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Maritime Engineering Journal

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Maritime Command's New Naval Engineering and Maintenance System

Also:

- *Naval Engineering and the Environment*
- *Looking Back at HMCS* **Ontario**

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Cruiser Routine

Looking Back at HMCS *Ontario*
...see page 18

Maritime Engineering Journal

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OUR COVER
Following a vigorous two-year review of its naval engineering and maintenance system, Maritime Command is set to stand up two new "fleet maintenance facilities" on April 1. Preparations for the sweeping changes about to hit the NEM system have been under way throughout the naval engineering community since 1994. The new system will operate on a firm business footing and promises more effiicient, cost-effective support to the fleet.

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Guest Editorial

The future ain't what it used to be!

By Captain(N) Gerry Humby, Commanding Officer (designate), Fleet Maintenance Facility Cape Scott

We are constantly hearing that we are in a period of unprecedented change. That may be true, but our navy is no stranger to change. I feel fairly qualified to make this observation, having been around for 35 years of such representative changes as the phase-out of the first tribals, the introduction and eventual phase-out of the "cadillacs," the first helos at sea in Canadian DDHs, the introduction (and demise) of the operator/maintainer trade concept, Unification, the introduction and modernization of the DDH-280s, and the introduction of the CPFs and MCDVs.

So what is it that separates the current climate of change from previous periods of change? Most folks have already correctly concluded that it is the scope and pace of the change. More significant changes are being developed and implemented in shorter time spans than ever before. Take those that have occurred in naval engineering and maintenance (NEM) in MARLANT in only one year. Three units are being disbanded to form a single, much leaner, maintenance and engineering unit. The new unit comes with major reductions in infrastructure and in civilian and military personnel. Besides reductions of almost 400 personnel, over the next year or so facility rationalization projects will relocate more than 500 people and free up 45,000 square metres of space for disposal or other uses. Formation engineering and maintenance staffs are also either being eliminated or amalgamated with operational staffs. Process reengineering and modern information technology initiatives will allow the streamlined NEM system to gain even further efficiencies. Business planning and budget devolution will increase the cost awareness of engineering and maintenance support and help maintain gains in efficiency and effectiveness.

The extent and intensive pace of the changes are placing demands on the naval technical community at all levels. In my view, the leadership and communication skills that successfully carried us through past changes are essential to seeing us through the turmoil and uncertainty of current and future changes.

In a climate of rapid change, effective leadership hinges on an open, two-way exchange of information. Leadership involves other significant elements, but all effort is wasted if a leader cannot communicate effectively. During the uncertainty associated with rapid change, leaders must establish and maintain order by providing vision and direction. They must identify key basic issues and develop an effective attack. Success depends on communicating the plan effectively. In my experience, those who consistently come out on top in tough circumstances are well versed in the basics of effective communication.

I must stress that everyone in the naval technical community has a role to play in effective communication during this period of unprecedented change. It is not enough for leaders just to pass the word down the chain, or for staff to wait passively to be informed. Communication cannot be one-way. (We have all seen the effects of someone stuck in Receive mode or, even worse, in Transmit.) Every member of the team must work to keep the lines of communication open. Effective personnel communicate.

I have observed change from many perspectives in my career and I can assure you that dealing successfully with change means communicating effectively at all levels. My most recent experiences with the NEM Functional Review and the stand-up of Fleet Maintenance Facility *Cape Scott* have only strengthened this opinion. This major restructuring activity is occurring in parallel with countless other changes at all levels of government and presents significant potential for chaos. An intensive effort on communication during our NEM renewal process has been and continues to be a critical factor to our success.

I do not believe that we can expect any respite from the current pace and scope of change. The naval technical community must therefore work as a team and adapt to the new order if it is to sustain the engineering and maintenance capability essential to our navy. As we continue to shape our future, we will be constantly challenged to improve our efficiency and effectiveness in serving the fleet. In my view, a commitment to leadership and communication at all levels will be essential in adapting to changing missions, roles and constraints. There is no doubt in my mind that we are capable of meeting this challenge.

Surf's up!

The *Maritime Engineering Journal* is now available on-line through the Internet. Readers can view the *Journal* at the DGMEPM home page:

http://limbo/dmcs.dnd.ca

The *Journal* home page can be found by selecting "Additional Pages" and looking under "Public Information." Letters to the Editor and article submissions can also be made through the Internet (**editor@dmcs.dnd.ca**).

Sharpen your pencils, everyone!

The *Maritime Engineering Journal* needs a motto.

What we are looking for is a slogan in English or French that describes the *Journal*'s purpose. Since we plan to use it as a subtitle for the magazine, it should be simple, yet elegant, and should incorporate some sense of the magazine's objectives (see below).

As if you needed any encouragement in so noble an undertaking, the editorial committee is even putting up a book prize for the winning entry.

The deadline for entries is June 15, 1996. Note that the *Journal* reserves the right to modify the winning entry or create its own motto if no suitable entry can be found.

You can send us your entry in a variety of ways:

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Maritime Engineering Journal Objectives

- To promote professionalism among maritime engineers and technicians.
- To provide an open forum where topics of interest to the maritime engineering community can be presented and discussed, even if they might be controversial.
- To present practical maritime engineering articles.
- To present historical perspectives on current programs, situations and events.
- To provide announcements of programs concerning maritime engineering personnel.
- To provide personnel news not covered by official publications.

Writer's Guide

The *Journal* welcomes **unclassified** submissions, in English or French, on subjects that meet any of the stated objectives. To avoid duplication of effort and to ensure suitability of subject matter, prospective contributors are strongly advised to contact **the Editor, Maritime Engineering Journal, DMMS, National Defence Headquarters, Ottawa, Ontario, K1A 0K2, Tel.(819) 997-9355,** before submitting material. Final selection of articles for publication is made by the *Journal*'s editorial committee.

As a general rule, article submissions should not exceed 12 double-spaced pages of text. The preferred format is WordPerfect on 3.5" diskette, accompanied by one copy of the typescript. The author's name, title, address and telephone number should appear on the first page. The last page should contain complete figure captions for all photographs and illustrations accompanying the article. Photos and other artwork should not be incorporated with the typescript, but should be protected and inserted loose in the mailing envelope. A photograph of the author would be appreciated.

Letters of any length are always welcome, but only signed correspondence will be considered for publication.

Commodore's Corner

The MOS Review and the MARE

By Commodore F.W. Gibson, OMM, CD
Director General Maritime Equipment Program Management

As you are no doubt aware, the MARE MOC is one of many occupations being examined under the VCDS-directed Military Occupational Structure (MOS) Review. The aim of the review is to determine the minimum number of MAREs that are needed for the navy to meet its roles and responsibilities. The detail of the process to be followed is:

- all ship positions will automatically be identified as being required;
- all shore billets will be reviewed to determine if they must be filled by a MARE. If the billet does not need to be filled by a MARE, it will be examined to determine if it should be filled by a public servant or if the work should be contracted;
- the resulting establishment will be reviewed to ensure that the occupation remains viable and that the sea/shore ratio and the guaranteeing factors for peacetime and contingency operations can be accommodated;
- recommendations for any changes to the MOC structure, training and recruiting will be developed as the review dictates; and
- recommendations will be made for the optimum approach to any transition that might be required.

This is the what and the how. Let me turn now to the questions that are on most everyone's mind.

Is this review a precursor to cuts? Yes and no. It is likely a precursor to further cuts if the recommended establishment is less than what it currently is. Whether these cuts would be taken immediately or not is unclear. No, it is not a precursor if the number is marginally the same.

Why are the operator trades not being subjected to this review? The simple answer to this question is that the operator trades are seen to be the "warfighters" and hence are being protected to maximize the "warfighting" capacity in this time of reduction. What must be determined is whether the support tail is at its minimum, so that if further reductions are required and the minimum support trade establishment is in place, it will be clear that further cuts can only be taken by affecting operations or by cutting the operator trades as well. No one wants to cut warfighting capacity if the cuts can be taken in the support tail at no cost to operations. Having said this, I believe there is growing evidence that the operator trades are starting to realize that they must go through this kind of review if they are to be able to quantify their establishments and know what the consequences will be on operations if further reductions must be made. I am also seeing evidence that more and more naval officers are recognizing that everyone ashore is part of the support tail. Put a different way, if the support tail is too large, then everyone ashore must be examined, not just MAREs and LOGs.

"The Maritime Commander understands what the MAREs bring to the naval team."

Does the Maritime Commander understand the role of the MARE and the value added of the MARE MOC? The answer to this question is, unequivocally, yes. I offer two excerpts from his most recent message to ADM(Per) on this issue: "When naval forces go to sea, all personnel fight their ship as full members of the combat team." He specifically stated that "the MARE, SEALOG and MARS MOCs form an essential team." He concluded, "...the leadership and technical expertise provided by the MARE and SEALOG MOCs...must not be undervalued." This should clearly provide all with a clear signal that the Maritime Commander understands what MAREs bring to the naval team and what they must continue to bring if the fleet is to receive the support that it needs.

I understand that this review is being viewed with concern and know that these words will not dispel all of your worries. This review is essential if we are to understand what the minimum is and to be able to defend it. I will update you as the MOS Review progresses.

Improving the MARS/MARE Interface

Article by Lt(N) Mike Meakin

Much of a MARE's training emphasizes the importance of proper integration of equipment. Indeed, understanding the "system level" of naval equipment is purported to be the most important aspect of our job. It is also generally recognized that while two systems might work excellently in isolation, they often work poorly, if at all, together. The single most important factor in allowing two systems to work in concert is whether or not there is good communication between them.

Despite this awareness, the MARE community appears to downplay the importance of a different kind of "system" integration — the operator/engineer interface. Little, if any, time is devoted during training to conveying even a rudimentary understanding of exactly what the operational commander's job entails, and to my knowledge the same may be said of the Maritime Surface and Subsurface (MARS) officer's understanding of the MARE side of the house (*February 1995 issue*). It seems only reasonable, then, that we should expand our definition of "system integration" to include the interaction between the two branches. By doing so, we might better utilize our engineering expertise in helping our MARS brethren accomplish the operational objectives of the navy.

Happily, a partial solution to this problem is already available, although at the moment it is apparently poorly advertised and underutilized within the MARE community. It is the two-week Maritime Warfare Standard course, offered twice a year by the Canadian Forces Maritime Warfare Centre in Halifax.

I recently had the opportunity to attend this course, along with students from allied nations such as the United States, the United Kingdom and Denmark. The diversity of our backgrounds (surface ships, submarines, air force, engineers and civilians) coupled with the encouragement of class participation allowed for wide-ranging and sometimes animated discussions of each other's tactics, experiences and attitudes. In many instances where a student had particular expertise in a lecture topic, the student was invited to present the brief.

The presentations themselves covered virtually all aspects of warfare, including ASW, AAW, surface warfare, mine warfare and amphibious assault. Briefs were given on the capabilities of the world's forces, allowing for an appreciation of the threats being faced both worldwide and in specific regions. Maritime law and rules of engagement (ROE) were explained, as were such less-obvious (to an engineer) subjects as waterspace and airspace management. Copious examples were used throughout these lectures, both by the instructors and the students, to explain and emphasize relevant points. Briefs which could have been rather dry became lively, informative discussions with input from different national perspectives on how policies and tactics were used during such experiences as the Falklands conflict, the Gulf War and the Canadian turbot dispute.

"It seems only reasonable that we should expand our definition of "system integration" to include the interaction between the two branches."

The course was more than simply a series of lectures. Throughout the two weeks the students were organized into syndicates and given a number of scenarios to address from the point of view of a task force commander. The scenarios related to the lectures and were simple at first (e.g. defining an ROE request), but as the course progressed they became more complex (e.g. maintaining a maritime interdiction operation). In these scenarios the syndicates were allocated certain resources, apprised of the threat being faced and assigned the mission to be accomplished. The syndicates were constructed to contain as broad a variety of student backgrounds as possible, both in experience and nationality, to allow the knowledge of the students themselves to become an additional resource. On completion of each of these exercises two syndicate solutions would be chosen for presentation to the course as a whole. Usually the two solutions were quite diverse, leading to lively discussion of the merits of each plan and demonstrating that there is more than one solution to any problem.

