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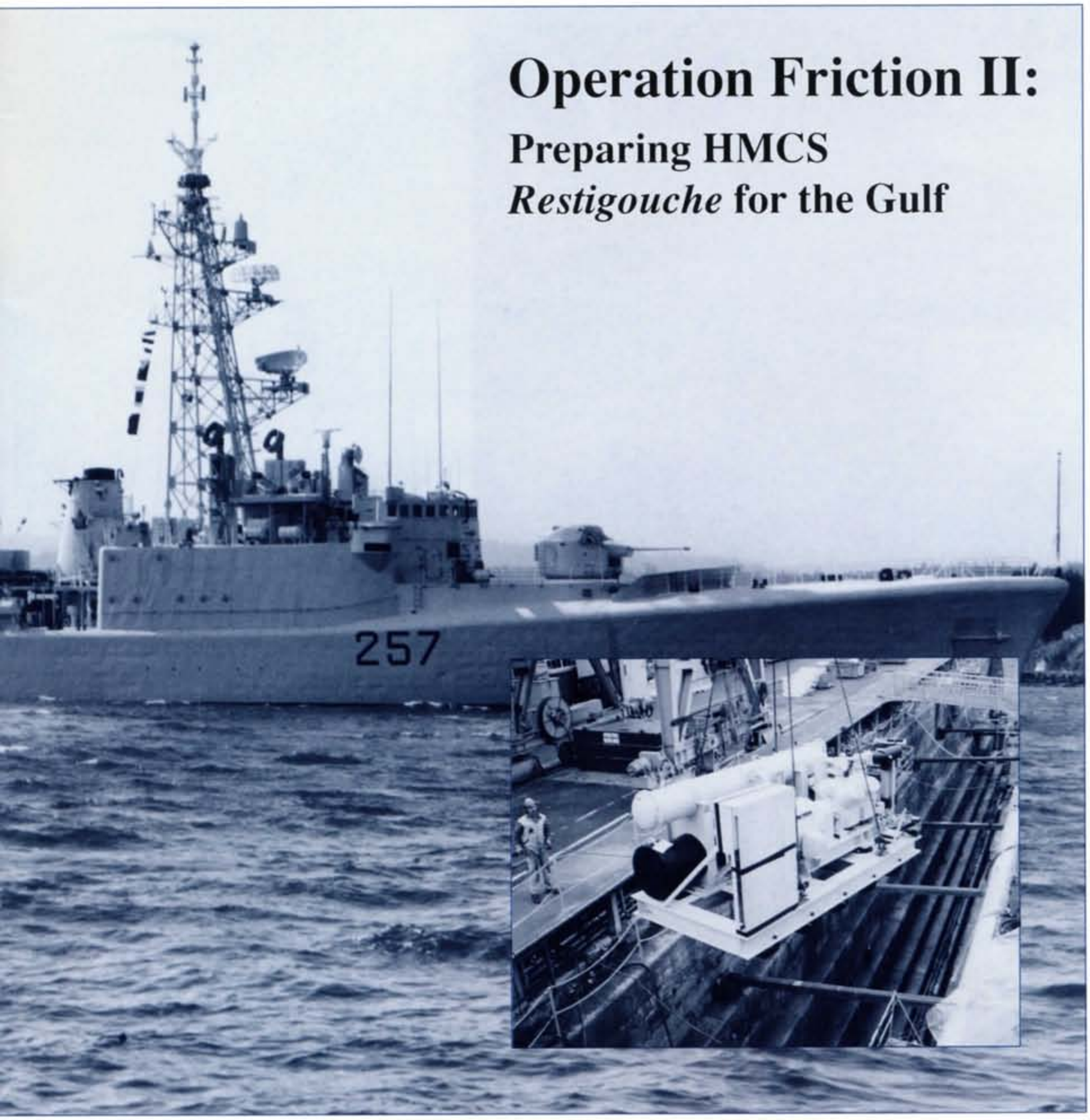
Maritime Engineering Journal

June 1992

Operation Friction II:

Preparing HMCS *Restigouche* for the Gulf



Canada

Is that a CSE shaking hands
with the Pope?

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Maritime Engineering Journal

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OUR COVER
A new 85-ton chiller unit *(inset)* is swayed into HMCS *Restigouche* as part of the ship's 1991 Op Friction II refit for Persian Gulf operations. *(Photos by Base Photo Esquimalt)*

JUNE 1992

DEPARTMENTS

FEATURES

Op Friction II Special — Preparing HMCS* Restigouche *for the Gulf

The Maritime Engineering Journal (ISSN 0713-0058) is an authorized, unofficial publication of the maritime engineers of the Canadian Forces, published four times a year by the Director General Maritime Engineering and Maintenance. Views expressed are those of the writers and do not necessarily reflect official opinion or policy. Correspondence can be addressed to: **The Editor, Maritime Engineering Journal, DMEE, National Defence Headquarters, MGen George R. Pearkes Building, Ottawa, Ontario, Canada K1A 0K2.** The editor reserves the right to reject or edit any editorial material, and while every effort is made to return artwork and photos in good condition the Journal can assume no responsibility for this. Unless otherwise stated, Journal articles may be reprinted with proper credit.

Editor's Notes

Preparing *Restigouche* for the Gulf:
A closer look at some Op Friction engineering

By Capt(N) D.W. Riis, OMM, CD
Director of Marine and Electrical Engineering

In the January issue of the *Journal* we gave you an overview of what it took to get three ships ready for Operation Friction. We also brought you the remarkable story of HMCS *Athabaskan*'s missile change-out in mid-deployment. In this issue, we continue our coverage of the Canadian naval engineering effort for the Gulf with a closer look at some of the technical aspects of the work.

Our focus this time is on HMCS *Restigouche* — the Op Friction II replacement for *Terra Nova*. Hostilities ended before *Restigouche* could join the Coalition forces in 1991, but early last February the ship once again received orders for the Middle East. This spring, under Operation Barrier, the West Coast-based destroyer sailed for a six-month tour with the UN naval force stationed in the Red Sea to enforce economic sanctions against Iraq.

As we have seen, taking what is primarily an ASW ship designed to operate in a temperate climate, and outfitting it for an entirely different role in a tropical climate is a massive undertaking. To give you a taste for some of the work, we are presenting technical descriptions of three of the major upgrades that were part of *Restigouche*'s Op Friction II conversion for Gulf operations. We will look in turn at the ship's Shield ECM and mine-avoidance sonar fits, but to lead off we will examine a system upgrade we hope is being enjoyed to the max by every sailor in the ship — the "new and improved" air conditioning system. While these technical write-ups relate specifically to *Restigouche*, the work in many cases stems directly from, or relates to, the engineering work conducted in HMC ships *Protecteur, Athabaskan, Terra Nova and Huron.*

I should mention that certain people have already expressed dismay over our decision to run this material so long after the fact. However, the importance of documenting activities such as these in the pages of our journal should not be undervalued. In a sense, the initial engineering work the writers are describing represents the "front end" of the lessons learned that will eventually make their way to the surface. The Royal Navy took great advantage of this with their experiences in the Falklands. For years after the actual events they documented their successes, failures and lessons learned in journals such as this so that others might gain from their experience. That is our intention here.

(CF photo by Cpl Cindy Trevorrow, CFB Ottawa (N))

The *Journal* extends best wishes to **Captain(N) Dent Harrison**, who retired from the navy this spring after 37 years of service. A former DMEE and editor of the *Journal*, he is probably best remembered in the naval community for his work as project manager of the Destroyer Life Extension Project in the 1980s (for which he received an ADM(Mat) Merit Award), and for his work as project manager of the Canadian Submarine Acquisition Project. Earlier in his career he received a Maritime Commander's Commendation for training submarine engineers.

Captain Harrison's "hard-driving pursuit of excellence," as RAdm Lynn Mason so aptly put it, was a hallmark of his career and served the navy well. Bravo zulu, Dent, and best wishes to you and Beverly for an enjoyable retirement.

HMCS *Restigouche* (Photo by Base Photo Esquimalt)

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, DMEE, 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 five-and-a-quarter-inch 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.

Letters

Special CFR university training plan unworkable

I read Cdr Cyr's article on CFR CSE training in the January '92 *Journal* with interest. The duration of training needed to produce a subclassification qualified CSE (from any entry plan) has been the subject of much discussion over the years.

The author points out what appears to be an expensive redundancy in the CFR CSE training profile, namely the extensive community college training required to upgrade the QL5/QL6A qualified naval technician to an electronics technologist. While I would fully support a review of this phase of training, I strongly oppose Cdr Cyr's call for the cancellation of some common CSE training for CFR candidates. Further, the author's proposal to create a special CFR University Training Plan is simplistic and not workable.

CSE training is structured to allow officers of different educational backgrounds to achieve a common subclassification qualification. The only part of CSE academic training unique to the CFR candidate is an initial 15 months (contact time) of subsidized training at a community college working toward a diploma as an electronics technologist. This qualification is also required as a minimum standard for CSEs entering under the Direct Entry Officer plan. The 11-month Phase 5 (academic) phase of CSE training is common to all CSE trainees lacking an undergraduate degree in electrical engineering. This group includes officers from all entry plans: CFR, DEO, ROTP and UTPM. The seven-month Phase 6 Applications Course is common to all CSE trainees.

As Cdr Cyr points out, it is very likely the initial 15 months of training has been made redundant by CFR candidates who have completed the new QL5 and QL6A courses. A careful comparison of the course work should be conducted to determine where overlapping training exists. Duplicate training should be deleted from the community college program and a new Course Training Standard for this phase of training should be developed. Cdr Cyr suggests that only four months of additional training would be required to attain certification as an electronics technologist. This would reduce the CFR academic training time from 33 months to 22. This is only four months longer than the amount of time required by all CSE trainees without electrical engineering degrees to reach the CSE Phase 6 (afloat) point.

By stating that the CFR CSE faces a limited career as a MARE because he lacks an engineering degree, Cdr Cyr reinforces the very myth the CSE training profile attempts to annul. Under the current training plan all CSEs achieve an equivalent amount of academic training and, in this respect, are equally employable once they are subclassification qualified. At this point all CSEs are judged by the same criteria for promotion; namely, performance and potential. Since the CFR CSE is not excluded from gaining important first-, second- and third-line engineering experience, only "potential" remains as an area where the CFR may suffer a disadvantage. For all officers this is where significant individual effort must be expended to upgrade skills through accredited academic programs, staff courses, specialty qualifications, second language training, etc.

Cdr Cyr proposes to make CFR CSEs equal players in the MARE community by "making" them graduate electrical engineers. The proposed method for doing this is to create a "UTPCFR" program which is similar to the current UTPO program. A fundamental problem with this approach is that RMC, or any other university for that matter, has academic prerequisites for third-year standing in an undergraduate program which cannot be fulfilled by ad hoc indoctrination and refresher courses. To be selected for UTPO, for example, candidates must be within two years of completing a recognized program. Further, RMC is not mandated to give academic refresher courses to students who lack prerequisites.

In summary, the CFR CSE training profile should be reviewed to determine if 15 months at a community college is warranted in light of the improved QL5 and QL6A courses which have reached steady state. If this phase could be shortened or deleted altogether, the scope and duration of CFR CSE training would be similar to that of CSEs from other entry plans. — **Lt(N) Craig Jansen, DMCS 6, Ottawa.**

Commodore's Corner

By Commodore M.T. Saker

One of the challenges of preparing an article for the Commodore's Corner is to choose one's words such that they withstand the test of time from first thought to when you finally read them some weeks later. To fix the time frame, it is the 29th of February (yes it's a leap year and this is a Saturday) and a number of your senior officers have just completed a multibranch exercise (MBX) on fleet support in Kingston. It has also been the week of Budget '92 and the tabling of the defence estimates. So one can hardly call it a normal week, although I must admit that I enjoyed getting away from Ottawa even if it was to work three very long but interesting days (and nights).

By the time you read this article the full impact of the budget on DND, and the navy in particular, should be fairly well known. At first glance it seems rather favourable, considering the very difficult economic times we are facing and the pressure we are under to reduce defence spending in the wake of the Cold War. The navy's two largest renewal projects, CPF and TRUMP, will produce 12 patrol frigates and four modernized Tribal-class destroyers as planned, the Mine Countermeasures and Coastal Defence Vessel (MCDV) should be in contract and we should be close to having a final decision on the New Shipborne Aircraft (NSA) project.

Those of you who live on the East Coast have already experienced the thrill of seeing our new ships, and the West Coast will soon be participating in the excitement as well. The future navy is on our doorstep and the remainder of this decade should be very exciting and busy. Yet, in the presence of all this good fortune, we are being presented with new challenges to reduce costs and personnel. Is there any sense to it?

I'm sure for most of us this is a very difficult question to answer in a positive sense. We see new ships, new inventories of complex equipment, and a move towards a more balanced East/West distribution of vessels, both in number and type of vessels. The West Coast clearly sees an increase in work, both quantitatively and qualitatively, while on the East Coast a largely qualitative change is envisioned. Yet we are being asked to cut back!

At the Kingston MBX we tried to quantify the impact of these changes across the whole spectrum of support activities and predict the required posture for the year 2006. Needless to say we did not answer all the questions or solve all the problems, but we did make a start. More and more we are becoming aware of the issues that need to be resolved to enable us to get the maximum benefit from our new vessels within the resource constraints.

In the coming months your leaders will be guiding you through various reviews to examine ways of economizing by eliminating certain functions, streamlining various procedures and processes, and possibly restructuring some organizations. It will be a difficult process and some of us may see long-cherished aspects of our work either changed or eliminated. However, it must be done if the navy is to succeed in its mission. It needs your support. I am counting on you.

This is the last time I will be addressing you in the Commodore's Corner as DGMEM. These last two years have been tremendously exciting and challenging, and I have enjoyed serving as your Senior Naval Engineer and Branch Adviser. I thank all of you for your loyalty and support.

In closing, I have heard some retired senior officers refer to the collapse of the Warsaw Pact and Soviet Union as equivalent to the winning of a war. I know some people remain skeptical, in that not one shot was fired and both sides still possess all their weapons, yet I can think of no more favourable way of "winning" a war than by peaceful means. The West's strategy of a credible collective defence worked! Today we face an equally challenging future as we reorganize our defence forces to meet a new world order. Good luck to you all.

On behalf of the maritime engineering community, congratulations and best wishes are extended to Commodore Saker who, in June, will be promoted rear-admiral and appointed Chief of Engineering and Maintenance at NDHQ. — Ed.

Operation Friction II: Preparing HMCS *Restigouche* for the Gulf

Part 1: Air conditioning for Persian Gulf operations

By LCdr R.B. Houseman and Lt(N) B.J. Corse

Introduction

During the fall of 1990 the IRE-class destroyer escort HMCS *Terra Nova* experienced difficulty in meeting air conditioning (A/C) demands while operating in the Persian Gulf. Ambient air and seawater temperatures approaching 50 and 40 degrees Celsius, respectively, far exceeded the rated design of the ship's air conditioning system. The problem was compounded by the additional heat load produced by equipment installed during Operation Friction Phase I.

