

H I S T O R Y

SIGALS PRODUCTION BRANCH

DEPARTMENT OF MUNITIONS & SUPPLY

(May 1, 1942 to August 31, 1943)

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EXPLANATORY NOTES

This history of the development of the Signals Production Branch (formally Communications and Fire Control Production Branch) has been prepared for the Minister of Munitions and Supply, at his request.

The prime purpose of the history is to present a concise picture of the endeavors and accomplishments of the Branch from the time of its inception, in May, 1942, to the end of August, 1943. At the same time, the vast expansion of production of Radar and Communications equipment in Canada is illustrated.

The method of presentation is that of knitting together a number of chronological stories so as to progress from the events leading up to the formation of the Branch, through development of the organization and the relation of this organization with the radar and communications programs, to a statistical recapitulation. This method has been chosen that easy reference may be made to the complete detail of any one subject.

Signals Production Branch
Department of Munitions and Supply
Ottawa, Ontario

October 15, 1943

PREFACE

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An electric signal was first transmitted and received without Benefit of intervening physical conductors by Sr. Guglielmo Marconi, At Bologna, Italy, less than 50 years ago.

At the time of writing this history, the activities of sailors, Soldiers and airman are coordinated over the same terrain by wireless Devices, which not only send and receive signals, but also project The sense of hearing and seeing miles away with, not human, but mathematical accuracy.

Canadian Industry has been to the fore in spanning the intervening gap, from the day in December, 1901 - shortly after Sr. Marconi's first transmission - when a signal from across the Atlantic was first heard in st. Johns, Newfoundland, to the day when warriors of the Allied Nations are disembarking on the shores of Italy, aided, somewhere along the lines, by devices of Canadian manufacture which have incorporated in them the most modern of electro-magnetic technical developments.

One of the earliest practical applications of wireless was in marine communications. Wireless operator, A.H. Ginman, now President of the Canadian Marconi Company, witnessed the relief of the first major marine disaster to be reported by radio, picking up the S.O.S signals passing between the liners Republic and Florida and the shore.

Canada was also right at the forefront in the greatest development Of wireless communication before the war - Radio Broadcasting. At Montreal

In 1919, C.F.C.F. was amongst the first Canadian broadcasting stations to go on the air. By 1939 eight-one broadcasting stations were operating in Canada under private and public ownership, all subject to government control.

Early stations were crude installations indeed, when judged by later standards. Their radiations usually occupied much space in the radio spectrum and were inclined to wander about in the spectrum, causing interference, one with the other.

Control of such conditions became an international duty. After one or two earlier efforts at control international agreement, a conference was held in Havana, Cuba, in 1937, at which all frequencies within the radio spectrum were redistributed amongst the North American countries, for their scientific conservation and utilization. This, coupled with the enormous strides in technical development has opened fertile fields in which post-war expansion can far exceed anything accomplished to date.

While industry, from the 1920's onwards, concentrated on catering to the entertainment of the public with radio broadcasting, the commercial employment of wireless also went on apace.

Long before the present hostilities started, marine navigation was by wireless direction finder and radio compass, the depth of the ocean was a continuous record on a dial in the wheelhouse and automatic alarms were set off by the signal S.O.S. All this aside from telephone communication between the Master or passengers on a liner and associates

ashore.

Before the war, Mr. Smith, sitting in his office in Toronto, could pick up his telephone and talk to a friend in Liverpool. The transatlantic link in this telephone system was mechanically controlled radio beams in which privacy of speech was assured by a method of distortion of the transmission known as "Scrambling".

Police, Mining, Forestry and such services found untold advantages in the science of wireless communication.

Aviation, in its rapid growth, absorbed all that technique could provide and demand more. In 1937, Canadian made radio Range beacons were installed in our airports. So important was this as a factor of safety, that planes henceforth were automatically grounded if a beacon was found not operating. At the same time a means of landing aircraft by remote radio control was in the development stage. The necessities of war have produced still further, almost magic controls which will remain secret until peace time.

Sound motion pictures, public address systems and industrial remote control devices are some of the myriad of electronic services growing parallel to the radio industry. Before the way television, facsimile and frequency modulation were being prepared for public service, while the electron microscope was being perfected for the use of the scientist. The post-war period should see these facilities quickly expanded, to the betterment of humanity.