An important point for an engineer to note is that the Maritime Warfare Standard course is an integral part of the Operations Room Officer (ORO) course taken by combat officers. For a short time, therefore, we are learning alongside the people for whom we ultimately work. Unfortunately, I was the only MARE on this course and, in speaking with the instructors, learned that few MAREs ever attend. LCdr DesLauriers, a course instructor and former executive officer of HMCS *Nipigon*, suggested that this course would be very useful to engineers going back to sea as a head of department. It would give them, he said, a better understanding of the command's warfighting concerns and the role engineering considerations play in the operational decisions that must be made.

A two-week course can only scratch the surface of what the ORO spends a year learning, but as an aid to improving communication between our two professions, and thus the ability of the two of us to work together to accomplish the mission, I feel this course is excellent. With so much of our time spent on machine/machine interfaces and even operator/machine interfaces, the Maritime Warfare Standard course would seem a logical and worthwhile step toward improving the MARS/MARE interface.

Lt(N) Meakin is the mine countermeasures liaison officer with the Esquimalt Defence Research Detachment.

Maritime Command's New Naval Engineering and Maintenance System

Article by Cdr P.J. Brinkhurst

During the past dozen or more years, the maritime engineering community has responded to the challenge of modernizing Canada's naval fleet by playing a major role in the design, construction, acceptance and support of two highly sophisticated classes of warship. Over the next 15 to 20 years it will be the navy's challenge to maintain the ships of the *Halifax* and modernized *Iroquois* classes as economically as possible so that they can continue to put to sea in support of government standing and contingency operations.

In terms of the naval engineering and maintenance (NEM) effort, the task at hand is to reduce support costs so that the savings can be reallocated to the operations budget. That means ensuring (and proving) that NEM resources are being used in the most cost-effective manner possible. Reduced budgets and the demand for tighter fiscal responsibility have led naturally to a situation where business practices must now begin to play a prominent role in the NEM support process. It is the integration of these practices that is behind a major effort by the navy to completely redesign its NEM system. The goal: a fully accountable system that has the flexibility to take maximum advantage of in-house and commercial industrial capabilities.

From an operational standpoint, there is no question that the present NEM system has been extremely effective (witness the preparations for Op Friction). It is just that we had no way of determining whether it was either *efficient* or *cost-effective*. There are a number of reasons for this. To begin with, the two coasts have long followed distinctly different implementations of the NEM system. They use different procedures and have a different management structure. Some of the differences were justified, many were not. What's more, because the management and service delivery functions of the units are mixed, it has been virtually impossible to clearly see how resources are being expended. How much time and money are being spent on managerial process or lost to inefficiency? No one can say. With a general lack of data on cost and performance, there is no way to measure and analyze the vital aspects of a unit's operation.

Ship Repair Unit Atlantic – Site of the new East Coast fleet maintenance facility.

Unfortunately, there is currently no single point of responsibility for naval E&M below the command level. Each of the three main engineering facilities on each coast — the ship repair unit, the

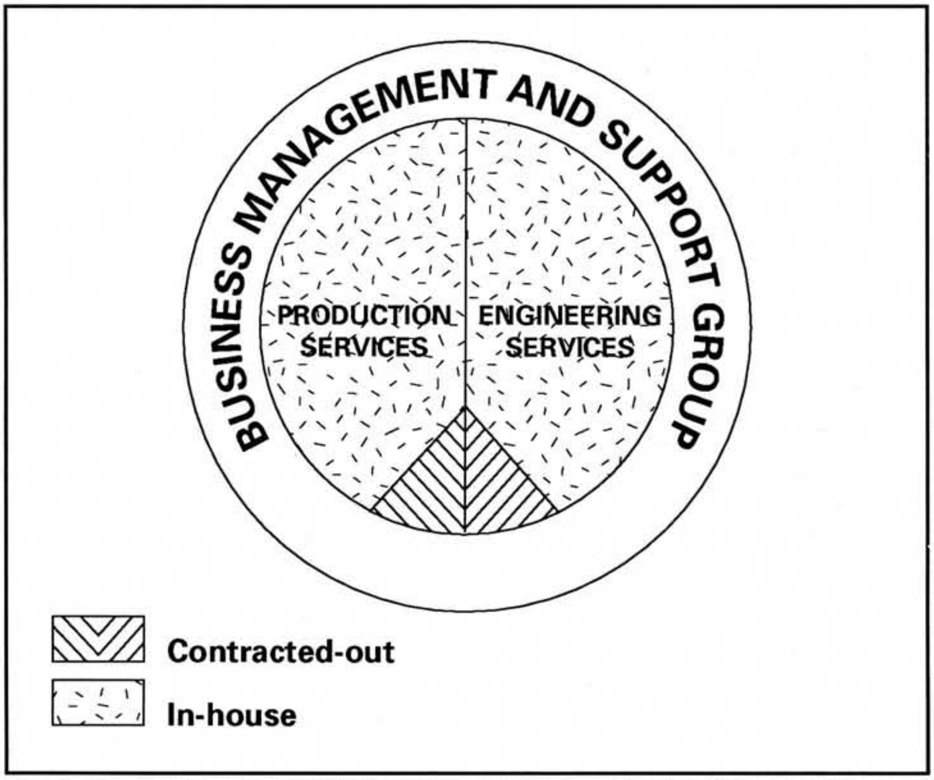


Fig. 1. The Production and Engineering Services part of the FMF deliver products to the customer, while the Business Management and Support group looks after management functions and the introduction of best business practice to the FMF. The two parts work together, but are distinct and their performance can be assessed separately.

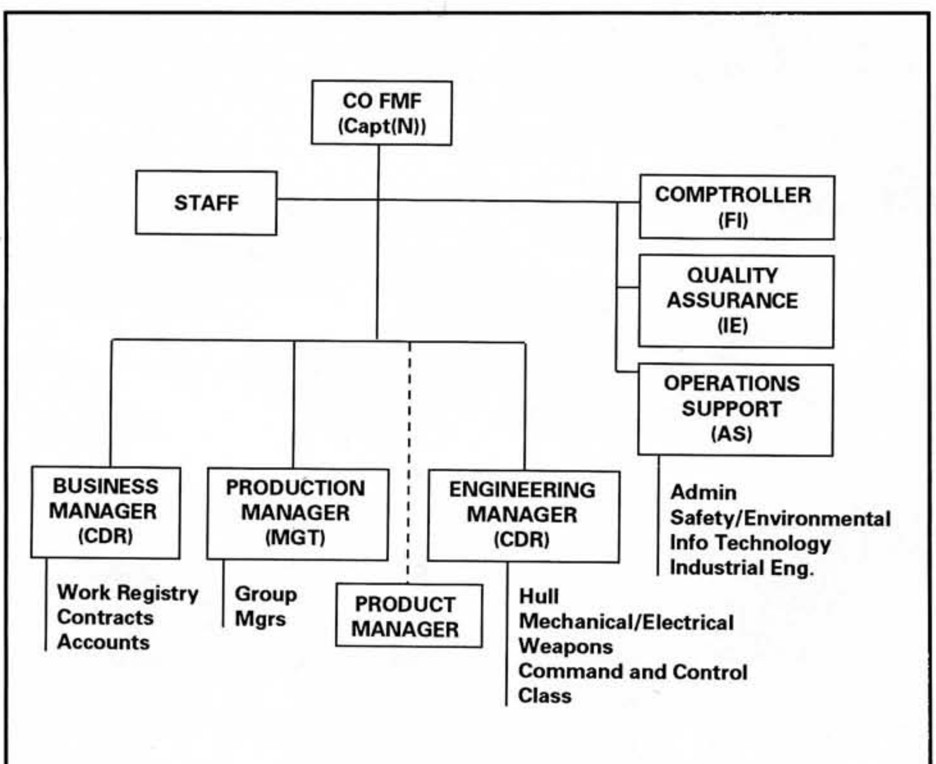


Fig. 2. Fleet Maintenance Facility Organization

naval engineering unit and the fleet maintenance group — has its own CO. In effect, there is no clear line of responsibility linking a particular requirement to a final product.

What really rounds out the challenge is that the entire support culture on the coasts has been characterized by a consumer (vice customer) attitude. This means, for example, that a ship could demand NEM services irrespective of cost. The affordability of an operationally based decision (such as a weekend overtime expenditure) has rarely been questioned. As long as the money existed, cost was simply not a consideration. Now that funds are short, the navy is having to reestablish its operational priorities and spending habits. Efficiency and cost-effectiveness — the business connection — are in.

A New NEM System

The navy's engineering and maintenance problems have been subject to a vigorous two-year functional review (NEMFR). Although official implementation of the major review recommendations is scheduled for April 1, preparations for the sweeping changes about to hit the NEM system have been taking place throughout the naval engineering community since 1994. In this regard, it must be widely understood that the term "naval engineering community" fully embraces the civilian members in the NEMS and that this significant reengineering activity has been advanced with their fullest possible participation and involvement. What people are preparing for is the creation of a new, single point of responsibility for NEM support activity, to be called the "fleet maintenance facility," or FMF. This unit will provide the services of the three old units on each coast with much less overlap and with clear accountability. The new FMF concept features:

- the inclusion of NEM activities in the business planning cycle, with the FMF producing its own yearly plan and a five-year forecast to help the engineering community stay ahead of the changing world;
- a fully integrated military/civilian work-force;
- a thoroughly customer-focused organization, with reduced layers of management, empowered supervisors and self-directed work teams;
- a work demand regime within which ships and shore units who draw upon the FMF's services are held accountable for their demands, are given some responsibility for the management of their maintenance requirements, and are made aware of the costs involved;
- the elimination of the engineering overseer's function from higher commands (i.e. staffs checking staffs — the FMFs will be held accountable for their products); and

• greater management flexibility for the FMFs to adjust their work-forces in response to workloads, to purchase material support at the best prices independent of source, and to contract directly to industry for those services which are more cost-effectively delivered by industry.

The FMF's new concept of operations is focused on reducing overhead and unnecessary duplication of effort, and eliminating work that offers no added value. The tool that has been adopted to help achieve this is the unit business plan. This document defines output and resource requirements, while establishing the FMF's accountability to the formation commander for E&M products such as short-work periods, docking work periods and engineering changes. While the unit business plan forms an integral part of the long-range vision and success of the FMF business environment, it requires a strong feedback loop to be truly effective. This feedback will be supplied through a performance measurement and analysis system (PMAS). Although the specific performance indices have yet to be finalized, the PMAS will consider such attributes as customer satisfaction, cost and the degree to which business plan targets and strategic goals are achieved. It will also recommend changes to operational processes and the business plan itself, or long-term changes to unit goals. The PMAS will ensure the system is operating at maximum efficiency, while meeting customer needs.

FMF Organization

It is important to realize that, although it is a single unit, the FMF has two clearly defined parts (*Fig. 1*). The first provides engineering and production services — actual products in support of the fleet. The second, a business management group, will attempt to take the best practices of the private sector and put them to work in the unit. Its role, in effect, is to ensure the FMF takes all necessary steps to become and remain competitive. The structure of the FMF is shown in *Fig. 2*.

The ***commanding officer*** will be held accountable to the formation commander for all assigned work (which we currently refer to as 2nd- and 3rd-line E&M activities) in accordance with an agreed business plan. The CO will be required to demonstrate that the unit is providing products and services at a competitive price.

The ***business manager*** will be responsible for all FMF business operations (i.e. strategic planning, business plans, performance analysis, business case analyses and industrial benchmarking) and for the critical functions of customer liaison and ensuring that the customer gets the best price possible. The creation of this position should act as a signal to the engineering community that the emphasis on what we do has indeed shifted toward a business footing and that our skill sets must be adjusted to include business-oriented methodologies and techniques.