The ship's difficulties with overheating equipment and uncomfortable living conditions moved Naval Engineering Unit Atlantic (NEUA), in consultation with DMEE 5 and Naval Engineering Unit Pacific (NEUP), to undertake an option analysis to address the problem. As a result, the decision was made to upgrade the air conditioning system in HMCS *Restigouche*, the West Coast IRE scheduled to relieve *Terra Nova* in the Gulf in April 1991. Increasing *Restigouche*'s chilled water capacity to 235 tons from 135 would thus become a significant part of the ship's Operation Friction II refit carried out by NEUP and Ship Repair Unit Pacific (SRUP) in early 1991.

Preparations

The originally designed chilled water system configuration for both *Restigouche* and *Terra Nova* consisted of a single 75-ton chiller plant and four 15-ton chiller units. Even though *Terra Nova* had replaced two of the 15-ton units with an extra 75-ton plant prior to Op Friction I, this clearly was still inadequate. Assuming maximum performance from the existing A/C batteries and fan-coil units, and allowing approximately 10 percent for growth, the new required chilling capacity would be approximately 200 tons. An estimated 15-percent reduction in chiller performance due to high ambient conditions meant the actual maximum capacity required would be 235 tons.

Various options were investigated, including refitting the 150-ton boiler room plant, fitting individual direct expansion units, and upgrading to the *Terra Nova* configuration and then fitting a third chiller plant. The 150-ton option was rejected as the unit was no longer considered support-

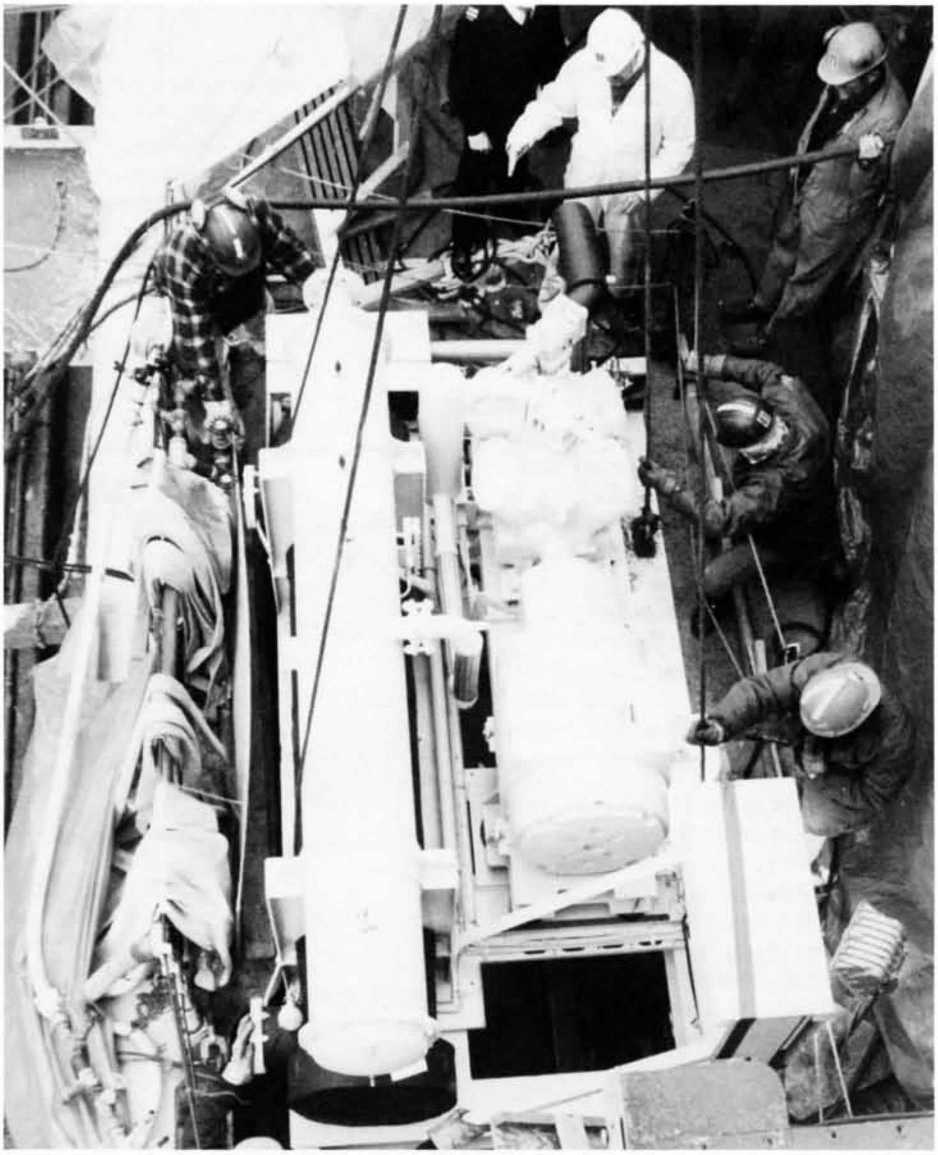


Fig. 1. This view from overhead shows HMCS *Restigouche*'s new self-contained 85-ton chiller unit being lowered into the engineers' workshop through an access cut into the upper deck. *(Photo by Base Photo Esquimalt)*

COMPARTMENT	TOTAL HEAT LOAD BASELINE (BTU/HR)	ADDITIONAL HEAT LOAD (BTU/HR)	TOTAL HEAT LOAD PERSIAN GULF (BTU/HR)	FITTED COOLING (BTU/HR)	ADDITIONAL COOLING REQUIRED (BTU/HR)
OPERATIONS ROOM	96411.0	9610.0	106021.0	53892.0	52129.0 (96%)
EWCR	25246.0	2129.0	27375.0	19332.0	8043.0 (42%)
EWER	45860.0	11982.0	57842.0	33132.0	24710.0 (25%)
JEZEBEL DETECTION ROOM	11251.0	17200.0	28451.0	11800.0	16571.0 (140%)
ADLIPS ROOM	50406.0	1412.0	51818.0	5616.0	46202.0 (822%)
RADIO 2	12132.0	22449.0	34581.0	20736.0	22449.0 (108%)
ASROC STORE	16004.0	5705.0	21709.0	30000.0	(8291.0)

Table 1 Summary of Compartment A/C Loading in HMCS *Restigouche*

able. The direct expansion units would solve problems in individual spaces, but were rejected because they would not allow any flexibility or redundancy in the event of a breakdown. For the circumstances, the best option was to replace two of the 15-ton units with a second 75-ton plant (as per *Terra Nova*) and install a third chiller plant with a design maximum capacity of approximately 85 tons. (The two remaining 15-ton units were ignored because their pumping capacity would be mismatched to the larger units.)

The unit eventually chosen for the *Restigouche* upgrade was the 85-ton chiller package selected for the Canadian patrol frigate. This 125-hp, six-cylinder (reciprocating compressor) unit is entirely self-contained and requires only seawater and power connections (*see Fig. 1 and inset, front cover*). A central processing unit automatically controls the capacity (cylinder unloader) according to chilled water outlet temperature. Also, the unit could be acquired from PMO CPF within one week.

The problem of where to install the unit was easily resolved. Because of its size the only choice was to place it in the engineers' workshop and move the workshop into the Mark 69 compartment. Most specifications for the fit were completed *in anticipation* of a requirement to outfit a second IRE-class destroyer for the Gulf. So when the call for *Restigouche* finally did come through on January 31st, the specs were ready to be delivered the next day.

Heat Load Survey

In addition to chilled water modifications the additional heat loads generated by the new Op Friction equipment had to be evaluated for sufficient cooling. Since very little time was available to assess the entire ship, it was assumed that compartments not fitted with new equipment would be adequately cooled by virtue of the increased chilled water capacity.

The first step was to establish a baseline heat load by surveying "as fitted" equipment. As no single document was available to provide this information, Norris Warming Canada Ltd. was contracted to conduct a heat load survey. (The company had completed a similar survey in HMCS *Nipigon* just weeks earlier as part of that ship's Op Friction II preparations.)

The heat load analysis revealed that the fitted cooling capability was inadequate for the ops room, EW control room and EW equipment room under *normal* conditions, never mind what the Persian Gulf had in store (*Table 1*). The additional required cooling was, typically, double the existing

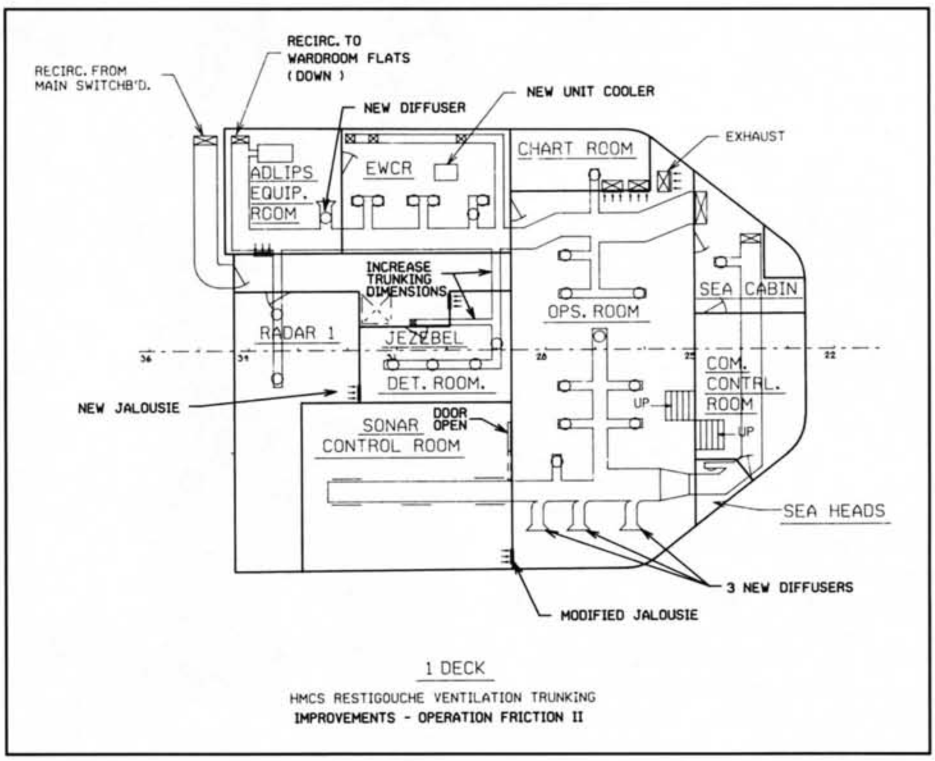


Fig. 2. HMCS *Restigouche* A/C Improvements

capability, except for the ADLIPS equipment room which would require an increase of 822 percent! To overcome these deficiencies a combination of additional unit coolers, increased unit cooler capacity and rerouted ventilation trunking would be utilized.

Chilled Water System Upgrade

Within three days of *Restigouche* entering drydock the engineer's workshop was stripped and the deckhead access cut to the upper deck to receive the new chilled water unit. The seatings were installed and the space prepared prior to the installation of the 85-ton-capacity unit 10 days later. Supply and return piping would be routed forward to the "ring main" and connected forward of the midship isolation valves. This configuration was adopted so the ship could be zoned if required, but the routing would prove difficult as deckhead space was at a premium.

Remaining problems associated with the 85-ton unit installation were minor and included details of instrumentation, strainer selection, and details of a chilled water bypass line for use when balancing the system.

With the assistance of Norris Warming, the spaces requiring additional unit coolers were identified and the units installed. A number of units were required in the upper superstructure which was fed from the ring main via two one-inch-diameter pipes. These pipe runs were so long (one of them was 150 feet in length) that the units at the uppermost extremities of the system were being starved of chilled water. An open header tank located at the same level as the uppermost fan-coil unit compounded the problem.

The piping arrangement fitted on board *Restigouche* was not a ring main system per se. Rather, it was a system of supply and return headers, with three chiller unit circulation pumps operating in parallel to supply the numerous coolers and fan-coil units. But as the pumps for the three A/C plants had significantly different pumping characteristics, the installation did not meet the criteria for correct parallel pump operation. A matched set of pumps would have to be installed.

System pumping requirements were determined for full and reduced load conditions. The calculated full-load condition would require a chilled water circulation of approximately 480 GPM, or 160 GPM per pump. Fortunately, the 609 CCRE pump being used in the CPF met all of the criteria for parallel pump operation, and had the required capacity at the calculated system head. Three of these pumps were installed in conjunction with the three main chiller units (i.e. the two 75-ton plants and the single 85-ton plant).

On the advisement of Norris Warming, two pressure tanks were constructed and installed to replace the open header tank. Two tanks were required to operate the chilled water system in two isolated sections under peak load conditions and not starve the forward units. The two smaller pipe runs were replaced by a single two-inch-diameter run which would be sufficient for Persian Gulf needs and allow for future expansion if required.

COMPARTMENT	PRE OP FRIC AIR FLOW (CFM)	POST OP FRIC AIR FLOW (CFM)
OPS ROOM	2495	3043
SCR	1400	1062
JDR	550	584
EWCR	895	835
RADAR 1	235	245
ADLIPS	260	521
EWER	145	400

Table 2 Air Conditioning Balancing Trials (#10 A/C Unit)

Air Conditioning Improvements

The additional 8,043 BTU/hr. capacity required for the EWCR (*Fig. 2*) was provided by a new 15,000-BTU/hr. fan-coil unit. The unit was mounted to the deckhead behind the electronics cabinets and was supplied by the chilled water system. The EW equipment room (*not shown*) required a bit more work. To provide the additional 24,710-BTU/hr. required, the existing 30,000-BTU/hr. unit cooler was replaced by a 50,000-BTU/hr. unit cooler, and the ventilation trunking from No.1 Deck was enlarged to increase the flow rate to 300 CFM from 100.

The jezebel detection room (JDR) required an additional 16,571 BTU/hr, but was too cramped to fit another unit cooler. However, since excess cooling capacity was available in the adjacent Radar 1 compartment, a 35 x 35-cm access was cut into the bulkhead to allow a flow of cool air into the JDR. On the other side of the coin both Radio 2 and the galley had plenty of space in which to install the new 30,000-BTU/hr. unit coolers they required. The presence of the chilled water main in these compartments made the installation easier still.

Like the JDR, the congested operations room had to rely on an adjacent compartment for additional cool air. Fortunately, the 38,000-BTU/hr. self-contained A/C unit in the adjoining sonar control room (SCR) was more than adequate for the SCR. (The newly installed mine avoidance sonar meant the ship's hull-mounted and variable-depth sonar equipment would likely not be operated.) By installing a wire mesh jalousie in the common bulkhead, and leaving the sliding door between the SCR and the ops room open, a natural air passage was established. A ventilation exhaust located port side forward in the ops room did the rest, drawing a flow of cool air across the entire ops room.

