

NATIONAL RESEARCH COUNCIL
OF CANADA AT OTTAWA

RADIO AND ELECTRICAL ENGINEERING DIVISION PHOTOGRAPHS
(1939 - 1967)

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Canada, Ottawa

Compiled in 1985 by:

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RADIO AND ELECTRICAL ENGINEERING DIVISION OF THE NATIONAL RESEARCH COUNCIL
OF CANADA - PHOTOGRAPHIC COLLECTIONS - 1939 - 1967

The negatives in these collections are representative of the research undertaken by the Radio and Electrical Engineering Division of the National Research Council from the late 1930's to the middle 1960's. Photographs taken after this period are retained by the Division as part of their active records. Following is a brief summary of the research activities undertaken by the Division as represented by the photo collections.

The Division of Radio and Electrical Engineering grew out of wartime electrical and radar research groups in the NRC's Division of Physics; it gained divisional status in 1948. One of these groups, the Radio Branch, made many contributions to radar development throughout World War II. Radar sets with large Canadian input were developed for coastal defence (the "Night Watchman"); for detection of surfaced submarines; for small craft (the 268 set); and the CDX for coastal defence gun-laying. The radar group also developed the GL III C, and early warning and gun-laying radar, used by anti-aircraft gunners. After the War the Division continued to do radar research on marine radar both to be carried on ships and shore-based installations.

To assist in marine radar research the Division purchased a 65 ft., 100 h.p., Diesel vessel, known as the "Radel", in the fall of 1946. It was converted and fitted out to be used for operational trials of merchant marine radar equipment. In 1950 a larger vessel, a Fairmile, 107 ft. in length, was acquired and fitted for experimental work. This vessel, the "Radel II", was used by the Division into the 1960's.

Work was also carried on in military radar with the Counter Mortar AN/MPQ 501 set. This was developed by the Division from 1950 to 1968. Other radar research was also undertaken including application of radar techniques to problems in aerial surveying.

Another research field in the Division was medical electronics. The first program was started in 1949 with research into the development of hypothermia procedures for heart surgery. The Division next turned to an investigation of cardiac stimulation and defibrillation which led to the development of the first heart stimulator or "pacer" and the first combined stimulator-defibrillator designed for clinical use. Other medical electronic research included developments in the following areas: perspiration-rate measurement as an indication of stress; a portable, cathode-ray electrocardiograph for post-operative cardiac monitoring; an electromechanical ground hazard indicator for isolated electrical circuits in hospital operating rooms; an area-display technique for electrocardiography using a chest electrode matrix; a foetal electrocardiograph to discriminate between the maternal and foetal signals; and the investigation of body-energized implanted electrical pacemakers.

The Division also did work on various equipment for use by the blind. Amongst these were; a weigh scale with a special attachment to allow the blind person to weigh with an accuracy of $\pm 1/2$ ounce; a braille slide-rule; a rigid folding cane for the blind traveller; a liquid level indicator; and a precision machinist's electronic level.

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A radio telescope first became part of the equipment of the NRC when one with a four foot parabolic reflector was made late in 1945 by the Division of Physics and Electrical Engineering, the parent of the present Radio and Electrical Engineering Division. The objective of the telescope, which was erected at the Radio Field Station on Metcalfe Road, was to detect cosmic radio noise. Solar noise observations in the 10-centimeter region were recorded for four years. In 1948, because of growing radio interference, a quieter site at Goth Hill, ten miles south of Ottawa, was established. Here a compound interferometer composed of a 4-element grating antenna, and a 150-foot horn was constructed in 1951-52. The four foot parabolic reflector was moved here with a ten-foot reflector being installed in 1959. This site was used until 1962 with the peak activity being from 1957-59. In 1959 a site relatively free from radio interference was selected in Algonquin Provincial Park for the establishment of a radio observatory. This observatory was completed in 1966. New studies in the field of radio astronomy were made possible with the completion of a 46-metre-diameter (150 ft.) parabolic reflector radio telescope at this site. A multi-stage 10 cm. interferometer built here enabled studies of the emission of radio waves from the sun and other strong radio sources possible. A staff apartment building and other staff accomodation as well as offices were also constructed at the site.

