as the curtain of design secrecy is dropped.

In the history of maritime nations there has been a long and deeply rooted tradition regarding aesthetics in warship design. From the lavishly ornamented galleons to the Great White Fleet, the warship has been regarded as an object of national pride, a reflection of the state of industrial art and technology, a demonstration of national determination and a floating showcase of cultural achievement.

Aside from the role of being able to wage war, the warship has served as a political tool of persuasion intended effectively to project a nation's naval power, prestige and influence. Consequently nations which have a strong maritime heritage have long taken great pride in the superior performance and appearance of their warships.

Over the past few years in several countries, there has been a noticeable trend away from considering appearance as an important aspect in contemporary warship design practices. For example, recent U.S. Navy ships convey the impression of being large, top-heavy, slabsided, static and underarmed. Warships such as the DD963 and FFG7 seem less fearsome than they could or ought to be. When compared to warships of other nations, such as the more recent additions to the Soviet Navy, the visual contrast is striking, leaving the impression that Soviet ships are more menacing and ominous.

What then are some of the reasons for such impressions? Why do some warships seem more impressive? Why do some appear faster and more powerful, while others fail to fulfill our expectations altogether?

The comments in this article attempt to answer these questions. They are directed primarily towards frigate, destroyer and cruiser type warships and the Canadian Conceptual Patrol Frigate (CPF) design in particular, but they are by no means confined to these types of ships, since to a greater or lesser degree, all ships share in common some of the elements introduced in this discussion.

What looks good in a warship design is admittedly subjective. However, it is reasonable to consider an experienced artistic opinion in order more accurately to decide what does make a better looking warship. For this discussion a measure of objectivity must be introduced and therefore a vocabulary of suitable ideas and terms has been developed for an enhanced understanding of a ship's visual effectiveness.

A warship is essentially a vehicle designed to operate effectively in water environment and serve as a platform for weapons and sensors. It must meet defined requirements for mobility and seaworthiness under a wide variety of sea states, provide some degree of survivability in battle and adequate habitability for its crew. To design and produce such a complex vehicle, nearly the full spectrum of a nation's technical ability must be utilized. Therefore, the warship is a form of architectural sculpture of equal significance to those of great buildings, bridges and aircraft.

In the past the shape of these objects has generally been the result of a total mechanical and aesthetic vision of a principal designer. Such designers succeeded because they had a unique appreciation of the basic nature of materials and mechanisms and knew how they could be artistically synthesized into a new and useful object.

While the architects of land structures have always maintained an intense interest in aesthetics, in the naval engineering community this has not always been the case. Because of the "design by committee" concept often employed today, the type of aesthetic impact Donald McKay had on clipper ships, John Roebling has on bridges, and Eturjo Bugatti had on automobiles, has been lost.

To compensate for the effects of "design by committee", modern industry uses industrial designers to improve product appeal, particularly when appearance impacts on sales. This same design concept has been successfully used for yachts and merchant ships but is not always present in the warship design process despite the ship's requirement to "show the flag".

Visual clues help us determine our relationship with an object and also shape our opinion as to whether the object is benign or threatening. The industrial designer makes full use of visual clues to enhance a product's appeal knowing that human beings have a preconception and predilection for certain forms to perform certain functions. Just as we naturally have a preference for a pretty face over one which is plain, we also see sharp, spear-shaped objects as threatening and the stereo with many lights and knobs as more effective. Visual clues as to what function a form serves are a very essential part of our evaluation mechanism.

There are five basic visual clues which seem to be common to better looking ships. They are:

a Lines of Force;

b. Dunn's Curve and Forward and Aft Slope;

c Profile Envelope and Silhouette;

d. Tumblehome and Flare;

e. Interval.

As shown in Figure 1, Lines of Force are the lines which unite the composition as a whole. Additionally, these lines can appear to spring out into surrounding space beyond the object, implying a gesture or pressure in that space. This visual interruption tends to give an object greater significance because of its eye-catching quality and visual excitement.

Lines of Force can give different impressions: being fast or slow, bold and of long duration or short, repetitive, and staccato. The sheerline of a ship is the most obvious example of a strong line of force as well as the single most important expression of the character of the ship. Other Lines of Force are found in the bow, stern, deck edges, and knuckles as well as those of even greater number and variety in the weapons and electronic systems, masts and funnels.

The greater the number or strength of coordinated lines, the higher the interest level in a design. Additionally, vertical lines tend to appear relatively static while lines set at an angle and thrust outward convey a sense of motion. A curved line is more interesting than a straight line and parallel lines reinforce each other. Lines which thrust in different directions work against each other and subvert a strong visual theme.