In Canada, industrial effort has been divided mainly between Quebec and Ontario. Of the eleven major radio establishments, the Three largest are in Montreal, while the remainder are centered around Toronto. The pre-war capitalization of the Canadian industry was approximately \$12,000,000. The major portion of this investment was used for the production of domestic broadcast transmitting and receiving equipment. Manufacturing employed approximately 5,000 people, while distribution and service employed an additional 20,000.

The manufacturing setup is one of the most complex in all industry. Starting by taking the time from the stars, to insure the accuracy of wavelength, it ends up by adequately enclosing sources of electrical energy which could injure a person fatally, even though no direct physical contact were made with the apparatus.

Factory personnel included representatives of all Branches of the Engineering profession. The whole gamut of raw materials is used. Production processes include these of raw materials inspection, tool Room, punch press department, sheet metal working, cabinet making, Automatic screw machine work, welding, cleaning, plating, painting, Coil wiring, assembling, electrical and mechanical testing and packing.

A chart of domestic receiver sales will illustrate the pre-war Industry in Canada, with its early trend to expensive sets, then the trend to volume and economy. During this period the trend in design was from large battery operated models, covering a narrow range in the

radio spectrum, to smaller, multi-band sets operating from A.C power sources and covering a greatly increased range of the spectrum to bring the continents into the living-room. The number of Canadian citizens to purchase radio receiving licenses grew to over 2,000,000.

Year -----	Units -----	Value -----
1926	42,400	\$ 2,253,000
1930	170,100	19,197,000
1933	112,300	4,401,000
1937	289,200	11,597,000
1938	242,700	8,802,000
1939	348,500	8,678,000

These figures grow insignificant when compared with those for The last four of the years bridging the gap from Bologna to Bologna; as illustrated in the succeeding pages.

VI RELATIONS WITH MANUFACTURE OF COMMERCIAL EQUIPMENT
=====

General:

In this chapter are included the stories of the production of a Number of communication equipments which have stood out prominently in the work of the Branch.

The equipments described have been chosen for their value in illustrating the operation of the Branch. The fact that they have been chosen does not necessarily attach more importance to them, as contracts, than to any other equipment covered by the 15,000 odd contracts handled by the Branch during its existence. This is particularly true in the case of wireless equipment procured by the Navy and the Air Force. Both of these services have placed some very large contracts through The Branch. However, once the contracts were let, the efforts of the Branch have not been required beyond the normal production control functions and the expediting of materials.

Wireless Set No. 19

This equipment was designed to meet the communication requirements of armoured fighting vehicles. It comprises three separate channels of two way communication, one for speech by wire telephone between the crew of the vehicle, one for radio telephone between adjacent vehicles separated by distances up to one mile, and for radio telegraph or radio telephone between vehicles - or between vehicle and fixed stations - over distances up to twenty miles. All three channels

may be operated simultaneously when suitably installed in a vehicle.

Somewhat complicated, but necessary, is the system of controls, with inter-connecting wires, which is installed in the vehicle and to which the set is connected. This is known as the Installation Kit. Its purpose is to bring the facilities of the set to members of the crew. By means of this installation, certain crew members can operate all three channels while others can communicate within the vehicle only. The make up of the Installation Kit varies with the type of vehicle. In value, the Kit represents between fifteen and thirty percent of the value of the complete wireless station.

The No. 19 Set was developed in U.K.. In the summer of 1941 the Department of National Defence authorized manufacture of the set in Canada. A group of engineers from Northern Electric Company visited U.K. to study manufacture there. They brought back complete manufacturing data with them and immediately commenced preparations for production on a small scale. A number of modifications were made, in consultation with an engineer from the Department of National Defence, to accommodate the set to Canadian manufacturing methods and also to increase its efficiency. This model was called Wireless Set No. 19 Mk.II.

By the beginning of 1942, Northern Electric Company were turning out sets at a low rate.

Meanwhile, orders for sets had been pouring in much faster than had been anticipated, so it was found necessary to negotiate with R.C.A. Victor Company and Canadian Marconi Company for additional manufacture.

