

**REFERENCES & GENERAL NOTES**  
**DRB/CRAD/DRDC INDUSTRIAL CONTRIBUTIONS**  
**VIS-A-VIS CANDIB**

1. DJ Goodspeed, DRB: A History of the Defence Research Board of Canada, Queen's Printer, Ottawa, 1958

Various entries re things naval, but not much on the relationship with industry. Chapters on chemical warfare research, operational research, northern research, telecommunications research, naval research, biosciences research all contain naval references. Final chapter - *The Past and the Future* - states DRB guiding principles, one of which is "to place research projects where they can be carried out most effectively, whether in DRB establishments, other government departments, universities, or INDUSTRY". To note: for the past 25 years or so, the "rule" in this context has been to contract out (to industry) as much work as possible as early in the R&D process as possible.

Naval research chapter outlines areas of research peculiar to the navy - sonar, corrosion, materials, early hydrofoil work. Mentions close working relationship with industry, but no specifics!

2. RP Chapman (Ed.), Alpha and Omega: An Informal History of the Defence Research Establishment Pacific 1948-1995, Fleming Express Press, Victoria BC, 1998

Page 31 - Construction of CNAV Endeavour by Yarrows Limited.

Page 60 - mention of increased emphasis on contracting out to industry, circa 1973-4.

Page 91 - cooperation with CAE on MAD

Page 95 - route survey technologies and West Coast industries.

Page 96 - shaft grounding and Davis Engineering

Page 109 - ISER and Theseus

Page 122 - CTF (Canadian Thin Films Inc.) and squid devices for MAD

Page 126 - mine hunting technology and Simrad Mesotech, OSL and ISR

Page 132 - Davis Engineering and shaft grounding and cathodic protection

Page 240 - shaft grounding and Davis

Page 243 - CTF Systems and semi-automated immersion ultrasonic unit

Page 243-4 - Lambda Technology and Ultrasonic Boiler Inspection system

3. A. Gelly & HP Tardif, Defence Research Establishment Valcartier: 1945-1995, 50 Years of History and Scientific Progress, Public Works and Government Services Canada, Ottawa, 1995.

Page 123 - mentions study of "An air defence system for escort vessels of the St. Laurent Class....at the request of the Royal Canadian Navy."

Page 262 - General Vulnerable Assessment Model (GVAM) for assessing ship survivability - transfer to Navtech Inc. of Quebec.

Page 278 - transfer to Davis Engineering of ship IR signature measurement software. (Known as SHIPIR and Naval Threat Countermeasures System [NTCS] this is now a NATO standard)

Page 278 - stabilized alignment system to Spar - used in AN/SAR-8 IRSTD project

Page 278 - consultation to CRAD HQ on a contract with Oerlikon that investigated the suitability of an ADATS-like system as a close-in defence system for ships.

Page 279 - contracts to Thomson CSF Systems Canada (now Thales Canada) on combat systems simulation and naval artificial intelligence.

4. J. Norman & R. Crow (compilers and editors), 50th Anniversary Edition of the History for Defence Research Establishment Ottawa: 1941 - 1991, DREO Special Edition, March 1992.

Another DRDC publication that for the most part does not mention industrial partners. There are, however, some exceptions.

Page 84 - a couple of paragraphs on CANEWS and its development phase that involved Canadian Westinghouse (MEL UK as a sub-contractor) and the later establishment of MEL Defence Systems Ltd. in Kanata to build production models.

Page 85 - development of CANEWS 2 involving industry (Lockheed Martin Canada who acquired the MEL facilities from the parent Philips Corp., with subcontractors Software Kinetics -

now X-Waves, and COMDEV). Note that text does not identify these companies!

Page 90 - mention of Marine Integrated Navigation System although contractor is not named - after some industry consolidation, the contractor was EDO Western in Calgary.

Page 98 - HF Surface Wave Radar: contractor is not mentioned but the prime beneficiary is Raytheon Canada of Waterloo Ont. A St. John's Nfld company was also involved in the development phase, but their name escapes me for the moment.

5. H.P. Tardif, DREV 1945-1995, Department of National Defence, Canada, 1995, ISBN 0-662-22456-6

Page 36 - Infrared Search and Designation System (SPSDS/IRST/AN-SAR-8) mentions Spar as prime contractor, but details inaccurate. Claims three full-scale engineering models built at contract cost of \$85M. Actually, one SPSDS was built which mutated into IRST for USN trials and two SAR-8 models built. Total value of contracts was in excess of \$150M!!

Page 37 - General vulnerability Assessment Model (GVAM) for ship survivability and other studies; contractor Navtech Inc. of Quebec. I know of at least one foreign sale - to Australia in the form of a variant known as XVAM.

Page 82 - Photo of SAR-8

Page 83 - sketch of application of GVAM to modelling of a tank.