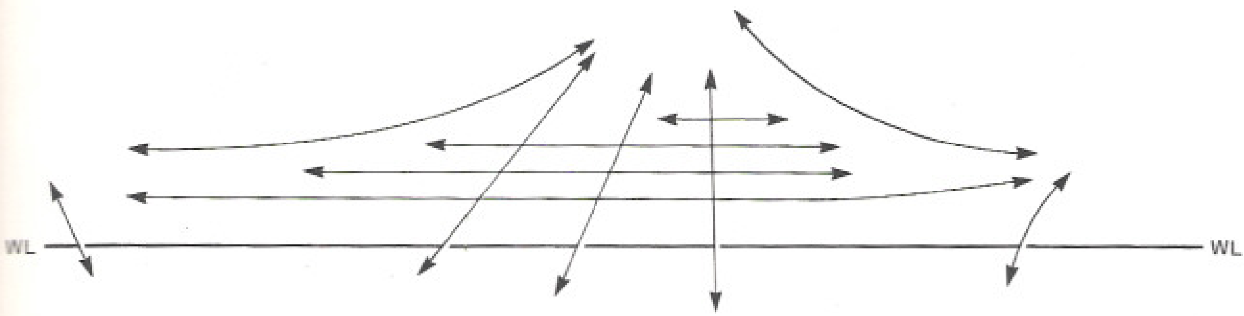
There are two more types of lines to be considered. The <u>Dunn Curve</u>*, illustrated in Figure 2, represents the preferred distribution of superstructure mass along the ship's length with the visual focus centered at about the first third of that length. In 1958, Lawrence Dunn put forth the idea that the general distribution of a ship's superstructure made a better appearance when it followed this curve. Perhaps the origin of the curve rests in early sailing ships, when the mainmast was taller than the foremast and the mizzen shorter than the other masts. But the curve became more apparent during the evolution of passenger liners where appearance was an important concern. This curve is amply apparent in such ships as the Mauretania, Normandie and the liner, United States. Because of the importance of this curve, it would seem equally applicable to warships as well. Interestingly, conventional destroyer and frigate designs of 1910-1960 vintage tended naturally to follow the Dunn Curve because of the location of the forward gun mounts and gun director. Thus the shape of the Dunn Curve has long been associated with what has been perceived to be rakish, lethal, surface combatants. The <u>Forward and Aft Slope</u> is nearly as important as the Dunn Curve because it represents the rate at which the superstructure is stepped upward.

<u>Interval</u>, <u>Tumblehome</u> and <u>Flare</u> are related to <u>Lines of Force</u> but convey different messages about the ship, all are shown in Figure 3.

* Dunn, Lawrence, <u>The Shaping of Passenger Liners</u>, Journal of Commerce Annual, 1958

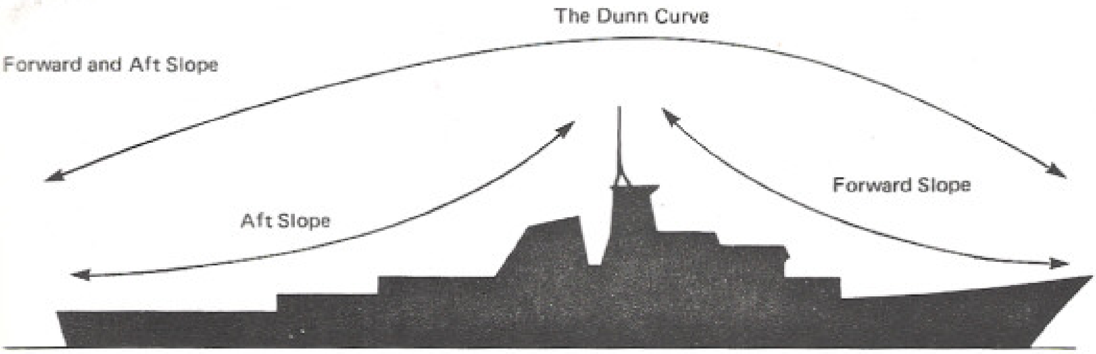
The Interval is the distance between decks or other major horizontals, and as such is related to the ship's length and freeboard. For a given ship, the greater the Interval the more bloated and chunky the ship will appear, while the same Interval in a longer ship will produce a feeling of sleekness. Additionally, a ship will appear to have a higher or lower profile due to a discrete balance between the horizontal and vertical distribution of the superstructure mass. The ship with a greater percentage of horizontal parallel lines (Lines of Force) such as the deck edge, sheerline, and knuckle will have an illusion of being lower and longer than the same ship without these lines.

Fig. 1 LINES OF FORCE



LINES OF FORCE are the lines which direct our attention and unite the ship into a compositional whole. These lines most often lie on the surface of a form such as a sheerline or a rake in the bow, but may be internal such as the thrust of a mast or the projection of a weapon. Lines of Force convey a sense of speed or stateliness depending on how they are coordinated and the type of line used.

Fig. 2 THE DUNN CURVE



*Hypothetical Cruiser

The DUNN CURVE represents the preferred distribution of superstructure along the ship's length which places the center of visual focus in the first third of the ship's length. The FORWARD & AFT SLOPE represents the rate at which the superstructure is stacked.

Tumblehome, whether found in the superstructure or hull, conveys a sense of the dynamic, unlike the static quality of straight perpendiculars.

Flare can be thought of as a curve in the hull form which, in part, forces water aside and also contributes to resisting plunging of the bow during pitching; but aesthetically, Flare is effective in reinforcing a projecting bow and emphasizing a strong sheerline.

All of these factors combine to define a warship's Silhouette and Profile Envelope as shown in Figure 4. Silhouette is the single continuous line which describes the contour of a ship's shape as seen from all angles. Objects which project outward from the silhouette are visually more demanding of attention because of their implied gesture and space interruption. Projections which give a ship a thorny, prickly appearance are caused by masts, radar and weapon systems. The thoughtful positioning of these systems to fill in space rather than to appear as singular units in a large void, makes for a variety of new shapes in the open area surrounding masts, funnels, weapons, and electronic arrangements.

If the Silhouette line is an unarticulated line, meaning one with few directional changes, generally, there is less interest and appeal than for one with a variety of directional changes. A line which defines a large shape with few variations or interruptions appears to exert a dull pressure on surrounding space in contrast to a sharp spike-like appearance which penetrates that space.

In viewing the profile of a ship in terms of Lines of Force (which can now be thought of as the internal compositional lines flowing through and across an object's form) and in terms of the Profile Envelope (which is the outline of the silhouette, including all guns, electronics, and other projections), it is apparent that these two features will largely determine how menacing an appearance a ship will have.