Another area of study connected with astronomy was that of meteor observation. From 1947 the NRC conducted a continuing program of meteor research, using a combination of radio, photographic, and visual techniques. Most of this work was done at the Metcalfe Road Field Station until 1957 when it was decided to set up a site which would be more suitable for meteor work. The site chosen was twenty miles south of Ottawa at Springhill where the observatory was built in the winter of 1956-57.

During the International Geophysical Year in 1957 several widespread observational programs were organized for auroral and meteor studies. The DA-3 auroral all-sky camera, designed in the Radio and Electrical Engineering Division, was operated at nine stations in Canada during this year. Five auroral radars were also operated continuously throughout the year.

At the Springhill Meteor Observatory visual and photographic meteor observations were carried out on specific nights for the IGY meteor program. The low-power meteor radar was operated continuously at Springhill throughout the International Geophysical Year, and the high-power meteor radar was operated during specified periods. The special meteor program terminated on January 31, 1959. Emphasis was on correlation of radar meteor rates with visual meteor counting, and on photographing the spectra of bright meteors. Meteor and auroral research continued after this period but at a much reduced state.

Research in electronic music was undertaken by the NRC in 1954 and continued through the 1960's. A touch sensitive organ; a monophonic instrument called the "electronic sackbut"; a multi-track tape recorder; and a conductive keyboard were some of the electronic music device developed in the Division. Staff from the NRC helped set-up electronic music studios at the University of Toronto and at McGill.

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In 1955, a project was undertaken to develop special rigid radomes to protect radar antennas operating under Arctic conditions. An extensive program of electrical and mechanical tests were begun. It was found that foam block radomes were more effective than single-skin radomes in allowing radio propagation. This research continued into the early 1960's.

The Space Electronics Section of the Division undertook to provide engineering assistance to the program of scientific rocket upper atmospheric sounding sponsored by the Associate Committee on Space Research in 1962. Black Brant rockets were used and were fired from the Churchill Research Range in Manitoba. Space and telemetry channels in the payload were shared by the Division and the Division of Pure Physics, and by experimenters from Canadian universities. The Division of Radio and Electrical Engineering coordinated the design of the payload and provided the necessary crew for final checkout and firing at Churchill. Photos related to this project cover the period 1962 to 1967.

Other research projects carried out in the period covered include research into problems of high voltage transmission; long distance radio propagation; stabilization of A.C. line voltage; analog computers; development of apparatus for the generation, radiation, and reception of microwaves; hail studies; wind telemetry; and methods of avalanche warning. An effective "Crash Position Indicator" for air-craft was also developed as well as an infrared detector used primarily to measure defective joints in power lines.

For more information concerning the early radar work done at the National Research Council please consult: "Radar Development in Canada: The Radio Branch of the National Research Council of Canada 1939-1946", by W.E.K. Middleton, published by Wilfred Laurier University Press in 1981. Information on other research done by the Radio and Electrical Division can be found in the annual "National Research Council of Canada Review" available at the PAC Library. Technical reports prepared by members of the Division's staff can be consulted at the Electrical Engineering Division Library on the Montreal Road campus of the NRC.

RADIO BRANCH PHOTOGRAPHS (c.1939 - 1941)

COLLECTION I

The photographs in this collection were taken by members of the Radio Branch staff in the early part of WW II and are mainly of devices related to the radar work done by the Branch at this time.

Some of the equipment shown in the collection is the following:

1. NW - Nightwatchman [radar]
2. MEW - Microwave Early Warning [radar]
3. CSC - Canadian Submarine Control [radar]
4. SWIC - Shipborne Radar on Metre Wavelengths
5. CD - Coast Defence [radar]
6. GL - GunLaying [radar]
7. APF - Accurate Position Finder
8. CRDF - Cathode Ray Direction Finder
9. ZPI Mk 1 & 2 - Zone Position Indicator [radar]

This collection consists of approximately 625 prints and 350 negatives.