Early in 1942 the U.S. Army Signal Corps became interested in the set and proceeded to establish manufacture in the United States to fill Lend-Lease orders. The set as manufactured in the United States was an exact copy of the Canadian version.

When the Branch came into being, all Canadian contractors were just getting early production troubles cleared from their assembly lines and were well on the way to high rates of production.

By this time there was a total of 36,000 sets on order in Canada.

Although the prime contractors were in a position to turn out sets at high rates, there were deterring factors which all but brought production to a stop time after time.

Tooling for component parts was one of the major stumbling blocks during the spring of 1942. The original tooling had been set up to produce for a total of 2,000 units at a low rate. When orders began to multiply, new suppliers and new tooling for hundreds of components had to be established. This resulted in a period when existing tooling was not only far from adequate but also, in some cases, unsatisfactory, and when the new tooling was not complete.

In the midst of this, the supply of purchased components such as vacuum tubes, indicating meters, resistors, capacitors, nearly failed. This was the time of sudden expansion of the communications industry throughout this continent and suppliers of components could not meet demands. The period was one of continuous consultation between the expediting personnel of the three contractors and of the Branch to

apportion available materials so as to keep production lines operating to best advantage.

The production difficulties were further amplified by continual design changes, first, to keep up with revisions to the set emanating from U.K. and second, to substitute for material which could not be obtained.

In spite of these difficulties, and by exemplary cooperation between contractors who previously has been unbending competitors, production continued to flow.

In the late summer of 1942, as a result of modifications to the set in U.K., and of a visit of Branch personnel to U.K., several major modifications to the Canadian set were proposed. Engineering work was assigned to R.C.A. Victor Company in collaboration with the Technical section of Branch. In October, a model of the new version, known as Wireless Set No. 19 Mk.III was completed, and demonstrated to the satisfaction of Canadian, U.K. authorities.

Next followed a period of discussion over placing the Mk.III set in production. In January a decision was reached to change over completely from the Mk.II to Mk.III version and a definite changeover point was chosen.

R.C.A Victor Company and Canadian Marconi Company commenced the changeover in May, 1943. Northern Electric Company continued the Mk.II set for another couple of months in order to clean up outstanding orders for all three contractors.

The expected difficulties were encountered bringing the Mk.III version into production. This resulted in a falling off of deliveries during the summer.

A statistical summary of the No. 19 Set is given below.

ORDERS FOR WIRELESS SET NO. 19
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Account	N.E. Co.	R.C.A. Victor Co.	Can.Marconi Co.	Total
-----	-----	-----	-----	-----
Wireless Set No.19 Mk.II =====				
Can. Army	4,587	2,364	1,149	8,100
War Supplies Ltd.	6,050	7,575	4,325	17,950
Ministry of Supply	1,250	1,253	750	3,253
New Zealand			2	2
	-----	-----	-----	-----
	11,887	11,192	6,226	29,305
	-----	-----	-----	-----
Wireless Set No.19 Mk.III =====				
Can. Army	2,788	2,546	576	5,910
Ministry of Supply	13,175	10,750	1,085	25,000
	-----	-----	-----	-----
	15,963	13,286	1,661	30,910
	-----	-----	-----	-----

At various times, Installation Kits have been manufactured for the following vehicles:-

- | | |
|--------------------------|---------------------------------|
| Universal Carrier | Cruiser Tank Ram Mk.III |
| Light Reconnaissance Car | Grizzly Tank Mk.I |
| Armoured Car | Valentine Tank Mk.VI and VII |
| Scout Car | Command Tank (Ram Mk.II Hull) |
| M3 Medium Tank | 25 Pr. Self Propelled Gun Mount |
| M4 Medium Tank | Russian Tank T34 |
| Cruiser Tank Ram Mk.II | Truck and Ground Station |

DELIVERIES OF WIRELESS SET NO. 19 (CUMULATIVE)