There is one more consideration included with these elements, Visual Texture. As sunlight reflects off the surface of a form, it is possible to determine if the object is relatively smooth and unarticulated or highly articulated because of the color value changes of light and shadow. Articulated surfaces are more interesting than smooth ones, a multi-faceted surface has more texture changes to catch the eye. The cactus is a good example of these two contrasting ideas; though it seems smooth and inviting to touch, there are those ever present spines pushing back at the viewer, which is also a common characteristic of the more menacing and ominous looking warships.

Of course, the basic ideas have been overly generalized for the purpose of making the principles clear. Nevertheless, when applied to warship design, these observations and thoughts come to the mind of the viewer, consciously or unconsciously, and seem to be the basis for why we react in certain ways when viewing a ship design.

Fig. 3 TUMBLEHOME, FLARE AND INTERVAL

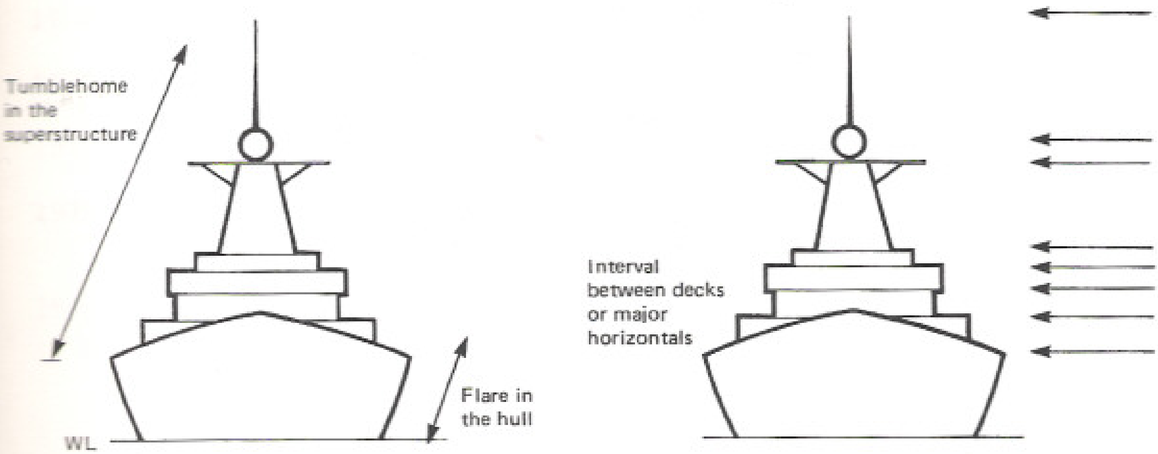
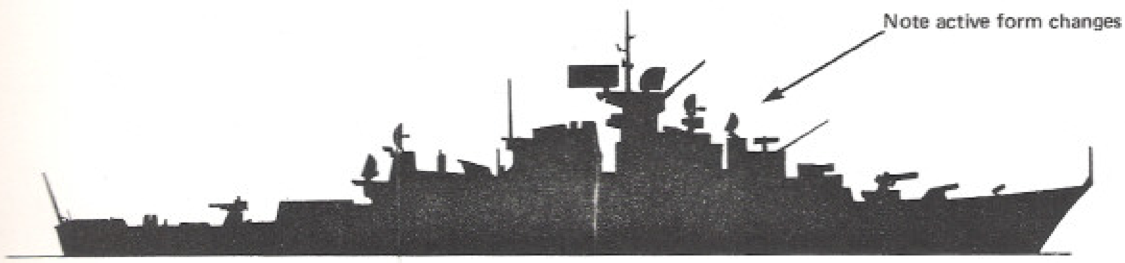


Fig. 4 PROFILE ENVELOPE/SILHOUETTE



The Profile Envelope is described by the line which follows the edge of the silhouette. Infill is caused by overlapping forms. The appearance of being low or high in profile is a result of a discrete balance in the percentage of vertical and horizontal distribution of the superstructure mass.

LCDR H. DAVID BROWN

1972 - Graduated University of New Brunswick with BSC in Electrical Engineering

1972-75 - CSE training culminating in completion of level II course

1975-77 - CSE HMCS Fraser

1977-78 - CSE level II course instructor CFFS(H)

1979 - Post graduate studies, Royal Military College of Science, Shrivenham, England resulting in MSc in Guided Weapons Systems

1980-82 - NDHQ/DMCS 2, surface-to-surface missile and vertical launch Seasparrow project officer

THE CSE TRAINING SYSTEM

LCdr H.D. Brown

INTRODUCTION

The Combat Systems Engineer's (CSE) training has evolved from its inception ten years ago to its current three year program. It has been continuously changed and updated based upon experience and feedback from former graduates. Many of these modifications appear to have been made to individual phases and courses in isolation without an overall examination of the entire training program.

The training system objective is to prepare officers to assume the position of CSE in a ship. The CSE is responsible for the maintenance of the ship's operations and weapons equipment in accordance with Canadian Forces maintenance policy as well as the day-to-day operation of his department. He must therefore have a sound technical knowledge of the equipment, a thorough understanding of the Naval Maintenance Management System and experience as a sea-going Naval Officer. This requires a combination of shore based and "at sea" training that will ensure the trainee has the basic knowledge and experience necessary to assume the responsibilities of a CSE.

This paper subjectively examines the current training system, outlines the perceived problems and proposes a method of more effectively integrating the various phases to improve the system.

THE CURRENT TRAINING SYSTEM

The current training system comprises a number of phases. A brief description of each phase is outlined in the following paragraphs.

Phase I is basic officer training and must be completed by all Canadian Forces Officers. Phase II is basic naval training and must be completed by all Naval Officers. Unique CSE training begins in Phase III. The aim is to ensure the candidate has the basic electronic and mechanical knowledge (both practical and theoretical) required to assist in the maintenance and repair of combat systems equipment. Theoretical topics are studied during a shore phase while practical aspects are covered during a sea phase.