PHOTOGRAPHIC COLLECTION FROM THE DIVISION OF RADIO AND ELECTRICAL ENGINEERING

NATIONAL RESEARCH COUNCIL OF CANADA - COLLECTION II

1942 - 1967

<u>SUBJECT GUIDE</u>	<u>DATE</u>
Aids to the Blind and the Handicapped	1947 - 67
Antenna Research	1943 - 67
Auroral Research (Including the All-sky Camera)	1957 - 65
Avalanche Warning System	1960 - 61
Black Brant Rocket Research	1962 - 67
Crash Position Indicator	1956 - 58
Direction Finders	1943 - 62
Electro-medical Research	
Diathermy Tests	1944 - 54
Cardiac Research	1951 - 64
Operating Theatre Monitoring	1957 - 62
Sweat Indicator	1959 - 60
Bird Telemetry	1963
Ultrasonics	1964 - 67
Fetal Recordings	1965
Electron Accelerator	1947 - 50
Electronic Music	1954 - 67
Geiger Counter	1945
Ground Scatter Studies	1956 - 59
High Voltage Research	1946 - 64
Marine Navigation	1949 - 64
Meteor Research	1959 - 66
Microwave Research	1944 - 65
Oscilloscopes	1942 - 46
pH Monitors	1947 - 48
Radar WW II	
Army - CD	1942
- CDX	1942 - 45
- GL III C	1942 - 48
- MZPI	1942 - 48
- SLC	1942 - 43

NEGATIVES LISTED BY RADIO AND ELECTRICAL ENGINEERING DIVISION PHOTO NUMBER
AND BY YEAR TAKEN - COLLECTION II

1942

1001
1002 A-B
1003
1005 A -K
1007 A - C
1008 A, C-E,G-K,M
1013 A-N
1017 A-O
1022 A-D
1027
1029 A-B
1031 A-B
1032 A-Z, AA-DD
1034 B-M
1035 A-B
1036 BB,LL-PP
1037 A-D
1038 A-Z (except X), AA-FF
1041
1042 A-D

1943

1043 A-C
1045 A-B
1046 A-D
1047 A-C
1049 A-T, 1-12
1050 A-F
1051 A-F
1053 A-F
1054 A-F
1056 A-R
1057 A-O
1058 1-42
1059 1,2,5,7,8,11,14,33,34,37,
40,42,43
1060 A-B
1064 A-G
1067 AA
1068 VV,WW-ZZ,AAA-BBB
1069
1070 A-F
1072 A-C
1074
1075 JJ,KK,NN,PP,RR,SS
1077

1944

1098 A-E,G-I
1117 A-Z,AA-ZZ,AAA-ZZZ
1141 D-E
1158 B-F
1164 A-F
1166 A-Z,AA-TT (Prints only)
1173 A-Z,AA-UU

1177 A-D
1178 A-P
1183 A-J
1202 A-J
1215 A-B
1218 A-L

1945

1221 A-K
 1232 A-N
 1233 A-D
 1252 A-C
 1254 A-C
 1257 A-J
 1259 A-O
 1264 A-Z, AA-QQ
 1273 A-E
 1275 A-E
 1276 A-M
 1288 A-Z, AA-ZZ, AAA-HHH
 1299 A-C
 1343 A-B
 1350 A-K

1946

1376 A-D
 1407 A-C
 1412 A-B
 1428 A-H
 1475 C-E
 1484 A-E
 1523 A-C
 1576

1947

1582
 1583
 1650 A-C
 1686 A-N

1948

1901 A-E
 1904 A-C
 1906 A-F
 1910
 1917 B-C
 1953
 1970 A-Y
 1988
 1990
 2001 A-B
 2002 A-C
 2005
 2012
 2016
 2055
 2069 A-G