The ***production manager*** and ***engineering manager*** will be responsible for the traditional SRU and NEU functions, respectively, but with fundamental changes in focus. The production manager will manage only those capabilities that can be retained in the FMF in a competitive manner, while the engineering manager will provide direct support to the fleet and to production staff (with engineering development activities being predominantly contracted-out).

The ***comptroller***, an entirely new function, is responsible for the development, implementation and maintenance

of an accounting and financial management system.

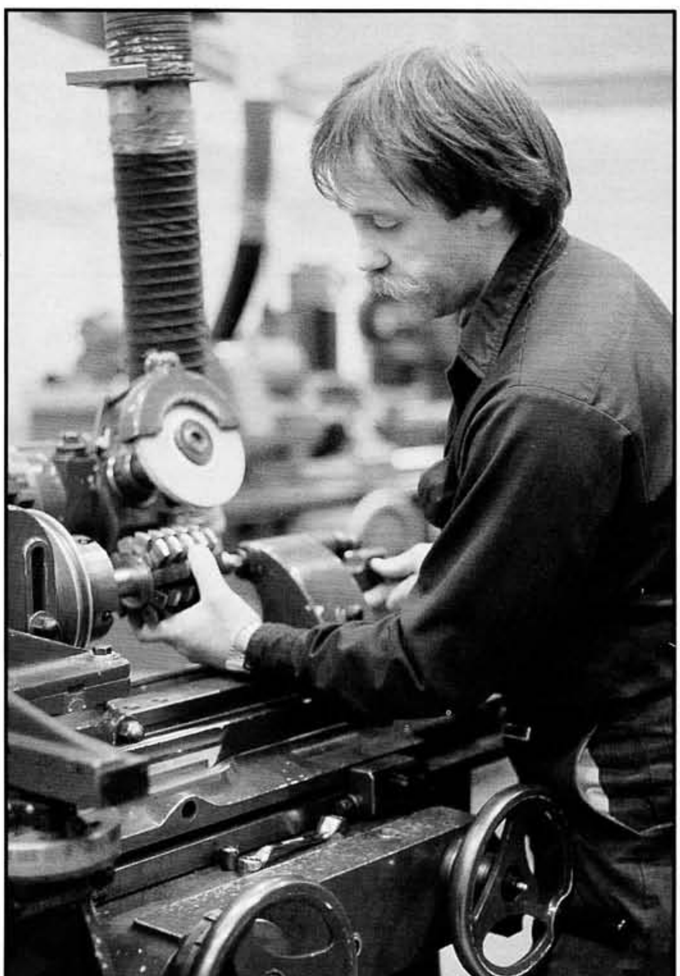
Of note also is the ***product manager***. After a work package has been agreed upon with a customer, the business manager will pass it on to an appointed product manager who will raise a team to run the project through to completion. Once the customer is happy with the final product, the team will disband. In this manner all members of the FMF will be able to participate directly in product delivery.

Delegation of Maintenance Budgets

While the creation of the FMF and the adoption of a business planning environment will significantly reduce the cost of doing business, it will not necessarily reduce customer demand. A principle strategy for achieving this reduction is the delegation of maintenance budgets to customers of the new FMF. Giving the consumer of a service greater control over how the available money is spent has proven to be an extremely effective means of reducing demand in both industry and the public sector. As the customers begin to see the money as "their own," they take a greater interest in ensuring each dollar is spent to good effect. Their growing awareness of cost leads them to establish priorities and find a balance between schedule, needs and costs.

In the case of the NEM system, maintenance budgets will be delegated to all customers in accordance with a requirement specified in their business plan. The FMF will maintain an account on behalf of the customer who will draw upon it as required through a variety of tasking interfaces that are still being developed. Access to FMF services will remain at least as direct and simple as in the past. It is possible, for example, that a price list for many services will be created so that customers can go directly to the source of expertise for work without waiting for a specific estimate.

It should be recognized that although the delegation of maintenance budgets increases the customer's influence on the way the FMF does business, it does not give the customer authority to seek maintenance services directly from private companies. Although theoretically possible, such freedom is still some way off and carries with it a range of contract management responsibilities the customer may not wish to handle. Instead, the customer's influence will be applied through the account manager, whose job it is to ensure the customer gets the best deal possible. The FMF will be responsible for providing the customer with the most cost-effective service, whether this means doing the work in-house, or contracting-out.



Conclusion

This restructuring of the NEM system is the first major step in an ongoing effort to satisfy the maritime commander's needs in the most cost-effective manner possible. We in the naval engineering community must be able to respond to the current environment and, at the same time, anticipate and position ourselves for further change. To achieve all this the NEM functional review team has worked with customers, labour and the existing NEM units to create a single point of responsibility for engineering and maintenance — the FMF. The FMF, and indeed the entire NEM system, will adopt best business practices in terms of human resource management and performance assessment, and is forging a partnership with industry where it is cost-effective to do so. Finally, the naval engineering community is putting pressure on itself to succeed by promoting a customer focus and empowering the customer through the delegation of NEM budgets.

The engineering community has led the way in adjusting to changing times through projects like the NEM functional review. The success of the new system requires continued foresight, the constant and visible commitment of all senior stakeholders, and most importantly, the dedication that has always characterized the people who "are" the Canadian naval engineering and maintenance system. Meeting these requirements may quite possibly represent our greatest challenge, but it is essential to the preservation of strong naval forces in Canada.

Cdr Brinkhurst is with the Naval Engineering and Maintenance Functional Review team in Halifax.

Electronic Warfare:

Fitting a CANEWS Software Interface to the TRUMP Command and Control System

Article by LCdr Peter Greenwood

The Problem

In the mid-1980s a version of the Canadian Electronic Warfare System (CANEWS) software designated DDH 2C0 was provided to Litton Systems of Canada Limited to be interfaced with the TRUMP command and control system. The result, version 3L1, was duly delivered by Litton to PMO TRUMP in 1988 as a component of the Tribal-class Update and Modernization Project's software suite. In the intervening years, however, the CANEWS software that was being used by the rest of the navy had evolved through six baselines that included more than 140 engineering changes to correct defects, improve performance and respond to changing requirements. As a result, a significant capability gap was created between the CANEWS version supplied to TRUMP ships and that being used by the rest of the fleet.

When the Fleet Software Support Centre (FSSC) issued its latest version of CANEWS (OPS-ADL 4.00) to non-TRUMP users in early 1995, the gap became so pronounced that some operators in the DDH-280s actually preferred using it over their less-capable interfaced version (even though it did *not* include a TRUMP CCS interface). Furthermore, the many differences that now existed between the TRUMP and fleet versions of CANEWS were posing problems for operator training and software maintenance — problems that could be avoided if only the two versions could be reconciled.

The Solution

Any attempt to integrate the more than 140 software changes into the TRUMP CANEWS version would have been impractical. Instead, an engineering change first proposed in 1992 by the TRUMP Detachment in Halifax to fit the latest fleet version of CANEWS with a TRUMP CCS interface was vigorously pursued. In fact, the FSSC had already established the feasibility of the proposal in an initial impact analysis in 1993, and by early 1994 had completed a detailed analysis which included a preliminary design of the required modifications. A meeting was held in November 1994 between representatives of Naval Engineering Unit Atlantic's FSSC and the TRUMP detachment to discuss the development of a CANEWS/TRUMP interface module (based on interface code in Litton's version 3L1) which could be grafted onto FSSC's version 4.00.

The proposal was constrained by the requirement to complete the modified version with existing FSSC resources and deliver it in time for TRUMP operational testing in May 1995. Since the FSSC CANEWS team had recently finished version 4.00, and a follow-on version had not yet been authorized, FSSC agreed to undertake the CANEWS Interface to TRUMP (CIT) upgrade project.

The Team

Shortly after completing version 4.00, the 12-person FSSC CANEWS programming section was scaled back to seven people. The team now comprised a program manager, two very experienced CANEWS programmers, and four programmers with less than two years' experience each. Fortunately, the less experienced programmers had completed a CANEWS software on-the-job training package, so they had a good understanding of the entire program. The team was supplemented by a CANEWS software test engineer from the FSSC testing section. Organizing the team as illustrated in *Fig. 1* allowed three branches of con-

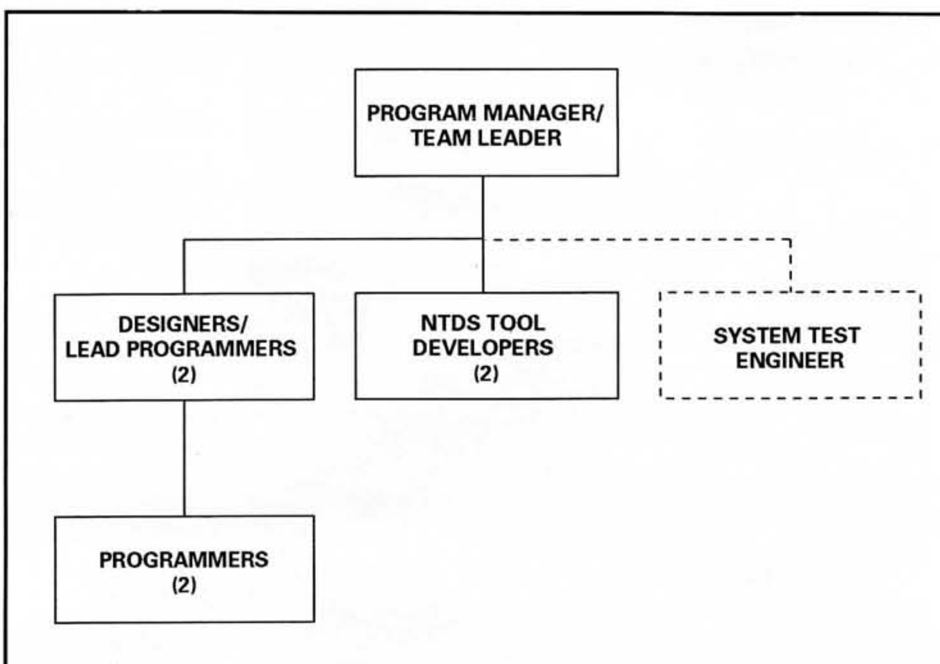


Fig. 1. CANEWS Interface-to-TRUMP Project Team Organization

current activity: software changes by the programmers, modification of testing tools, and revision of the system test procedure.

The Tools

The FSSC facility at CFB Halifax includes a VAX-based computer environment, with networked terminals and workstations for the programmers. This allowed the CANEWS programming team to work concurrently to review and modify existing source code, develop new code, compile and build the CANEWS program, and generate media. Although the team did not have unrestricted use of a CANEWS target system, they were able to share the CANEWS equipment held by the Canadian Forces naval engineering school.

The greatest challenge in designing and implementing the CIT was the programming team's limited access to a TRUMP command and control system. At the outset of the project PMO TRUMP had been unable to guarantee access to a TRUMP CCS, but as the work progressed some testing did take place on board HMCS *Iroquois* (DDH-280). To help overcome the testing shortfall, an existing naval tactical data system (NTDS) simulator was modified to act as the CCS side of the interface. The NTDS tool required modification by the CANEWS team to accurately simulate the data flow from the CCS, and to validate the data flow from CANEWS to the CCS to ensure it was in accordance with the interface specifications.

The Methodology

The first weeks of the CIT effort involved project management activities to estimate resources, devise a schedule and organize the team. These activities were completed before the Christmas break, so the team was ready to begin work in earnest with the start of the new year 1995.

The first step in the process of adding a TRUMP CCS functionality to the CANEWS software involved reverse engineering, a phase often described in software maintenance literature as the "undesign" phase. The structure and functionality of the existing systems had to be fully understood before modification could be undertaken. The team collected as much of the relevant documentation as possible. CANEWS design documentation was readily available, since FSSC has been maintaining CANEWS software for more than 10 years. On the TRUMP side, the team required copies of the TRUMP software requirements specification, the TRUMP/CANEWS interface requirements, the TRUMP Operations and Users Manual, a wide range of TRUMP software design documents, CANEWS/CCS test plans and procedures, and copies of reports on the testing conducted to date.