The Phase IV ashore training ensures that the candidate has the managerial knowledge and the basic level of practical equipment experience required to supervise the maintenance and repair of DDE 261 combat systems. This phase consists of 5 weeks instruction in general combat systems engineering at the Naval Officers Training Center (NOTC) and 15 weeks instruction on DDE 261 equipment.

The aim of the Phase IV afloat phase is to insure the trainee has a practical shipboard experience necessary to perform the duties of an assistant CSE (A/CSE). In each section the trainee operates the equipment for maintenance purposes, uses fitted test equipment and handbooks to trace signal flow through the systems and sub-systems and performs routine tests and defect repairs.

On completion of the Phase IV afloat, the trainee sits a competency board at the NOTC and on successful completion is awarded a Certificate of Competency Level I. He then proceeds to an operational destroyer for the A/CSE phase.

As an A/CSE the trainee spends ten months understudying the ship's CSE and gaining experience in maintenance management, personnel management, logistics support, and practical first line maintenance. Based on his performance during this phase, the trainee is selected for the Level II course.

The Level II course is the final phase of formal CSE training. This is a 16 month course consisting of the following three distinct areas of study:

a theory;

b. naval applications; and

c equipment.

The theory phase consists of detailed studies in various topics at the university engineering course level. The applications phase relates the theory to the general equipment groups and examines how the theory is applied to naval systems. In the equipment phase the specific systems from all ships, except the DDH 280 class, are studied. Upon successful completion of the Level II course, the trainee is awarded a Certificate of Competency Level II and is a fully qualified CSE.

PROBLEM AREAS

The most obvious problem with the current training system is the method of sequencing the various phases. The A/CSE phase is an essential and critical part of the training period because it is during this phase that the trainee gains the majority of his shipborne practical experience. Yet he receives only basic introductory level courses and only DDE 261 class equipment ashore prior to this phase. A/CSEs often join a ship fitted with equipment with which they have little or no theoretical or practical knowledge. They then go ashore on the Level II course to learn theory and the equipment they have just left. Is this really desirable, effective or productive?

Currently this course is 10 months long and represents two thirds of the trainee's total sea time prior to joining a ship as a department head. A MARS Officer has a minimum of 40 months at sea before becoming a department head. Admittedly CSE's are highly intelligent and fast learners, however are we really that much better?

The training assessment procedures are also out of sequence. The final CSE qualification is awarded after the 16 month Level II course which is held totally in classrooms ashore. Should the final evaluation of an officer's ability to assume the responsibilities of a ship's CSE be assessed on how well he can regurgitate information learned in a classroom?

The current system wastes much valuable time - time which could be productively used at sea gaining practical knowledge and experience. There is duplication of information covered on the Phase IV course and Level II course. Do we have to be taught things twice? There is also the problem of having a trainee with a degree in Electrical Engineering studying electricity and electronics on Phase IV and Level II. Do we have to be taught things three times? It must be difficult to maintain a trainee's interest and morale during this type of repetition.

PROPOSED SYSTEM

The Phase IV ashore and the Level II course should be combined and taught directly after university graduation. The new shore training should be divided into a theory phase (Level I) and an application and equipment phase (Level II). The length of the theory phase would depend upon the background of the individual (see FIGURE 1). The application phase would be studied by all trainees and the equipment phase could be tailored to the individual classes of ships. The trainee would graduate from this shore training with a complete background in theory, application, equipment and the maintenance management system fully prepared to go to sea.

The "at sea" training phase would follow in an operational destroyer. The trainee should be referred to as a deputy CSE (D/CSE) rather than an A/CSE to indicate that this is a full posting into a meaningful position rather than an intermediate training position. The D/CSE phase would be at least two years in length for university graduates and as short as one year for officers Commissioned From the Ranks (CFR's). This sea posting would initially be a training phase but it is considered that after a short time onboard, the trainee would be making a tangible contribution to the CSE department. The D/CSE position then becomes a useful job rather than just more training. By the end of this phase a realistic evaluation of the ability of the trainee to assume the duties of a ship's CSE could be made.

The progression from phase to phase/job to job in the proposed system is a much more effective and productive sequence than in the present system. The manner in which one phase prepares the trainee for the next phase is far superior. Duplication is eliminated and the method of evaluating the trainee's ability is vastly improved. The actual amount of training time is reduced and the "at sea" training time is increased and made more productive.

