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Dr. Carmen L. Piggott—Career and Character

*Naming Ceremony for DRDC – Atlantic Research Centre
Building DA-26 on 23 May 2018*

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Defence Research and Development Canada

Reference Document
DRDC-RDDC-2018-D050
May 2018

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Abstract

Dr. Carmen L. Piggott was a Defence Scientist working for the Naval Research Establishment (NRE, now known as the DRDC – Atlantic Research Centre) when he lost his life in the 1965 crash of a Maritime Patrol Aircraft while performing scientific duties in the field of Anti-Submarine Warfare. This document provides information regarding the circumstances of his tragic death, his scientific accomplishments, and the nature of his well-regarded character. On 23 May 2018, DRDC – Atlantic Research Centre’s new building (DA-26) was officially named in his honour.

Significance to Defence and Security

Dr. Piggott’s accomplishments as a Defence Scientist focused on three topics, all of which impacted the operational capabilities of the Canadian Armed Forces to conduct underwater surveillance and Anti-Submarine Warfare. These accomplishments included mitigating the effects of ship-radiated noise on the performance of the NRE-developed Variable Depth Sonar, characterizing the ambient noise spectrum levels at low frequencies in shallow water and its systematic dependence on wind speed, and contributions to the development of an airborne submarine detection technique known as Explosive Echo Ranging. In support of this work, he was appointed scientific consultant to the Air Officer Commanding the RCAF Maritime Air Command.



Résumé

Carmen L. Piggott, Ph. D., scientifique de la défense dans le domaine de la guerre anti-sous-marine au Centre de recherche navale (CRN, maintenant RDDC – Centre de recherches de l’Atlantique), a perdu la vie dans l’exercice de son travail lors de l’écrasement d’un avion de patrouille maritime en 1965. Le présent document contient l’information sur les circonstances entourant ce tragique événement et sur les réalisations de cet éminent chercheur. On a donc nommé officiellement le nouveau bâtiment (DA-26) de RDDC – Centre de recherches de l’Atlantique en son honneur le 23 mai 2018.

Importance pour la défense et la sécurité

Les réalisations de M. Piggott à titre de scientifique de la défense portaient principalement sur trois thèmes et celles-ci ont toutes eu une incidence sur les capacités opérationnelles des Forces armées canadiennes dans l’exercice de la surveillance sous-marine et de la guerre anti-sous-marine. Parmi ces réalisations figurent l’atténuation des effets du bruit émis par les navires sur les performances du sonar à immersion variable mis au point au CRN; la caractérisation des niveaux de bruit ambiant à basse fréquence en eau peu profonde et la dépendance systématique de celui-ci avec la vitesse du vent; et enfin, sa contribution à la mise au point d’une technique de détection aérienne et sous-marine appelée repérage par écho de détonation. En soutien à ces travaux, on l’a nommé expert-conseil scientifique auprès du commandant de l’aviation du commandement aéronaval de l’Aviation royale canadienne (ARC).



Acknowledgements

The authors wish to thank Dr. Harold Merklinger, a former Director General of the Defence Research Establishment Atlantic, and Mr. Frank Payne, a former colleague of Dr. Piggott, for their contributions and recollections. The authors also wish to thank the family of Dr. Piggott for providing newspaper articles regarding the tragic event. Additional material and assistance were provided by Mr. Denton Froese, Chair of the Employees' Association, Ms. Meaghan LeBlanc, Library Technician for the Atlantic Research Centre, and Major Dugald Thomson, DRDC Air Liaison Officer, and personnel from CFB Greenwood.



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1 Introduction

Defence Research and Development Canada (DRDC) – Atlantic Research Centre’s new building is named after Dr. Carmen Piggott, the only DRDC employee to lose his life while performing scientific duties in the 75 year history of DRDC. A memorial plaque at CFB Greenwood (Figure 1) describes the accident: “On the night of 23rd March 1965, while deployed on exercise to Puerto Rico, 404 Maritime Patrol and Training Squadron Argus 20727 plunged into the ocean 60 miles north of the island. The entire crew and a government scientist perished in the crash.” Dr. Piggott was 37 years old and was survived at the time of the crash by his wife Dorothy and two sons, Stephen, aged 6, and Jeffrey, aged 4.