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Month -----	N.E. Co. -----	R.C.A. -----	C.M.Co. -----	Total -----
January, 1942	25	--	--	25
February	71	--	--	71
March	184	81	5	270
April	315	420	200	935
May	550	850	480	1,880
June	1,380	1,280	850	3,510
July	2,480	1,980	1,285	5,745
August	3,400	2,720	1,710	7,830
September	4,210	3,670	2,060	9,940
October	4,970	4,845	2,600	12,415
November	5,875	5,705	3,100	14,675
December	6,720	6,535	3,625	16,880
January, 1943	8,820	7,435	4,160	20,405
February	9,040	8,635	4,775	22,450
March	9,490	8,790	5,025	23,305
April	10,290	9,735	5,725	25,750
May	11,390	11,135	6,225	28,750
June	11,485	11,375	6,225	29,085
July	11,930	12,040	6,425	30,395
August	11,975	12,610	6,860	31,445

DELIVERIES OF INSTALLATION KITS (CUMULATIVE)

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Month -----	N.E. Co. -----	R.C.A. -----	C.M.Co. -----	Total -----
March, 1942	78	--	--	78
April	410	--	--	410
May	825	--	--	825
June	1,360	470	--	1,830
July	1,795	1,230	70	3,095
August	2,650	2,505	455	5,610
September	4,860	2,940	1,100	8,900
October	7,130	3,580	2,215	12,925
November	--	3,745	3,140	--
December	8,535	4,190	3,400	16,125
January, 1943	9,895	4,215	3,465	17,575
February	9,995	4,230	3,575	17,800
March	10,020	4,695	"	18,290
April	"	6,340	"	19,935
May	10,620	7,185	"	21,380
June	11,140	7,375	3,675	22,790
July	"	8,490	4,075	23,705
August	11,915	8,565	4,495	24,975

Amplifier for Wireless Set No. 19

This equipment was developed for use in conjunction with the long range transmitter portion of the No. 19 Set, to extend the range.

The amplifier was conceived and developed by the Department Group of Directorate of Signals Design, A.E.D.E., during the early months of 1942.

In June, 1942, an order for 37 units was released through the Branch, 25 to be made at Canadian Marconi Company and 12 at Canadian Signals Experimental Establishment. Early production forecasts were for delivery in September, 1942.

In October, Canadian Marconi Company had not completed the order because of lack of materials. During November the Company experienced numerous difficulties in making the design operate.

In January, 1943, Canadian Marconi Company completed delivery of their 25 units but the sets did not meet all the desired operating conditions.

In March, 1943, an additional order for 450 amplifiers was placed on Rogers Majestic Limited after Canadian Marconi Company had declined to accept it because of already heavy commitments. About the same time an order for 50 more units was placed on C.S.E.E.

It was decided to make some design modifications before production of the new orders was started. For this reason, delivery was forecast for October, 1943.

In June, 1943, reports from overseas indicated that the sets

already delivered contained faults the clearing of which required further design changes.

No satisfactory progress having been made during the summer, on the first of September the Branch called the contractor to Ottawa and, with representatives of the Army design group present, endeavoured to establish a production schedule. From this meeting, it is apparent that sets will not be delivered until early 1944 at least.

Wireless Set No. 9

Wireless Set No. 9 is a combination Transmitter/Receiver with facilities for both radio telegraph and radio telephone operation over distances up to 50 miles. It is a portable unit designed for transportation by truck. In the field, it may be operated in a specially prepared vehicle or it may be set up as a ground station. Power for the set is derived from dynamotors which, in turn, are supplied by storage batteries. The set was developed in U.K. As early as November, 1938, the Department of National Defence Gave indication that manufacture of the set would be undertaken in Canada. It was not till the middle of 1940, though, that any active negotiations were undertaken.

During the summer of 1940 technical information was provided From which Canadian Marconi Company prepared a quotation. In September, 1940, Canadian Marconi Company and Northern Electric Company were authorized to manufacture 650 sets, dividing the component parts between them.

In November, 1940, complete manufacturing specifications were received from U.K.

During the next six months preparations for production proceeded. Throughout this period there was continual indecision over the quantity of sets required. Finally, late in May, 1941, D.M. & S. issued a formal contract for 650 stations.

In June, 1941, it became apparent that original delivery forecasts could not be met, because the time estimated for setting up production had been underestimated. Also, at this time, difficulties began to develop in procurement of materials, dynamotors in particular.