1949

2127 A-D
 2150
 2155 A-H
 2157 A-F
 2167 A-K
 2305 A-I
 2315 E, G-K, N-P, R
 2319
 2321 C
 2328 A-E
 2360 A, D, F

1950

2392 A-G
2401
2432 A-C
2455
2476 A-E
2524 A-H
2553
2561 A-E
2608 A-C
2626 A-B
2634

1951

2763 A-E
2808 A-G
2829 A-D
2832 A-E
2849 A-D
2882 A-G
2902 A-B
2907 B,D,E,G
2908 A-B
2915 A-K
2925
2927
2951 A-E
2969

1952

2996 A-B
3007 A-B,D
3036 A-B
3040 A-K
3041 A-C
3095 A-H,J-W
3120 A-C
3231 A-C
3384 A-D

1953

3416 A-G
3497

1954

3653 A-B
3699 B-E,G-H,J
3702
3728 A-B
3745 A-E
3755 A-K
3819 A-Z,AA
3837 A-D, F-I,K-L
3849 A-B
3858 A-J
3882 D-E
3895 A-E
3907 A-H,J-L
3914 A-B
3963 A-C
3983 A-H
3989 A-B
3993 A-D
4002 B

4027 A-F

1955

4028 A-C
 4034
 4040
 4055 A-D,F-G
 4062
 4098 A-B
 4115 B-C
 4130 A-E
 4141 A-B
 4153 A-B
 4167 A-H
 4170 A-B
 4217 A-D
 4228 A-B,E-O
 4236 A-I
 4241
 4259
 4270 A-B
 4277 A-E
 4309
 4334 A-E

§

1956

4396 A-T
 4406 A,E-F
 4442 A-I
 4497 A-E
 4498 A-C,E,G
 4503 A-C
 4516 A-E
 4530 A-F
 4532 A-B
 4545 A-B
 4546
 4558 A-C
 4580 A-E

1956 cont.

4585 A,C
 4614 A-L
 4619 A-L
 4630 A-D
 4631
 4640 A-D
 4664 A-C
 4665 A-B,D-G,I-L
 4666
 4668

1957

4731 A-D
 4732 A-D
 4734 A-H
 4765 A-G
 4813 A-E
 4875 A-N
 4924 A-B
 4979
 5019
 5020 A-B
 5062 B,D,F,G-K,N-R
 5127 A-B
 5159 A-B
 5179 A-C
 5206

(5.)

<u>1958</u>	<u>1959</u>
5214 A-I	5880 A-D
5218 A-C	5883 A,D
5268 A-C	5887 A-D
5272 A-C	5910 A-E
5276	5926
5285 A-N	5927
5300 A-C	5932
5301 A-D	5933 A-C
5315	5934
5317 A-D	5941
5335 A-B	5952 A-H, K-M,O-R
5388 A-D	5957
5414	6018
5416	6019
5425 A-C	6020 A-G
5434	6048
5452 A,C	6059 A-C
5460	6062 A-C
5497	6064 A-F
5524 A-C	6091 A-E
5528	6107
5544 F	6114 A-F
5570 A-B	6139 A-Z, BB
5576 A-B	6154 A,E
5580 A-R	6201 A-C
5607 A-B	
5609 A-B	
5610 A,D,E	
5635 A-J	
5639 A-E	
5643 A-B	
5682 A-B	
5711 A,P-R,T,U	
5716 A-C	
5792	

(6.)