An extensive review of the TRUMP documentation was then required to ensure the team had a thorough understanding of the behaviour they might expect from the TRUMP side of the interface. It was during this time that informal testing to ensure the TRUMP software performed as described in the design documentation took place in *Iroquois*. Once the interface requirements were fully understood, the lead programmers identified the changes that were required to make CANEWS version 4.00 software compatible with the modified interface code.

A "mini-engineering-change" process was employed within the team, in which proposed changes were identified, documented and reviewed for accuracy and applicability. Once a change requirement was validated, one or more possible solutions would be proposed, the best solution would be selected and the appropriate software changes would be designed and implemented. This process ensured that only code changes necessary to support the interface were implemented and that all changes were fully documented. As with any software maintenance project, other potential code changes and improvements were identified along the way, but the team strictly avoided any changes not specifically mandated by interface requirements. This was necessary to maintain the integrity of the software's configuration management, to minimize the operator/machine interface changes, and to ease operator transition to the new software. In all, 24 specific changes were made to the CANEWS software to make it compatible with the interface module.

Once validated, programming tasks were assigned to individual programmers. Changes were executed in logical order: database modifications were implemented first, followed by operator/machine interface changes and, finally, by interface function changes. Since many of the changes were interrelated, weekly meetings were instituted to keep all team members aware of each others' activities and to review work that had been completed. The TRUMP detachment in Halifax was briefed every six weeks on progress, including any problems encountered which required PMO decision to resolve. The CANEWS life-cycle material manager (LCMM) from headquarters attended the first of these briefings and was kept fully informed throughout the project. Notes were prepared to capture the content of each of these briefings and detailed minutes of ensuing discussion were also kept. These efforts all served to ensure that no key observations or decisions "fell through the cracks" or went unrecorded.

Specific sets of deliverables were also negotiated as the project evolved. PMO TRUMP required program tapes, user

CANEWS Programming Team: (*Standing*) Mr. Grant MacLeod, PO1 Guy LeBlancq, CPO2 Wayne King and Lt(USN) Mike Holland; (*Seated*) Lt(N) Chris Larivee, Lt(N) Craig Wicks and author Lt(N) [now LCdr] Peter Greenwood.

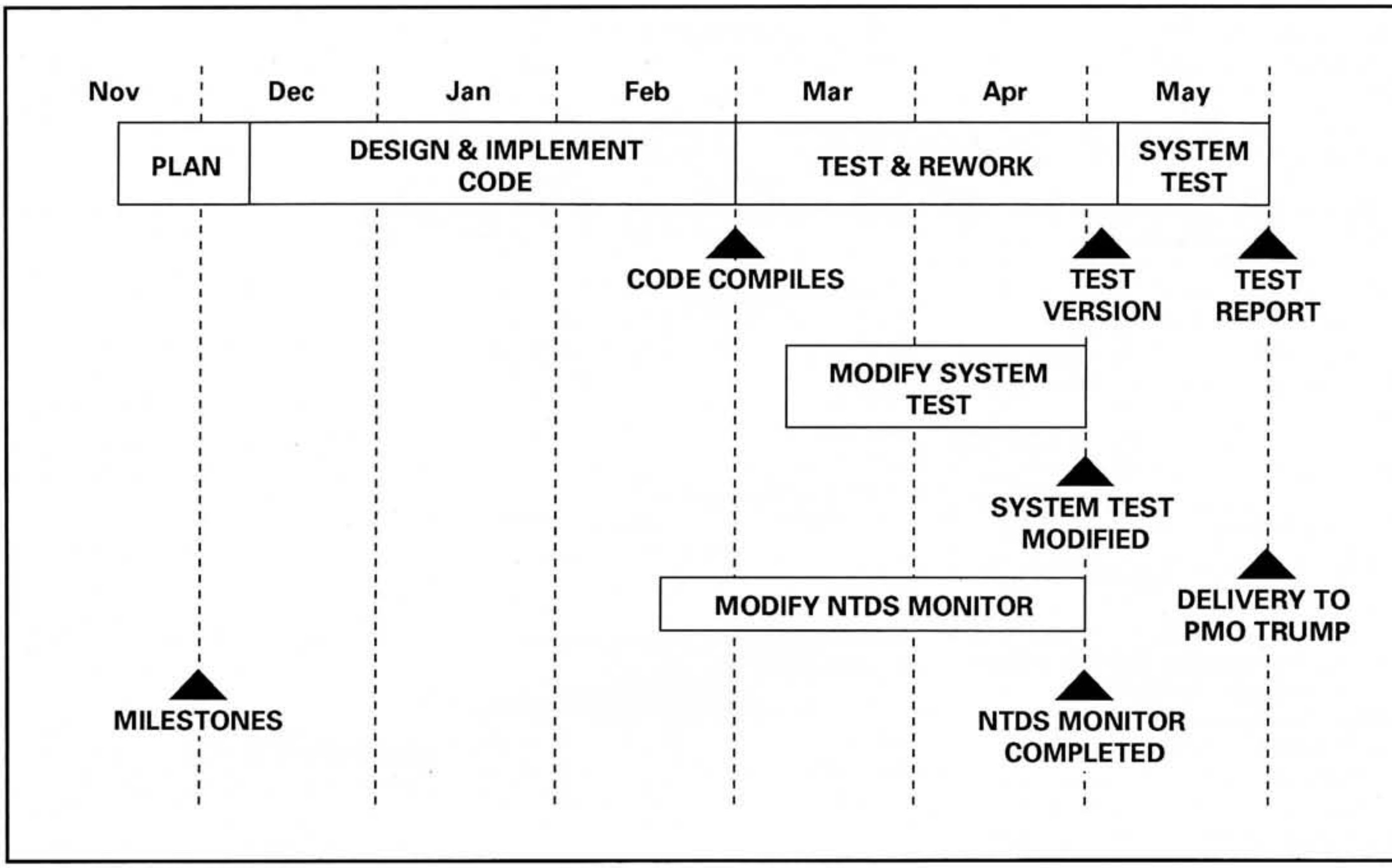


Fig. 2. TRUMP CANEWS Software Interface Production Schedule

documentation, a system test procedure and a system test report. In addition, the LCMM also required the source code and design documentation for follow-on maintenance support.

The Result

Modifications to the CANEWS software were completed in early May 1995. A full system test which had been extensively revised to reflect the additional interface functionality was then conducted. It was recognized from the outset that the system test would be restricted by the use of the NTDS tool, rather than an actual TRUMP CCS, but operational ship scheduling and the lack of a fully compliant test bed made this unavoidable. As much testing as possible was conducted alongside in *Iroquois* and *Athabaskan* (DDH-282). One example of the need for testing was a CCS/CANEWS timing problem that was identified during onboard testing and corrected before the final software version was released. The modified CANEWS software, designated CANEWS OPS-TRP 1.00, was delivered to the TRUMP detachment on June 1, 1995, as scheduled (*Fig. 2*). The software has been employed in TRUMP ships since that time, and has been reported to be a useful and reliable adjunct to the TRUMP command and control system.

Lessons Learned

Detailed project planning and progress monitoring kept the team on or ahead of an ambitious production schedule. For example, the original plan called for only one programmer to modify the NTDS tool, but when it became apparent that the effort required for this task was greater than anticipated, a second programmer was assigned. This early intervention kept the modification on schedule and ensured the tool's availability for the integration testing phase. As well, the review and approval process developed by the team ensured that only changes necessary to support the task at hand were undertaken. The problem of "capability creep" (i.e. making "just one more little change"), which is a well-known problem in software projects, was therefore successfully avoided.

The use of a small programming team with a good blend of experience and enthusiasm also contributed to the success of the project. Each programmer was able to maintain familiarity with the concurrent activities of the rest of the team. The same people were involved throughout the entire project, from inception to implementation and testing. Adding more programmers to the team, especially once the project got under way, probably would not have accelerated progress. A high rate of personnel turnover would undoubtedly have hampered the process. The excellent rapport between the software team and its customer, the PMO TRUMP detachment in Halifax, was vital to the success of the project. PMO responded promptly to documentation requests and action items from progress briefings. Timely decisions concerning implementation alternatives also helped keep the project on schedule.

Tom Clancy's bestseller *Debt of Honor* included among its themes the concept that "if it is not written down, it did not happen." Throughout this project, the content of each briefing and meeting was captured and circulated for accuracy and concurrence. In this way, all participants shared the same vision of the CIT's goals and progress throughout the life of the project.

LCdr Greenwood is the former project manager for CANEWS at the Fleet Software Support Centre in Halifax. He is currently the MARS career manager at National Defence Headquarters in Ottawa.

MRSV: Multirole Support Vessel — An Electric Propulsion Option

Article by L.T. Taylor

In the article, "Afloat Logistic Support — The future is *now* for multirole support vessels" (*Maritime Engineering Journal* June 1994), the propulsion option specified for the proposed MRSV is twin diesels, providing 15,400 kilowatts of power to a single controllable-pitch propeller. Later in the same issue of the *Journal* is an article entitled, "An AC Electric Propulsion Concept for a DDH-280-class Replacement." On the heels of these two articles, it seemed that an electric propulsion option for the MRSV might have some merit, particularly since an electric propulsion retrofit has been studied for the AORs.

Why electric versus geared diesel

The MRSV will have a very high connected electrical load with its container crane, bow thruster, bow and stern ramps and doors, pontoon handling system, air-conditioning, services and power for the container village, RAS gear and the services for the joint-force support group. Many of these services are not required concurrently with full propulsion power, so that the central electrical generating station which can feed propulsion or other loads may be able to reduce the ship's total installed prime-mover horsepower (as was the case in the design of the maritime coastal defence vessel). The geared-diesel MRSV will have at least six diesel engines: two for propulsion, three one-megawatt generators and one 500-kilowatt generator. It might also have a diesel for the bow thruster and even another for the crane.

A geared diesel propulsion system would require the vehicle decks to be reduced in width above the machinery space to allow for intake and exhaust ducting. With electric propulsion, particularly gas-turbine (GT) electric, the generator sets can be located above the vehicle decks with only cableways and minor space ventilation trunking leading down to the motor-room. There exists at least one commercial GT electric RO/RO ship and it is assumed that the vehicle deck space advantage was sufficient to overcome the increased fuel costs associated with a less efficient propulsion system.

The MRSV is designed to carry a very small crew, particularly in comparison with an AOR. The size of the engineering department and the requirement for maintenance of the six or more diesel engines on board may be incompatible. Operating experience in the Canadian patrol frigates (CPF) suggests that diesels are much more maintenance-intensive than gas turbines.

The candidate main engine and generator diesels for the MRSV were not mentioned in the *Journal* article. The Pielstick PA6 fitted in the CPF is now offered in a version of sufficient power to meet the requirement of the MRSV. Using the arguments of commonality of training and support, the PA6 is a contender. There are a variety of medium-speed engines which can meet the power requirement with fewer cylinders than the PA6 and be more in line with commercial practice. The physically larger size of these alternatives, combined with an additional maintenance height requirement, might affect the height of the vehicle deck. The navy already has in its inventory one-megawatt and 500-kilowatt diesel generators driven by a common engine, the Detroit Diesel 149. These could be the choice to utilize training and support already available within DND. Commercial practice would use slower speed diesels with fewer cylinders.

The proposed MRSV propulsion includes a controllable-pitch propeller (CPP). The electric propulsion option would use a fixed-pitch propeller which is more efficient and less complex than the CPP. DND experience has been that there is an increased docking requirement for CPP ships versus those with fixed-pitch propellers. The geared medium-speed diesel CPP propulsion is reasonably common commercially, but so also is electric propulsion in specialized service such as cruise ships and icebreakers. One negative factor in the application of commercial technology to a DND vessel is that DND does not operate vessels in the same manner as a commercial operator. The current AORs, with their commercial propulsion plant, are a case in point. A commercial tanker would manoeuvre out of harbour, increase power to 80 percent or 90 percent of maximum continuous, and steady steam to the next port. AORs, on the other hand, conduct officer-of-the-watch manoeuvres, man overboard drills and other naval operational requirements involving considerable power changes and manoeuvring.