Figure 1: Memorial plaque at CFB Greenwood to commemorate the accident in which Dr. Piggott perished (credit: DRDC).

2 Career and Character of Dr. Carmen Piggott

2.1 Biography

Dr. Piggott (Figure 2) grew up in Bridgetown, Annapolis County, with his younger sister, Jackie. He graduated from Bridgetown High School with Honours in 1945, and was subsequently awarded a Foundation Scholarship to Kings University in Halifax for four years. Upon his graduation from Kings University with a BSc with Honours in 1948, he went on to continue his studies for a Master's degree at Dalhousie under a scholarship from the National Research Council. He completed his Master's degree in 1950, and was awarded a scholarship for further studies at McGill University in Montreal. While at McGill University he married Dorothy Smith—also of Bridgetown Nova Scotia—in 1949, and went on to receive his Doctoral degree in Physics from McGill University in 1953.



Figure 2: Photo of Dr. Carmen L. Piggott (credit: DND).

2.2 Scientific Accomplishments and Operational Impact

Upon joining the Naval Research Establishment (later named Defence Research Establishment Atlantic and now Defence Research and Development Canada – Atlantic Research Centre), Dr. Piggott worked for 10 years on the very challenging problem of detecting submarines. In the first years of his career, he characterized the properties of different sound absorbing and reflecting materials to reduce the interference of ship-radiated noise and enhance the performance of the NRE-developed Variable Depth Sonar (Canadian research prototypes were tested in 1958 and introduced into operational service in 1963) [1].

The course for the next phase of his career (and pursued for decades after his death) was charted in a 1957 Research Note in which he laid out the objectives of a joint Canadian and British programme to undertake fundamental research into low-frequency acoustics in shallow-water, focusing on “Ambient Noise” and “Signal Propagation.” In 1964, he reported his findings regarding “Ambient Sea Noise of the Scotian Shelf” in the Journal of the Acoustical Society of America [2], revealing systematic relationships between ambient noise spectrum levels and wind speed, and seasonal variations independent of wind speed. This paper has been cited more than 150 times, of which 80 citations have been in the last ten years, including 14 times in 2017 alone. The paper has been cited in review articles by some of the most prominent names in Underwater Acoustics, including: Urick (1986) [3]; Goodman (1993) [4]; Carey (2011) [5]; and Bjorno (2017) [6]. His work contributed to a much larger international program called SOSUS (Sound Surveillance System) [7] which was a crucial Allied cold war effort to track submarines throughout the world. Technology at the time was moving from vacuum tubes to solid state electronics and Dr. Piggott played an important role for Canada and its NATO allies in bringing sound detection technology forward.

The final phase of his career (and final paper presented at a Defence Research Board Symposium in December 1964) involved the development of a submarine detection technique using explosive charges and listening buoys deployed from Maritime Patrol Aircraft known as Explosive Echo Ranging [8]. Another important technique to detect and track submarines involved Magnetic Anomaly Detection (MAD) systems from maritime patrol aircraft (ARGUS at the time). This involved flying very tight cloverleaf patterns over the submarine, near the sea surface, often at night.

In support of this work, he was appointed scientific consultant to the Air Officer Commanding the RCAF Maritime Air Command. While undertaking one of these submarine detection exercises—named operation Maple Spring Board on March 23, 1965, which involved three ARGUS aircraft—Dr. Piggott and 15 RCAF personnel died, when the aircraft they were flying in crashed off the coast of Puerto Rico. This was the first accident with the ARGUS aircraft which were built by Canadair in Montreal and went into service in 1958 (Figure 3).



Figure 3: Photo of ARGUS 727 Maritime Patrol Aircraft (credit: DND).