<u>1960</u>	<u>1961 cont.</u>	
6240	6824 A,I-J	
6249 A-B	6825	
6250 A-I	6845 A-B	
6268	6853 A,C	
6285 A-B	6860 A-C	
6304	6871 A-E	
6324 A-Q	6872 A-R	
6373 A-D	6879 A-C	
6376 A-C	6915 A-E	
6401 A-D	6940	
6409 A-B	6961 A-B	
6424 A-B	6968 A-C	
6447	6969 A-D	
6450	7025 A-E	
6452		
6502 A-J	<u>1962</u>	
6504 A-D	7038 A-C	7299 A-G
6507 A-B	7040	7300
6549 B-C,E-G	7056 A-C	
6555 A-B	7058 A-C	
6569	7066 A-C	
6602 B,D-E	7068 A-E	
6621 A-C	7077 R	
6630 A-D	7080 A-G	
6635 A	7099 A-D	
6637 A-K	7124 A-F	
6660 A-B	7125 A-F	
	7133 A	
	7139	
	7156 A,C,D	
<u>1961</u>	7164 A-D	
6676 A-D	7179 A-E,G,H,K	
6704 A-C	7211	
6754 A-B	7222 A-B	
6753 A-D	7226 C	
6788 A-I	7260 A-C	
6789 A-R	7265 A-D,F-J,M,N	
	7279 C,D,F-J,L-O,X,Y,NN	

1963

7332 A-F
 7340 A-B,D
 7346 A-B
 7367 A-B
 7396 A,C-I,K,O-S,U
 7415
 7419 A-K
 7476 A-E
 7501 A-H
 7517 A-B
 7529 A,E-M
 7562 A-F,J
 7564 A-B
 7542
 7574 A-C
 7605
 7613
 7650
 7679 A-B
 7680 A-B
 7682 A-J

1964

7718 A-I
 7720 A-D
 7726 A-F,K-M,BB,DD-GG
 7727 A-B
 7771 A-B
 7785 C-D
 7790 A-D
 7792 A-J
 7796 A-D
 7812 A-B
 7823 A-F
 7843 A-B

1964 cont.

7846 A-C
 7852
 7857 A-F
 7877
 7879 A-I
 7897 A-B
 7902 A,C-F,H-L,N,O,Q-Z,AA,EE-GG
 7937 B,C,F,G,L,M
 7940 A-B
 7949 A-D
 7950 A-G
 7993 A-B
 7999 A-H
 8010 I,J,M,P

1965

8017 B,E,I,P
 8019 I,O
 8027
 8035 A-N
 8036 D-G
 8040 A-C,V,R,T,W-Y,Z
 8042 A-C
 8046 AA-HH,A-K
 8050 A-D
 8054 A-Q
 8071 B,F
 8084
 8111
 8127 A-I
 8132 A,G-K
 8136 A-B,P
 8139
 8144
 8152 A-N
 8157 A-B
 8172
 8182 A-G
 8188 A-Z,EE-FF,
 WW-ZZ,AAA-
 DDD
 8196 A-F,J-M
 8197 H-I,L-Z
 8198 B,L,P
 8223
 8229 A-B,G,I,K-O
 8253
 8200 A-F
 8202
 8209 A-B
 8212 A-B,F-I,N

1966

8263 A-C

8279 A,C-D,H-X,BB

8328 A-F

8344 A-L,Q-Z,BB,DD,HH-PP

8351 B-C

8364 A-I

8390 A-Z,AA-ZZ,AAA-CCC

8405 A-D

8410 A-M

1967

8453 A-I

8455 A-J,N,O

8458 A-G

8478 A-B

8550

8562 A-B

1977

9427 A

Report No. ERA - 141

The National Research Council of Canada

Radio Branch

THE WAR HISTORY OF THE RADIO BRANCH

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Ottawa, August 1948.