The Electric Propulsion Plant

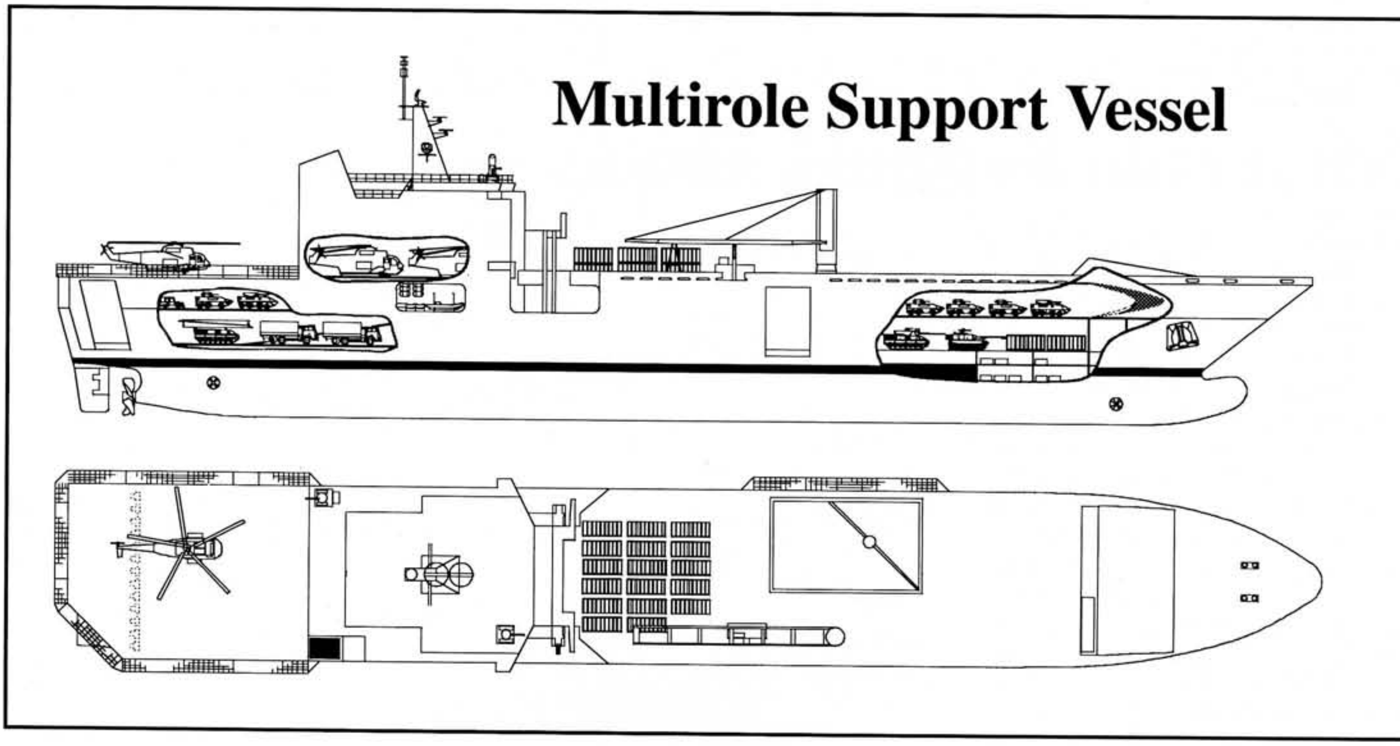
Canada has an industrial base capable of providing the electric propulsion, but does not have the gearing production capability. We can produce fixed-pitch propellers, but not CPPs in the required power range. Electric propulsion would have more Canadian content than the geared diesel alternative.

To meet the power range requirement, an AC-AC system would be used with variable frequency from power electronics for motor-speed control and with phase-switching for reversing. High-power electronics for frequency variation and phase reversal have been proven in marine use in cruise ships and icebreakers. The advantage of the icebreaker experience is that these systems have been proven in crash reversals and rapid manoeuvring, necessary features in a naval vessel even if commercial standards are specified. If redundancy were desired, it would be possible to put two motors in tandem on the single shaft.

Generator Prime Movers

First, a review of gas-turbine prime movers already in Canadian naval service for which training and support are in place:

LM 2500 (and FT4) — a single engine meets the power requirement, but poor low-power fuel consumption makes



it unsuitable (FT4 has even worse fuel consumption);

Allison 570 — four engines would meet the installed power requirements, but the ship would require additional generators for the hotel load to avoid the fuel penalty of operating the gas turbine at below 50 percent power when propulsion is not required.

Some gas turbines which are currently not in the inventory, but for which DND has similar units supported and training in place are:

Allison 571 — essentially a 570 with a three-stage power turbine and power output of 5.7 MW versus 4.7 MW; a fit of three would meet the power requirement with additional generators for the hotel load;

Allison 501 — used in the USN to drive two- to three-MW generators, this industrial and marine derivative of an aero engine used by DND could be fitted in a mix with 571s and an emergency generator, and would have improved fuel consumption at hotel loads compared to using a 570 or 571.

A combination of gas turbines and diesels could meet the requirement with the equivalent efficiency of diesels when auxiliary steaming, while meeting part-load requirements combined with the high power-to-weight ratio of gas turbines. Two Allison 571 engines with two eight-cylinder rail traction diesels at 2.25 MW each would satisfy the installed power requirement. Adding an emergency/alongside service diesel-generator brings it to only five engines with three diesels and not too many cylinders.

Machinery Arrangement

The gas-turbine generator sets are relatively light and could be installed high in the ship at the sides of the hangar. This would maximize the below-deck width available for RO/RO lanes. The gas turbine/diesel combination of generator sets does involve more weight, and the location in the hangar sides presents some stability concerns, but it is possible. DMSS 2 is currently modifying the MRSV design such that stability requirements will be met, although positioning large diesel-generator sets high in the ship would pose an added challenge. The emergency/alongside service generator would be located forward. The structure where the vehicle ramp opens to the upper deck could be made to house this generator.

Conclusion

The electric propulsion option has some benefits for the MRSV and should be taken through comparative preliminary design analysis. Canadian naval experience with gas turbines vis-à-vis diesels supports gas turbines as propulsion engines if fuel economy is close. With the small crew proposed for the MRSV, gas-turbine maintenance will be more easily handled. The electric option can be created with fewer engines, but with more redundancy/capability after the loss of an engine.

The department has studied electric propulsion for several retrofits and for propulsion comparisons. An electric propulsion option study should be carried out for the MRSV early in the design process to ensure that the possible benefits of the option are adequately explored and quantified.

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Naval Engineering and the Environment

Article by LCdr S.K. Dewar

One of the major trends of the last quarter century has been the growth of environmental concerns in the public agenda. That it has affected the navy is beyond question; within the span of a decade we have seen our concept for waste management at sea change from a simple belief that "the dark of night will hide all our sins" to become a highly regulated and restricted practice. The navy's commitment to environmental concerns is such that it is willing to spend significant money to comply with environmental regulations, the current $65-million Maritime Environmental Protection Project being only one example.

DND policy does commit us to complying with national and provincial environmental legislation, and to adopting a "code of stewardship" for the environment. Although these policies are caveated to ensure that the operational requirement remains paramount, they are binding on all of us in DND, including those of us who make naval engineering our profession. The aim of this article is to discuss how this thing called "environmental protection" affects the practice of naval engineering and what professional obligations it implies.

The Current Situation

Without question, environmental issues are here to stay as a public concern. The growth of populations and competition for resources will ensure that this is so. Furthermore, it should also be obvious in the post-cold war era that militaries can only claim exemption from compliance with environmental regulations at great risk to public trust.

In general, there are two routes to compliance: through procedural means and through technological means. Procedural methods are often very simple — don't go to ports where regulations are strict, or leave the scene as soon as your holding tanks are full. However, the pervasiveness of environmental regulations and the potential disruption to our operations implied by procedural solutions really push us toward adopting technological solutions to compliance. This is where the link to engineering is most apparent.

Unfortunately, finding practical solutions is far from straightforward. The situation is complicated by the following factors:

- There is often contradiction between environmental legislation at international, national, and local levels. Of course, the most stringent requirements are the most costly to meet;
- Most legislation was not specifically designed with warships in mind, and warships may in fact be exempt. Despite this, there is nonetheless strong pressure to comply; and
- Environmental legislation is frequently ahead of the ability of technology to comply.

Beyond the obvious desire to reduce every harmful environmental impact possible, there is rarely consensus (even among fundamentalists) on the relative importance of various environmental concerns. Without agreement on the priority of problems it is difficult to make the trade-off decisions that are so necessary to the practice of engineering. For example, decreases in engine air emissions (principally nitrogen oxides) are often achieved at the expense of increased fuel consumption (and, hence, more CO_2). Which is the greater priority — smog from NOX or global warming? Caution should therefore be exercised before jumping onto the latest environmental bandwagon as there is an element of "flavour of the week" to environmental issues. The term "environmental friendliness" can sometimes be a moveable feast defined by whoever's agenda is driving at the time.

The Future

Crystal balls are just as cloudy with respect to new environmental protection requirements as they are with anything else, but two things seem fairly certain. First, the amount of environmental legislation will no doubt increase (unless governments become preoccupied with other matters), and second, technology and regulation will likely never converge. An effect I call "creeping limit-itis" is emerging, where as soon as technology allows one set of regulatory limits to be met, the limits are tightened.

While this certainly means that we as engineers will never get to rest on our laurels, the situation clearly poses a number of risks. In this day and age we all know the real cost of spending money unwisely, and as naval engineers we also are acutely aware of the result of misusing critical weight and space allocations on board ship. Sorting the essential from the desirable will not be easy.

We can take some comfort from the fact that we are not alone in this problem. Worldwide naval experience suggests that there are several common pitfalls which have resulted in non-optimal application of environmental technology:

- There is a tendency to assume that compliance is necessary with each and every piece of legislation, even when exemptions apply;
- Less-than-informed knowledge has resulted in false or sweeping assumptions about the scope of regulation, which in effect means trying to comply with rules that don't exist; and
- In an effort to demonstrate environmental leadership, navies adopt "feel good" agendas with good optics. These invariably go beyond the requirement, but have unquantifiable or questionable environmental benefit (and generally high cost).

The pressures that create these pitfalls are understandable, and sometimes decisions based on optics are necessary. We just have to remember that space allocated to today's environmentally friendly technology may be needed for tomorrow's messdecks or weapons.

Naval Engineering Practice

What is very clear is that the practice of naval engineering has definitely been altered by environmental concerns, although the effect is not widely understood. There have really been two major

Some thoughts on "due diligence"

Several recent legal cases provide an interesting perspective on how the courts view the requirements for due diligence. A landmark decision is the so-called "Bata" case[1], where the Ontario Provincial Court convicted Bata Industries and two of its directors for offences under the Environmental Protection Act and the Ontario Water Resources Act. The court set forth very clear guidelines for what it considered to be due diligence. These are summarized as:

• Was a pollution prevention system established?

• Was there supervision or inspection?

• Did directors exhort those they controlled or influenced to exercise due diligence?

• Were periodic reports submitted on the effectiveness of the system?

• Were subordinates instructed to report any non-compliance to senior management in a timely manner and was personal action taken immediately when required?

Note that the court also found that the "on-site" director is personally responsible to inspect on a regular basis (i.e. perform a walkabout). This perhaps gives increased significance to the time-honoured practice of daily rounds at sea. There were warnings as well for those of us sailing desks. The fact that the plant manager knew of a problem for several years and had even set aside money to rectify it at a future date was not deemed acceptable.

Other cases have found employees liable for offences[2], so it is not only senior management that is at risk. Employees' liability extends to not only trying to prevent the offence, but doing everything within their scope of authority to bring the problem to the attention of superiors, requesting continual updates from persons reporting to them, and submitting periodic reports to superiors outlining the nature of or solutions to a problem.

What is clear then, is that there are many facets to showing you are duly diligent; but the key feature of all of them is taking an active, dynamic role in preventing offences. Beware to those who believe due diligence can be satisfied by issuing memos from a desk.