2.3 Employee Well-being and Tributes

At a memorial service at Grace United church in Dartmouth, the pastor paid tribute by saying that “Dr. Piggott was blest with a very pleasing personality and that his friendly nature had endeared him to a

large host of friends and associates; that he had been blest with a keen intellect, consequently he had a brilliant academic career.” [9] He was also remembered as a Boy Scout leader, member of the committee of stewards at Grace United, an excellent ball player, a bowling enthusiast and a member of the Dartmouth Curling Club.

Remaining colleagues from the time remember Dr. Piggott as a typical, dedicated scientist. Being a fairly new laboratory at the time, NRE attracted leading young scientists from across Canada and allied nations. This created a close internal social network with staff participating in baseball, golf, bridge and formal and informal dinners to entertain visiting scientists. He was the Chair of the NRE Employees’ Committee, and in that capacity, he wrote a letter to the Chief Superintendent in May 1958 requesting approval and shop resources to establish a volleyball court in the rear courtyard (a legacy that continues to this day) and two horseshoe pitches on the east side of the establishment (Figure A.1). A tribute in the Nova Scotia House of Assembly stated “Dr. Piggott, the only civilian on board the Argus, was a native of Bridgetown and had a distinguished record as an outstanding Nova Scotian.” [10]

Dr. Piggott has been remembered as a highly-regarded member of the NRE/DRDC family by award of a scholarship (Figures A.2 and A.3) in his name every year at Bridgetown High School; Dr. Carolyn Binder of DRDC – Atlantic Research Centre was a recipient of this scholarship.

3 Conclusion

Dr. Piggott is now further remembered through the naming of the main research facility of DRDC – Atlantic Research Centre campus in his honour. This is fitting and an inspiration for all staff given the significant research achievements in his short career, his concern for the morale and well-being of his fellow employees, and his commitment to address the operational requirements of DND and CAF.

References

- [1] Merklinger, H.M., and Osler, J.C. (2015), A few Canadian contributions to underwater acoustics, *Proceedings of Meetings on Acoustics*, Vol. 23, Issue 1.
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- [3] Urick, R.J. (1986), *Ambient noise in the sea*, Peninsula Publishing, Los Altos, California.
- [4] Goodman, R.R., and Krishnan, P. (1993), A review of environmental measurements taken during ambient noise experiments, in B.R. Kerman (Ed.), *Natural Physical Sources of Underwater Sound*, Springer, Dordrecht, pp. 85–92.
- [5] Carey, W.M., and Evans, R.B. (2011), *Ocean ambient noise: measurement and theory*, Springer-Verlag, New York.
- [6] Bjorno, L. (2017), Chapter 6 – Ambient noise, in T.H. Neighbors and D. Bradley (Eds.), *Applied Underwater Acoustics*, Elsevier, pp. 363–401.
- [7] Whitman, E.C. (2005), SOSUS: The “secret weapon” of undersea surveillance, *Undersea Warfare*, Vol. 7, No. 2.
- [8] Obituary for Carmen L. Piggott (1965), *Physics in Canada*, Canadian Association of Physicists, Vol. 21.
- [9] Memorial service held for Argus crash victims, *The Marine*, Bridgetown, Nova Scotia, Wednesday Evening, March 31, 1965.
- [10] Message of sympathy to be sent, *The Chronicle Herald*, Halifax, Nova Scotia, March 26, 1965.