The ADLIPS equipment room's normal system of exhausting heat through an "M" opening to the upper deck was inadequate to begin with. Under closed-ship conditions (with the "M" opening sealed) excessive heat build-up very quickly forced the shut-down of equipment. An 822-percent increase in cooling capacity was required for this space, but wasn't feasible. However, by exhausting the heat to the wardroom flats instead of recirculating it within the space when the ship was closed down, the capacity was improved. Additional A/C air was supplied through an enlarged primary air-branch trunk and directed onto the equipment racks.

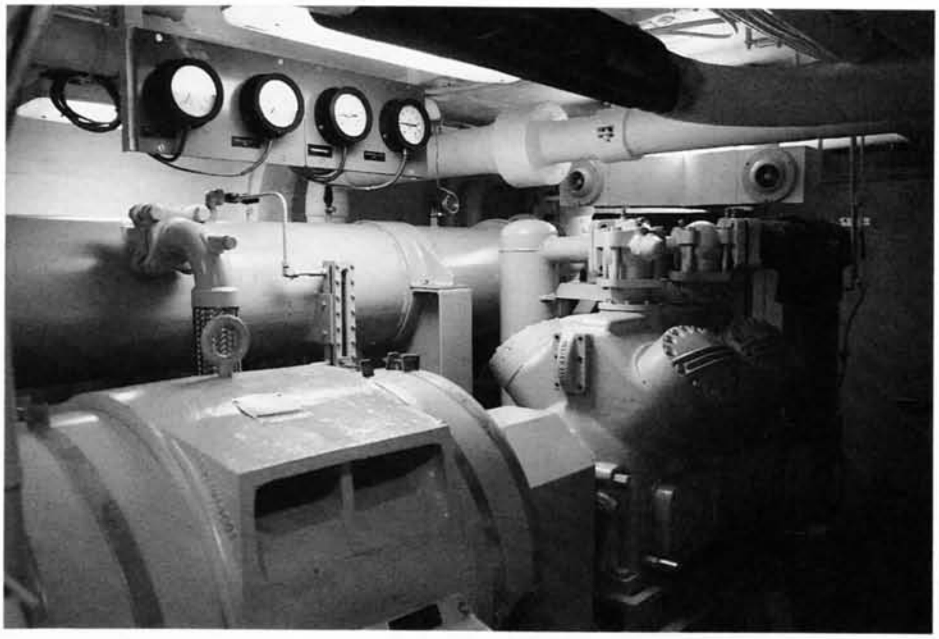
Trials

The new 85-ton chiller plant was successfully tried out with the assistance of a service representative from Stork Canada Ltd. The large compressor drew 520 amps on a reduced-voltage start and settled down to an operating current between 70 and 120 amps (depending on load). As it was impossible to simulate Gulf conditions, the system was balanced for full-load operation. With the chiller plants *shut down* and the A/C batteries and fan-coil units fully open, the flow to each unit was measured and adjusted to achieve maximum performance from the chilled water system. The flow through the chiller plants was adjusted using a pump bypass line. The method proved very effective for the trials.

Air balancing trials were conducted immediately after completion of modifications to the ventilation trunking. *Table 2* illustrates the airflow measurements prior to and after the modifications. Significant improvements in airflow were measured in the ops room, ADLIPS equipment room and EWER. Airflow rates were reduced in the EWCR, but this was offset by the newly installed fan-coil unit.

Conclusion

Although *Restigouche*'s improved air conditioning system would not be put to the test in the Gulf for another year, the trials in Esquimalt indicated that performance expectations could be met. From the moment the requirements were identified to the completion of trials, 31 days had expired. Under these circumstances the success of the installation can be attributed to the excellent co-operation between NEUP and SRUP, whose efforts ensured the most efficient integration of engineering and production. The quality of the workmanship by SRUP was second to none.



Restigouche's* chilled water capacity almost doubled with the installation of this new 85-ton chiller plant. *(Photo by LCdr R.B. Houseman)

Acknowledgments

The authors gratefully acknowledge the contributions made by staff within the Marine Systems and Naval Architecture divisions of NEUP, the support of the Drawing Office, and the support provided by DMEE 5. The rapid response and support given by Norris Warming Canada Ltd. was greatly appreciated.

LCdr Rick Houseman is the Naval Architecture Officer at NEUP.

Lt(N) Brian Corse is the Gas Turbine Class Officer at NEUP.

Operation Friction II

Part 2: Shield ECM fit in HMCS *Restigouche*

By Lt(N) Chris Hargreaves and Lt(N) Frank Pearce

Introduction

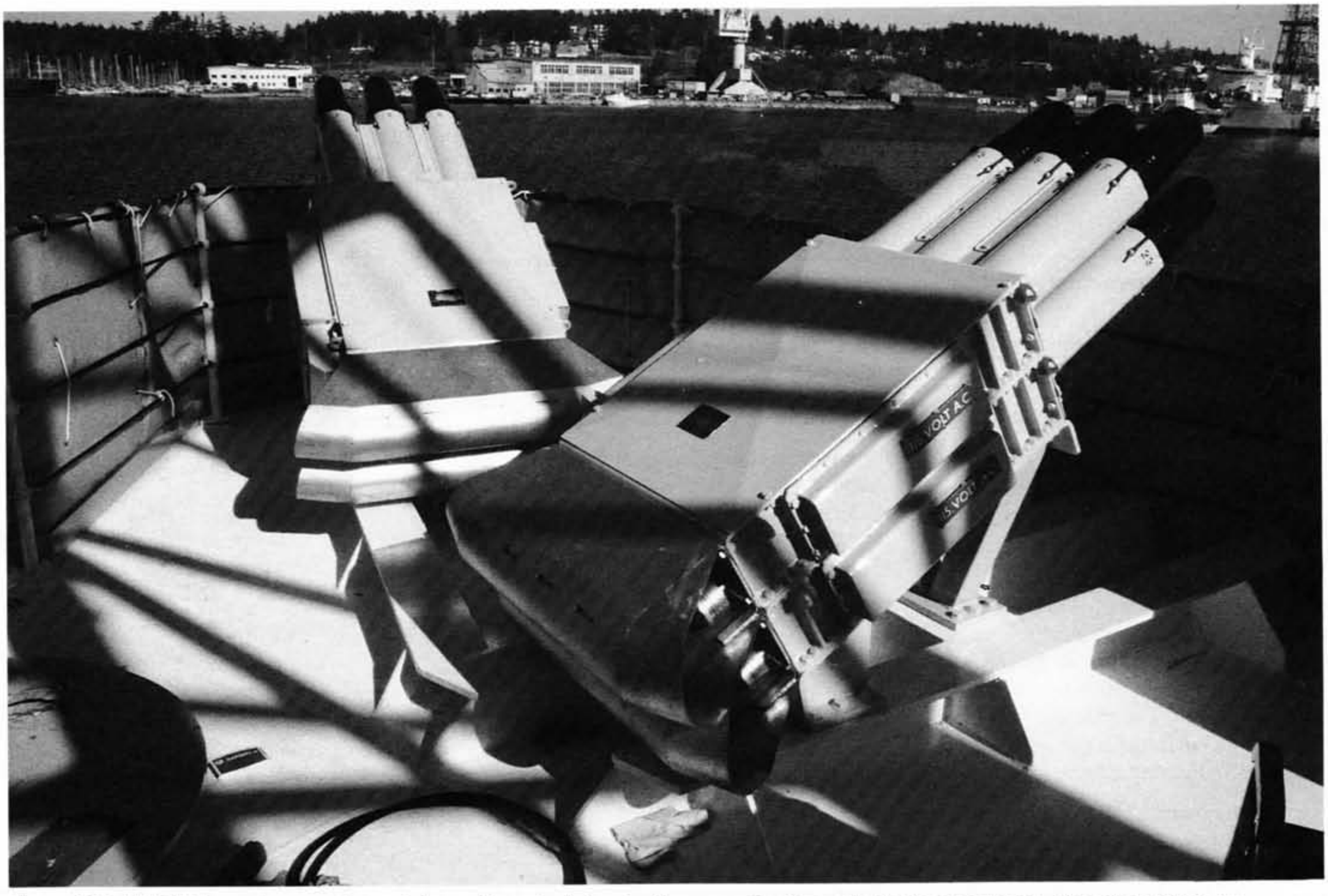
During Operation Friction phase I in August 1990 HMC ships *Athabaskan* and *Protecteur* were fitted with, among other equipment, the Plessey Shield passive ECM system. Designed to counter enemy missile threats, Shield is capable of launching chaff decoys against radar-guided missiles, and infra-red (IR) decoy flares against heat-seeking missiles. *Terra Nova*, already fitted with an SRBOC (chaff) system, was not fitted with Shield. (SRBOC, like its Shield counterpart, is capable of launching IR flares, although none were available to be carried on board *Terra Nova*.)

By the time Op Friction II (*Huron* and *Restigouche*) was announced at the end of January 1991, all Canadian ships operating in the Persian Gulf were required to have an infra-red ECM capability. Accordingly, *Huron* was fitted with Shield during her Op Friction conversion in Halifax, as was *Restigouche* in Esquimalt. *Restigouche* had an SRBOC chaff system, but as there were not enough IR flare rounds available to meet the Gulf requirement the only alternative was to fit Shield.

Getting Started

The Plessey Shield system is standard equipment for the CPF and TRUMP classes. System components are identical, but there are minor software differences to accommodate the inherent differences between the chaff deployment tactics of the two classes. While Shield is designed to be used in either a fully automatic or semi-automatic mode, the older command and control systems of the converted Op Friction ships were limited to manual operation of the system.

When the Naval Engineering Unit Pacific (NEUP) learned that *Restigouche* would indeed receive Shield, it was assumed that, like *Athabaskan* and *Protecteur*, the TRUMP version of the system would be installed. In anticipation of just such a fit for *Restigouche*, NEUP



These Shield ECM launchers make an interesting study in shadows on *Restigouche's* starboard gun-direction platform extension. Installed for Op Friction II, the Shield system will cover the ship against missile threats during Operation Barrier. Radar absorbent padding has been placed around the stanchions and guardrails. *(Photo by LCdr R.B. Houseman)*

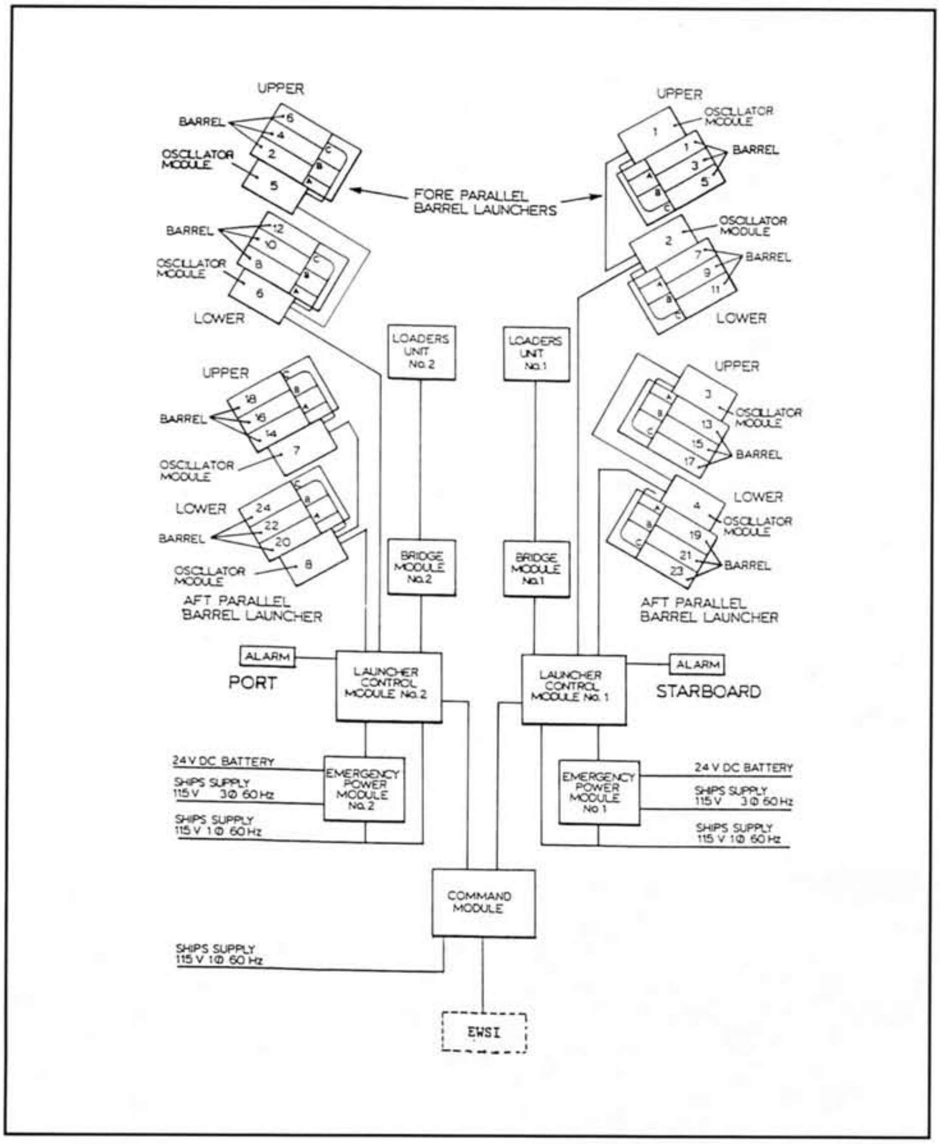


Fig. 1. Shield System Configuration

developed a Shield engineering package based on the Op Friction I work.

The mandate, when it came, was to install a modified two-launcher system as opposed to Plessey's complete four-launcher system. This configuration could be fitted on existing deck space, avoiding extensive alterations to the ship's superstructure. However, five days after preliminary design work began, it became evident that a two-launcher system could not be guaranteed to function since the inherent Shield system diagnostics assumed a four-launcher system. The mandate was therefore changed to install a normal four-launcher configuration *(Fig. 1)*.

At the same time, NEUP learned that *Restigouche* would be getting the *CPF* Shield system, not the TRUMP system as expected. While there were basic differences between the two systems, it was determined that the original engineering packages could be used with some minor modifications.

System Installation Considerations

As far as the placement of the launchers went, there were certain criteria to consider:

a. the maximum allowable cable length between system components;

b. the firing arcs, including a clear zone of 10 degrees off the centre line of each launcher barrel, and sufficient space beyond the launcher efflux zone *(Fig. 2)* for a "safe position" for loader personnel; and

c. 600 mm of muzzle-loading clearance in front of each barrel.

From the outset, the critical factor driving the launcher placement was the maximum allowable cable length between components, in particular the 10-metre limitation between the loader unit (near the launchers) and the bridge module. The launchers clearly had to be close to the bridge, but no acceptable site could be found on the flag deck. However, an extension to the gun-direction platform (one deck above, and abaft the bridge) would satisfy the cabling requirements and all remaining criteria as well. The only drawback was that the ready use ammunition lockers would interfere with the gun-direction officer's (GDO) mobility during operations. How this was subsequently minimized will be described in the next section.