S.K.D.

requirements placed on all engineers, whether afloat or ashore, by the growing body of environmental law:

• we are all required to assess, and mitigate if necessary, the impact of our actions; and

• we must exercise "due diligence" to ensure the environment is not unnecessarily damaged. This is generally our only defence if charged under environmental law.

Environmental Assessment (EA)

This term undoubtedly conjures up horrible visions of formal, complicated studies or boisterous public hearings pitting hapless naval officers against hordes of tree-huggers. In fact, it is a graduated process that ranges from simple screening to very detailed ecological impact analyses and public panels.

Many of our common shipboard activities will be exempt from continual environmental screening and assessment. For those activities exempt from assessment, training and procedures to assist ship's staff in conducting an environmental screening are being developed. The tricky part is determining when the line between an exempted activity and a screening requirement may be crossed. For example, if it were deemed that internal fuel transfer operations were normally excluded from screening, but if at one point the ship were moored in an area of extreme environmental sensitivity, would a screening then be required? Human judgment will always be needed to make such decisions.

For those of us ashore, the situation is a tad more complicated. Many of us may not be aware that we are now required to conduct an environmental assessment on all DND projects *regardless of size*. The definition of "project" is of key importance. While it is not difficult to connect a major crown project like the Canadian Patrol Frigate project to a requirement for assessment, any headquarters-directed change in preventive maintenance procedures that might affect the environment is also a "project." Moreover, the environmental assessment is the responsibility of the project OPI — not some specialist environmental agency — and there is also a requirement to register the assessment formally. For most projects a simple environmental screening is sufficient, but more complicated projects may require (and be forced to conduct) a full impact study including public involvement mechanisms.

What must be made clear is that this requirement cannot be bypassed. Engineering more than most other professions involves shaping the natural environment for technological ends. It is therefore now an integral part of our profession to understand the impact of our activities on the environment in both a detailed and broad sense. In short, if you aren't familiar with "EA," become so — fast!

Due Diligence

More sleep has been lost over the concept of due diligence than is perhaps warranted. Simply put, exercising due diligence means taking reasonable care to anticipate and prevent environmental damage. Reasonableness is judged in terms of the knowledge and skill expected of you, the availability of alternatives and the standard of care required by the value and importance of that which is at risk. It does not mean having to try to be "greener than green." Despite a widespread belief that there is some mysterious code of practice to ensure you are duly diligent, it is difficult to think of specific requirements which do not simply come under the heading of good engineering practice. In other words, positive steps are necessary to inform people of the risks and relevant policies, and to ensure that practices are monitored. Above all, it must be clear that lax practices will not be tolerated.

Much of the discussion on due diligence in the engineering community has been focused on those of us afloat, but for those of us ashore there are also difficult issues. What represents a reasonable standard of care for the deskbound? Given the diffuse nature of bureaucracy, what is our individual liability? There have been surprising arguments made that our liability extends to the conduct of contractors or industries performing work on our behalf. We have only begun to scratch the surface of how this affects our profession. We may yet see the requirement to add "environmentally friendly" procurement clauses to contracts.

Technology

Some general comments on the effect of technological change on the profession in this area are in order. Despite what was stated earlier about the legal requirements for environmental assessment, understanding environmental impact is essential as part of our professional obligation to anticipate and prepare for future naval requirements. We must stand ready to advise operational commanders as to how their needs can be met by technology; and what penalties ensue from application of technology. This applies no less to technology which may lessen environmental impact and improve the ability of the navy to comply with environmental law.

It would be unwise to assume, however, that this is a specialist area where only a few people need be knowledgeable about the environment and engineering. The fact that most of the current shipboard environmental protection technology has been the province of the MARE/MS does not indemnify others from concern. For example, when the sensor/comms suite of a visiting U.S. warship allegedly affected the City of Vancouver's emergency medical communication system, there were public cries for assessment and regulation of electromagnetic emissions on environmental and safety grounds. Combat system engineers and technicians take note.

Engineers of all stripes are clearly going to have to come to terms with the environmental fallout of their work. While design and introduction of equipment may be one area where environmental impact is felt, so too are maintenance and operation procedures severely affected by environmental considerations. Environmental assessment and due diligence will therefore demand more than casual interest from each one of us involved in the naval engineering effort. It makes no sense to neglect the environmental concerns, especially since we might one day be held accountable for them.

Conclusion

Environmental protection is now, and will always be, an integral and growing part of the practice of naval engineering. As a result, I believe that there are a number of commandments we should all follow:

- The old adage of what you don't know can't hurt you was never less true than in this area. We must all become knowledgeable about environmental issues to ensure that we can proactively manage new concerns and position ourselves to take advantage of new technologies;

- There will be times when we need to rely on our credibility and past performance with regulators and the public. We must be careful that, in trying to set an image of leadership, we do not unwittingly promise more than we can deliver; and

- Above all, we must remember that warships must be effective fighting units first and foremost. Environmental concerns are important, but we must have the discipline and courage, if necessary, to subordinate them to operational need.

Perhaps what we should take to heart most is found in the words of one writer: "The bottom line is that naval engineers are the ultimate stewards of the navy's ability to comply with environmental requirements aboard ship in a responsible and cost effective way."[3]

References

[1] L. Huestis, "The Bata Case: Lessons on Corporate Director Liability," *Canadian Environmental Protection*, Vol. 7, No. 2, March 1995.

[2] L. Huestis, "Employee Liability for Environmental Harm," *Canadian Environmental Protection*, Vol. 7, No. 3., April 1995.

[3] R. Guida, "Environmental Compliance in the Navy," *Naval Engineers Journal*, September 1994.

LCdr Dewar is the DMSS 4 project manager for the Maritime Environmental Protection Project.

Vermicomposting — Goin' green with a blue box full of red wigglers

Not content to limit his participation in environmentally friendly activities to filing spurious memoranda in the "blue file," LCdr Doug Brown, a Combat Systems Engineer with DMSS 8, has been operating a vermicomposting facility for the office coffee boat. The "facility" is essentially a covered recycling blue box full of small earthworms called red wigglers (*eisenia foetida* to the biologists). The worms and box were provided by the Director of Environment at NDHQ and have been operating for the past year and a half, with the worms thriving on a steady diet of coffee grounds, apple cores, orange peels and neglect. The eight-centimetre-long wigglers easily handle all of the section's used coffee grounds and lunchtime fruit remnants, and in return produce exceptionally good soil for the office plants, which in turn improves the indoor air quality. While a single facility of this type does not make a significant reduction in the office waste stream, the potential for numerous small facilities to make a noticeable difference is significant. So far, Brown has had no problems maintaining his vermicomposting operation — except for keeping the worms during fishing season.

HMCS *Ontario* (CLB-32)

When this cruiser decommissioned in 1958, it marked the end of big guns at sea for the Canadian navy.

Article by Harvey Johnson

HMCS *Ontario* was laid down for the Royal Navy on Nov. 20, 1941 by Harland and Wolff Ltd. of Belfast and christened *Minotaur* at her launching. She was to have become part of the British fleet under that name, joining other cruisers of her class such as *Swiftsure*, *Ceylon* and *Newfoundland*, but was commissioned instead by the RCN on April 26, 1945. *Ontario* joined her sister ship *Uganda* (later renamed *Quebec*) which had been acquired from the U.K. on Oct. 21, 1944.

Ontario (CLB-32) was the third ship to bear that name. A British sloop brought into service in 1756 and lost in Lake Ontario during Seven Years War with the French was the first. The second was a brig-sloop completed in 1814 for the Royal Navy and sold in 1832. HMCS *Ontario* joined the Canadian fleet under the command of Captain H.T.W. Grant DSO RCN. The ship was manned on commissioning at Belfast, Ireland by a Canadian crew of 62 officers, 836 ratings and two sergeants of the Canadian Dental Corps, for a total complement of 900. Representing Canada was the High Commissioner, The Right Honourable Vincent Massey KC, and representing the Province of Ontario was Major J.S.P. Armstrong, Agent General for Ontario. Presentations to the ship from the people of Ontario included an engraved silver tray and rose bowl, and a cheque for $5,000. The ship was sponsored by the Ontario Chapter of The Imperial Order of the Daughters of the Empire who presented the ship $1,500. In addition, the Royal Canadian Legion presented the ship with pianos, other musical instruments and sports equipment.

The ship was a development of several cruisers of her type built in the U.K., being exceptionally rugged with many over-built components. *Ontario*'s specifications were impressive. The ship's four Admiralty three-drum type boilers and four Parsons geared turbines developed 75,000 s.h.p. to drive four screws with enough force to give the ship a speed of 31.5 knots. She also boasted three triple-mount six-inch guns, five twin-mount four-inch guns, a bristling array of 40-mm Bofors and 20-mm Oerlikons, and six 21-inch torpedo tubes. Cordite and shells for the radar-controlled six-inch guns were brought up from the magazine on separate conveyors. Tracking of aircraft was accomplished by a plotting system that worked automatically in conjunction with the ship's type 281 radar out to a range of 225 km. Only *Ontario* and her sister ships *Superb* and *Swiftsure* were fitted with this system, which made them the most modern of their type.

HMCS *Ontario* with a new paint scheme in the South Pacific in 1955. *(DND archive photo EKS-103)*


The ship's Electrical Department in 1952. *(DND archive photo OT-2432)*

Living conditions were quite different from those experienced today. The accent was on speed and firepower, with creature comforts a secondary consideration. For instance, air-conditioning was fitted to cool critical electronic equipment and not the crew. Officers lived in cabins fitted with bunks and with fittings and amenities in keeping with the rank of the occupant. Officers were fed from the wardroom galley, while the main galley provided for the ratings. As crew messing was in vogue at the time, meals would be drawn from the galley in pans by the "cook of the mess," which sometimes resulted in a first-at-the-trough-best-fed situation. This was especially true at breakfast, when the eggs were sometimes mixed in with the "red lead" (heated canned tomatoes) and the bacon. Since the crew's hammocks were slung over the mess tables, the conflicts between the sailors climbing out of their hammocks and the sailors attempting to dine were predictable and need no explanation. Dishes were washed by the watch coming off and stored in the messdeck "fanny" (cupboard). The degree of cleanliness of the cutlery and dishes and the amount of grease left thereon were wholly dependant upon the enthusiasm of the washer. Yet it seemed that illness was a rarity! The food was nourishing and substantial, although perhaps not always a culinary delight. It must be remembered that the variety of food and cooking facilities were not what they are today. The non-air-conditioned galleys resembled blast furnaces when the ship was in warm weather.

Off-duty watchkeepers slept where they could during the day. It was sometimes possible to find a spot on one of the long narrow benches that served as seating for the mess tables. In warm weather "slinging spots" would be chosen on the upper deck to get away from the internal heat of the ship which could be oppressive. Salt tablet dispensers were well used in such conditions. In light sea states, wind scoops would be fitted in the scuttles to draw in fresh air, but although these helped, there was always the inevitable freak wave that came along to create an unscheduled messdeck washing. Watches at sea were either one-in-three or one-in-four rotation, depending on the department involved.

Back in the '40s and '50s the engineering and electrical departments were separate entities, each having a section head with the rank of commander. The electrical department had a much wider scope of responsibilities than it does now as it had to maintain the operations, communication and weapon systems, in addition to the power-generation systems. The propulsion system consisted of two engine-rooms and boiler-rooms which were reliable, but required a large number of personnel for operation and maintenance. One of the main difficulties in southern latitudes was in making sufficient fresh water. When the situation became critical, the showers and (in extreme conditions) even the water coolers would be shut off.

Electrical department watches at sea were occasionally punctuated by a fan motor going up in flames, or by similar problems for which DC-powered ships are famous. The main switchboard was modern in appearance even by today's standards with its maze of lights and associated switches which remotely operated the ship's main breakers and cross-connect switches. The ship was fitted with a ring main system which allowed great flexibility in connecting generators to the distribution system in the event some part became damaged.