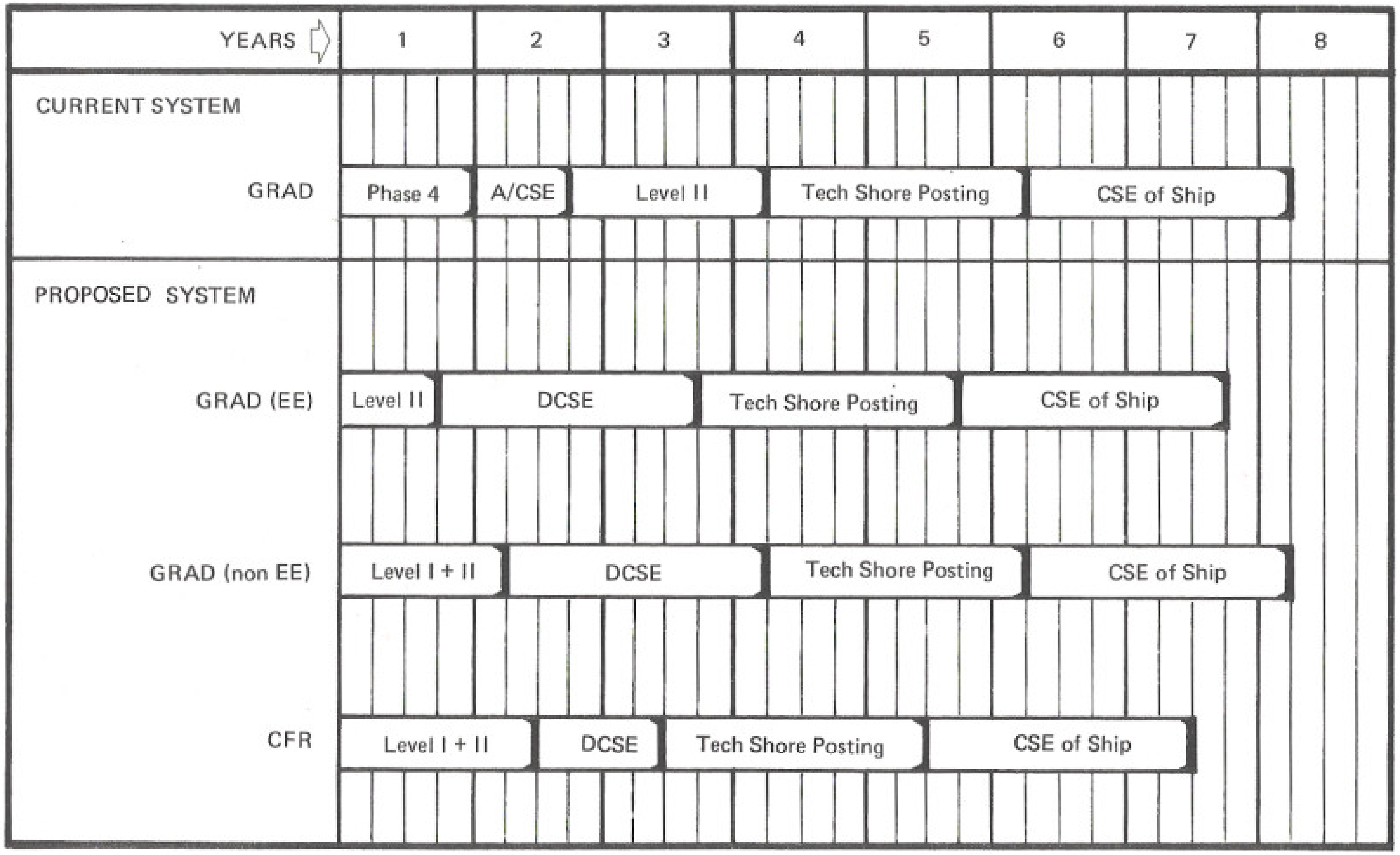

YEARS
1
2
3
4
5
6
7
8
CURRENT SYSTEM
GRAD
Phase 4
A/CSE
Level II
Tech Shore Posting
CSE of Ship
PROPOSED SYSTEM
GRAD (EE)
Level II
DCSE
Tech Shore Posting
CSE of Ship
GRAD (non EE)
Level I + II
DCSE
Tech Shore Posting
CSE of Ship
CFR
Level I + II
DCSE
Tech Shore Posting
CSE of Ship

Fig. 1

CONCLUSIONS

The current CSE training system has many weaknesses and the "band-aid" fixes of the past have not solved the problem. It must be emphasized that the content of the present individual courses is both relevant and sound, however the sequencing is wrong. The system requires a complete rearrangement as outlined in the proposed system above. The proposed changes would benefit the ships, the system and the individual trainees.

It must be admitted that the proposed training system is not a brilliant new conception from the fertile mind of the author. The Royal Navy and the Royal Netherlands Navy have been training their Weapons Electrical Officers (CSE equivalents) in this exact manner for many years. They find it to be a very successful training method with no major problems. I am convinced that this training scheme would be equally successful in the Canadian Navy and would prove to be a vast improvement over the present system.

To: Canada's Naval Engineers

THE CANADIAN INSTITUTE FOR CANADA'S NAVAL ENGINEERS

I believe we are all members of associations of one kind or another, whether they be Provincial regulatory bodies or learned societies. We belong to the one or ones which best suit our needs, or which provide the social or professional contacts which we desire. There are some, also, who seek to contribute to the professionalism of their "trade" by supporting studies and other programmes which will advance the science and practice in their particular niche in the engineering field. The aim of this article is to sketch the history of the Canadian Institute of Marine Engineers (CIMarE) and to explain why it is considered that it is the one organization in Canada which attempts to identify closely with the needs and aspirations of Canadian engineers working in the Marine field.

The Canadian Institute is just over five years old, having received Federal letters patent in April, 1976. It was formed using as a pattern the Institute of Marine Engineers (UK) (IMarE) because the UK institute was unable to relate to the national needs and aspirations of Canadian engineers.

In an effort to show as few changes as possible in the nature of the new association, and in order to retain as many of the Canadian members of CIMarE as possible, CIMarE patterned itself fairly closely to its British parent but with some key differences. The principal one was that sea-going engineers (First and Second Class) were eligible for election to Corporate or voting membership in the Canadian Institute - not the case in the UK. Also, other engineers or industrial persons in positions of professional responsibility or in superior positions of responsibility, but not certificated Marine Engineers, were eligible for election as voting members of the Canadian Institute.

Time passed and the Canadian Institute quickly began to grow. As it grew, its programmes expanded, though carefully because of the need to remain within a tight and small budget. In 1978, the National Council of CIMarE began to acknowledge excellence in Naval engineering and approved the annual awarding of two prizes to DND's top MSE Certificate of Competency candidates (one each for Part I and Part II).