It should be mentioned here that the heaters for the Shield launcher barrels, although part of the system, were not installed. Their electrical and physical space demands were deemed unjustified in a ship that would be steaming in the tropical climate of the Persian Gulf.

Platform Design

Figure 3 illustrates *Restigouche's* structural configuration in the vicinity of the launchers before and after the gun-direction platform was extended. The 5x2.4-metre pillar-supported extensions (port and starboard) were of aluminum construction, incorporating 5/16-inch plating and 5x3x5/16-inch angle bar beams. Design features of the platform included:

a. relocated pre-wet sprinklers;

b. an ammunition numbers' access ladder fitted to the after end of the gun-direction platform;

c. additional installed drainage points at low spots (due to the camber of the deck); and

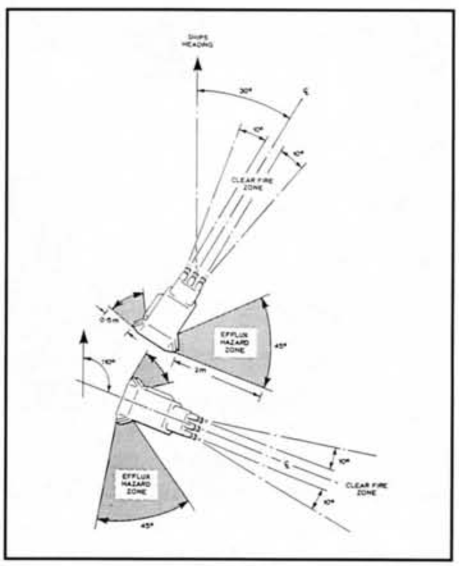


Fig. 2. Rocket Efflux Hazard Zone

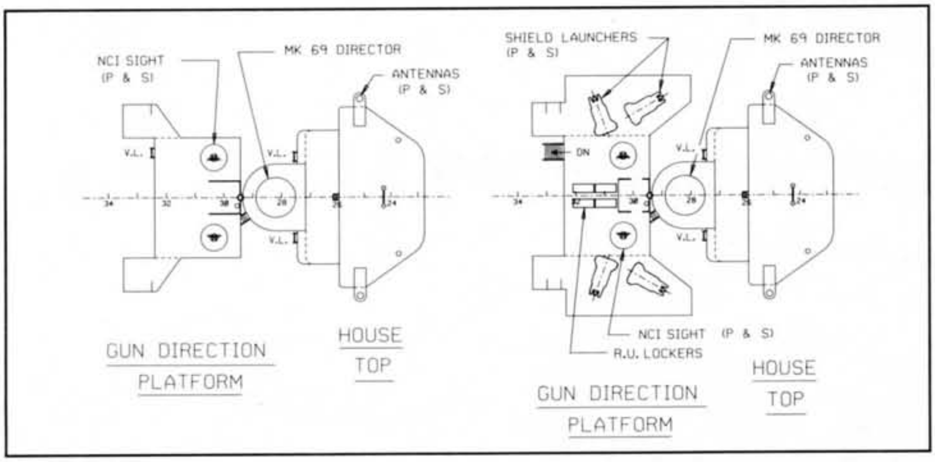


Fig. 3. *Restigouche's* gun-direction platform configuration before and after the Shield conversion. Note the platform extensions *(P & S)* and the changes to the GDO position bulwarks at frame 30.

d. the incorporation of a cantilever section overhanging the bimetallic joint abaft the bridge.

Structural modifications included alterations to the GDO position located on the ship's centre line. The GDO must have all-round access to the gun-direction platform, including the port and starboard visual designators for the forward 3" 70 gun. But as is illustrated in *Fig. 3*, the two Shield ready use (RU) ammunition lockers fitted on either side of the gun-direction platform centre line hindered the GDO's mobility. Access openings cut into the GDO position bulwarks in the vicinity of frame 30 solved the problem.

Magazine Considerations

Toward the middle of February NEUP was advised of the stowage requirements for Shield ammunition. *Restigouche*, it was learned, would carry a minimum of 200 Shield chaff and IR flare rounds, and would receive four CPF-pattern ready use ammunition lockers (i.e. enough to store 96 rounds). The overflow would be stowed in the ASROC magazine.

Safety regulations required that the different types of ammunition be stored separately. Accordingly, two of the ready use lockers were fitted in the mortar well for the IR rounds, and space was made available in the ASROC magazine for up to 108 chaff rounds. The remaining two RU lockers were placed on the gun-direction platform, one each for IR and chaff rounds. To avoid having to have fire hoses rigged whenever the ready use lockers contained Shield rounds, the lockers were modified to accept permanent flood system connections from the fire-main.

Set To Work and Trials

With the functional arrangement of the Shield launchers complete, NEUP developed the schematic and production drawings for the installation. A Shield field service representative (FSR) was called in to assist with the set-to-work procedures since in-house expertise was unavailable. Eventually all Shield components arrived safely at Ship Repair Unit Pacific, and from there all aspects of the installation and set to work went smoothly.

The only piece of kit missing for the operation was a damper test lever which was needed to test the Shield system. With the system trial dates looming, SRUP responded by manufacturing their own fully integrated damper test lever from specifications provided by the FSR!

The first trials consisted of alongside pre-firing checks, involving some 23 hours of tests. Then, on February 27th, *Restigouche* proceeded to sea for live-firing trials of Shield IR flare decoy rounds. A Sea King helicopter equipped with a thermal imaging camera flew photo runs around the ship to determine *Restigouche's* baseline heat signature. Then, as the ship put up IR flares with the Shield launchers, the camera crew in the Sea King rephotographed the ship from various angles with their heat-sensing camera. The trials were successful. Subsequent analysis of the thermograms showed that the decoys had effectively masked the heat signature of the ship.

Conclusion

The initial Shield design was engineered from incomplete data packages and operational requirements. After considerable on-site engineering, specification revisions and changing operational mandates, the final design configuration was implemented 26 days after work was initiated. This system fit was typical of other *Restigouche* Op Friction II fits, and demonstrated the ability of NEUP and SRUP to engineer and implement a large, complicated scope of work within a demanding time schedule.

Acknowledgment

The authors would like to thank Paramax Electronics Inc., DMCS 9, NEUA, NEUP and the Drawing Office for their contributions to the Op Friction II Shield upgrade project for HMCS *Restigouche*. This project could not have been completed as efficiently and expeditiously as it was without the excellent support of Ship Repair Unit Pacific. It is a tribute to the efforts of the management, engineers and workforce of NEUP and SRUP that *Restigouche's* conversion was completed two days ahead of schedule.

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Lt(N) Frank Pearce was an NEUP combat systems project officer until his posting in April to PMO TRUMP in Ottawa.

Operation Friction II

Part 3: Mine-avoidance sonar for HMCS *Restigouche*

By LCdr F. Ruttan (CF Ret.) and Lt(N) F. Pearce

Introduction

The hull-mounted and variable-depth sonars carried in Canadian warships are of little use in detecting small anti-shipping mines. These ASW sonars are designed to detect much larger targets at some distance from the ship and simply do not have accurate enough bearing and range resolution to locate small objects at close range.

When Canadian warships were committed to the Persian Gulf for Operation Friction it became apparent they would require either new state-of-the-art sonar systems, or upgrades to their existing sonars to enable them to operate safely in their area of operations. The idea was not to equip them as mine*hunters*. Rather, the naval planning requirement specified that the ships be given a mine-*avoidance* capability, allowing them to navigate safely should they inadvertently stray into a mined area.

MAS for Op Friction I

During the Op Friction I conversions of the East Coast ships there was not enough time to even begin modifying the hull-mounted ASW sonar equipment for use as mine-avoidance sonar (MAS). A new system was desperately needed, and the only one available on an urgent basis was the Spectra-Scan 3000 fish-finding sonar, manufactured by C-Tech Ltd. of Cornwall, Ontario. Although sensitive to adverse environmental conditions, the Spectra-Scan does offer some degree of protection against moored mines. It does not have a capability against ground mines lying on the seabed.

To support the Spectra-Scan in its new role, the system was modified to incorporate:

a. *pulse length reduction,* which improves mine-detection performance by: reducing reverberation, increasing the signal-to-noise ratio, providing better target resolution and reducing scintillation; and

b. *beam shading,* to give better rejection of surface and bottom reverberation.

The Op Friction I MAS upgrade for HMCS *Terra Nova (Restigouche's* sister ship) involved removing the four-metre dome for the AN/SQS-505 hull-mounted sonar (HMS) and replacing it with an adapter plate *(Fig. 1)* capable of housing the transducer and hoist assembly of the Spectra-Scan 3000. This required the 505 hull outfit and transducer to be fully raised and locked, thus rendering the HMS system inoperative. Although not a fully satisfactory solution, it was nevertheless adopted. However, it should be noted that the decision to mute the 505 sonar was based on operational considerations; an Iraqi submarine threat was non-existent.

MAS for *Restigouche*

When it came time to proceed with the MAS installation engineering specifications for the anticipated Op Friction II conversion of West Coast ships, a number of alternatives to the Op Friction I solution were explored. The Directorate of Maritime Combat Systems (DMCS) investigated the feasibility of:

a. modifying the AN/SQS-505 hull-mounted ASW sonar for a mine-detection role;

b. replacing the AN/SQS-505 electronics with the next-generation AN/SQS-510 (MAS capable) system electronics;

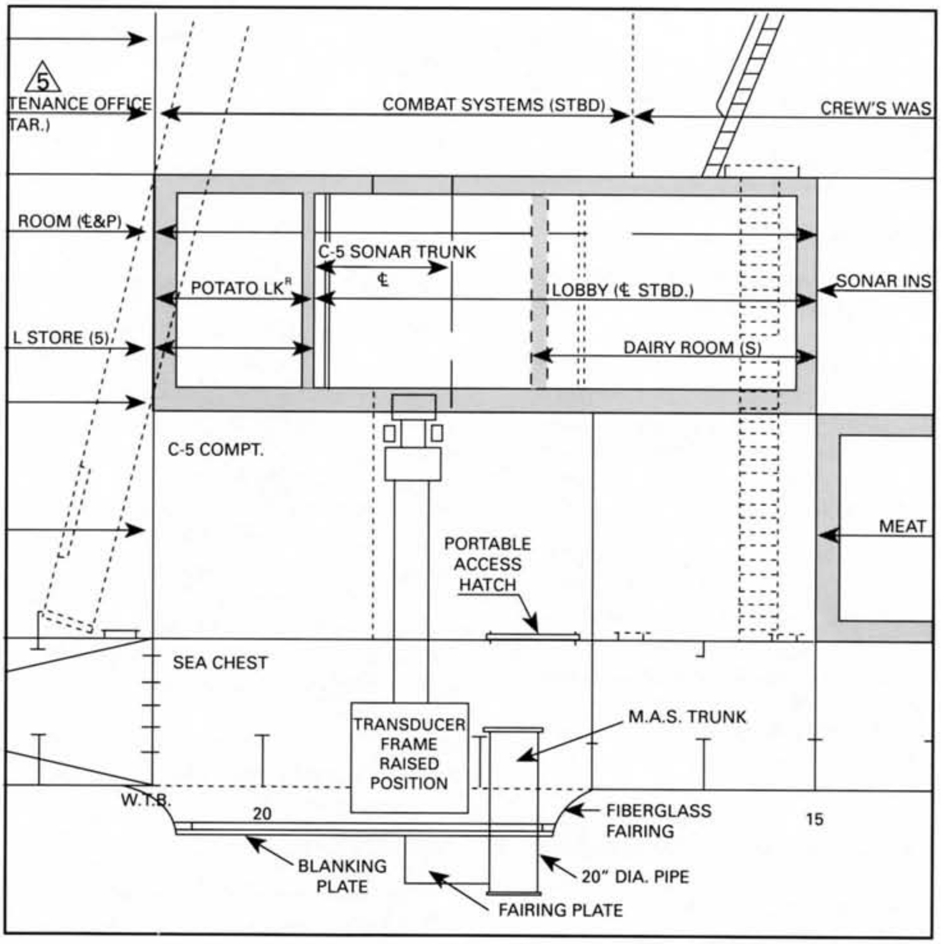

Fig. 1. The Op Friction I MAS solution for HMCS *Terra Nova:* the dome has been removed, the outfit raised and locked, and a blanking (adapter) plate has been installed to accept the Spectra-Scan 3000 MAS assembly.

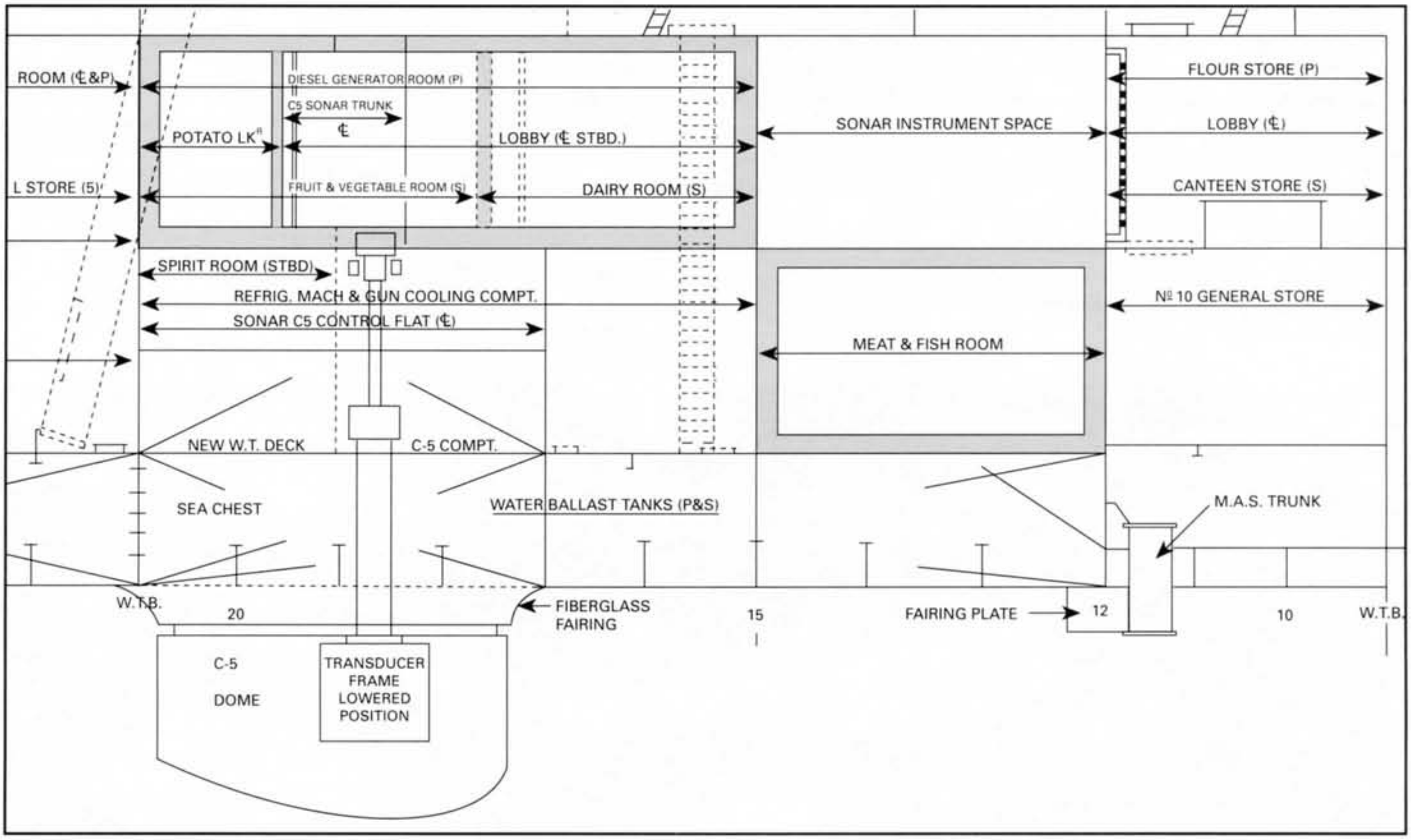

Fig. 2. The Op Friction II MAS arrangement for *Restigouche*: note the separation between the C-5 sonar dome and the new MAS at frame 11.

c. purchasing C-Tech's CTS-36 mine-detection sonar system (then under development for the Royal Danish Navy); or

d. using the C-Tech Spectra-Scan 3000 sonar with the pulse-length and beam-shading modifications outlined earlier.