The maintenance of the ship with its vast array of equipment was carried out almost entirely by the crew, with dockyard assistance as a last resort. The maintenance philosophy was that the ship was an independent unit, and for the most part, self-sufficient. It was not unusual for parts to be manufactured on board — valve spindles would be made and electric motor armatures rewound. Numerous spare parts were carried in wooden boxes as per the British system, but these were kept in separate store rooms, locked and secure, and used only when all efforts to manufacture the part on board failed. Frivolous entry into these sacred boxes was at one's peril. One such spares box which was bolted to the deck in one of the forward mess decks contained a massive armature weighing some 900 kg. Although the crew in whose mess it resided had no idea what was inside, the box offered a convenient seat at tot time and was, of course, regularly treated to copious quantities of paint. Those who knew the identity of the object within often pondered how it would be moved should it ever be required. It apparently remained untouched until the ship decommissioned.

Ontario was refitted in 1950 and then employed as a training ship for officer cadets. In 1954 all of her medium- and close-range armament was removed, with the exception of the after twin four-inch mounting, one quad Bofors mounting and one Boffin mounting. Her torpedo tubes were also removed. In addition she received a new paint scheme

Ontario's last commanding officer was Captain Littler, seen here on Jan. 30, 1958. ***(DND photo OT- 3761)***

of light grey and was redesignated from CL to CLB.

The ship carried out many training deployments which included trips to Australia, Europe and the Far East. She carried her own band during these deployments, and it was always a treat to listen to their practice sessions at sea. A ceremonial guard was also made up of selected members of the ship's company. Many traditional sunset ceremonies were performed in foreign ports to the delight of the spectators who had never witnessed one. The equator crossings and the associated "crossing the line" ceremonies were major events and anticipated by all. Occasionally "banyans" were held ashore. These were essentially beach parties, usually held on some remote shore when the ship was on a long deployment. It was the only opportunity for shore leave when port visits were few and far between. LS and below were allowed an extra beer in addition to their ration of one beer a day. Training exercises were carried out on a regular basis when the ship worked independently or with other fleet units. Junior officers and cadets were kept well occupied.

When the envisioned role of the navy refocused on anti-submarine warfare with the introduction of the new *St. Laurent*-class destroyers in the 1950s, HMCS *Ontario*'s days were numbered. Her surface-to-air weapons had been obsolete since the end of the war with the advent of jet aircraft. Her six-inch guns were dated, and a logical replacement would have been a quick-firing weapon as was planned by Royal Navy for its cruisers. Other updates would have been required for the ship to remain a viable unit in modern warfare, but in 1958 the ship was decommissioned and, in 1960, broken up for scrap at Osaka, Japan. It was a sad and, some say, premature end for a great ship, and marked the end of big guns at sea in the Canadian navy.

Author's note

My sincere thanks to Mr. Donald Scott of Sudbury, Ontario for supplying the information on HMCS *Ontario*'s commissioning. Mr. Scott was a member of the commissioning crew and is organizing a reunion of former members of the ship's company which to be held in Toronto, April 26-28, 1996. Anyone interested in attending the reunion may contact him at (705) 670-0180, or by mail at 405-190 Mountain St., Sudbury, Ont. P3B 4G2.

Harvey Johnson served as an electrician in HMCS Ontario *from 1954 to 1957. He retired from the navy as a chief petty officer first class in 1981, and is now a technologist in the DMSS 4 Hull Outfitting section.*

The CIMarE *Online!* comes to the Internet

Just point your WWW browser to: http://infoweb.magi.com/~isaacs/cimare/cimare.htm

The CIMarE has set off on an exciting new venture! Not too long ago, with very little fanfare, the first pages of the new CIMarE *Online!* were rolled out onto the Internet.

The CIMarE *Online!* contains links to other marine-related WWW sites. There are many resources available on the Internet related to the marine industry. An excellent example is the MariNet, which contains a wide listing of companies that offer marine engineering services, daily marine industry news reports and links to marine engineering publications available on the Internet. Other links available include the U.S. National Shipbuilding Network and Jane's Information Store.

The addition of the CIMarE to the Internet can be seen as a significant milestone for the Institute. The CIMarE *Online!* will be accessible via the World Wide Web (WWW) by virtually anyone in the world who has access to the Internet. This includes, of course, CIMarE members from branches across Canada. Through the CIMarE *Online!* we hope to link all our members in ways that were never before possible. We envision that one day any member will be able to access the latest information from any of the branches of the CIMarE, or from one of Her Majesty's Canadian ships.

We hope to see you soon at CIMarE *Online!* And while you are there, sign our guest book and drop us a line to let us know what you think.

News Briefs

New supermodule CPF construction

HMCS *Ottawa* (CPF-12) completed her erection sequence in Saint John Shipbuilding Limited's graving dock last November. Since the inception of the CPF project SJSL has continued to adapt its construction approach to reduce construction time and person-hours while improving overall quality (see "CPF Construction — Experience Gained," June 1995 issue). Typical of this was the recent decision by SJSL to install a second manotoic ringer crane. The first crane was installed in October 1989 to implement megamodule construction, starting with HMCS *Toronto.* The second crane, installed in March 1995, increased SJSL's lifting capacity from 450 tonnes to more than 800 tonnes. SJSL immediately began plans to take advantage of this new capability. Proposals were developed for dual crane lifts, including (*Fig. 1*):

- combining megamodules 4 and 5 into the single *super*module 4/5;
- increasing the outfitting level of the keel (megamodule 3A), consisting of the FAMR, FER, and AER, by installing the GT raft, gearbox, and diesel generators in the module hall;

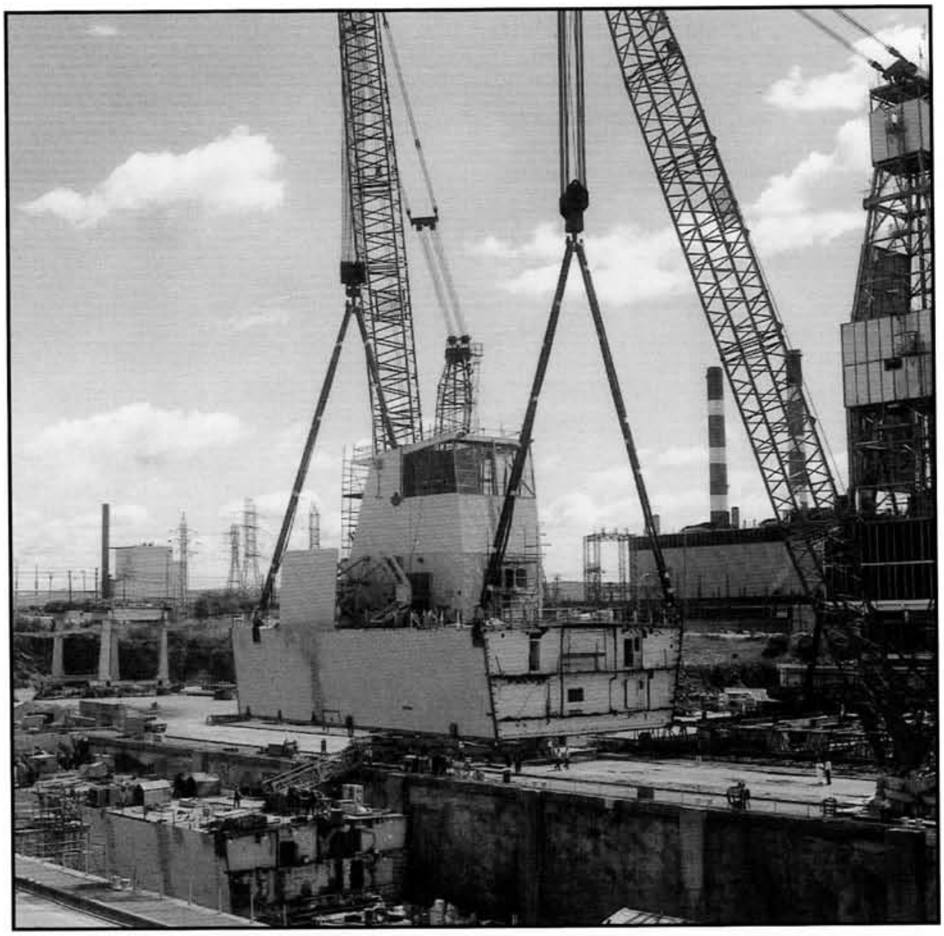

Fig. 2. The erection of HMCS *Ottawa*'s megamodule 8 on Aug. 23, 1995.

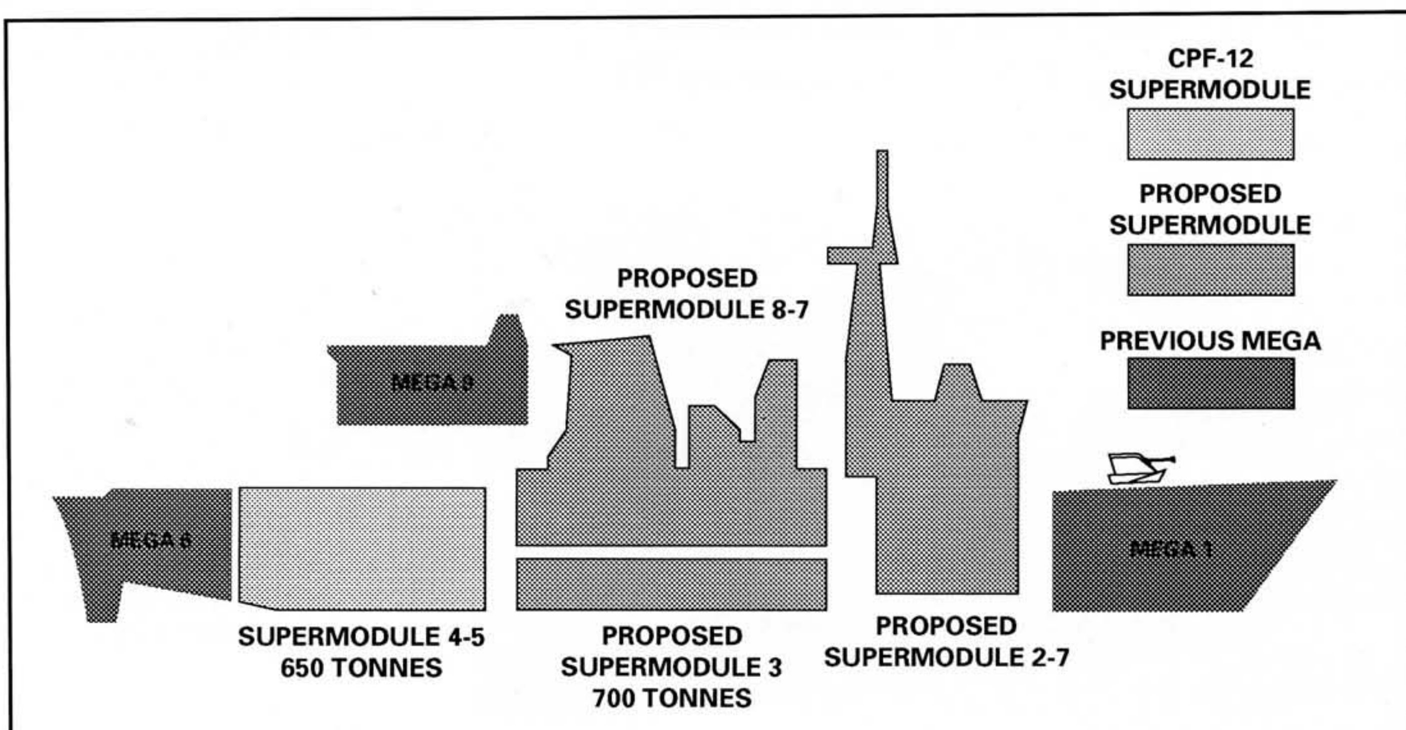

Fig. 1. Proposed CPF Supermodules

• combining portions of megamodules 2, 7 and 8 to form two new supermodules, one of which would cap all machinery spaces at once, the other combining the superstructure, operations and bridge complexes.