In 1979, recognizing the rather narrow-sounding scope of the Institute's aims, National Council expanded them to "advance and promote in Canada the science and practice of marine engineering, naval engineering, naval architecture, marine electrics and electronics, and other associated professions", thus effectively embracing all engineers and technologists associated in any way with the marine field. These expanded aims were taken to the membership present at the 1980 Annual General Meeting and were approved unanimously with no dissenting discussion. Thus the Canadian Institute of Marine Engineers now recognizes a very broad range of marine interest and is the only truly Canadian association to do so. In 1980, the Council approved amendments to the By-Laws, which were ratified at the Annual General Meeting in Toronto this past June, recognizing Naval certificates of competency in Combat Systems Engineering. Thus CSE, Level II may become Members and Level I CSE's Associated Members of CIMarE exactly the same as their fellow MARE's of the MS sub-classification. It should be noted that equivalent bench-marks are being developed for naval architects, marine electrical and marine electronic engineers.

The Canadian Institute's membership has increased from 480 in 1976 to nearly 1000 members but is somewhat short of the numbers needed to support fully effective programmes. Those in a better position to know say that about $120,000 annual revenue is needed to operate an effective national organization. For this reason, the Canadian Institute is looking for short-term financing from industry while it launches a membership drive. Thus the membership to produce sufficient revenue must be in place when the short-term expires, likely in 1983/84. At current rates, a total of 2500 members are needed or 500 new members per year for three years.

There have been encouraging signs of a continued growth in membership and some interest is being shown by engineers other than those of the marine systems specialty. In NDHQ, recent response from naval architects and combat systems engineers has been most encouraging as naval engineers of these specialties seek membership. Up to the present, the response on both coasts has been uniformly poor.

Naval engineers are in excellent position to seek membership in a variety of marine-oriented associations such as:

Society of Naval Architects & Marine Engineers (SNAME)
American Society of Naval Engineers (ASNE)
Institute of Electrical & Electronic Engineers (IEEE)
Institute of Marine Engineers (UK) (IMarE)
Canadian Institute of Marine Engineers (CIMarE)

depending upon their specialties and most of these groups cater to one particular branch of engineering. Let me say why I believe you should choose CIMarE.

Membership in CIMarE exposes the Naval engineer to technical papers covering a rather wide range of marine interest and thus we have an opportunity to broaden our horizons. Not only do we hear papers on topics from related marine fields, but also we are able to do so in company with engineers from other government departments and members of the private sector. While many of us do this as part of our jobs, it is a refreshing change to interact professionally outside the work situation.

The Canadian Institute has a social side as well. Members in Montreal repair each year to the Ritz Carleton for their annual Marine Ball. In Victoria, it is a Dinner Dance, this year at the Princess Mary. The Atlantic Branch, in Halifax has its Dinner Dance at HMCS SCOTIAN and this last year the Ottawa Branch held a Marine Ball at the top of the Skyline Hotel.

Our Institute has reached a turning point. A major short-term funding drive is about to be launched to give us working capital quickly to reach a significantly higher level of activity. Our aim is to become a "world class" association in the next few years with technical publications and seminar/symposia programmes second to none. A better funding base will draw better papers for our Branch meetings and annual national meeting.

In parallel with this funding drive is a membership drive designed to bring in 500 new members each year for three years - aiming to give us the sustained funding with reasonable annual dues by the time the short-term funding runs out.

We are at the stage now where it will just take a little up-push to get us "over the hump". Our members in Transport and other agencies and companies are telling their folks the time has come to get involved in Canada's marine institute for engineers. It is time the Naval engineers did likewise.

Naval engineers of all specialties are welcome. Those wishing further information are urged to contact Commander Don Wilson in NDHQ or speak to others who also are members.

Let's take the opportunity to increase the Naval participation in CIMarE. We will benefit and so will the Institute.

D.W. Wilson
Commander
Member of National Council
Ottawa Branch
of the
Canadian Institute of Maritime Engineering

CDR RON J. RHODENIZER

1971 - Graduated RMC with BEng (Mech)

1971-75 - MSE training

1975-76 - E.O. HMCS Fraser

1976-77 - Dagger Course, Royal Naval Engineering College, Manadon, Plymouth England, resulting in MSc in Marine Engineering

1977-79 - NDHQ/DMEE 5 RAS systems project officer

1979-81 - Exchange Duties, Bath England, Marine Spey gas turbine project engineer

1981-82 - NDHQ/DMEE 7 Controls and Instrumentation project officer

1982 - NDHQ/DMEE 5 Section Head

THE BIRTHRIGHT

INTRODUCTION

1. The aims of this paper are:

   a. To review the evoluation of Canadian naval engineering;

   b. To comment on the present state of Canadian naval engineering; and

   c. To identify some changes within the Department necessary to maintain high naval engineering standards.

This paper intends to highlight impressive Canadian naval engineering achievements as a background to the state of naval engineering today, and also notes some areas that must be addressed in order to improve present Canadian naval engineering professionalism. It is realized that some impacts on the navy, such as national politics and international relations, are beyond the control of serving members, however this should not preclude naval engineers from striving to improve their professional standards. Professionalism can be developed, even in difficult times, and it must be strived for if we are to leave a worthwhile legacy to following generations of naval engineers.

NAVAL ENGINEERING HISTORY

The Royal Canadian Navy came into existence in 1910 and the first RCN ships, two cruisers, Rainbow and Niobe, were purchased from the Royal Navy in that year. In 1914 two submarines were acquired from the United States and a number of government and private vessels were converted in Canada for the War effort. During 1917 three classes of minesweepers, as well as trawlers and drifters were built in a variety of yards on the Great Lakes and St. Lawrence River. After the war the cruiser Aurora and destroyers Patrician and Patriot were procured from Britain to replace the Rainbow and Niobe. Two more submarines were obtained from the United States in 1920. By 1922 however, Aurora and the four submarines had been scrapped. Between 1928 and 1938 Patrician and Patriot were paid off and eight former RN destroyers were acquired from Britain. Two of these were subsequently paid off in the latter stages of this period maintaining the Canadian destroyer strength at six ships. Twelve Battle Class trawlers were laid down in the St. Lawrence and Great Lake Yards in the 1920's and 30's but nearly all were paid off by 1938. Four Minesweepers were built in Canada in 1938 completing the pre-World War Two ship acquisitions. Thus Canada entered WWII with a Fleet of six destroyers, four minesweepers, a trawler and two training ships. In the history of the RCN up until 1939 it can be seen that naval building, design and development experience was limited. All the major warships had been procured offshore including the submarines. In the few years ahead this was all to change.