6. 50 - DCIEM The First Fifty Years: 1939 - 1989, Design and Photography by DCIEM Graphic Arts and Photo Section, Typography by Typeworks Ltd.

This a photographic record of the fifty years of the establishment and its predecessor units.

Page 28 - photo of mock-up at IAM (Institute of Aviation Medicine) used to measure the effect of motion on crew performance in FHE 400 hydrofoil.

Page 58 - photo of Submersible Diver Lockout (SDL-1) full scale mockup. Was the actual SDL built by ISE?

Page 70 - photo of the Diving Research Facility under construction at Vickers Montreal.

Page 88 - photo of mock-up of SHINMACS main control panel.

Page 91 - photo of TRUMP bridge mock-up. Connection to Litton?

Page 100 - photo of 55 metre clearance diving apparatus (CDDA aka CDBA). CDBA and CUMA (Canadian Underwater Mine-countermeasures Apparatus - designed to NATO standard 81 metre depth) came from the same in-house design at DCIEM, were built by Fullerton-Sherwood of Toronto and sold to several nations.

7. J.R. Longard, Knots, Volts & Decibels: An Informal History of the Naval Research Establishment, 1940-1967, DREA Dartmouth NS, 1993

Once again, this text is short on specifics in correlating research with industrial participation.

Page 14 - Marine Division of NS Light and Power (a wartime entity) and installation of degaussing cables on over 1600 ships of 19 nations.

Page 15 - Marine Division of NS Light and Power and installation (starting in 1944) of acoustic minesweeping gear on a number of sweepers.

Pages 61,62 - Foundation Maritime built and installed three trials towers off Hartlen Point in 1955-56 for low frequency underwater acoustics experiments.

Page 71 - Fairey Aviation builds the CANBY VDS body.

Pages 72,73,74 - Cossor Canada and others (not specified!) manufacture of Cast/1X VDS electronics

Page 72 - production by Canadian industry (again not specified!) of NRE-4 ceramic transducer.

Page 81 - Explosive echo ranging trials using ASW Lancaster with equipment fitted by Fairey Aviation.

Pages 85-93 - Chapter 10, The Canadian Hydrofoil Project; summary from the NRE point of view.

Page 112 - Burrard Dry Dock Company build AGOR 172 (CNAV Quest)

8. R.M. Heggie & G.L. Nelms, Development in Canada: Meeting the Needs of the Canadian

Forces, CRAD Report 2/92

This could be considered somewhat self serving as it "justifies" R&D investment. Be that as it may, it does contain some useful information on navy-oriented R&D major projects (originally set at any project over \$250K, but eventually set at \$1.0M minimum). Among the four projects given detailed analysis are two for the navy - CANTASS (a passive towed array sonar system) and CANEWS (electronic warfare system). Once again in this publication, there is very little mention of industrial partners. An exception is the Maritime Laser Rangefinder in which DREV and industry (Spar and Lumonics) collaborated in developing and evaluating. Also mentioned is the original contractor for SHINCOM - Leigh Instruments (following this company's bankruptcy, first Spar acquired the project and then sold its electronics business to DRS Technologies, a US firm). Interesting to note that the original Canadian navy procurement for CANEWS (\$160M) was 27 systems (DELEX, TRUMP, CPF), while SHINMACS (\$80M) and SHINCOM (\$70M) went at 16 systems each (TRUMP, CPF) and SHINPADS (\$110M) at 18 systems (TRUMP, CPF, Shore support). To note that CAE was the SHINMACS prime and has been very successful flogging a derivative IMCS around the world's navies. SHINPADS' prime was a division of UNIVAC which mutated into Paramax and then Lockheed-Martin; Computing Devices (now GD Canada) built the associated standard displays which appear in a variety of equipments in addition to SHINPADS.

#### 9. Defence Research Establishment Suffield

DRES published a short history of the establishment, but it did not touch on specific projects, only program areas. DRES was involved in a number of projects for the navy with a number of them being in-house efforts (ROBOT-9 ballistic target, SAWS-280 trials, Milkcan towed target, SAWIS-280, universal control station for UAVs). From my own recollections are listed the navy oriented projects that involved industry in some way:

a. ROBOT-X preprogrammed unmanned target vehicle propelled by 19 Bristol Aerospace CRV-7 rocket motors. Contractor originally was Boeing Canada, but after the parent ordered it out of the defence business, the project (and all target work) was taken over by Bristol.

b. Barracuda remotely controlled surface target (uses the universal control station mentioned above) built and upgraded by Bristol until they too got out of the business. Has now been turned over to a Medicine Hat-based company whose name I believe is Schreiner.

c. DRES ball developed at DRES and contracted out to Davis Engineering of Ottawa. Total system fitted to CPF's, TRUMP received eductor/diffuser portion. Systems or derivatives sold to several countries' navies.

d. SIBADS chemical agent detector (used generally by the CF, fitted to Canadian ships) and built by?