Annex A Supplemental Material

MEMORANDUM

TO: A/O

FM: Chairman/ NRE Employees' Committee

VOLLEYBALL AND HORSESHOE ACTIVITIES AT NRE

1. Further to the recent discussion between ourselves and the Chief Superintendent, and the approval in principle by the Chief Superintendent of the NRE Employees' Committee recommendation for the organization of Volleyball and Horsehoe activities at NRE, it is requested that:

- (a) the rear courtyard at NRE, consisting of the area extending laterally between the bounding walls of both wings of the Establishment and in length from the rear wall of the Establishment to the outside chimney, be cleared of all materials and supplies by June 1st to provide a playing area for volleyball,
- (b) NRE staff be requested to maintain this area clear of obstruction during the summer months,
- (c) permission be granted to establish two horseshoe pitches on the lawn area at the East side of the Establishment (i.e. between the Establishment fence and building adjacent to the Seminar Room),
- (d) Shops and Maintenance be advised of Administration's approval of an internal work order on the Carpenter Shop for construction of four wooden 'pits' for the horseshoe pitches.

2. Following formal approval of these requests a notice to NRE Staff, noting Administration's approval for the organization of these activities and requesting Staff to respect the privileges granted without abuse of Establishment property or working regulations, will be issued by the undersigned.

C.L. Piggott
C.L. Piggott

May 14, 1958.

Figure A.1: Letter from Dr. Piggott as Chair of the NRE Employees' Committee.

R. Church

C. L. FIGGOTT FUND

1. Collection started. Originally to cover period April 15 to May 1. Collection 90% completed for non-professionals
- \$203.00
60% completed for professionals
- \$473.00
2. Called local income tax people re official receipts and wrote Ottawa. Reply attached. Will follow up after collections completed.
3. Called Eastern Trust - Mr. Matthews - Advised that should wait until collections completed.
4. Called Mrs. Figgott and advised her of collection, etc.
5. Notified HQ personnel up to level of DMR.

TO BE DONE

1. Finalize collection.
2. Deposit moneys in a special account, NRE Employees Special Account, to be held until final disposition.
3. Write Chairman, DRB, MAC, Master of Ships.

Figure A.2: Status of fundraising and other efforts to establish the C. L. Piggott Fund and a scholarship in his memory.



EASTERN & CHARTERED TRUST COMPANY

20 PRINCE STREET, HALIFAX, NOVA SCOTIA - TELEPHONE 422 1021

140-4 c/s.

July 30, 1965

OUR FILE NO.



Mr. Charles G. Church
Chairman
N. R. E. Employees' Assoc.
Grove Street
Dartmouth, Nova Scotia

Re: Naval Research Establishment - Carmen
L. Piggott Memorial Fund Agency

Dear Mr. Church:

We are now enclosing for your perusal three copies of the Agency Agreement between the Naval Research Establishment Employees' Association and this Company under which we are to administer a sum of money to be deposited with us.

We trust this document has been completed in accordance with your particular wishes; however, if there are further amendments to be made, please advise. We have not, of course, been able to complete Schedule "A" as we do not know the amount of money to be deposited.

If in fact the Agreement meets with your approval as it presently stands, you might have the authorized officers of the Association sign all copies where indicated returning them to us for the signatures of our authorized officers. At that time also, you might advise us of the amount of the deposit so that Schedule "A" might be completed. We shall then return two completed copies to you for your records or more if you require them.

Yours very truly,

EASTERN & CHARTERED TRUST COMPANY

J. F. Doig
Trust Officer.

JFD/mpr
Encls.

PLEASE RETURN ALL CORRECTIONS TO THE COMPANY

Figure A.3: Agreement between the Naval Research Establishment and the Eastern and Chartered Trust Company to establish the Carmen L. Piggott Memorial Fund Agency.

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<p>4. AUTHORS (last name, followed by initials – ranks, titles, etc., not to be used)</p> <p>Osler, Dr. J.; Pegg, Dr. N.</p>		
<p>5. DATE OF PUBLICATION (Month and year of publication of document.)</p> <p>May 2018</p>	<p>6a. NO. OF PAGES (Total containing information, including Annexes, Appendices, etc.)</p> <p style="text-align: center;">13</p>	<p>6b. NO. OF REFS (Total cited in document.)</p> <p style="text-align: center;">10</p>
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Ambient Noise; Sonar; Underwater Acoustic Materials; Underwater Acoustics; Underwater Warfare