In August, 1941, the requirement was reduced to 500 sets. materials purchased for the remaining 150 sets were to be disposed of by delivering them as maintenance spares.

In the fall for 1941 the transmitter unit was partially redesigned, resulting in a very appreciable increase in efficiency.

By the first of December, 1941, completed sets had been produced. First shipments were made late in the same month.

Lack of dynamotors delayed completion of the order until the late summer of 1942.

In June, 1942, additional orders for the set, totalling 1150 stations, were placed through the Branch. Because of numerous difficulties experienced with the first order, it was decided to modify the design somewhat and to place complete manufacture in the hands of

one contractor. Canadian Marconi Company was chosen and letter of intent was sent to the company late in June.

The modified set was named Wireless Set No. 9 Mark I.

During July a number of engineering meetings were held between the Technical section of the Branch and Canadian Marconi Company. By the end of August, redesign of the set had been completed by the company. Delivery was forecast for February, 1943.

In October, 1942, as a result of a visit overseas of Branch personnel, it was decided that a set would be modified still further. Since current orders were well advanced, these modifications were set over for future production, although Canadian Marconi Company were authorized to proceed with development work. This second modified version of the set was named Wireless Set No. 9 Mk.II.

A new order for 1650 Sets was received from U.K. in November, 1942, while, in March, 1943, Canadian Army added 162 Sets. These orders were placed at manufacture as Mk. II sets.

In May, 1943, a sample Mk. I set was demonstrated to the Canadian General Staff who approved it. First deliveries were made during May and, by the end of August, 250 Sets had been delivered. Completion of the Mk. I version is forecast for December, 1943.

By the end of August, 1943, development of the Mk II version was nearing completion. Production of pilot models was forecast for November, 1943, while main production was forecast for March, 1944.

Standard Communications Receiver

One of the first jobs undertaken by the Inter-Service Committee on Design was the approval of a Receiver for general communications work, which would be standard for all Services.

Late in the summer of 1942 the Committee prepared a specification covering the desired equipment and this specification was sent to all radio manufacturers in Canada with an invitation to submit a design.

The invitation was accepted by only two firms, R.C.A Victor Company proposed their Receiver Type AR88 which had just been designed by their United States affiliate, R.C.A Victor, Camden, N.J. Canadian Marconi Company submitted their Receiver Type CSR 5.

In November, 1942, the committee sat to compare the two receivers with the specifications. They finally decided on the type AR 88 with slight modifications.

Orders began to come in for the AR 88 receiver before the end of 1942. By the end of August, 1943, R.C.A Victor Company had orders totalling approximately 5400 Sets from Canadian Army, R.C.A.F., B.A.T.R, British Army, and New Zealand.

The original delivery forecast for this receiver was July, 1943. Design modifications instituted by R.C.A. Victor (U.S.) delayed the Final ordering of materials to the extent that no sets had been delivered by the end of August. Deliveries did commence in September.

Meanwhile, the Canadian Navy had placed orders for the type CSR 5 Receiver instead of the AR 88. Between March and August, 1943,

this Service ordered a total of 740 Sets. New Zealand also placed an order for 100 of the Sets.

At the end of August, 1943, no CSR 5 Receivers had been delivered, although original forecasts were for July. The latest forecast for start of deliveries is December, 1943.

Wireless Equipment for Mosquito and Lancaster Aircraft

Contracts for production of this equipment in Canada were let to Northern Electric Company by the Aircraft manufacturers during the summer of 1942.

Complete equipment for a Mosquito aircraft, as supplied by Northern Electric Company, consists of a radio receiver, a radio transmitter and a radio compass, together with a large quantity of auxiliary apparatus for operating the main components by remote control. All this equipment is of a design developed by Bendix Aviation Radio Corporation in the United States. Northern Electric Company were called upon to supply, in addition to this equipment, interconnecting cables for other wireless equipment which is installed when the aircraft reaches the field.

The Bendix equipment for the Lancaster aircraft is similar to that used in the Mosquito aircraft except two transmitters are installed and a larger quantity of auxiliary apparatus is required. In addition, Northern Electric Company were called upon to supply another wireless set of the transmitter-receiver type, of British design, and provide harness for installing it in the aircraft.