Once again time was a factor in the decision-making process. The AN/SQS-505, for instance, could have been modified for a mine-detection capability *eventually,* but not in time for the Op Friction II deployment. The new AN/SQS-510 option was also rejected, even though it had already demonstrated excellent potential as a mine-avoidance sonar. It simply would not be ready in time.

As for the commercially available equipment, the state-of-the-art CTS-36 multipurpose sonar would have made a good candidate. However, sea trials of the CTS-36 were scheduled to begin with the Danish navy only in March 1991 — several weeks too late for the system to be considered for *Restigouche's* Operation Friction II refit in February. The Spectra-Scan 3000, on the other hand, although less capable than the CTS-36, was more or less ready to go.

In the end, the navy decided on a rather interesting solution to the Op Friction II MAS dilemma. They would install the Spectra-Scan 3000...but would mount it in a *CTS-36* hoist group! Confident that the upcoming CTS-36 validation would be successful, the idea was for the Spectra-Scan to be replaced by the CTS-36 as soon as it became available (likely while the ship was in-theatre).

Fig. 3. The sea tube of the CTS-36 system on *Restigouche*. (*Base Photo Esquimalt*)

There was a fair bit of work to do. Not only did the Spectra-Scan have to be matched up with the larger CTS-36 hoist group, but the site had to be prepared such that it would accommodate the full CTS-36 system at some later date. Also, in keeping with a new requirement to keep the hull-mounted SQS-505 sonar operational, the MAS had to be located away from the C-5 dome, and as far forward as possible to give it an unrestricted view ahead of the ship.

It was decided, therefore, that the MAS would be installed in a separate hull-mounted configuration at frame 11 *(Fig. 2)*. Internal space limitations complicated matters, and new specifications would have to be drawn up, but the results would be superior to the Op Friction I arrangement.

Outfitting

The MAS consisted of a sonar well, a fairing dome, a transducer and hoist mechanism, equipment racks, receiver, power control panel, transmitter, control data formatter and hoist control unit — all of which had to be fitted low in the ship. The space designated for the MAS in the IRE class was situated below No.10 storeroom, between frames 11 and 11.5. With the stores removed from No.10

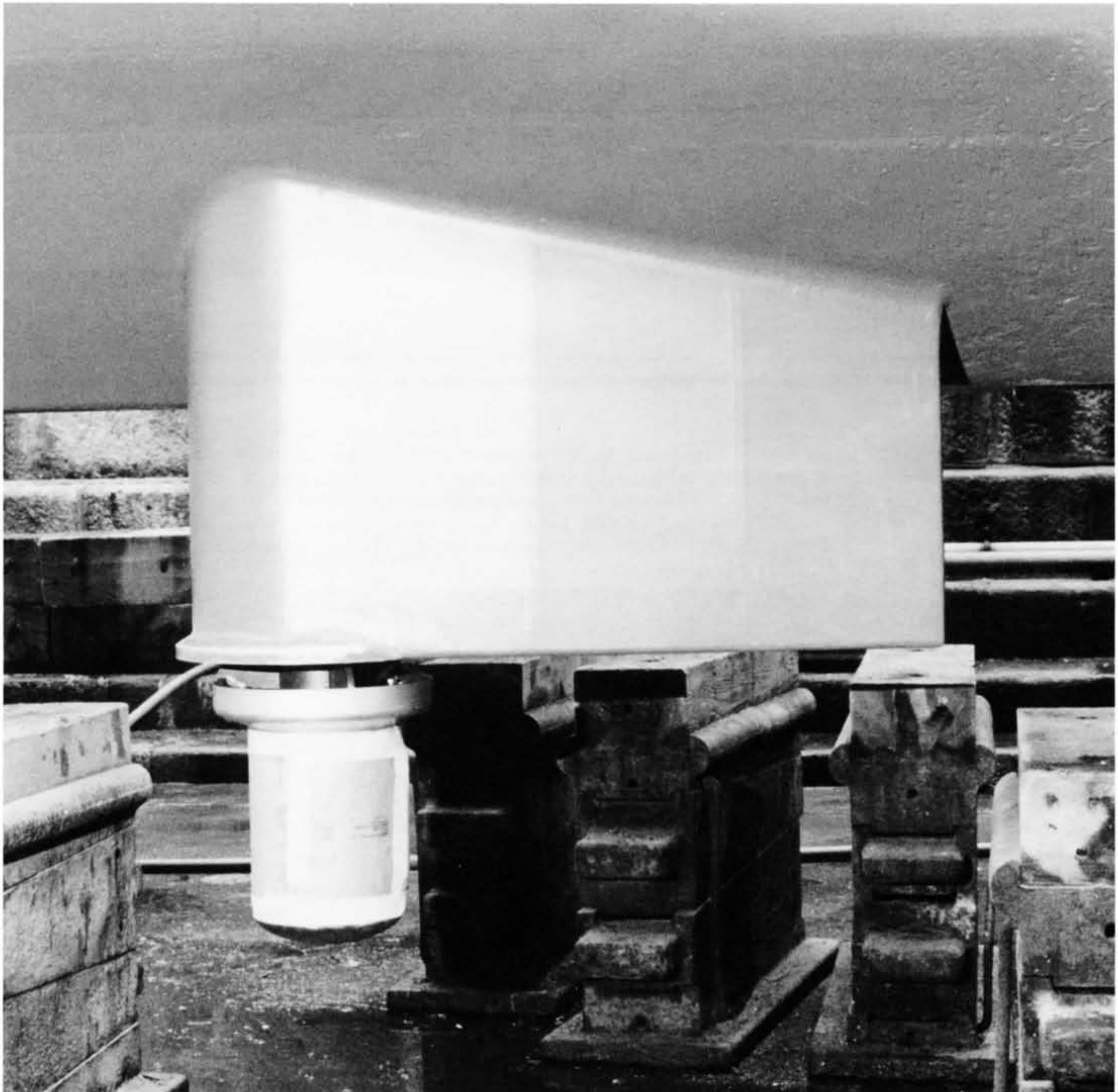

Fig. 4. The finished product. Note the Spectra-Scan transducer in its extended position. *(Base Photo Esquimalt)*

Stores, there was also room for the electrical operating gear. An operator console and display unit were fitted in the sonar control room, with a repeater in the forward gunar room.

To accommodate a change-out of the Spectra-Scan 3000 for a CTS-36 system some time after *Restigouche* arrived in the Gulf, the larger CTS-36 sea tube assembly was installed. DMCS, in conjunction with NEUP and C-Tech, adapted the Spectra-Scan to operate with the CTS-36 sea tube and hoist group assembly.

Number 10 storeroom was modified and fitted with the CTS-36 equipment seatings and racks; No.5 Deck (a non-watertight deck) was holed to accommodate the top of the transducer hoist group and tilt unit. The Spectra-Scan MAS outfit was positioned to port of the centre vertical keel so as not to compromise the ship's main longitudinal structural member.

To be effective, the Spectra-Scan transducer had to be positioned 51 cm below the keel of the ship. The sea tube, which is 51 cm in diameter and made of 13-mm steel, required precision mounting to ensure an exact alignment of the MAS sonar heading with the ship's head. The sea tube was welded to No.1 longitudinal, reinforced with tripping brackets and attached to the hull *(Fig. 3)*. An exterior fairing piece *(Fig. 4)* was designed and installed.

Trials

After undocking, minor leakage was discovered in the top gland of the tilt unit. To correct this, divers from the fleet diving unit installed a cover plate on the underside of the well, after which the well was pumped out and a new gasket applied.

Restigouche conducted sea trials of her mine-avoidance sonar in Parry Bay, just outside Esquimalt Harbour. The 30-to-40-metre depth of water and the sand and gravel bottom approximated conditions expected in the Gulf. The ship made a series of runs against a simulated target mine which was moored seven metres below the surface. Recognizing the inherent limitations of this remarkably capable fish-finding sonar in a mine-avoidance role, the results of the trial were deemed to be satisfactory and the Spectra-Scan 3000 sonar was declared suitable for deployment to the Gulf.

Conclusion

The technical challenge of equipping Canadian warships with a mine-avoidance capability was achieved. The Gulf conflict ended before *Restigouche* could be deployed, but she did carry the mine-avoidance sonar during a subsequent deployment with the NATO squadron. In February of this year HMCS *Restigouche* left Esquimalt for a six-month deployment with the multinational Maritime Interception Force in the Red Sea. En route, the ship will call at Norfolk, Virginia where she will be fitted with a variation of the CTS-36 sonar — the *CMAS*-36 — which has been optimized for Canadian navy service in the mine-avoidance role.

Acknowledgments

The success of the MAS fit in HMCS *Restigouche* was due to the efforts of a number of people and units: LCdr Jim Hewitt *(Command Mine Warfare Officer at MARCOM)* specified the operational requirements and wrote the operational procedures for the MAS; Tom Hedley *(Sonar Technical Officer at NEUP)*, along with members of the Naval Architecture section, wrote the technical specifications for, and oversaw, the MAS fit; and, the Directorate of Maritime Combat Systems, the Ship Repair Unit (Pacific) and the Defence Research Establishment (Pacific) provided valuable contributions to the engineering and construction of the MAS fit.

Finally, thanks and appreciation are extended to the dockyard personnel who actually fitted the MAS in *Restigouche*. Their precision, particularly in cutting the hull and welding the sonar tube to the longitudinals, was completed under very exacting conditions with very little room for physical manoeuvrability. The finished product is testimony to the quality of their workmanship.

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What is a Combat Systems Engineer?

A Constitution for the Practising MARE/CS Professional

By LCdr P.J. Lenk

Existing definitions of the Combat Systems Engineer, such as are found in the MARE/CS occupation specification[1] and the first chapter of the Naval Engineering Manual[2], are all given in terms of the individual tasks or duties a CSE must be capable of performing. What is missing is a clear statement of the overall role the CSE is expected to play in the naval community. Imagine describing an automobile in terms of the functions of its components, without ever once mentioning what a car is *used* for. Such is the dilemma of the CSE occupation. Without a governing constitution to define the *principles* upon which the occupation is founded — the role, in other words — the present definitions of the CSE do little more than describe function without context.

As the classification has searched for its identity during the last twenty years there has always been an undercurrent of opposition to its existence, or at least a misunderstanding of its function by some members of the naval community. No doubt the lack of a clearly defined, well-stated role for the CSE has made the problem worse. The time is ripe for a higher-level definition of the CSE than presently exists; a constitution, if you like, and it is the purpose of this paper to propose such a definition.

"What is missing is a clear statement of the overall role the CSE is expected to play in the naval community."

Characteristics of a Definition

Let us first consider the characteristics a definition should possess. It should be high-level and should serve as a form of constitution for the CSE sub-MOC; that is, it should constitute a guiding philosophy by which the tasks and duties of the CSE are determined. As with the American Constitution, the truth of the definition should be self-evident. There should be no way of proving or disproving the statement. In the end it must simply be accepted as defining what is required within the context of the overall organization of the naval community. The statement should be universal in the sense that it should apply equally to all (in-trade) jobs the CSE might fill. Finally, the definition should be robust; it should seldom need amendment. A CSE's tasks and duties may change periodically, but the role to be fulfilled should almost never vary.

"A CSE's tasks and duties may change, but the role to be fulfilled should almost never vary."

The Proposed Definition

The Combat Systems Engineer is a naval officer whose role is to:

a. **provide** the Command with the **combat-related tools** (eg. weapons, sensors and C^3 equipment) it requires to complete its assigned missions;

b. **provide engineering advice** to the Command on the operational capability and employment of its own combat equipment, and on the potential effectiveness of an enemy's combat equipment; and

c. **perpetuate the CSE profession** such that there will always be CSEs capable of fulfilling the roles outlined in paragraphs a, b and c.

Notice the definition does not attempt to deduce the particular skills a CSE needs, or the particular tasks a CSE should be capable of performing. Rather, it limits itself to the role of the CSE in the naval community. The "hows" must be left to the occupation specification. Note also that the definition includes some responsibilities which are not covered by the present specification.

Now let's examine the definition in more detail.

Responsibility 1 — Providing Tools

This is the traditional role of the CSE. The statement applies equally well to the CSE at sea, in a dockyard, in a naval engineering unit, or even in NDHQ. At sea "provide" is interpreted to mean *maintain* the maximum combat capability of the available combat systems. At NDHQ, "provide" means *acquire* sensors, weapons or C^3 equipment to satisfy the requirements set by MARS officers, and also to support the fleet on a day-to-day basis by keeping the in-service equipment operational.

Responsibility 2 — Providing Advice

Although the CSE currently does have an advisory role, it is limited to advising solely on the operational capability of the equipment *(Ref 1, Duty 6; and Ref 2, Duty 3)*. Inclusion of the word "employment" in the definition expands the present role to include advising on how best to utilize the equipment. At present the tactical considerations are entirely the purview of the combat control officer and, ultimately, the commanding officer. However, without taking anything away from the combat officer, the CSE could and should provide input here. Having been trained specifically to understand the workings of the combat equipment, the CSE could provide crucial technical advice in tactical or strategic situations.