#### 10. RL Gaede & HM Merklinger, Seas, Ships and Sensors: An Informal History of Defence Research Establishment Atlantic 1968-1995, June 2003, Defence Research & Development Canada - Atlantic (DRAFT)

Page 12 - Teamed Architecture Signal Processor (TASP), nomenclature AN/UYS 501; industry not identified, but project started with ESE as the contractor until they went through some sort of merger/absorption by Motorola. Project eventually landed at Computing Devices (now GD Canada). Used as processor in AN/SQS 510 sonar and AN/SQR 501 CANTASS Towed Array. Variants in USA and Australia.

Page 13 - AN/SQS 510 Sonar, developed under contract and manufactured by GD Canada (not mentioned!). Fitted to Canadian, Portugese, Belgian navies.

Page 13 - mention of hydrofoil research and FHE-400.

Page 14 - Ship design and analysis tools (SHOP, SHIPMO, VAST) licenced to industry - widespread commercial use.

Page 41 - Hermes Electronics and three Canadian designed towed arrays for the Oberon-class submarines.

Page 44 - further mention of TASP and the follow-on development of Next Generation Signal Processor (NGSP) - no mention of Applied Microelectronics' efforts.

Page 50 - TANDEM sonobuoy - 75 prototypes manufactured - by whom? (Hermes, Sparton??)

Page 50 - DIFAR sonobuoy - "worlds best" manufactured by Hermes.

Page 51 - Microbuoys developed with Sparton and Hermes - technology not used, but evident in reduced size full performance DIFAR buoys.

Page 55 - Ring Shell Projector design technology transferred to Sparton - two 330Hz projectors built.

Page 56 - Barrel stave flextensional transducer design transferred to Sparton.

Page 61 - Superdirective hydrophone array for sonobuoys - contract to Hermes.

Page 64 - Towed Acoustic Tactical Trainer (TATT) - contract to Sparton.

Page 70 & on - Research and design support to the FHE-400 and support of contractor (De Havilland) sea trials.

Page 80 - SHOP 4, SHOP 5 computer aided design tools passed to Fleet Technologies for ongoing maintenance.

Page 82 - design of DDH-280 low cavitation/noise propeller for TRUMP - no mention of manufacturer!

Page 87 - development and build of Eddy Current Probe for detecting mechanical failures in situ in cooperation with Proto Manufacturing.

Page 99 & page 140 - APhiUS ultrasonic scanning/survey tool development and build in conjunction with Tektrend.

Page 100 - Teaming arrangement with Hawkesbury Submarine International (HSI) in underwater explosion bulge testing of submarine steels.

Page 115 - mention of government "make or buy" policy and its serving to "forge a closer alliance between DREA and the Canadian defence industry".

Page 134 - CNAV (later CFAV) Quest's construction by Burrard Dry Dock Co. Ltd.

Page 141 - Chapter 10: Relationships with Industry - I have picked out the following companies that were not credited and/or mentioned earlier in the text:

a. Acres consulting/Ontario Research Foundation - finite element modelling for sonar transducer design (benefit to Hermes and Sparton in manufacturing transducers.

b. Martec - develop and market products for analysing ships' structures (see page 14 reference above).

c. CANTASS and relationship with Computing Devices (GD Canada) - see page 12 above.

d. Metocean Data Systems - R&D/product areas not mentioned.

e. Focal Technologies - R&D/product areas not mentioned, but I do know the company specialized in underwater optical devices.

f. Seimac - R&D/product areas not mentioned, but one company product was a very successful current measuring buoy that found use in search and rescue.

g. Macdonald Dettwiler - DREA efforts in surveillance systems, towed array systems and route survey systems lead to the company establishing a Dartmouth NS office. This company was a contractor for the MCDV mine hunting/minesweeping systems and had worked in conjunction with DREP prior to its closure and the transfer of the technologies to DREA so the initiative makes sense.

## 11. Defence Industrial Research (DIR) Program

The DIR program is one in which an industry and DRDC share 50/50 the costs of an approved research project. To be eligible, the proposed project must be research (not development), have defence relevance and, of course, have scientific merit. Funding for this program has varied over the years, but at present stands at about \$4.0M per year. Selection of projects, following initial vetting for the factors mentioned is by a board consisting of members not just from DND, but also from such entities as NRC, CRC and Public Works/Government Services Canada. This is not a rubber stamp group by any means! Over the years there have been variants of the program; in the 1950's, it started with the so-called one dollar per year contracts which then morphed into a DRB-sponsored DIR program. With the demise of DRB (1974 time frame) the program died. It was resurrected in its present format in the 1980's. The program aims for the synergism of the influence of defence-oriented R&D on industry and the converse influence of industry on defence R&D. [I WILL DIG UP SOME EXAMPLES FOR HERE - one that comes to mind is Hemosol and their artificial blood product]