In the end, the advanced state of HMCS *Ottawa*'s erection prevented the full implementation of the supermodules. Nevertheless, SJSL management decided to implement a reduced proposal which would still enable them to significantly increase their pre-oufit. This included the full implementation of supermodule 4/5 and increasing the level of pre-outfit of megamodule eight. These two proposals were evaluated for structural impact on the existing lifting points and both proposals were deemed feasible.

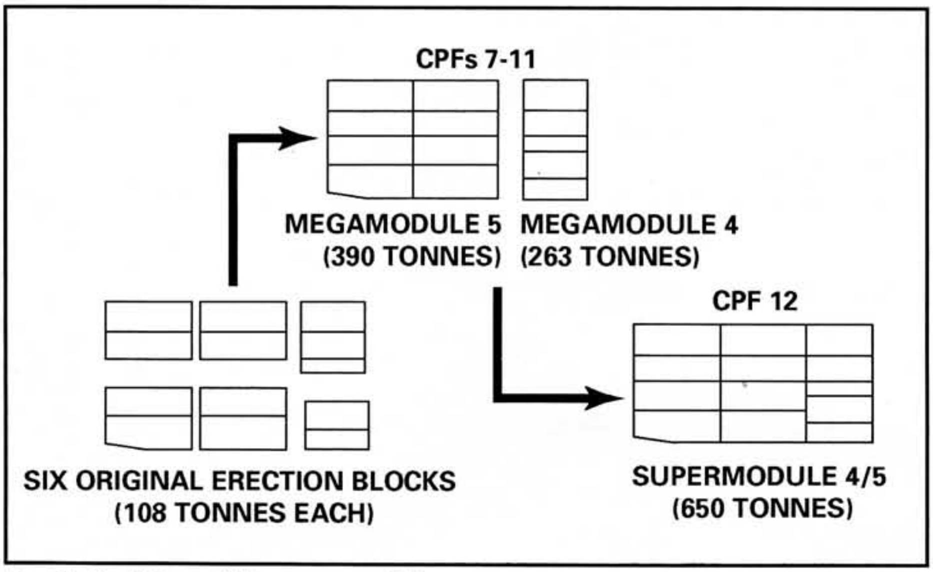

Fig. 3. Evolution of the supermodule.

Fig. 4. The erection of supermodule 4/5 on July 24, 1995.

Figure 2 shows megamodule 8 (now over 500 tonnes) being erected by the dual manotoic cranes, with additional items such as the vertical-launch system blast shields in place. *Figure 3* demonstrates the evolution of supermodule 4/5 from the original six erection blocks used on the first six CPFs, to the megamodules developed for the SRP II ships, and finally the combined supermodule 4/5 used for CPF-12. The maximum lift-weight increased from 108 tonnes for the original erection units to more than 650 tonnes for CPF-12. *Figure 4* shows the erection of supermodule 4/5 (with one of the Hibernia drilling platforms in the background).

Thus the CPF project has and continues to allow SJSL the opportunity to optimize its construction techniques and building strategies. This process of continuous improvement will be of paramount importance if SJSL is to remain competitive as it prepares to reenter the commercial shipbuilding market.— **Lt(N) L.M. Maxwell, NAO, CPF Detachment Saint John, N.B.**

ISO 9000 for NETE?

With the assistance of 3 CFQAR, NETE has commenced a critical review of internal policies, procedures and work instructions to satisfy the requirements of ISO 9001 (94) quality standards. It is expected that this work, which has been authorized under NP0032, will be completed by mid-FY 96/97, at which time a decision will be made by the NETE management committee on whether or not to seek ISO certification for the test and evaluation services provided by NETE. **— S. Fournier, Eng., Manager, Facilities & Property Section, NETE.**

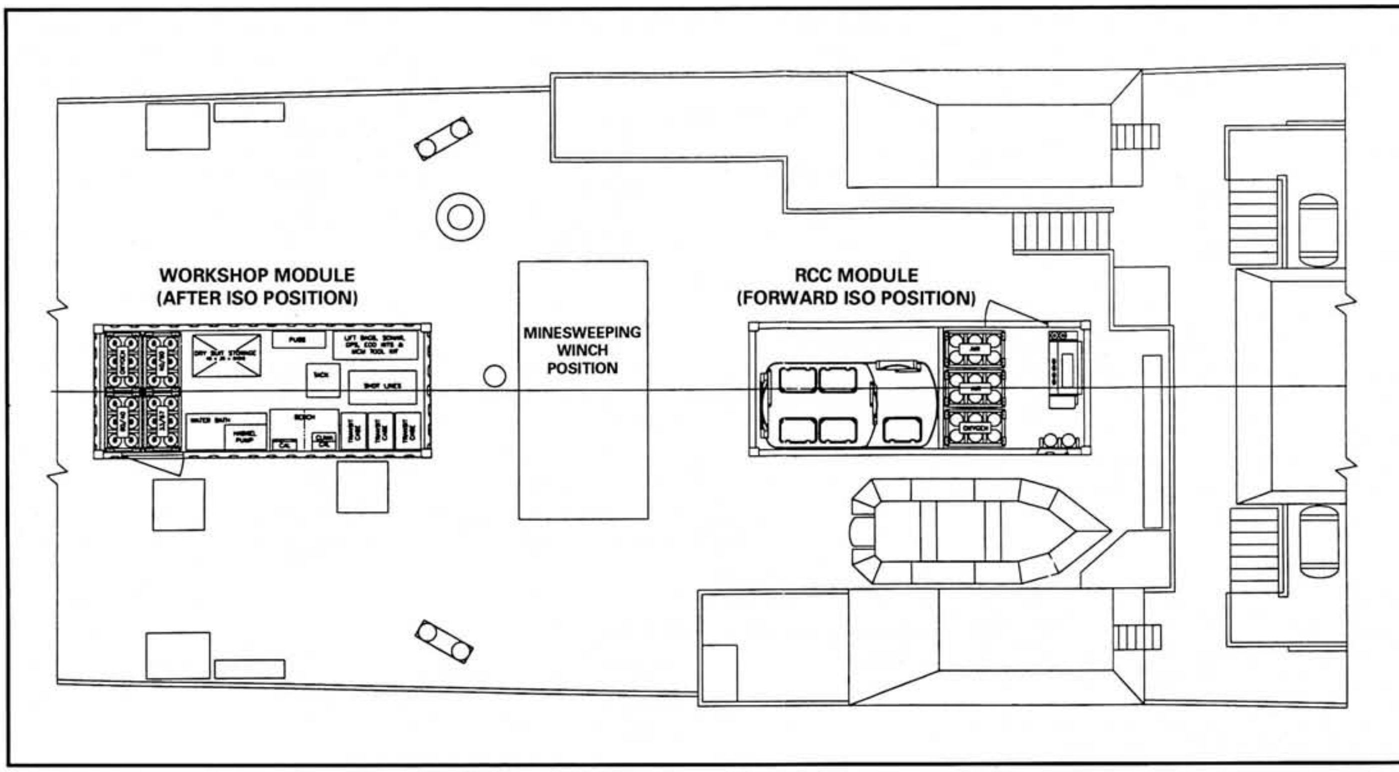

Fig. 1. Overhead view of the containerized diving system layout on board an MCDV sweepdeck

Containerized diving and ROV systems to replace Cormorant

Maritime Command's deep-diving capability is about to become substantially reduced with the announced paying-off of the diving-support ship HMCS *Cormorant* in 1997. Rather than replace *Cormorant* in the conventional manner (i.e. ship for ship), the Directorate of Naval Requirements and the Directorate of Maritime Ship Support are working together to develop a design package for a containerized diving system and a containerized remotely operated vehicle (ROV) system for use primarily on board the *Kingston*-class maritime coastal defence vessel (MCDV).

The shipboard diving outfit consists of two 8x8x20-foot (2.4x2.4x6-metre) ISO-type containers. (*Figure 1* shows their arrangement on board an MCDV sweepdeck.) The forward container is the RCC module, which will house a recompression chamber and air compressors. The aftermost container is a workshop module that can be outfitted for surface-supplied diving, mine countermeasures diving, or battle damage repair operations. The design actually calls for this module to carry equipment that is common to all three missions (e.g. workbench, diving-suit stowage), with any mission-specific equipment being loaded as necessary in less than 24 hours.

Diving equipment that has been packaged inside standard ISO-size containers and embarked only for the duration of a mission has the distinct advantage of being able to be loaded aboard "vessels of opportunity." Such usage also eliminates the cost and overhead associated with acquiring and maintaining purpose-built diving tenders. The navy intends to procure one containerized diving system for each coast.

The *SDL-1* and *Pisces IV* manned submersibles now carried by *Cormorant* will be replaced by a deep-dive ROV system capable of providing inspection, and object search and recovery capabilities to 2,000 metres. The specific equipment to be procured awaits an engineering analysis of the MCDV's capabilities, but the ROV outfit is expected to comprise three modules — a containerized control van in the forward ISO position, an umbilical winch in the minesweeping winch position, and a deep-dive ROV stowed in an A-frame aft. — **Lt(N) G. Alexander, DMSS 2-3; Mr. R. Atwood, DMSS 2-7.**

1994 Peacock Award

Belated congratulations are in order for **Lt(N) Eric van Gemeren** for receiving the 1994 Peacock Award for excellence in MARE 44B training. The presentation was made at last year's West Coast engineering conference by Peacock Inc. Senior Vice-president and General Manager Randy Hammell. Van Gemeren also won the 1993 CAE Award for top marks during his 44B shore phase (October 1994 issue). Bravo Zulu, Eric, for consistent, outstanding effort.

CIWS update

A contract was signed late last November with Hughes Canada's Services and Support Division in Calgary to purchase ordnance alterations (ordalts) for the navy's 21 Phalanx close-in weapon systems. Over time these ordalts will bring the systems to the USN block 1, baseline 2D configuration. This will involve 17 block 1, baseline 0, and four block 1, baseline 1C systems. The significant difference between the baseline 0 and baseline 1C systems is the conversion of the hydraulic gun-drive to a pneumatic system.

Major improvements covered by the baseline 2D ordalts include replacing the obsolete CDC 496E computer with a modern supportable high-order language RISC processor, as well replacing the present hydraulic gun drive with a pneumatic drive (baseline 0 systems only), and improving the search/track subsystem. In addition the parameter analysis and storage system computer will be upgraded and an end-to-end test system will be incorporated.

These improvements will be welcomed from an operational and engineering perspective, but the main reason for bringing the systems up to the 2D baseline is to guarantee configuration and logistic support compatibility with the USN, thereby ensuring the systems are supportable for the remainder of their life.— **CPO1 Craig Calvert, DMSS 6.**

New performance test for ship NBC filter stations

In collaboration with DMSS 4, the Naval Engineering Test Establishment in LaSalle, Que. has developed a capability to conduct in-situ evaluations of ships' NBC filter stations. The test equipment is compliant with NATO STANAGs and recommendations, and is held by the NETE East and West Coast field service representatives to provide rapid support to the fleet. Filter station tests can be arranged through the NETE FSR or the LCMM for shipboard NBC filters, DMSS 4-2-3, Lt(N) D. Sisley, to meet planned maintenance requirements, if a problem is suspected, or before deployment to areas where a potential NBC risk exists.

The test procedure involves injecting challenge substances into the filter station inlet and monitoring the outlet air with sensitive detectors. Leaks as small as 5×10^{-5} (downstream concentration/ inlet concentration) can be detected. The challenge substances are used at low concentrations which are not hazardous to ship personnel. Testing is normally completed alongside, without assistance from ship's staff and without impact on normal ship activities. The tests have been shown to identify mechanical faults, such as defective or improperly installed filters, and exhausted gas-filter charcoal.

NETE has documented the test procedures for *Iroquois*- and *Halifax*-class ships in CFTOs promulgated by DMSS 4-2-3. For *Iroquois*-class ships, information can be found in C77-263-000/NK-001; for the *Halifax* class, see C77-304-000/NK-001. — **Michael Davies, Head, Testing and Applied Engineering Section, NETE.**

Index to 1995 Articles