The same reasoning applies to the second part of this responsibility — providing advice on the capabilities of an enemy's equipment. Because of the CSE's technical training, the CSE rather than the combat officer is likely to have the better appreciation for the capabilities of enemy equipment in various circumstances, especially if the equipment is new or unfamiliar. At present this expertise is not being exploited; there is nothing in the 44C specification or in the 44.A8 OSQ to cover it. Taking on such a responsibility would provide a significant overlap in the knowledge bases of CSEs and combat officers, and would perhaps lead to a better understanding of each other's role and capabilities.

Responsibility 3 — Perpetuating the Profession

This final responsibility is common to all professions. The profession must provide clear entrance requirements to prospective members and stipulate the professional development path required to achieve membership. Equally, it is every Combat System Engineer's individual responsibility to advise aspirants on the merits of the profession, and to take an active role in the professional development of subordinate CSEs.

Conclusions

In many ways what has been proposed here is a statement of the obvious. This is as it should be.

If this, or any other, definition of the CS sub-MOC is accepted, then the next step should be to amend the occupation specification to agree with it. At that point the minimum qualifications and training required to enter the profession can be determined.

References

1. **A-PD-150-002/PP-002, MOC 44C.**
2. **Naval Engineering Manual, Vol.2, Combat Systems Engineering.**
3. **A-PD-150-004/PQ-002, OSQ 44.A8**

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Five reasons why you should become a P.Eng. when you don't have to

By LCdr Charles Hierons, P. Eng.

During my time as head of the Combat Systems section at NOTC, I was frequently asked by young naval engineers, and a few of the older ones as well, why they should become professional engineers when there is no requirement for professional status in the military. Good question. Initially my response was "Don't bother." Naval engineers already have important military professional development to worry about, such as writing OPDP exams. I have since changed my views on this.

I now believe that being a member of a professional engineering association complements the profile of a MARE officer. Qualified engineers in the military have much to gain by maintaining close ties with the broad cadre of "professional" engineers, and they should strive to do so. In this paper I will offer five good reasons why we as naval engineering officers should become professional engineers.

1. Professional Development

Naval engineers lead a dual existence in that they are both professional naval officers and professional engineers. Professional naval officer development is well covered within the Forces under such schemes as OPDP, language training, staff school and staff college. However, while training is intensive in the early years of an engineer's career, there are few opportunities for professional engineering development later on, apart from the annual MARE Seminar and the *Maritime Engineering Journal.*

"I firmly believe that widespread membership and participation within the professional engineering associations by MAREs is of benefit to the individual, the navy and the profession."

Becoming an active member of a professional organization is conducive to keeping abreast of new ideas and developments within the engineering profession. I do not advocate that P. Eng. status should interfere with promotion or even job selection. I do, however, firmly believe that widespread membership and participation within the professional engineering associations by MAREs is of benefit to the individual, the navy and the profession. Knowing how other engineers think improves your credibility as a technical authority and as a manager. This is of advantage especially when dealing with staff, associates and industry.

2. Professional Relationships and Standards

Naval engineering officers often work with civilian engineers, many of whom do not understand the naval engineering structure, eg. ranks, MOCs, etc. However, the civilian does understand the meaning of the title P. Eng. To the civilian, being entitled to use the P. Eng. designation shows a dedication to professionalism. It says that, as a P. Eng., you consider being an engineer something more than completing a program of post-secondary training in engineering.

As a professional you understand and subscribe to a code of ethics. These ethics tell the members of the public that they can trust your professional actions and advice. The title "Professional Engineer" is well regarded by society, and the public's respect for the engineering profession ranks as high as for any other professional body.

3. Self-Respect and Personal Pride

As in all aspects of life, recognition is a basic want of most individuals; rank and promotion signify this recognition within the navy. However, in civilian life professional status is recognized by being accepted as a member of a professional body. For engineers this is the Professional Engineering Association. The designation "P. Eng." gives recognition to a person who is reasonably intelligent, has self-discipline, who is not averse to hard work to achieve goals and who has accomplished something to be proud of. It is the pinnacle of the engineering profession.

4. Furtherance of Canadian Professional Engineering Associations

The benefit is not one-sided. The professional associations will also gain from a membership which contains a broad spectrum of naval engineering experience and practice. Civilian engineers will profit from the liaison by receiving a better understanding of the naval system and naval training.

5. Life After a Naval Career

It is possible in the navy to further a career without attaining professional status. But at some point we all have to leave the service, and very few of us will want, or be able, to take full retirement once we do. Most of us will likely want to continue working within the engineering world. If this is the case, then the P. Eng. designation, rather than any former rank or position, may be of more value to getting a good job.

Summary

Being a P. Eng. is not just having a title and a rubber stamp. It is useful to you as a naval engineer and will enhance your ability as a naval officer. However, the title without the commitment is meaningless; the more you become involved, the more you get back.

If you are thinking about registering as a professional engineer, you might want to act sooner rather than later. There is some movement by the professional engineering associations to raise entry standards, and candidates who are acceptable today may one day find themselves ineligible for registration. To meet the new standards candidates may be required to upgrade their education or write even more exams before acceptance.

In British Columbia, for example, a move is already afoot to raise the standard of entry to the BC Association of Professional Engineers. This stems from investigations into the 1988 roof collapse of a Burnaby food store. A special review committee of the Professional Engineers of BC has recommended, in part, that the Association increase the minimum registration requirement from two years to four years of supervised engineer-in-training (EIT) experience, and that a mandatory, preregistration EIT professional development program be established.

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The Structural Maintenance of Warships

By LCdr Paul Brinkhurst

Introduction

Traditionally the challenge of identifying and remedying structural failures such as cracking, corrosion and buckling, before they become hazardous or diminish a ship's operational effectiveness, has been met through regular baseline refits. As a result, the general structural condition of our ships compares favourably to that of ships of other western navies.

But now this record is in danger. As the navy moves away from its practice of conducting baseline refits and turns to a program favouring longer-spaced overhauls (for CPF, a midlife refit after 12 years of operation has been proposed), the fleet will gradually become more and more structurally vulnerable. The factors that contribute to this vulnerability, and the steps that can be taken to counter their effects, are the subject of this paper.

Fig. 1. The extremely corroded structure found in this ship's machinery space is blunt testimony of inadequate survey and repair.

Problems of the Modern Ship

To meet modern displacement constraints, warship designers generally try to reduce the weight where it is most concentrated — in the ship's structure. Optimizing for low displacement often involves using high-strength steels and the production of thinly plated, closely stiffened structures. This is the mould from which many western warships, including the CPF, are now cast. But there is a price to pay in terms of:

a. increased fatigue vulnerability (unless production quality is greatly enhanced);

b. decreased accessability;

c. increased initial distortion;

d. increased complexity, and

e. decreased damage resistance.

One consequence of all these effects is that the low-weight ships we are building will require more structural maintenance, while the emphasis now is on reducing maintenance expenditure. Furthermore, the easiest way to minimize displacement is to minimize volume. But whereas a little extra volume allows for growth, equipment/hull accessability and a more robust, less maintenance-oriented ship structure, it is often erroneously perceived as being wasteful. In fact, the net effects of limiting volume too much are greater acquisition and through-life costs, and decreased survivability.

The structural maintenance picture gets even worse as the period between major overhauls is extended. Crews will be expected to shoulder more of the maintenance load, but with the pressure on nowadays to reduce crew sizes that might be asking too much. Reductions in crew size will simply lead to less routine maintenance and, just as importantly, less structural examination during daily routines. Furthermore, the absence of formal repair standards at a time when maintenance funds are tight will leave structures especially vulnerable to "justifiable inattention" *(Fig. 1)*.

The imbalance between our level of awareness of structural problems and those of other systems also gives cause for concern. Crews generally *expect* their ship's structure to be sound and don't actively seek out problems. Localized corrosion, for example, may be seen as an inevitable norm that can be "remedied" by a coat of paint in time for Captain's rounds, when it could be a telltale of a condition requiring potentially serious repair.

And yet ship structures are exposed to tremendous stresses in a terribly demanding environment. Parts cannot be replaced as easily as printed circuit boards, and there is no automated diagnostic system for rapidly identifying faults. Ships are usually designed to last somewhat in excess of 20 years (but are generally expected, and usually required, to last much longer), much of this time being spent at unnecessarily high stress levels because of our failure to enforce weight-growth restrictions.

The practice of baseline refits, combined with the inherent robustness of our ships, has so far allowed us to counter the effects of such failures, and structural deterioration in general, fairly successfully. That we have been able to keep up with the required maintenance is thanks primarily to the quality of the individuals, at sea and ashore, charged with doing so. The approach, however, has been reactionary, with more effort going into repair than into prevention. In the case of CPF, the apparent lack of a connection between the ship's structural design and its planned maintenance (PM) schedule would make such an approach increasingly costly. Defects will have to be identified and repaired *before* they become so major that they cannot be accommodated in the PM schedule without compromising fleet effectiveness.

Fig. 2. There is no automated diagnostic system for identifying structural faults. Careful area examinations and experience in knowing what to look for are the keys to successful hull health monitoring. *(Photo: Base Photo Esquimalt)*

There are a number of ways in which we can improve our current system to meet the challenge of lightweight structures and less frequent surveys. It will mean involving ship's crews, maintainers and designers, but at least the improvements can be readily integrated into the existing maintenance administrative framework.

A Way Ahead:

Hull Health Monitoring

As structural surveys become less frequent, it must fall to ship's crews to take up the front lines in the battle against structural degradation. The concept of hull health monitoring (HHM) is designed to involve the hull department in a formalized examination procedure and at the same time raise the general awareness of the entire ship's company toward structural issues.

Hull health monitoring is not new. The requirement for engineers to ensure that "a thorough examination of every accessible part of the inner and outer bottom plating...is continually in progress during the whole time the ship is in commission" is clearly stated in the Naval Engineering Manual (NEM Vol.1, Part 23). In the past this has generally been interpreted as an order to complete the few structural planned maintenance routines that exist, and conduct pre-refit and refit surveys as required. HHM goes one step farther by establishing a priority-based routine of hull examinations such that the condition of the hull can be known at all times.

The hull-monitoring planned maintenance program attacks the problem one step at a time. The ship is divided into areas which can be examined visually by a hull technician (HT) in a relatively short time, and then each area is assigned a priority based on its importance to the ship's strength and/or watertight integrity. The priority determines the frequency of inspection. The schedules are then arranged so that the entire ship is examined over a five-year period, at the end of which time a full survey is conducted by NEU surveyors to confirm the ship's status and provide a configuration baseline for the next operational cycle.

Critical structure should be examined every six months, while secondary structure requires attention only once in the refit cycle. (Newly commissioned ships would probably be given more frequent examinations until run-in or warranty periods had expired.) The examinations would generally be limited to simple visual assessments, including the use of mirrors, but not the use of more complex equipment such as boroscopes (which would be held by the NEU).

To complete a proper examination an HT must be familiar with the ship and have a reasonably good understanding of corrosion, cracking and deformation. Experience in knowing where to look would speed up the process, but junior HTs should be able to contribute if they are given some on-site training and the time to conduct careful area examinations. It would be up to the senior HT to conduct spot checks and ensure schedules were met. NEU could assist with difficult examinations and on-the-job training.

A hull health monitoring program as described here would undoubtedly create an increased workload for the hull department. However, the operational impact of this could be minimized by reassessing HT tasking priorities and concentrating HT resources on the department's primary responsibilities — planned maintenance and damage control. *Figure 3* shows how a hull monitoring program for a typical frigate would take approximately 222 hours per year of HT time (excluding any shop support). This equates to less than one hour per working day, which is certainly no more than is currently allocated to meet the existing NEM requirement.

An alternative to this program would be to drop our practice of conducting one-shot surveys. Given the CPF maintenance schedule, it might be necessary for surveys to become progressive throughout the operational cycle of the ship. In this case many of the hull monitoring routines could be completed by the NEU staff as part of the progressive survey. But there is a drawback to this system, apart from the increased management required to organize full-ship coverage. By the time the ship reaches its end-of-cycle maintenance period, the information gathered from surveys early in the cycle will have become dated and, unavoidably, inaccurate.

Standards

A formal program of hull monitoring can go a long way toward improving our awareness of structural problems in the navy, as well as augmenting the refit survey information needed to maintain the fleet. But having access to regular structural sitreps on all vessels for input to operational and maintenance planning is only part of the answer. The next step is to see that all ships are repaired to a common standard.

East or West, our ships must be given the level of structural maintenance resources they require to meet at least a minimum standard of seaworthiness. In the civilian world this is achieved by requiring ships to hold valid certificates of seaworthiness (based on government or classification society standards of survey and repair) to qualify for insurance. Similar proce-

HHM INSPECTIONS FOR A TYPICAL FRIGATE

Priority	Frequency months	Spaces	Inspections per 5 years	Typical structure
A	6	12	120	ER, BR, 1 Deck midship
B	12	75	375	Masts, 1 Deck fore & aft, wet spaces
C	60	60	60	Superstructure
D	Refit		0	Tanks, unless opportunity arises

Total inspections:	555
Average hours per inspection:	2
Total hours per 5 years:	1110
Total hours per year:	222

Fig. 3. HHM Inspections for a Typical Frigate

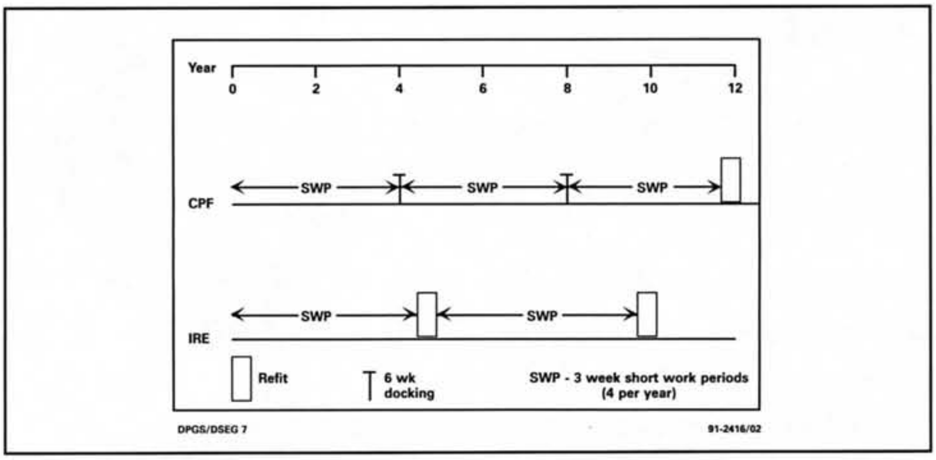


Fig. 4. Comparison of Maintenance Schedules for CPFs and IRE-Class Destroyers

dures, unrelated to insurance, are now being formulated for the naval fleet.

At present the decision to make or delay structural repairs is made by the NEUs, with DNASE assisting as required. These decisions are based on the individual engineering judgments of the people involved. There is no standard for surface ships that explicitly states the allowable percentage loss of plating thickness, or the maximum size of deformation that can be left unrepaired. As a result, different ships are left with various degrees of structural degradation. Introducing a standard for repair will control this variance by specifying to what level structural defects must be repaired.