GLOSSARY OF ABBREVIATIONS USED

ADRDE	- Air Defence Research and Development Establishment (Great Britain).
AFC	- Automatic Frequency Control.
AI	- Air-borne radar "Aircraft Interception".
"AJ Set"	- An early model of MEW/AS.
APF	- Accurate Position Finder Radar (a portion of the GL Mark III C).
ASV	- Air to Surface Vessel Radar.
BABS	- Blind Approach Beam System.
BTH	- British Thompson Huston Company.
BTL	- Bell Telephone Laboratories.
CAA	- Civil Aeronautics Authority.
CD	- Coast Defence Radar.
CD/X	- A Microwave Coast Defence Radar.
CDY	- An Experimental Fortress Commander's Radar.
CERCA	- Commonwealth and Empire Radio for Civil Aviation.
CHL	- An Early Warning Radar.
CNJ	- Canadian Naval Jammer.
CRDF	- Cathode Ray Direction Finder.
CRT	- Cathode Ray Oscilloscope.
CSC	- Canadian Submarine Control Radar.
FAW	- Forward Area Warning.
GCI	- Ground Control Interception.
GL	- Anti-Aircraft Gun Laying Radar.
GL Mark III C	- A Canadian Anti-Aircraft Gun Laying Radar.
HPI	- Height Position Indicator.
IF	- Intermediate Frequency.
IFF	- Identification Friend or Foe.
IRE	- Institute of Radio Engineers.
Kc/s	- Kilocycles per second.
LR EW	- Long Range Early Warning.
MAW	- Microwave Air Warning.
Mc/s	- Megacycles per second.
MEW	- Microwave Early Warning.
MEW/AS	- Microwave Early Warning - Anti-Submarine.
MHF	- Microwave Height Finder.
MIT	- Massachusetts Institute of Technology.

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MTB - Motor Torpedo Boat.
MZPI - Microwave Zone Position Indicator.

NDRC - National Defence Research Council.
NRC - National Research Council.
NRL - Naval Research Laboratories (U.S.A.).
NW - Night Watchman Radar.

PBY - A type of aircraft.
P'F - Panoramic Reception.
PICAO - Provisional International Civil Aviation Organization.
PPI - Plan Position Indicator.
PRF - Pulse Recurrence Frequency.

RAE - Royal Aircraft Establishment (Great Britain).
RCN - Royal Canadian Navy.
RDF - Range and Direction Finding (early term now radar).
RDI - Radar Distance Indicator.
REL - Research Enterprises Limited.
RF - Radio Frequency.
RIS - Radar Interference Suppressor.
RRDE - Radar Research and Development Establishment (Gt. Britain).
RX/C - A Marine Radar.
RX/F - A Marine Radar.

S Band - Wavelength of 10 centimeters.
SLC - Search Light Control.
SS2C - A Marine Radar.
SWIC - A Marine Radar.

T/R - Transmitter Receiver.
TRE - Telecommunications Research Establishment (Great Britain).

UHF - Ultra High Frequency.

VEB - Variable Elevation Beam Radar (for aircraft height finding).

X Band - Wavelength of 3 centimeters.

ZPI - Zone Position Indicator (early warning portion of the GL Mark III C).

268 - Production name for RX/F.

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MOST SECRET

REL CODES

RA/X	UIF A.S.V. (British AVS)	
RB	GL	Gun Laying
RE/RI	GL/EW	Gun Laying & Early Warning
RD	SLC	Search Light Control
RDX	SLC	U.H.F. Light Control
RE	CD	Coastal Defence
REX	CD	Coastal Defence U.H.F.
RF	CHL (Early Mark not produced)	Chain Low Angle
RG	AI	Aircraft Interception
RG/H	AI Mark IV	
RG/T	AI Trainer	R.E.L. Type 2 Trainer
RH-1	I.F.F. RWG	
RH-2	I.F.F. RN-1	
RH-3	I.P.F. RN-4	
RH-4	I.F.F. RC-188 for SCR-588	
RH-5	I.F.F. RC-148 for SCR-268	
RH-6	I.F.F. RB	
RH-7	I.F.F. REX	
RH-8	I.P.F. RIC	
RH-9	I.P.F. RMC	
RH-10	I.P.F. RLU	
RH-11	I.P.F. RXP	

RN1 - SW1C - 200 MC. with Yagi
RN3 - SW2C - 214 MC. with Yagi
RN4 - SW3C - 214 Mc. with triple Yagi *Handwritten signature*
RN6 - SW2C - 214 Mc. with type 3 antenna
RN7 - SW2C - 214 Mc. with type 4 antenna