Upon the outbreak of WWII, in September 1939, Canadian commercial and privately owned ships were taken over and converted for naval use. Many of these were fitted out for anti-submarine and minesweeping duties. Some commercial vessels were also obtained from the United States through private agents. This conversion phase of the naval programme was quickly followed by new shipbuilding programmes. Smaller vessels of the Corvette type were laid down first since there was sufficient ship design and construction experience in Canada to support this work. Destroyers however, were another problem since they were much more complicated and the necessary technical experience did not exist in Canada to undertake such work. During 1939 the Canadian Government petitioned the Admiralty in Britian for the technical expertise necessary to build destroyers in Canada. Britain was hard pressed for new ships at that time and suggested Canada turn to the United States for help. Despite this, a Canadian decision was made to stay with RN design and requests for British technical help were renewed. As the war progressed, companies like Dominion Engineering and John Inglis were able to take on the building of diesels, boilers, main propulsion steam engines, gearing and shafting. Eventually a British Admiralty Technical Mission was sent to Ottawa arriving in July 1940. In January 1941, Vickers-Armstrong UK Ltd. agreed to co-operate in the plan to construct destroyers in Canada and subsequently sent technical personnel to help in this work. Seven USN Destroyers were accepted in 1941 as part of the "Lend/Lease Programme" and one destroyer was procured from Britain in that year.

From 1941 to 43, during the Battle of the Atlantic it became obvious that there were too few effective escorts to support convoys and engage in anti submarine work. Canada now had the capacity to turn out most of the necessary equipment to address this escort problem and geared up to the task of building frigates. When the submarine war started to decline Canada cut back escort building but decided to acquire other types of warships instead. The final phase of the war, as far as ship procurement for the Canadian navy was concerned, began in the autumn of 1943. Between then and VJ day Canada acquired or arranged to acquire, mainly through the British Admiralty, many types of ships ranging from cruisers and light fleet carriers to motor torpedo boats. This extensive transfer of ships to the Canadian navy was to provide an opportunity to expand and update the RCN. A navy which entered WWII almost entirely as an escort force would be modified to become a diversified and well balanced Fleet, able to participate effectively in the invasion of Europe and in the Pacific war, and at the same time able to meet the needs of the post-war period. By the end of the war there were more than nine hundred ships commissioned in the Canadian navy. Many of them were local craft performing miscellaneous harbour duties but over 375 were armed for offensive action against the enemy. Although the larger ones had been obtained from the United Kingdom and others had been converted from peace time use; by far the greater number of ships had been built in Canadian yards during the almost six years of hostilities. The four Tribal Class Destroyers Nootka, Micmac, Cayuga, and Athabaskan were examples of this work. They had been completely built in Canada except for major components of the propulsion system including turbines and gearing. Canada had thus come through the war having developed a major ship-building industry.

After WWII many of the Canadian naval vessels were decommissioned and the Fleet was run down with manning levels falling from 100,000 to 6,900. However, the deficiencies in the Canadian navy were redressed, in 1949, under the authority of the Defence Production Act and by the end of the Korean War the navy was back to a strength of 21,000. This was a period of immense building activity when Canada continued the policy of domestic naval systems development as opposed to offshore procurement. The highlight of this period was the production of twenty Destroyer Escorts (St. Laurent, Restigouche, Mackenzie and Annapolis Classes). These ships were almost totally built in Canada with boilers, turbines, gearing, shafting, and sonar all being manufactured by Canadian Industry. Over this period the aircraft carrier capability was maintained by replacing Warrior with Magnificent and she in turn by Bonaventure. Twenty-one frigates were radically rebuilt as "Ocean Escorts" from 1953 to 58. Twenty Bay Class Coastal Minesweepers were built during 1950 and 1951 with six more in 1954. The Canadian navy's only icebreaker, HMCS Labrador, a design adopted from the US Wind Class, was commissioned in 1954 and transferred to the Dept of Transport in 1958. One former USN Submarine was acquired in 1961 and replaced by another in 1968, which in turn was decommissioned in 1975. Three British built "O" Class Submarines were acquired between 1965 and 1967. From 1962 to 1966 the St. Laurent Class Destroyers were rebuilt to carry helicopters, and in addition fitted with the Canadian-designed helicopter haul-down and variable depth sonar systems. The four Restigouche Class Destroyers were modernized to carry ASROC missiles and returned to the Fleet in the 1970-71 period with an improved Canadian designed hull mounted and variable depth sonar. Between 1963 and 1970 three supply ships were commissioned. These ships carried a replenishment-at-sea system, which although USN in concept, had been totally implemented in Canada. 1968 saw the successful commissioning of the innovative Canadian designed hydrofoil Bras d'Or. The DDH-280's entered service in 1972 representing some outstanding Canadian Marine Engineering. Canadians had carried out the design integration for the complicated DDH-280 combat systems and had put gas turbine propulsion to sea ahead of many other of the world's navies. The latest Canadian naval engineering development was the commissioning of a Diving Support Ship to carry and tend to the Canadian-developed, PISCES type miniature submersible.

NAVAL ENGINEERING TODAY

After a very long dormant period the Canadian navy is now in the process of purchasing six new ships, the Canadian Patrol Frigates. Many younger members of the profession look to the CPF and its follow on variants as an area where they can become involved in ship design and equipment development.