The standard will also specify how often surveys are to be completed. The frequency of structural inspections should be dictated by our ability to forecast structural problems. It is as simple as that. Surveying every four or five years, as has been our practice, provided an excellent baseline for making structural predictions, allowing defects to be identified and repaired before they become a significant burden on maintenance resources. Forcing an increase in the length of our predictions by reducing survey frequency, without a commensurate increase in our ability to make predictions, will eventually result in a backlog of defects that could affect operational schedules. Therefore, the standard will state that all compartments in a ship must be surveyed every five years.

Within a program of longer-spaced overhauls, such as has been proposed for the CPF, conducting surveys won't be as simple as it has been. Apart from a midlife overhaul, the CPF will get a six-week docking (extended work period) every four years *(see Fig. 4)*. Since a complete hull survey and associated repairs cannot be completed in six weeks, a system of partial surveys will have to be established. The standard will ensure that sufficient time and resources are provided during the ship's several *short* work periods each year to allow NEU surveyors to have lagging removed, tanks freed of gas, etc., and complete proper surveys. This will leave the extended work periods available for necessary structural repair work.

Statement of Structural Integrity

DNASE is considering introducing statements of structural integrity which would state that a ship is structurally capable of completing the operational task for which it was designed. The statement would also highlight any structural concerns held by DNASE or the NEUs, and in this sense would become the structural equivalent of a statement of metacentric height.

The issuance of a statement of structural integrity would accomplish several other things. To begin with, what better testimony could there be of a navy's commitment to safety than a statement of structural integrity issued against an accepted standard and uninfluenced by either operational or maintenance considerations? On the same tack, the statement would ensure that survey and repair standards were not compromised without conscious acknowledgment of the potential repercussions on safety. A ship's captain would thus be made aware of areas of significant structural weakness and could use this information, but not be constrained by it, when making operational decisions.

Statements of structural integrity would be issued by the NEU Naval Architecture Officer, under the authority of the Director Naval Architecture and Specialty Engineering, and would be valid for approximately five years. All being well, a ship would enter an extended maintenance period before the statement expired. Renewal could only take place after a full survey was completed.

Conclusion

This paper has attempted to outline the problem facing structural maintainers in the future, and to suggest ways of tackling it. Survey and repair standards are being developed. An interim hull health monitoring routine for HMCS *Halifax* has already been promulgated, and a formal schedule is being developed. The debate on structural certification continues.

At the same time, however, we should be reconsidering the design philosophies which have led us to maintenance-intensive ships. Our assumptions regarding the desirability of low-weight designs must be reassessed, and we must improve our control over weight growth during design and through-life. We also have to look harder at the through-life benefits and costs of structural design, rather than the initial costs alone. We might end up spending a little more during acquisition, but we stand to make it up in the savings on the maintenance bill farther down the road.

The key is balance. Balanced designs, balanced maintenance philosophies, and an attitude that balances the needs of the ship's hull with the systems it bears. If we establish such a balance now and maintain it, we can expect better from the ships we do have and from those still to come.

LCdr Brinkhurst is the DNASE 3 naval architect for ship structures.

NATO Defense College

Higher education with an Italian flavour

Rome. The Eternal City. Once the seat of a formidable empire, this ancient city on the Tiber today plays host to soldiers of many nations who come to study at the NATO Defense College. For 26 years, now, the NATO Alliance has been sending its people to this sunny Mediterranean capital for an "international" education with an Italian flavour.

By Cdr Roger Cyr

When the North Atlantic Treaty Organization was formed in 1949, a need arose for an institute to prepare personnel from the NATO member nations for employment in the organizational structure of the Alliance. In 1950 General Dwight Eisenhower recommended to the North Atlantic Council the creation of a NATO defence college, which was subsequently approved by the Council and established on June 25, 1951. Five months later the College opened its doors at the École Militaire in Paris for its first course of 47 students from 10 member nations. Only Iceland and Luxembourg were not represented. In 1966 the College moved to its present location in Rome, Italy.

Established in Paris in 1951, the NATO Defense College has been serving the Alliance from its present location in Rome since 1966.

The raison d'être of the College is to familiarize its students with the structure, aims and strategic concept of NATO. Students also learn about the geographical, political, military and cultural characteristics of member nations, and examine the impact of their current defence, technological and economic problems on NATO policy and planning. Another important aspect of the curriculum deals with developments outside of NATO and their effect on the Alliance.

The College conducts two courses per year — a summer term from February to July, and a winter session from September to February — for officers of colonel and lieutenant-colonel rank and for civilian defence and foreign affairs employees. Students who complete the course are normally posted to international NATO billets, or to national NATO-related billets in their own countries.

Command of the NATO Defense College is held, traditionally, by an officer of general rank, or a civilian of equivalent standing. The only Canadian ever to command the College was a naval officer — Vice-Admiral J. O'Brien, when he held the position from 1970 to 1973.

Course 77

The author attended the 77th course of the College from August 1990 to February 1991. It was a particularly interesting session because of the situation in the Persian Gulf and the changes taking place in Eastern Europe. It was also a session marked by "firsts." For example, for the first time in the College's 40-year history, representatives of Eastern European nations (Poland and Czechoslovakia) were invited to lecture at the College. By the same token, this was the first course to include a visit to a former East Bloc country in its curriculum. It also marked the first occasion of attendance on the course by a MARE.

The scope of the course was achieved through three basic college activities: daily lectures and study sessions on global political, economic and military issues; committee work and dialogue among the students; and two international tours of NATO and NATO-member facilities. An important cultural aspect to the program provided students with opportunities for sightseeing in a number of countries.

Rome's famous Spanish Steps are just one of the many fascinating sights in the Eternal City. Students attending the NATO Defense College are exposed to an extensive cultural program as part of their curriculum.

A typical day at the College started at 0800 with language instruction (in English, French or Italian), after which students joined their committees to prepare for the instructional lecture of the day. The one-hour morning lecture was the basic element of the course and was followed by a one-hour question and dialogue period with the lecturer. During the coffee break and lunch period, students had the opportunity to discuss issues with the day's lecturer, the faculty advisers and with other students. The afternoon was normally devoted to committee work on a course study project.

Daily Lectures

The daily lectures are the essential element of the academic program at the College and serve also as the basis for committee discussions. The College calls on lecturers of international standing who are eminent experts in their respective fields. They come not only from NATO nations, but also from Eastern European nations and other areas of the world. During Course 77, some 96 lecturers from 20 countries (including Canada) gave presentations at the College. Lecturers are invited to be frank and open in their deliberations and are assured of a privileged platform. All lectures given at the College are transcribed and translated in English and French, and simultaneous translation is available in the lecture hall.

The lecture program of Course 77 was divided into six study periods that addressed:

- Instruments of Power and Global Challenges;
- NATO, Alliance in Transition;
- The USSR and Eastern Europe;
- A New European Order;
- Factors Affecting Future NATO Policy; and
- World Regions and their Importance for NATO Member Nations and the Alliance.

Committee Work

At the beginning of the course students are divided into committees of about nine students, each group having its own faculty adviser. Committees must research a topic relating to an assigned theme, and prepare a study project and report for presentation to the course. (The theme for the Course 77 study projects was appropriately entitled, *The Future of the Alliance*.) Reports having special merit are later presented to the NATO Military Committee in Brussels by the commandant of the College.

Instructional Tours

The course participated in two major instructional tours of approximately three weeks' duration each. The first, to the Iberian Peninsula, United States and Canada, featured a visit to the Portuguese air force base in the Azores, briefings from SACLANT in Norfolk, Virginia, and an address by the chairman of the Joint Chiefs of Staff in Washington. Students also had

West meets East? The author with two Red Army soldiers outside Red Army Headquarters in the former East Berlin.

the opportunity to tour ICBM sites in Wyoming, NORAD headquarters in Colorado, and to observe U.S. Army field manoeuvres. The tour concluded with visits to Ottawa, Toronto and Montreal.

The second tour centred on Europe and included visits to military and industrial facilities in Greece, Germany, Belgium, the Netherlands, Denmark, the United Kingdom and France. Italian military and cultural sites were also visited during a short tour to Sardinia, and the course had the very special privilege of being granted a general audience with his Holiness Pope John Paul II at the Vatican.

Cultural activities are an important aspect of the College program, and students are encouraged to have their spouses and families accompany them to Rome for the duration of the course. The city abounds with cultural delights and historical landmarks — just *living* there is a cultural experience! The College program provides opportunities to learn about Italian art history, and to visit historical sites in and around Rome. The social event of the season for Course 77 was the wedding of a UK course member. The ceremony was truly a college affair with an international flavour.

NATO Defense College aims to prepare students for all aspects of employment in an international environment. And in this it succeeds, through a stimulating program in a most memorable city. *Arrivederci Roma!*

Commander Cyr is with the Directorate of International Armaments Co-operation. He has the distinction of being the first MARE to attend NATO Defense College.

Greenspace: Maritime Environmental Protection

Environmental Evaluation of an Arctic Project

By Lt(N) Donald Smith

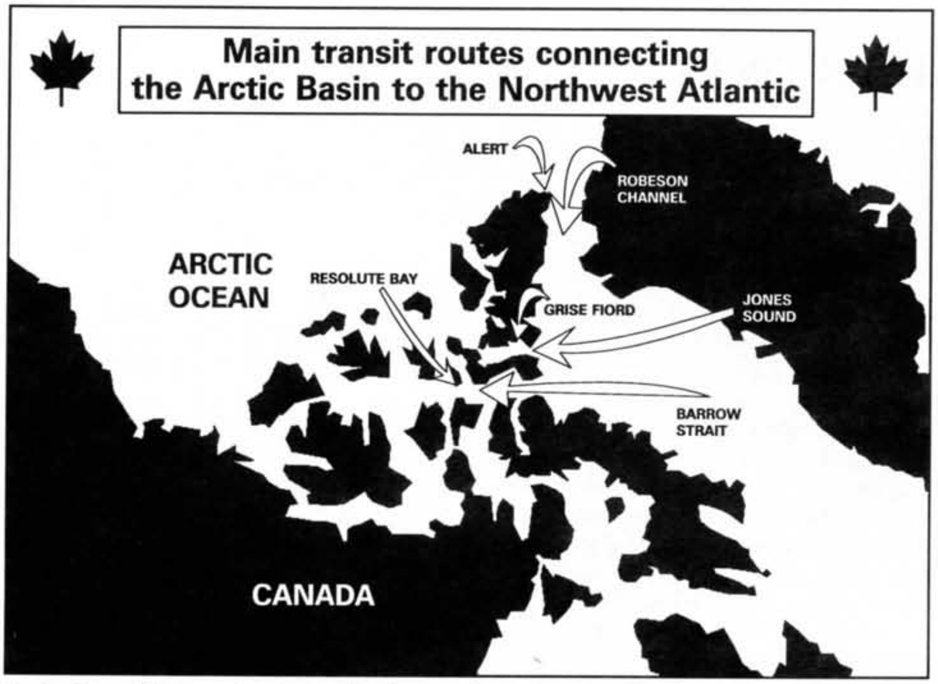
DND is presently in the project definition phase of an undertaking to establish fixed, underwater surveillance systems at three submarine transit choke points in the Canadian Arctic Archipelago. The Arctic Subsurface Surveillance System (ARCSSS) project, as it is called, is the result of an operational and sovereignty initiative (identified in the 1987 defence white paper) to monitor submarine traffic between the Arctic and Atlantic oceans in Barrow Strait, Jones Sound and Robeson Channel.

Installing these systems will entail a significant amount of activity in Canada's High Arctic. Sensors will have to be positioned on the seabed, cables will have to be laid and brought up to and across the foreshore through deep trenches or directionally drilled conduits, and enclosures will have to be constructed on the shore to house electronic equipment. Near the Barrow Strait and Jones Sound sites lie two of Canada's most northern Inuit communities — Resolute Bay on Cornwallis Island and Grise Fiord on Ellesmere Island. The more remote Robeson Channel site is at Wrangel Bay, 70 kilometres south of CFS Alert.

Initial Environmental Evaluation

Protection of the environment has been a key element of the ARCSSS project from the start. It was recognized during planning that a proper environmental assessment would be crucial to the success of the project's implementation. Preliminary concerns identified during an environmental screening of the ARCSSS project were

Grise Fiord on Ellesmere Island: igloos still have a place in Canada's northern communities — as doghouses. Today's Inuit live mostly in houses of woodframe construction. *(Photo by Lt(N) Don Smith).*



Protection of the environment has been a key element of the navy's plan to install an underwater surveillance system in Canada's High Arctic. (DPGS 7 graphic).

the protection of the local environment and the possible disruption of the Inuit communities, particularly with respect to marine mammal harvesting.

These concerns were sufficient to warrant an Initial Environmental Evaluation (IEE), in accordance with the federal Environmental Assessment and Review Process. From a project perspective the IEE process places the onus of responsibility for environmental protection upon the user, in this case DND. It guides the user to either resolve potential environmental conflicts, or else reexamine the design (or even the viability) of a project. With many projects the IEE is done in conjunction with system design. However, for the ARCSSS, DND decided to conduct the IEE before awarding contracts for project definition so that the design and installation plans could take into account any environmental requirements.

The author at the crossroads in Resolute, NWT. Lt(N) Don Smith is the DMCS 3 project systems engineer for the ARCSSS project.

In 1989, LGL Limited of King City, Ontario, an environmental research company with Arctic experience, was contracted by DND to conduct an IEE for the ARCSSS project. The conduct of an IEE varies from project to project, and in the case of ARCSSS it was determined that close community consultation should augment the environmental data gathered through published research and field work.

The first field investigations and Inuit community involvement took place during 1990/91. DND's recognition of both the uniqueness of the environment and the Inuit's dependence on it have formed the basis for a constructive dialogue between the project team and the communities of Resolute Bay and Grise Fiord. One of the results of this consultation process has been DND's decision to tailor a flexible ARCSSS implementation plan to accommodate marine mammal migrations and Inuit hunting patterns. Today, community consultation is an ongoing ARCSSS project activity, essential for keeping current with native concerns.

Pointers for conducting a successful environmental assessment

Does your project require an environmental assessment? If it does, you might want to consider these few lessons learned:

a. start the environmental assessment as early as possible in the project;

b. consult with the Directorate of Environmental Protection for guidance with the environmental assessment and review process and current DND policy;

c. contact all federal and provincial/territorial agencies that might have input by first contacting the appropriate Regional Screening Committee of Environment Canada;

d. direct consultation with the public can be beneficial in establishing confidence in DND and quickly identifying potential concerns;

e. keep current with policies and guidelines and adhere strictly to them; and

f. be patient and consistent and you will overcome many of the problems you will encounter.

D.S.

Looking Back

DDE Main Boiler Explosion

The Events

A 257-class destroyer was participating in an exercise just after commissioning. During the middle watch the bridge ordered one boiler to be shut down because the ship would be steady steaming for the next 12 hours. Shortly after 0300, the starboard boiler was taken off line and shut down. The boiler room chief decided this was a perfect opportunity to repair a leak which had developed in the starboard fuel supply system. He informed the boiler operator of his intentions and took the job on himself.

Shortly after the watch changed at 0345, the bridge rang down Stop on both engines and an anxious officer of the watch was on the phone to the engine room. A large fireball and a lot of black smoke had just been seen issuing from the funnel. The EOOW checked his gauges, found everything normal, and told the officer of the watch he would call him back. He had barely replaced the receiver when the phone rang again. This time there was an excited boiler operator on the line, and did *he* have a problem. An explosion had just ripped through the starboard boiler and black smoke was coming from it!

The Chief ERA and engineer officer were called and the ship resumed operations on one boiler limited to 50-percent power. When the furnace of the starboard boiler was finally sighted, one look at the mess inside was enough to see that it had suffered serious damage. Loose furnace bricks were lying scattered all over the furnace floor. It was clearly a job for the dockyard.

Machinery Damage

So what happened? Well, having completed his repairs to the fuel line, the chief decided to test it for leaks. But instead of opening the "recirc" valve to get a fuel flow, he accidentally opened the valves to the boiler front. Fuel sprayed onto the hot brickwork where it ignited and exploded. The chief closed the valves immediately, but by then of course it was too late.

The explosion caused the boiler casings to expand, and caused extensive damage to the brickwork. The boiler required complete rebricking.

Lessons Learned

1. The ease with which human error can occur is, in retrospect, sobering.
2. The EOOW was not told of repairs being made to machinery in his charge. The boiler operator, in addition to failing to inform the EOOW, was not in touch with what was occurring in his space with a system for which he was responsible.
3. Extensive damage can result from igniting fuel off hot brickwork.

News Briefs

Advances in managing shipboard information

It's no secret that the task of managing information on board naval ships is becoming increasingly complex and cumbersome. Yet, despite the dramatic growth in the volume of technical and operational data that modern warships are required to carry, information retrieval remains essentially a manual and sequential activity.

If present trends and practices are allowed to continue, shipboard management of paper-based and microfiche-based information will eventually consume a disproportionate amount of human resources. In CPF and TRUMP ships, this could adversely affect productivity in maintaining the more elaborate engineering systems.

The news is not all bad, however. Recent developments in CD-ROM (Compact Disc Read Only Memory) technology have demonstrated the feasibility of storing, retrieving, controlling, distributing and reproducing information in electronic form. With CD-ROM, data is stored on 12-cm plastic discs that are physically identical to standard audio compact discs. Each 100-gram disc can hold up to 630 megabytes of data, which is roughly equivalent to 300,000 pages of text.

The space- and weight-saving potential associated with widespread application of CD-ROM information technology is enormous. In CPF and TRUMP ships, for instance, an estimated 14 tons of administrative orders, technical orders, material catalogues, technical data packages, etc., could be replaced by a stack of CD-ROM discs light enough for a child to carry.

The application of CD-ROM technology to information management has been the subject of an ongoing trial in DND since 1990. A prototype electronic version of the CF Equipment Support List (ESL) was developed on CD-ROM for the DMES 6 maintenance management section at NDHQ by the Naval Engineering Test Establishment. NETE assembled the data and created programs to format the files for input to commercial CD-ROM authoring software (Questar by Sony) which compressed the data and created indexes to facilitate rapid access on the CD-ROM. The entire set of ESL files and indexes, presently contained on about 1,000 microfiche cards, fit easily onto two CD-ROM discs.

CD-ROM: the way of the future for shipboard information management. These two CD-ROM drives were installed in HMCS *Huron* in 1991 for the shipboard trial of a prototype electronic version of the CF Equipment Support List. *(NETE photo by George Csukly)*

In February 1991 two Hitachi CD-ROM drives were installed in HMCS *Huron* for the first shipboard trial of the CD-ROM ESL. Although the drives were physically connected to only one workstation on the ship's computer LAN, optical networking software from On-Line Computer Systems Inc. made it possible to access the CD-ROMs from any of the other 10 workstations.

The project has had its share of teething problems, but for the most part these have been resolved and feedback from *Huron* has been encouraging. Generally, ship's personnel have found the system to be efficient, easy to use, and a definite step forward from using paper or microfiche versions of the same information. For example, where the microfiche indexing requires a user to make a number of different queries to gather data on a particular item, the CD-ROM automatically gathers every reference to an item called up in the ESL.

Negative comments have mainly concerned the limited memory of the LAN workstations, which restricts certain activities such as searches for large families of items like fuses or capacitors. However, should the Canadian Forces decide to proceed with full implementation of the CD-ROM ESL system, this could be easily overcome by upgrading to workstations with more memory.

Further investigations into CD-ROM technology within DND have included devices such as the Meridian CD-NET, which permits simultaneous access to 14 CD-ROMs in a multi-user environment, and Scenario's Dynavision III, a 4.5-kg notebook-style computer with an integrated CD-ROM drive which can be operated independent of ship's main power. In addition, a second CF publication (CFP-137, the Canadian Forces Catalogue of Materials) has been used to evaluate a new authoring software called Dataware.

Although none of these subsequent investigations has reached the point of a shipboard trial, the encouraging results obtained to date with the CD-ROM ESL suggest that the paperless ship will one day become a reality within the Canadian navy...**by Andrew Gurudata, Naval Engineering Test Establishment, with files from Lt(N) Gaston Lamontagne, DMES 6-3-2.**

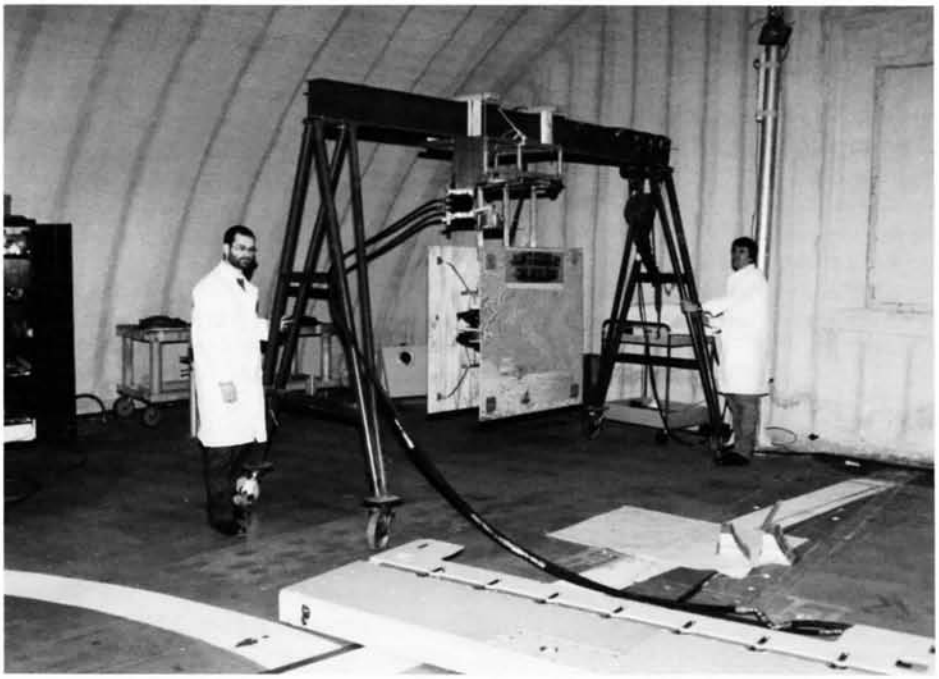
News Briefs

RAST Mk III factory demo successful

Good news from the RAST Mk III helo handling system project. Indal Technologies Inc. has successfully demonstrated the integration of the hardware and software components of the Helo Position Sensing Equipment (HPSE), Pilot Cues Controller (PCC) and Rapid Securing Device (RSD).

For the demonstration at Indal's Mississauga test facility last March, an infra-red sensing camera was used to track the position of a simulated helicopter airframe in relation to an RSD. The limitations of the simulation restricted the speed of the helo's movement athwartships, but allowed rapid movements fore and aft. The equipment responded swiftly to any movement of the beacon test bed, correctly positioning the RSD and/or displaying landing cues to the pilot.

Shore-based testing of the RAST Mk III HPSE and PCC got under way in April. The destroyer evaluation of the full RAST Mk III system is scheduled for June and July in HMCS *Ottawa*.



Indal technicians manoeuvre a simulated helicopter airframe to demonstrate the integration of hardware/software components of the RAST Mk III helo handling system. The Rapid Securing Device is visible in the foreground, while in the background the infra-red sensing camera can be seen just to the left of the boards suspending the beacon array. *(Photo courtesy of Indal Technologies Inc.)*

In preparation for shore-based testing of the RAST Mk III Helo Position Sensing Equipment and Pilot Cues Controller at CFB Shearwater, a mock-up 205-class hangar and flight-deck are subjected to downwash from a Sea King helicopter. *(NETE photo by Peter Michetti)*

VLS support facility open in Halifax

A land-based test site for the NATO Seasparrow Mk 48 Guided Missile Vertical Launch System (GMVLS) has opened for business in the Dockyard Annex of CFB Halifax. The site, which opened on March 18th, will be managed by a NETE in-service engineering agent (ISEA) on behalf of a three-nation NATO consortium.

Last year Canada was selected by the NATO Seasparrow Project Steering Committee to provide an ISEA to represent the Mk 48 GMVLS interests of Canada, the Netherlands and Greece. The three countries are funding the ISEA through the NATO Seasparrow Project. While each country retains responsibility for supporting its own systems, the ISEA provides a technical resource that can be drawn upon for all aspects of Mk 48 GMVLS life-cycle operation and maintenance.

Facilities at the site include a control room, which incorporates a missile launcher controller and STIR simulator, and a full-scale launcher (complete with missile canisters) set up indoors. Raytheon Company's Equipment Division, the prime contractor for the missile system, conducted the set-to-work phase of the installation in early March.

For now, the test site will be used by the ISEA to provide long-term engineering and logistics support for the Mk 48 vertical launch systems which will be fitted in 12 Canadian patrol frigates, eight M-class ships belonging to the Royal Netherlands Navy, and four Meko-200-class ships of the Hellenic navy. This considerable technical database will likely grow as more countries join the consortium.

According to **LCdr W.F. Vachon**, project officer for the NATO Seasparrow missile system in Canada, having the test facility in this country will be a definite asset. "The major advantage," he said, "is the direct, real-time support for the (Canadian) LCMMs and naval engineering units."

This Mk 48 GMVLS shipboard mounting interface was installed as part of the new land-based test site in Halifax. *(Photo by Base Photo Halifax)*

NATO Seasparrow Project Manager Captain JS Beachy (USN) discusses the set-to-work of the Mk 48 GMVLS missile launcher controller with LCdr WF Vachon, project officer for the equipment in Canada. With them are ISEA System Manager Ken McLaren *(left)*, and David Lyndon of Raytheon Company's Equipment Division. *(Photo by Base Photo Halifax)*

1992 senior naval promotions and appointments

The following senior naval officer promotions and appointments have been announced for 1992:

Cmdre M.T. Saker, DGMEM, will be promoted rear-admiral in June and appointed Chief of Engineering and Maintenance at NDHQ.

Cmdre R.L. Preston, COS MAT, will be appointed Director General Maritime Engineering and Maintenance.

Cmdre Dennis Reilley, PM CPF, will be appointed Canadian Forces Naval Attaché in Washington, DC in August.

Capt(N) D. Faulkner, CO NEUA, will be promoted commodore and appointed Chief of Staff (Materiel) at Maritime Command Headquarters.

Capt(N) W. Gibson, Base Commander CFB Esquimalt, will be promoted commodore and appointed Project Manager, Canadian Patrol Frigate at NDHQ.

VAdm R.E. George, DCDS, will be appointed Canadian Military Representative to the NATO Military Committee in Brussels.

VAdm J.R. Anderson, Commander MARCOM, will be appointed Vice Chief of the Defence Staff.

RAdm P.W. Cairns, Commander, Maritime Forces Pacific, will be promoted vice-admiral and appointed Commander Maritime Command.

RAdm L.G. Mason, CMDO, will be appointed Chief of Staff, Maritime Command in Halifax.

RAdm R.C. Waller, Chief of Staff, Maritime Command, will be appointed Commander, Maritime Forces Pacific and Deputy Commander Maritime Command in Esquimalt.

Cmdre K.J. Summers, Chief of Staff, MARPAC, will be promoted rear-admiral and appointed Commander, CDLS Washington.

NW Tech Occupation Specification Writing Board
(Front row): **LCdr S Beland** ***(CPF Det. Montreal),*** **Lt(N) M Jones** ***(OSWB Chairman, Directorate of Manpower Planning),*** **Ms. M Breton** ***(WP Operator, DMP),*** **LCdr WG Dziadyk** ***(Senior Board Member, DMCS). (Middle row):*** **CPO2 BJ Dunning** ***(CFFS Esquimalt),*** **CPO2 RL MacLean** ***(DMCS),*** **PO1 AD Doiron** ***(CFFS Halifax),*** **PO1 CF Alguire** ***(PMO CPF),*** **PO1 VG Shaw** ***(CFFS Halifax),*** **PO2 D Boston** ***(NET(T), PMO CPF)*** ***(Back row):*** **CPO2 JC Moreau** ***(PMO TRUMP),*** **CPO2 GL Desorcy** ***(CFFS Halifax),*** **CPO2 LA Luddington** ***(CPF Det. St John),*** **CPO2 PG Moore** ***(CFFS Halifax),*** **PO2 KE Davidson** ***(Board Secretary, HMCS Vancouver). (Not shown):*** **CPO2 DS Robertson** ***(NET(S), PMO CPF).***

NW Tech spec writing board

Combat System Engineers and senior personnel from the Naval Weapons Technician (NW Tech) occupation got together in Ottawa for two weeks last fall to update the occupation specifications for MOC 065 NW Techs. Two "honest brokers" from the Naval Electronics Technician occupation helped maintain an overall combat systems perspective during the deliberations. Maritime Command and NDHQ staffs are now reviewing the draft of the specifications, which were being updated to reflect CPF and TRUMP requirements.

U.S. Naval Institute to sponsor essay/photo contests

The U.S. Naval Institute in Annapolis, Maryland is inviting writers and photographers of all nationalities to enter the Naval Institute's "International Navies" essay and photo contests. The deadline for entries for both contests is August 1st.

Essays must be no longer than 3,000 words. Photographers may submit up to five slide or photo entries. Cash prizes will be awarded for the top three entries in each contest. Full details and complete contest rules can be found in the March 1992 issue of the U.S. Naval Institute's *Proceedings* magazine. A copy of the contest rules can also be obtained by contacting the *Maritime Engineering Journal* at **(819) 997-9355**.

A submarine battery monitoring system

Coming up in our next issue