However, to be realistic the decision to contract the CPF design out to industry will preclude any major hands-on engineering involvement. Many of the department's engineers have realized this and are joining the private sector in search of more direct engineering involvement in the CPF design. At the rate of talent departure from the department and considering the very small base of experience in the navy of actually doing ship design and construction, it is possible that the navy will not even be capable of adequately evaluating the CPF design proposals.

In order to maintain ship design and construction expertise it is imperative that naval engineers do work in this area. It is realized that the CPF procurement philosophy cannot be changed or a new major ship modernization project launched at the drop of a hat. However, there are planned ship updates and auxiliary vessel procurements going forward. Naval engineers must be involved in these to the maximum extent possible. Design and construction experience can only be developed by doing design and construction projects. This expertise is necessary to be able to ensure that contractors produce ships that meet specified requirements or even to be able to write the ship requirements in the first place. Design and construction expertise could also be obtained through the CPF project upon completion of the competitive phase provided more technical interaction were allowed between DND naval engineers and the contractor's staff.

The 1950's and 1960's saw Canadian naval engineers at the forefront of maritime technology. This did not come easily but through twenty years of involvement and hard work under war and peace time conditions. Since 1970 naval engineering in Canada has been on the decline for a variety of reasons and this is particularly true in the Canadian navy. In these politically difficult times it will be hard to reverse this downward trend. One means of redressing this decline is the provision of challenging tasks for young engineers. It is only through doing real, useful engineering projects that naval engineering talent can be developed. Well defined projects must be initiated that can be brought to fruitful completion.

Senior management presently screen projects to ensure that they are important, are properly authorized, and funded to allow appropriate application of time and technical effort. However, excessive bureaucratic safeguards, checks and balances, seem to be stifling technical initiative and interest. Too much engineering manpower is being spent on management and administration and not enough on hard engineering. Junior engineers will have plenty of time for administration and management later in their careers. Many dedicated personnel are addressing such problems as training, manning, and pay but few seem to be concerned with the tasking of young naval engineers. If engineers are to be challenged and a sense of achievement fostered, then they must be assigned appropriate work and ways must be found of shedding disheartening administrative tasks such as work-load reviews.

The current policy of contracting out real engineering and leaving only engineering management within the department is fundamentally wrong. Every time a new contract is raised on one of the "Body Shops" it seems that another engineer leaves the service. Naval engineers are telling us with their feet that they want to do engineering. It is also in the best interest of the service that naval engineers take on a larger technical workload. One can only effectively manage engineering if one has done real engineering. Therefore no engineering organization depending entirely on internal promotion/career flow can produce good engineering managers unless it has real, hard engineering activity at a level of effort sufficient to give potential managers a good experience base. If contracting out must be followed, due to personnel shortages, then the time-consuming, low level and mundane tasks are the ones to be contracted. It is a major mistake to contract out detailed engineering investigations and feasibility studies.

The policy of appointing young inexperienced engineer officers to headquarters organizations is wrong. For some reason, likely manpower shortages, numerous inexperienced junior personnel are being appointed to NDHQ (DGMEM). These personnel are expected to make intelligent engineering decisions and initiate Fleet equipment improvements. In many cases they don't have the "hands-on" experience necessary to carry out this work. At one time all naval engineers serving in DGMEM were experienced personnel having been to sea as engineer officers of at least one, or more vessels. Now DGMEM is gaining Sub Lieutenants who can only be employed effectively in administration type work because no junior level engineering is done in headquarters. These personnel should be at the "coal face" learning their trade for future employment in headquarter roles. This year a number of shipboard engineering officer billets will be left vacant in order that headquarters billets can be filled. Those affected will be Sub Lieutenants and junior Lieutenants. They are the people who will suffer in the long run from missing "hands-on" experience. Also, it is possible that they will become frustrated by not being able to do the engineering jobs they imagined they would do. Thus the service will lose in both personnel quality and personnel satisfaction.

In the 1950's and 60's the aircraft carrier was an ideal ship to complete the training of young engineers. This ship through her size and variety of equipment carried, provided a means for young qualified engineers to get their journeyman experience. These ships are no longer available and the number of shipboard engineerng jobs between training and charge hand is limited. Consideration must be given to finding jobs within the Canadian destroyer fleet for young qualified engineer officers to gain more experience for future jobs in NEU's, CFTSD's and NDHQ.

In the late 60's and early 70's many of the present MARE senior managers were busy building ships, tackling problems, testing equipment and setting systems to work. They gained extensive experience in those years which stands them in good stead today in their present managerial positions. The number of young engineers engaged in similar activities today is considerably less than it was ten years ago. The author considers this will have a significant effect on the abilities of the MARE senior management of the 1990's. If one considers that in the 1990's the navy will be replacing most of its vessels, then this will be a time when a high calibre of engineering leadership will be necessary.

There are few major projects going forward in the navy today that young engineers can gain engineering experience from. However, there are still some projects available even though they may be small. One way to recover lost skills and develop new ones is to use these projects to best advantage, that is to do the work in service and accept responsibility for the results. This will require a revolution in current policies, but it is definitely within the navy's capability to do more of the detailed work on smaller projects. Such work will stand the navy in good stead for the future.

CONCLUSIONS

The Canadian navy has come a long way since 1910. The development of shipbuilding in the second world war was impressive. The building of modern ships and systems in Canada throughout the 50's and 60's was based on that wartime experience. The 70's saw a decline in naval engineering capabilities. This decline is often blamed on the political climate. Politicians are easy targets, it is more difficult to look inward and see if there is something wrong with the way we train, develop and task our engineers. If we don't start addressing these aspects soon the professional capability of the next generation of naval engineers will be well short of that of our predecessors.